


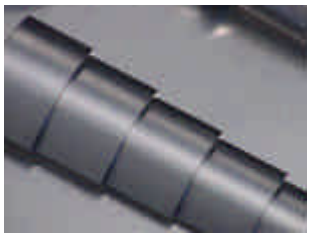

TRANSDUCER

CATALOGUE

SONATEST

THE LEADERS AND INNOVATORS IN THE SCIENCE OF NDT

Sonatest has one over-riding and driving motivation—to design, manufacture and markets the world's best NDT products. The pace of our own R&D investment has increased and we have formed strategic partnerships to provide our customers with an unmatched range of leading edge NDT instruments, transducers and systems. We are delighted to present our growing range of transducers over the next 30 pages.

Our global network of 150 distributors should ensure that excellent technical and after-sales support is available locally. Many of our distributors are offering a transducer certification service.

Sonatest Plc manufacture a complete range of high performance, high technology ultrasonic transducers for general flaw detection and thickness measurement applications. Each transducer is made to exacting standards regarding acoustical, electronic and mechanical properties. Our transducers are tested thoroughly, typically at three stages of manufacture. The complete range of transducer types are available with a variety of connector styles, case configurations, frequencies and element sizes. This catalogue lists our standard-build angle, frequency and diameter configurations only—other combinations are available on request.

Our transducers are used across a wide range of industries including aerospace, automotive, marine, petrochemical, nuclear, power generation, metal and composite fabrication. Applications include a spectrum of inspection and evaluation testing procedures, ie aircraft engine components, nuclear components such as fuel containers, automotive components, petrochemical processing equipment and general high performance, critical materials.

We are sure that you will find the correct product to provide the results that you require. However if you find you require further advice or consultation on specific applications, do not hesitate to contact us. With our expertise and knowledge we guarantee to provide the best NDT solutions for the most challenging of applications. Should you require more detailed information, technical assistance, on-site demonstration, training or a quotation, please contact us and we guarantee a prompt response.

SONATEST PLC

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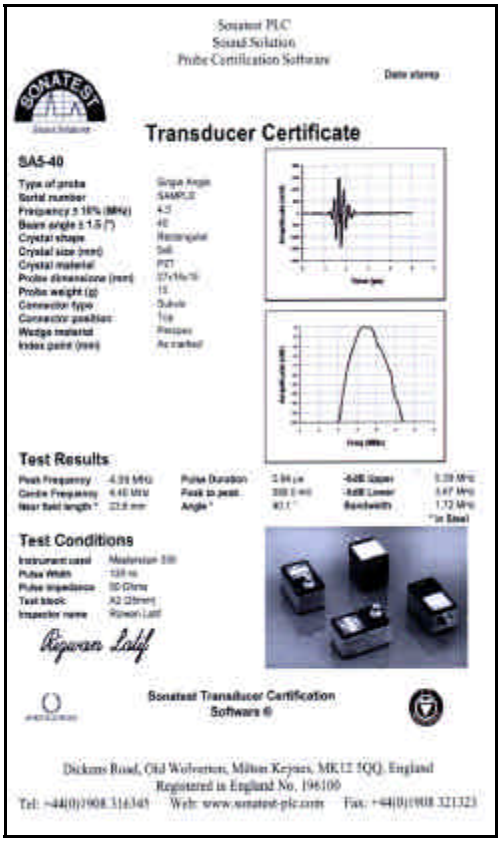
CONTENTS

TRANSDUCER CERTIFICATION - SONACERT

Sonatest Plc now has one of the best and most versatile test and certification systems for transducers. As standard and at no extra cost for each transducer, a high quality certificate is provided with the specific test results of that individual transducer. This information is now stored in an extensive database that includes all the test results, along with the signal waveform and frequency spectrum of that particular transducer. With these results, Sonatest are now able to carry out statistical batch analysis of transducer characteristics and increase the consistency, quality and performance of transducer manufacturing.


Sonatest PLC
Sound Solution
Probe Certification Software

Transducer Certificate

SA5-40

Test Results

Test Conditions

Sonatest Transducer Certification Software ©

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SonaCert is an ultrasonic transducer system that is used to test ultrasonic transducers and generate the relevant certificate. Unlike other ultrasonic systems where there is a need for extra PC hardware, such as a pulser-receiver and analog to digital converter card, SonaCert needs only a PC along with a Sonatest Digital Flaw Detector (a Masterscan 330 or higher spec.). Using a Sonatest Digital Ultrasonic Flaw Detector with your PC, provides exceptionally accurate test results for each transducer.

