Sonatest

Ultrasonic Phased Array Flaw Detector Series

Sonatest **veo series**

Power & performance **perfectly** packaged.

The veo range of Phased Array ultrasonic flaw detectors reinforces Sonatest's reputation for innovative technician focussed product development. Simple controls, superior performance, advanced features and rugged enclosure deliver simplicity, capability and reliability to the technician's finger tips.

Ultrasonic Phased Array technology has become the established method for advanced NDT testing applications. Phased Array techniques allow the user to control parameters such as beam angle and focal distance to create an image of the test part; enhancing defect detection and speed of testing. In addition, using the latest computer technology, data can be permanently recorded for processing and report generation. The veo's robust design, intuitive user interface and extensive online help brings the power of Phased Array to the field-based technician. Typical applications include Weld Inspection, Corrosion Mapping, Aerospace and Composite Testing.

Simplicity

The intuitive menu system is application and workflow driven, with set up and operation swiftly becoming second nature. Integrated Help and Wizards guide the user through scan set up whilst **Optimisation Tips** ensure the **veo** always performs at the highest level. The unique **3D ScanPlan** view gives immediate visual confirmation of correct set up and ultrasound coverage, even in complex multi-probe applications.

Fast and efficient wizards for Sound Velocity, Wedge Delay, TCG, DAC, Sensitivity and Encoder calibration are all provided as standard. Clear indication of the calibration status is provided on screen via a simple traffic light system, so that operators can check at a glance that the veo is calibrated for the inspection task.

Menu navigation uses Sonatest's second generation scroll wheel technology for fast parameter selection, with shortcut keys for the most used functions and alphanumeric entry. The familiar Start, Stop and Record keys switch quickly between set up, acquisition and recording modes.

Capability

The powerful **veo** platform unlocks a new level of performance in a portable instrument, helping you to maximize your efficiency on-site. The Inspection Plan shows the operator in 2D and 3D where probes are positioned on the test part, simplifying the inspection setup and providing an inspection reference for reporting. All adjustments to focal laws are instantaneous, with angle resolution to 0.1^0 and up to 1024 focal laws without loss of performance. Multiple scans from

different probes may be displayed and evaluated at the same time. Multiple sectorial scans, true top, side and end view extractions plus C-Scans are all supported by the veo. TOFD and Phased array inspections can be carried out in tandem at full scanning speed and with up to 3GB data files large areas can be inspected more efficiently. Full resolution waveform data can be stored directly to a removable USB data key for ease of back up and transfer to PC.

The **veo** has two dedicated mono element flaw detection channels for conventional UT and TOFD inspection. Based on Sonatest's Masterscan flaw detector the channels have 400V pulsers, Time Corrected Gain and low noise amplifiers for the most demanding applications. An impressive hardware specification provides high quality ultrasonic data, via a full 16 bit high speed architecture and 12 bit ADC technology. Digital signal processing enables smoothing and averaging, enhances image interpretation. Measurement and sizing of indications are quickly achieved using advanced measuring tools such as Hyperbolic Cursors for TOFD.

For any flaw detector the display is a crucial element. The Sonatest **veo** range has a colour transflective TFT LCD, providing high visibility in all conditions, with the highest display to size ratio of any field instrument.

Reliability

Robust design and proven reliability are essential attributes in demanding NDT environments. Down time is expensive and should be minimized to ensure maximum productivity. Sonatest's reputation for rugged construction and high quality products has been earned over 50 years serving the industry. The **veo** is constructed to exacting standards using a rigid, shock mounted, internal chassis surrounded by an impact absorbing enclosure and designed to meet IP66. Designed to incorporate many features to make site work easier, the **veo** is fitted with standard camera mount fittings underneath and four attachment points on the back for tripods and other equipment accessories. Additionally the four corner D-rings allow the **veo** to be attached to carry straps or 4 point body harnesses, for easy movement, freeing hands for scanning. The **veo** has a two battery design which are "hot swappable", therefore minimising down time and heightening the reliability of performance in the field.