BENEFITS

- Quality Assurance & Verification of newly purchased transducers.
- Periodic Certification.
- Identification of unlabelled transducers.
- Establishing a cataloguing database and dating.
- Ease and speed of testing.
- Photo Library of Sonatest range available.

MEASUREMENT PARAMETERS

The Probe Tester is programmed in a Microsoft Office environment utilising both Access and Excel. Access is used for it's database and report creation capabilities and Excel for scientific functionalities such as Fast Fourier Transform (FFT).

In accordance with the new European Norms for ultrasonic transducers, the following parameters are measured by the system during the process of certification.

- **Frequency**
  (Peak, -6dB upper, -6dB lower, Centre, Bandwidth)
- **Pulse Length**
- **Signal to Noise**
- **Dead Zone (TX)**
- **Near Field Length**
- **Beam Angle**
- **Probe Output**

Upon completion of the testing procedure, the results are compared to the pre-defined tolerance values, ensuring that the transducer has satisfied all the preset criteria—therefore maintaining and improving standards. SonaCert can be used for all manufacturer's transducers.

The following Applications Table is a Quick Reference Guide to selecting which transducers may be suitable for your specific application or material that requires testing. This guide cannot be absolute or all-inclusive. If your requirements are not listed below please call Sonatest on +44 (0)1908 316345 or email sales@sonatest-plc.com for further advice.

	TRANSDUCER MODEL																				
	LONGITUDINAL											ANGLE									
MATERIAL/APPLICATION	SLH	SLM	SLF	LLF	SLP	SLC	SLG	D	CD	CDF	GEM	ORION	SAO	SA	LSA	HSA	CDA	SLIM	TOFD	TMP	STP
PAGE NO.	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Aerospace Applications				●	●			●	●		●							●		●	
Bars			●			●	●		●	●	●										
Billets			●	●		●	●		●	●	●										
Bond Testing			●					●	●	●	●									●	●
Castings			●	●		●	●		●	●	●	●	●	●	●		●				
Ceramics	●	●			●		●		●		●	●		●							
Composites	●	●		●	●		●		●		●									●	●
Lamination			●			●	●		●	●	●										
Forgings			●	●		●	●		●	●	●	●	●	●	●		●	●			
Glass			●								●									●	
Joints -Brazed/Soldered								●		●	●									●	
Machined Components	●	●			●	●	●	●	●	●	●	●	●	●				●		●	
Thickness Measurement	●							●	●		●								●	●	
Tube & Pipe								●	●		●	●	●	●		●	●	●	●	●	
Welds—critical							●			●	●	●			●	●	●		●		
Welds—general							●			●	●		●	●	●	●	●		●		
White Metal Bearings			●					●	●	●									●		

TRANSDUCER KITS

Transducer Kits are now available, supplying you with a comprehensive range of transducers for specific applications. All transducer kits are supplied with a carrying case.

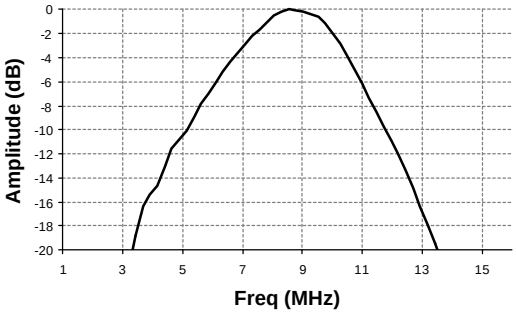
KIT	ORDER CODE
Welding	PTK1
Forging	PTK2
Aircraft	PTK3
Steel	PTK4
Casting	PTK5

SINGLE COMPRESSION—HIGH DAMPED (SLH)

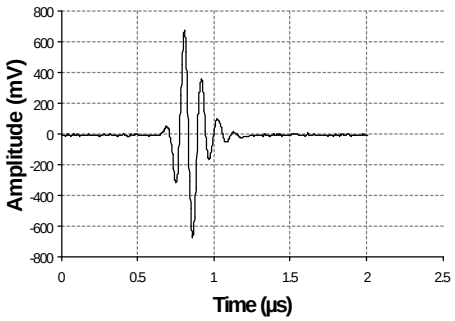
SLH FEATURES

- High damped, low noise, 0º, short pulse, lead metaniobate element providing superior resolution with optimum gain.
- Rugged stainless steel case designed for fatigue free handling, with good grip and stability.
- Ceramic wear face and hardened steel wear ring to maximise transducer service life.
- A regular standard transducer used for testing small to large components of different materials and geometries.

Frequency Spectrum



Signal Waveform

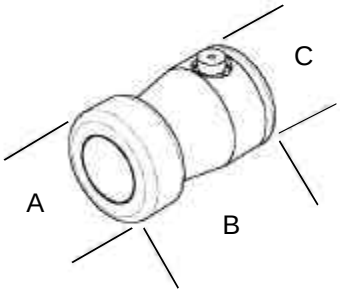


FREQUENT APPLICATIONS

Normal beam flaw detection, detection of delaminations, thickness gauging, metals, glass, ceramics, porcelain, composites.

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SLH 1-25	25	1.25	32	5.0	1.0	50.0
SLH 2-10	10	2.25	9	4.0	1.3	5.0
SLH 2-15	15	2.25	21	4.0	1.5	5.0
SLH 2-20	20	2.25	37	4.0	1.5	8.0
SLH 2-25	25	2.25	59	4.0	1.5	8.0
SLH 4-10	10	4	17	2.0	2.7	3.0
SLH 4-25	25	4	105	2.0	2.3	5.0
SLH 5-10	10	5	21	2.0	2.5	3.0
SLH 5-15	15	5	47	2.0	2.5	3.0
SLH 5-20	20	5	84	2.0	2.5	5.0
SLH 5-25	25	5	131	2.0	2.5	5.0
SLH 10-5	5	10	10	1.5	5.0	2.0
SLH 10-10	10	10	42	1.5	5.0	2.0

* Equivalent distance in steel



DIMENSIONS (mm)

Element Diameter	A	B	C
10 mm	21	32	19
15 mm	26	32	24
20 mm	36	38	34
25 mm	36	38	34

AVAILABLE CONNECTORS:

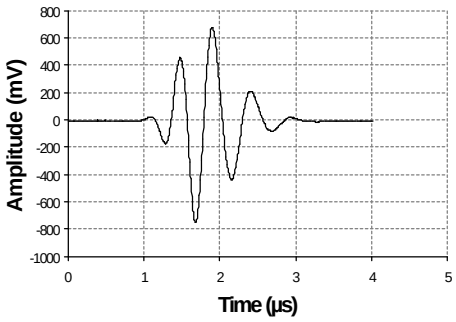
BNC (B)
Lemo 1 (L)
Lemo 00 (Z)
Microdot (D)
Subvis (S)

SINGLE COMPRESSION– MEDIUM DAMPED (SLM)

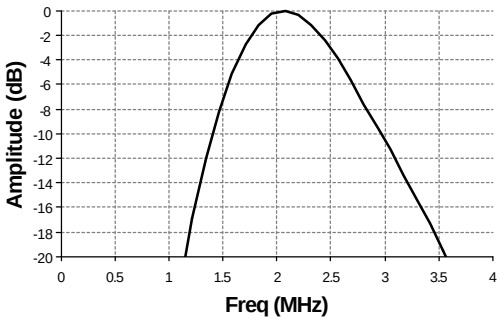
SLM FEATURES

- Medium damped, low noise, 0º, medium pulse width, lead metaniobate element with high gain.
- Tuned to optimise sensitivity, penetration and resolution
- Robust stainless steel case designed for fatigue free handling with stability during hand scanning.
- Ceramic wear face and hardened steel wear ring to maximise transducer service life.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

A regular standard transducer used for testing small to large components of different materials and geometries such as: metals, glass, ceramics, porcelain, composites.