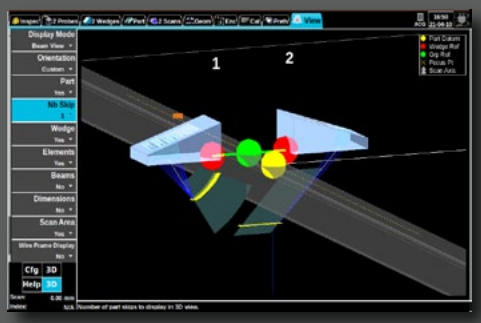
UT Studio

UT Studio is a PC based software, which comes as part of the **veo** package, for Phased Array configuration development, data analysis and report generation. Recorded **veo** data files are easily transferred via a network or USB data key and used to generate new views and projections. Using a familiar windows drag and drop interface, the user can create multiple views such as Top, End and B-Scan by simply dragging **veo** data files onto templates for display.

Powerful measurement cursors and extractors can added be to identify indications, size and annotate defects. Reports are easily generated and can be exported into PDF format for review and circulation. Free download of UT Studio Viewer is available for the technician's client.

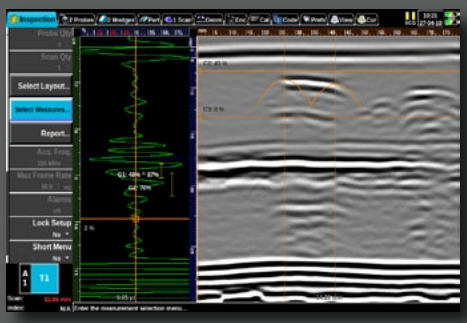
veo 16:64

- Superior Imaging
- Full Data Recording
- Fast Encoded Scans
- Multi Scan
- Simultaneous UT & PA
- Instant Focal Law Calculations
- Easy Report Generation
- IP66 Enclosure
- Calibration Wizards
- 3D ScanPlan
- Probe & Wedge Databases
- TCG and DAC
- Unlimited Scan Lengths



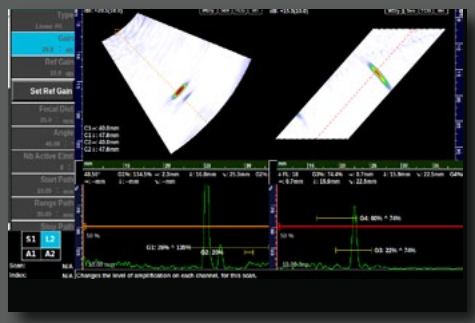
3D Scanplan

The **veo** Scanplan supports multiple probes and scans, enabling the set up of inspection plans from a number of sources quickly and efficiently. Choose from a range of weld geometries and visualise the probes on the part in the locations you choose. Multiple skip paths are shown on the 3D Scanplan allowing the user to ensure coverage for weld inspections. Simple reference points are indicated for easy interpretation and locations of probes on the part can be quickly defined. Mixtures of probe types are supported in pulse echo and pitch and catch: phased array; TOFD or conventional UT. The Scanplan is an invaluable reference for your inspection report, communicating the results of your inspection more clearly, and saved as part of your inspection for future use.



TOFD

The **veo** has a dedicated analogue architecture for TOFD inspection, using analogue filters developed from the Sonatest range of flaw detectors. Coupled with the lowest noise amplifiers, high speed data acquisition and a high definition display, superior quality TOFD scans can be viewed live at the same time as Phased Array. Phased Array and TOFD inspections can be evaluated together for added confidence during weld inspection. Built in evaluation tools, such as straightening and lateral wave removal, allow quick and accurate evaluation of the TOFD inspection, which can be included in a test report.



Multi Scans

The **veo** can be quickly configured to display a large range of multi scan views. This allows the user to select the views important for the inspection and to get best use from the display. Sector scan, top, side and end views can all be combined with multiple A-Scan views and TOFD. Cursors and rulers are used to identify indications in the views, whilst measurement tools give size and annotation.

www.sonatestveo.com

veo 16:128

Huge File Size (3GB)

USB key Data Storage

WheelProbe Compatible

Hot Swap Battery Packs

Merged C-Scan

Simultaneous
TOFD & PA

Ray Tracing
with Reflection

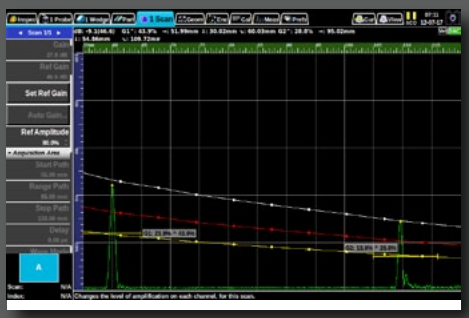
Interface Triggering
(TCG/DAC)