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SLM 1-25	25	1.25	32	10.0	0.5	20.0
SLM 2-10	10	2.25	9	4.0	1.3	10.0
SLM 2-15	15	2.25	21	4.0	1.3	6.0
SLM 2-20	20	2.25	37	4.0	1.3	8.0
SLM 2-25	25	2.25	59	4.0	1.5	8.0
SLM 4-10	10	4	17	3.0	2.3	5.0
SLM 4-25	25	4	105	4.0	5.0	5.0
SLM 5-10	10	5	21	2.0	2.5	3.0
SLM 5-15	15	5	47	2.0	3.0	6.0
SLM 5-20	20	5	84	3.0	3.0	6.0
SLM 5-25	25	5	131	4.0	3.0	6.0
SLM 10-10	10	10	42	1.0	5.0	2.0

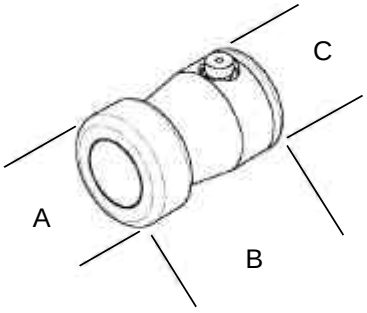
* Equivalent distance in steel

AVAILABLE CONNECTORS:

BNC (B)
Lemo 1 (L)
Lemo 00 (Z)
Microdot (D)
Subvis (S)

DIMENSIONS (mm)

Element Diameter	A	B	C
10 mm	21	32	19
15 mm	26	32	24
20 mm	36	38	34
25 mm	36	38	34

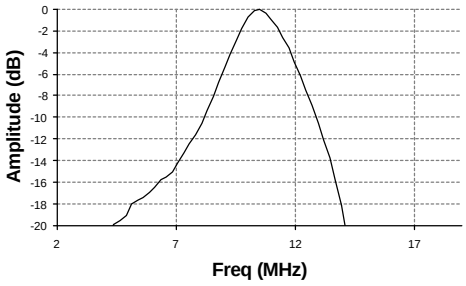


SINGLE COMPRESSION– REPLACEABLE MEMBRANE (SLF)

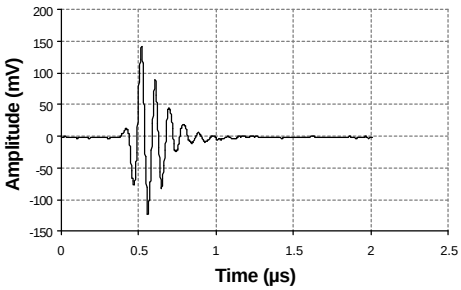
SLF FEATURES

- Medium damped, 0º transducers of high specification for use with replaceable protective membranes or high temperature delay lines.
- Replaceable protective membrane improves contact on rough surfaces & maximises transducer service life.
- Delay line has low thermal conductivity, recommended for use on surface temperatures up to 400ºc (750ºF). Max contact time 8 secs., immediate cooling time in cold water 10 secs..
- Tuned medium damped lead metaniobate element providing low noise with high gain,

Frequency Spectrum



Signal Waveform

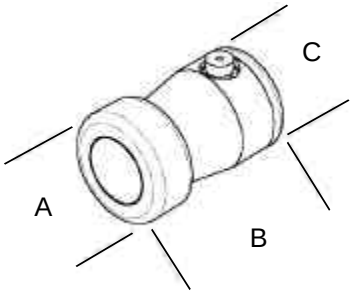


FREQUENT APPLICATIONS

Used for contact testing on rough, cast, pitted or abrasive surfaces with minimal transducer wear, such as: castings, forgings, billets.

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SLF 1-25	25	1.25	32	7.0	0.6	40.0
SLF 2-10	10	2.25	9	5.0	1.0	10.0
SLF 2-15	15	2.25	21	5.0	1.3	10.0
SLF 2-20	20	2.25	37	4.0	1.3	12.0
SLF 2-25	25	2.25	59	7.0	1.0	12.0
SLF 4-10	10	4	17	4.0	1.2	5.0
SLF 4-25	25	4	105	4.0	1.3	10.0
SLF 5-10	10	5	21	4.0	1.5	5.0
SLF 5-15	15	5	47	4.0	1.5	5.0
SLF 5-20	20	5	84	4.0	1.5	8.0
SLF 5-25	25	5	131	4.0	1.5	8.0

* Equivalent distance in steel



DIMENSIONS (mm)

Element Diameter	A	B	C
10 mm	21	32	19
15 mm	26	32	24
20 mm	36	38	34
25 mm	36	38	34

AVAILABLE CONNECTORS:

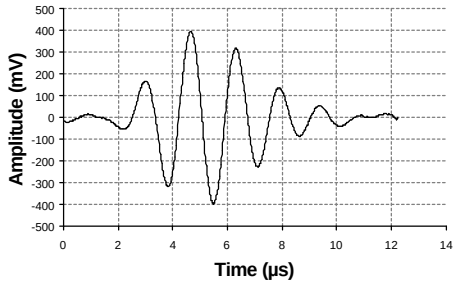
BNC (B)
Lemo 1 (L)
Lemo 00 (Z)
Microdot (D)
Subvis (S)

SINGLE COMPRESSION—LARGE LOW FREQUENCY (LLF)

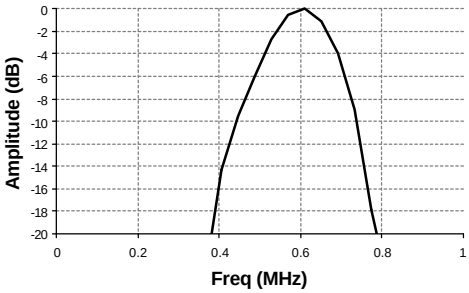
LLF FEATURES

- Medium damped, 0º transducers of high specification for use with replaceable protective membranes.
- Replaceable protective membrane improves contact on rough surfaces & maximises transducer service life.
- Lead metaniobate element providing low noise with high gain.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

Used for contact testing, with minimal transducer wear, on larger or highly attenuative work pieces with rough, cast, pitted or abrasive surfaces such as: castings, forgings, billets.

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution * (mm)
LLF 0.5-34	34	0.5	21	10.0	0.2	175.0
LLF 1-34	34	1.25	60	8.0	0.8	30.0
LLF 2-30	30	2.25	85	5.0	1.0	15.0

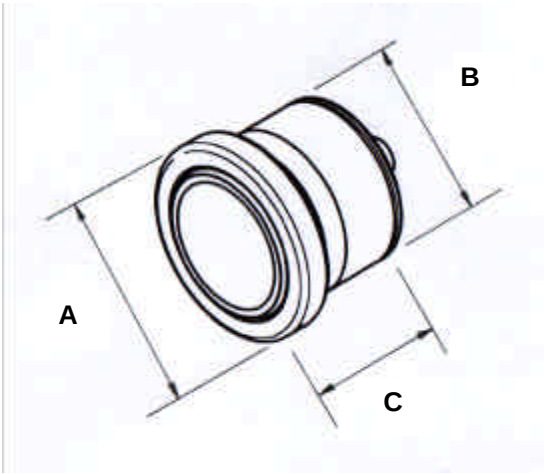
* Equivalent distance in steel

AVAILABLE CONNECTORS:

BNC (B)
Lemo 1 (L)

DIMENSIONS (mm)

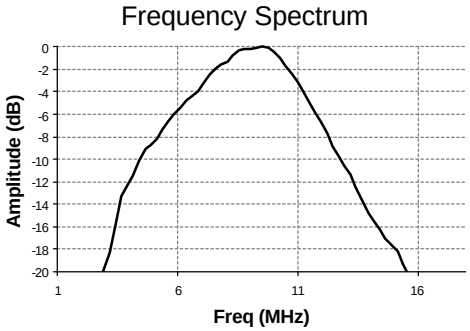
Element Diameter	A	B	C
All	53.5	39	44

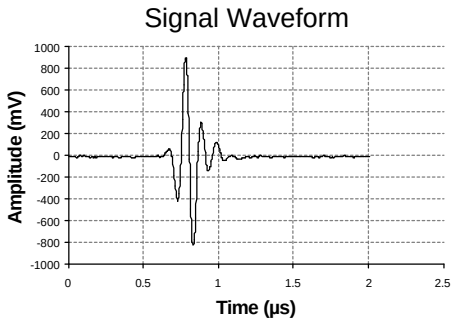


SINGLE COMPRESSION HIGH DAMPED—LOW PROFILE (SLP)

SLP FEATURES

- High damped, low profile, 0º transducers of high specification
- Knurled stainless steel case designed to facilitate entry into areas inaccessible to larger single longitudinal transducers.
- Low noise, lead metaniobate elements provide excellent near and far surface resolution with optimum gain.
- Ceramic-faced with thick-walled stainless steel case for extended wear life and dependability.