16:128 (additional features)

Up to 128 probe elements

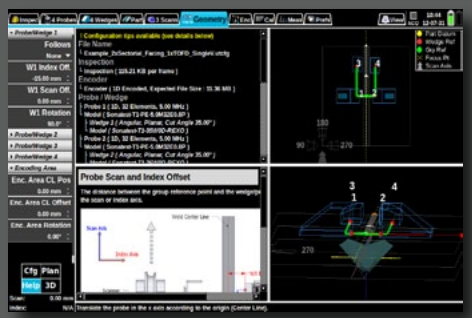
High Power -130 volts

Enhanced Multigroup
up to 6 concurrent scans



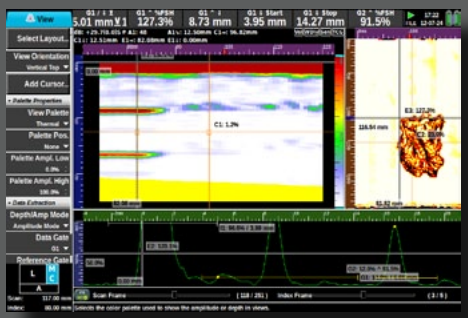
A-Scan

The **veo** supports traditional ultrasonic testing with mono transducers. The high definition LCD and fast graphics rendering ensure high levels of accuracy and a fast interactive waveform display. Thanks to the high resolution of the LCD display, measurements are clear and easy to read, and the wide screen format provides a huge viewing area for the scan. The A-Scan display ensures the peak signal is always displayed so that you never miss a defect.



Stop Mode

In stop mode the **veo** system is able to display four screens of information simultaneously. For example a Configurations Summary, Help Page, Plan view of Inspection (showing expected probe movement), 3D Scanplan (showing the probes, parts, inspection beams and planes of focus - as above. Any one of these can be maximised to a full screen view.



C-Scan

The **veo** offers full merged C-Scan capabilities allowing the inspector to see the complete area of inspection. TOP views (from angled or normal beam inspections) or C-Scans (from normal beam inspection) can be producec based on either amplitude or time of flight data. C-Scans from multiple passes can be merged together. This is particularly valuable for corrosion mapping and assessment of large composite structures.

Veo & Corrosion WheelProbe Scanning Systems

The Corrosion WheelProbe is a tried and tested solution for corrosion mapping and can be combined with the veo and scanning system to provide simple and effective scanning solutions in this field. The scan width is close to 50mm in one pass and can be used on diameters from 12 -120cm (4 - 48 in). Importantly the tyre allows excellent coupling to rough surfaces, and the design allows for consistent reliable inspection in both depth and amplitude. Advantages of this system include the portability, relative simplicity and complete autonomy from the need for additional power sources on the inspection site. Additionally the veo CWP system gives the flexibility of utilising the CWP on a manual basis for small area scans, e.g. screening of pipe work of vessels (where LRUT has been used) or scanning along the length (Axial) of the pipe.

veo Specifications (specifications are subject to change)

PHASED ARRAY

Pulsers

Configuration	16:64 (16 pulsers/receivers; driving up to 64 elements)
Test Mode	Pulse-Echo and Transmit/Receive
Transducer Socket	I-PEX
Pulse Voltage	-50 V to -100 V (in steps of 10 V)
Pulse Shape	Negative square wave (with ActiveEdge)
Pulse Width	adjustable 25ns to 1000ns (2.5ns resolution)
Edge Time	<10 ns in 50 ohms load @100V
Output Impedance	<16 ohms
Tx/Rx Focus	
Delay Range	0 to 10 μs (2.5 ns resolution)

Receivers

Gain Range	0-84 dB, in steps of 0.1dB
Input Impedance	50 ohms
Bandwidth	200kHz - 27MHz (-3 dB)