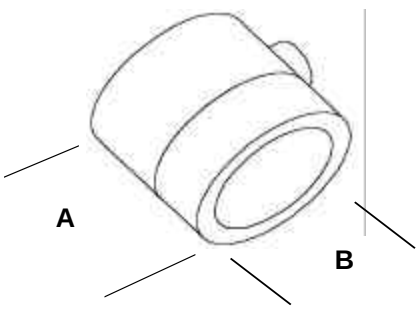


FREQUENT APPLICATIONS

The same damping as with the SLH series but with a low profile housing which allows access to hard to reach areas. Regularly used as a search probe in environments such as aircraft applications, machined components, composites.

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SLP 1-20	20	1.25	20	5.0	1.0	25.0
SLP 1-25	25	1.25	32	5.0	1.0	50.0
SLP 2-10	10	2.25	9	4.0	1.3	5.0
SLP 2-15	15	2.25	21	4.0	1.5	5.0
SLP 2-20	20	2.25	37	4.0	1.5	8.0
SLP 2-25	25	2.25	59	4.0	1.5	8.0
SLP 4-10	10	4	17	2.0	2.7	3.0
SLP 4-25	25	4	105	2.0	2.3	5.0
SLP 5-5	5	5	5	2.0	2.5	2.0
SLP 5-10	10	5	21	2.0	2.5	3.0
SLP 5-15	15	5	47	2.0	2.5	3.0
SLP 5-20	20	5	84	2.0	2.5	5.0
SLP 5-25	25	5	131	2.0	2.5	5.0
SLP 10-5	5	10	10	1.5	5.0	2.0
SLP 10-10	10	10	42	1.5	5.0	2.0

* Equivalent distance in steel



DIMENSIONS

Element Diameter	A	B
5 mm	**12**	**12**
10 mm	**15**	**17**
15 mm	**15**	**22**
20 mm	**15**	**27**
25 mm	**15**	**32**

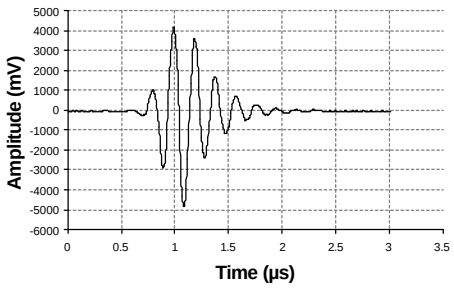
AVAILABLE CONNECTORS:

Microdot (D)
Subvis (S)

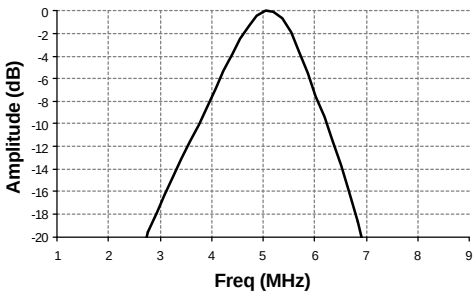
SLC FEATURES

- Low damped, 0º transducers with ceramic wearface for general purpose use.
- Knurled stainless steel case designed to provide grip and reliability for continuous scanning.
- Low damped, lead zirconate elements to provide high gain for maximum penetration.
- Excellent value for money transducers providing high wear resistance.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

These longitudinal contact transducers are suited where power and penetration is more important than near surface resolution: bar and billets

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SLC 1-20	20	1.25	20	7.0	0.8	20.0
SLC 2-10	10	2.25	9	6.0	0.8	10.0
SLC 2-15	15	2.25	21	6.0	0.8	10.0
SLC 2-20	20	2.25	37	5.0	0.9	12.0
SLC 2-25	25	2.25	59	6.0	1.0	12.0
SLC 4-10	10	4	17	3.0	1.5	5.0
SLC 4-15	15	4	38	3.0	1.3	7.0
SLC 4-20	20	4	67	5.0	1.0	10.0
SLC 5-10	10	5	21	3.0	2.0	5.0

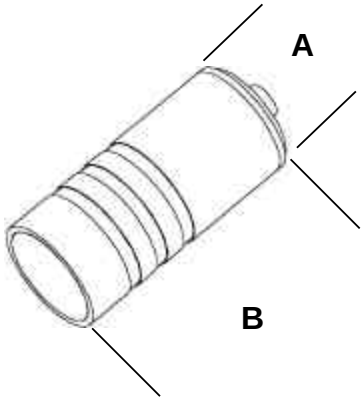
* Equivalent distance in steel

AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)

DIMENSIONS

Element Diameter	A	B
10 mm	**17**	**37**
15 mm	**22**	**44**
20 mm	**27**	**52**
25 mm	**35**	**56**

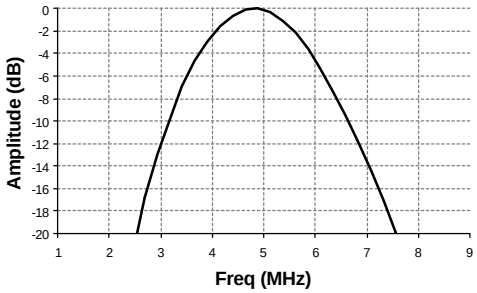


SINGLE COMPRESSION — HIGH DAMPED (SLG)

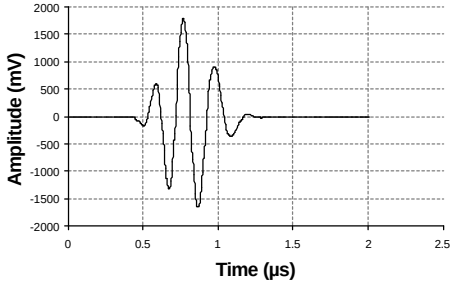
SLG FEATURES

- High damped 0º transducers
- Low noise, lead metaniobate elements provide excellent near and far surface resolution with optimum gain.
- Ceramic faced with stainless steel wear ring for extended wear life and dependability
- Excellent value for money transducers with ergonomic finger grip housing.

Frequency Spectrum



Signal Waveform



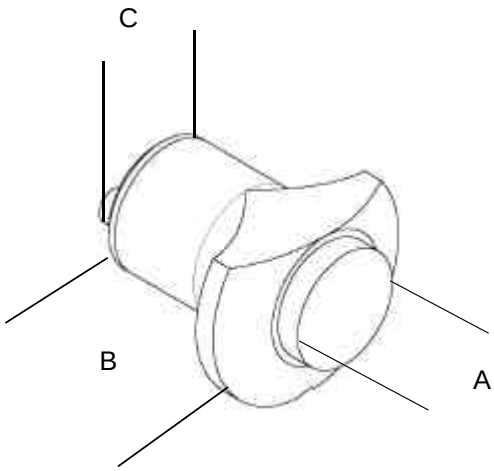
FREQUENT APPLICATIONS

A regular transducer used for testing small and large components of different materials such as:

- Metals
- Ceramics
- Glass
- Porcelain

Code	Crystal Diameter (mm)	Frequency (MHz)	Nearfield Length * (mm)	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SLG 2-10	10	2.25	9	4.0	1.3	5.0
SLG 4-10	10	4	17	2.0	2.7	3.0
SLG 5-10	10	5	21	2.0	2.5	3.0
SLG 10-10	10	10	42	1.5	5.0	2.0

* Equivalent distance in steel



DIMENSIONS (mm)

Element Diameter	A	B	C
10 mm	**17**	**32**	**19**

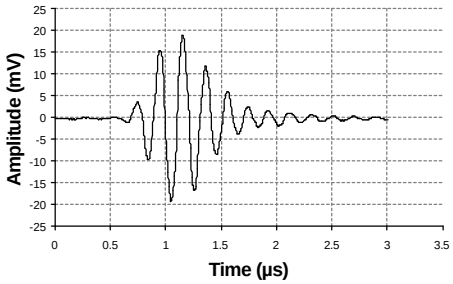
AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)