Data Acquisition

Architecture	Full digital delay and sum architecture
Digitizing Frequency	50/100 MHz
Digitizer Resolution	12 bits
Data Processing	16 bits/sample
Data Recording	Full raw data recorded
Max A-Scan Length	8192 samples (32 metres in steel LW, 50MHz, 1:128)
Maximum PRF	20 kHz
Focal Law Qty	Up to 1024
Focusing Type	Constant Depth, Constant Sound Path, Constant Offset
Processing	Digital filters, Smoothing, Contouring, Rejection
Filters	7 narrow bands and 3 broadbands, automatic
Sub-sampling	1:1 to 1:128
Rectifier	RF, Full, Positive, Negative.
Trigger Synchronisation	On encoder resolution or internal PRF (not encoded)
Reference	Initial pulse or gate, IFT supported

Scan & Views

Supported Scans	S-Scan & L-Scan
Real Time Views	S, L, B, C-Scan, Merged Top and End view.
Colour Maps	10 Standard & User customisable pallete
Multi-Group	4 scans and 1 TOFD Scan

Cursors

Types	Cartesian, Extraction Box, Angular
Measurements	Path Length, Depth, Surface Distance, DAC, AWS

CONVENTIONAL UT/TOFD (MONO ELEMENT CHANNELS)

Pulsers

No. of Channels	2 TX/RX (2 multiplexed channels) 2 RX
Test Mode	Pulse-Echo, transmit/receive, TOFD
Transducer Socket	BNC or LEMO 1 (factory option)
Pulse Voltage	-400 V (adjustable from -100 to -400 V in steps of 10 V)
Pulse Shape	Negative Square Pulse (with ActiveEdge)
Pulse Width	Adjustable from 25 ns to 2000 ns, resolution 2.5 ns
Edge Time	<20 ns in 50 ohms load @400V <10 ns in 50 ohms load @150V
Output Impedance	<10 ohms

Receivers

Gain Range	102 dB (-30 dB to 72 dB)
Input Impedance	400 ohms
Filter Bands	Narrow bands centred at 0.5 MHz, 1 MHz, 2.25 MHz 5 MHz, 7.5 MHz, 10 MHz and 15 MHz Broadband at 1 MHz to 18 MHz (-6dB)

Data Acquisition

Digitizing Frequency	50/100/200 MHz
Digitizer Resolution	10 bits/sample
Data Processing	16 bits
Data Recording	Full raw data recorded
Max. A-Scan Length	8192 samples (32 metres in steel LW, 50 MHz, 1:128)
Maximum PRF	20 kHz
Processing	Digital Filters, Smoothing, Contouring, Rejection, Averaging.
Sub-sampling	1:1 to 1:128
Rectifier	RF, Full, Positive, Negative
Trigger Synchronisation	On encoder resolution or internal PRF (both encoded or not)

Scans & Views

Supported Scans	A-Scans & TOFD
Views	A, B, C-Scan, Merged & TOFD

Cursors

Type	Cartesian, Hyperbolic
Measurements	Path Length, Depth, Surface Distance, DAC, AWS, DGS

CONVENTIONAL AND PHASED ARRAY

DAC

Number of Points	16
DAC Quantity	1 with 3 sub-DAC (per focal law in PA)

Time Corrected Gain (TCG)

Number of Points	16
Gain Range	0 to 60 dB
Max Gain Slope	>50 dB/μs

Gates

A-Scan Gates	4 gates per A-scan (3 extracted A-scans per S/L-scan)
Gate Trigger	Flank/Peak
S/L-Scan	2 Extraction Boxes per S/L-scan
Alarm LED	1 (sync on all gates & DACs)
Measurements	Available in A-Scan view Peak & Flank (FSH, dB, Depth, Beam Path Length, Surface Distance), Echo-to-Echo, Floating Gates (reference from IFT)

GENERAL

Data Storage

Internal	6 GB (standard)
External	Hot removable "User" USB8 GB (standard) Only limited by USB key capacity
Transfer Rate	To User Key - Up to 23 MB/s Write mode Up to 27 MB/s Read mode
Data File size	3GB (FAT32 file system)
Typical Scanning Speed	10 to 15 cm/s (3.9 to 5.9 in/s)
Typical Scan Length	>10 m (32.8ft)

Display

Size	25.9 cm (10.2 in) Wide aspect ratio
Resolution	1024 x 600 pixels
Colour	260k (65535 colours for scan palettes)
Type	TFT LCD

I/O Ports

USB Ports	3 x USB certified ports (480 Mbps)
Ethernet	Gbit Ethernet (1000 Mbps)
Video Output	VGA Analog (1024 x 600)

I/O

Encoder	1 or 2 axis quadrature encoder (LEMO connectors) Single ended and differential input
Digital Inputs	2 input lines (5V TTL)
Digital Outputs	4 Output lines (5V TTL, 20 mA) for alarm or other external control
Power Output	5 V, 500 mA, current limited

Interface and Reporting

Integrated Help	Active help & parameter description / Optimization
Language (Dynamic)	Selectable: English, German, French, Spanish, Russian, Chinese, Hungarian, Italian, Portuguese.
Remote Connection	Onboard VNC Server and FTP Server (connection through Ethernet protocol)
Wizards	Configuration, Velocity and Zero, Wedge Delay, Sensitivity, TCG, DAC, DGS, Element Activation, Encoder.
Report Generation	PDF Report (includes customer logo, scan acoustic parameters, measurements, etc.), PNG screen capture
PDF Reader	Allows viewing any uploaded PDF file, scan plan, procedures, old reports etc.

Batteries & Power Supply

Battery Type	Intelligent Li-ion batteries
Number of Batteries	2
Operation	1 battery or 2 batteries, DC Power pack
Battery Replacement	Hot swappable - no tools required
Battery Recharge	Batteries recharge in unit, operating or not
Battery Life	6+ hours (typical operation).

Enclosure

Size	H220 mm x W335 mm x D115 mm (8.66 in x 13.19 in x 4.52 in)
Weight	5.28 kg(11.6 lb) 1 battery/ 5.75 kg (12.6 lb) 2 batteries

Environmental

Temperature	Operating -10 °C to 40 °C (14 °F -104 °F). Storage -25 °C to 70 °C (-13 °F -158 °F)
Relative Humidity	5 to 95% non-condensing
Environmental	Designed to meet IP66

Warranty	1 year.
Calibration Standard	EN12668.
Vibration	EN60068-2-6 Sinusoidal vibration, 50hz to 500Hz, 0.5mm, 18g, 5 sweep cycles
Shock (drop) Tested	According to MIL-STD-810F, Method 516.5, Procedure IV; 26 "1-meter drops" (each face, edge, corner), while operating, to 2 inch plywood over concrete.

Veo 16:128 only

PHASED ARRAY

Pulsers

Configuration	16:128 (16 pulser/receivers; driving up to 128 elements)
Pulse Voltage	-50 V to 130 V (insteps of 10V)
Output Impedance	<32 ohms

Data Acquisition

Trigger Synchronisation	External digital input, encoder or internal

Scan & Views

Multi-Group	Up to 6 scans (6 phased array or 4 phased array with 2UT/TOFD)

Software Options

TOFD	TOFD module includes all acquisition & measurement software tools.
CSV EXPORT	Software function to export view data into a CSV format

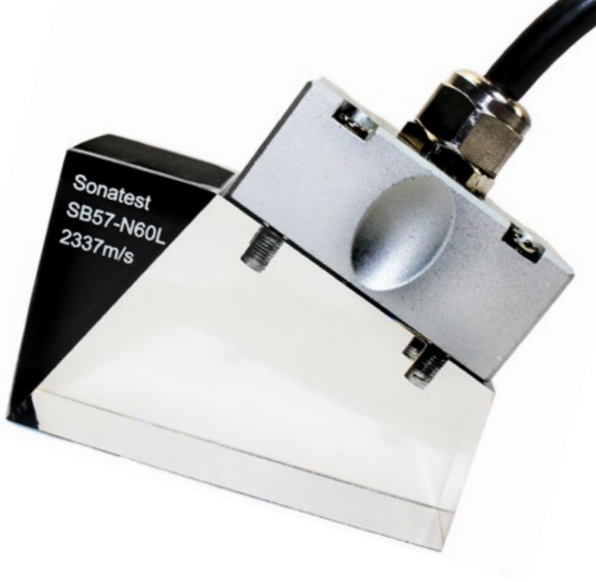
Supported Inspection Codes

Other relevant Codes are also met.

- ASME Code Case 2235-9 Use of Ultrasonic Examination in Lieu of Radiography
- ASME Code Case 2541 Use of Manual Phased Array Ultrasonic Examination Section V ASME • ASTM E2491 Standard Guide for Evaluating Performance Characteristics of Phased-Array Ultrasonic Examination Instruments and Systems
- ASTM E2700 Standard Practice for Contact Ultrasonic Testing of Welds Using Phased Array
- CEN EN 583-6 - Nondestructive testing - Ultrasonic examination - Part 6 -TOFD as a Method for Defect Detection and Sizing
- BSI BS7706 - Guide to Calibration and Setting-Up of the Ultrasonic TOFD Technique for the Detection, Location, and Sizing of Flaws

Phased Array Transducers

X-Series



Building on the Phased Array instrumentation range from Sonatest Ltd, the X-Series of transducers now offer the operator a broader choice in range and frequencies; together with the assurance of industry standard configurations. These X-Series phased array probes have an integral 2.5 metre cable and an IPEX connector, compatible with the Sonatest veo and other leading phased array testing equipment.

X1 Series - Miniature & Sub-Miniature PA Probes

The X1 models are small probes for aerospace and limited access work. Key applications include “Scribe line” inspection.

X2 Series - General Purpose PA Probes

This is a general purpose compact probe design suitable for sector scanning applications.

X3 Series - Long Array Probes for Electronic Scanning

These probes are ideal for Linear Scanning applications (L-Scan or E-Scan).

X4 Series - Miniature Phased Array Probes with Integral Wedge

An integral wedge design which are dimensionally and ultrasonically equivalent to standard European mono-element shear wave probes. A good choice where a compact angle beam is required.

X5 Series - Medium Phased Array Probes - AWS, High Temperature & Deep Penetration

These are low frequency high energy probes intended for fairly deep penetration applications and general testing. These can also be used with the appropriate SW62XXX range wedges, including the “Snail” and high temperature.

DAAH (Detachable Active Array Head)

Sonatest manufacture a wide range of Array and Mono-Element probes suitable for use on the veo and other phased array flaw detectors.

The DAAH (Detachable Active Array Head) range provides a unique phased array probe solution using standard cables and a range of detachable probe heads. This concept yeilds advantages in cost and gives the end user more flexibility in the field during the inspection process.

Frequency (MHz)	Model Number	No.of Elements	Pitch (mm)	Wedge
2.25	T1-PE-2.25M20E1.2P	20	1.2	External
2.25	T1-PE-2.25M14E1.2P-35W0D	14	1.2	35^0 Integral
2.25	T1-PE-2.25M18E1.2P-17W0D	18	1.2	17^0 Integral
5	T1-PE-5.0M32E0.8P	32	0.8	External
5	T1-PE-5.0M22E0.8P-35W0D	22	0.8	35^0 Integral
5	T1-PE-5.0M26E0.8P-17W0D	26	0.8	17^0 Integral
7.5	T1-PE-7.5M44E0.6P	44	0.6	External
7.5	T1-PE-7.5M30E0.6P-35W0D	30	0.6	35^0 Integral
7.5	T1-PE-7.5M40E0.6P-17W0D	40	0.6	17^0 Integral
5 MHz	CWP-05-64-08-05-veo	64	0.8	WheelProbe
2 MHz	CWP-02-64-08-05-veo	64	0.8	WheelProbe

Further transducer models available. Enquire for full range.

veo Kits & Accessories

Standard veo Kit

Calibration Certificate
UT Studio Single user licence
• Conventional Views (A/B/C/D)
• Phased Array Views (S/L-Scan)
• Viewing Reports
USB Memory Stick (8GB)
Lithium-Ion Battery packs x 2
Power Cord & Power Supply adaptor
Couplant
Quick Start Guide & User Manual CD
Screen Protector (Anti-Glare)
Carry Strap
4-point Neck Harness
Transport Case (Airplane carry on size)

veo Kits

- **veo** & Magman Scanner
- **veo** & Corrosion WheelProbe
- **veo** & Manual TOFD
- **veo** & Manual Weld

veo Accessories

Splash Proof USB Keyboard
Waterproof Mouse
Battery Charger
Tripod
Lithium-Ion Battery pack
UT Studio - Professional edition
QuickTrace Encoder
Rapidscan to **veo** Encoder Adapter
DAAH Array probe cable
Screen Protector
USB Memory Stick (8GB)
Phased Array Cable Y-Splitter
Splitter Box (32/32 or 64/64)
TOFD 40 dB Pre-amp
Phased Array Test Block Steel
Phased Array Test Block Aluminium
HD15 Encoder Adapter

Sonatest

bsi. ISO 9001 Quality Management

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