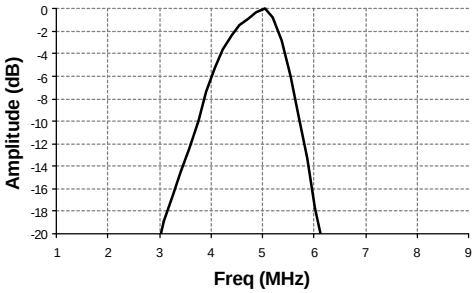
D FEATURES

- Medium damped, 0º, elements provide low noise and high gain.
- Stainless Steel fingertip case with knurled grip.
- Side entry sheath to minimise integral cable damage.
- Acrylic shoes allow for shaping to curvatures.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

For thickness measurement in areas of restricted access and near surface flaw detection.

- Brazed or soldered joints.
- Concave surfaces - white metal bearings.

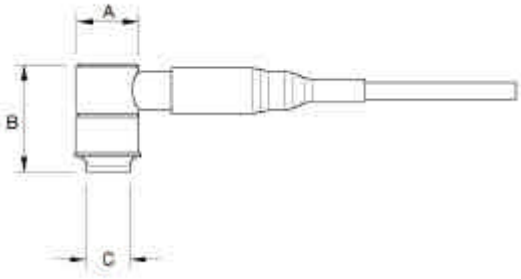
Code	Crystal Diameter (mm)	Frequency (MHz)	Focal Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
D 2-10	10	2.25	7	13	0.5	2.0
D 5-5	5	5.0	6	4	1.4	1.0
D 5-10	10	5.0	7	4	1.4	1.0

AVAILABLE CONNECTORS:

BNC (B)
LEMO 00(Z)
LEMO 1(L)

DIMENSIONS (mm)

Element Diameter	A	B	C
5 mm	**17**	**10**	**7**
10 mm	**17**	**16**	**12.5**

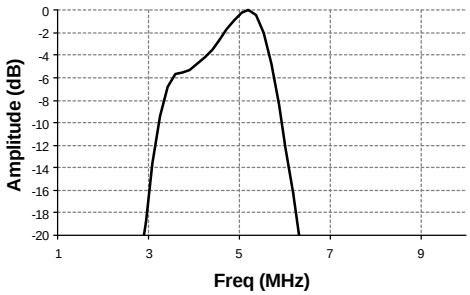


TWIN COMPRESSION — COMBINED DOUBLE (CD)

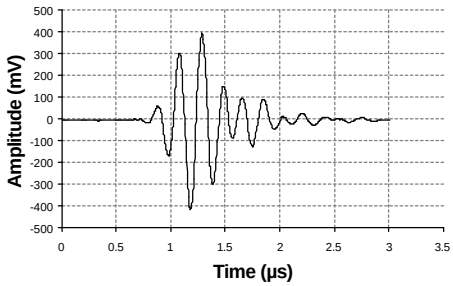
CD FEATURES

- Medium damped, 0º, lead zirconate titanate elements.
- Stainless steel case for durability.
- Perspex shoe allows shaping for curvature.
- Economical transducers for general purpose use.

Frequency Spectrum



Signal Waveform



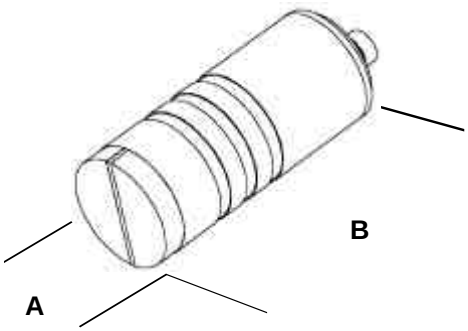
FREQUENT APPLICATIONS

Corrosion inspection, thickness measurement and locations of the defects near the surface. Pipes & vessels, plate, small bore pipework, brazed joint inspection, bond testing on white metal bearings, aerospace applications.

Code	Crystal Diameter (mm)	Frequency (MHz)	Focal Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
CD 1-15	15	1.25	20	12.0	0.4	6.0
CD 1-20	20	1.25	25	14.0	0.4	13.0
CD 2-10	2x4x8	2.25	7	7.0	0.8	2.0
CD 2-15	2x5x13	2.25	16	6.0	0.9	2.0
CD 2-20	2x6x17	2.25	19	6.5	0.8	2.0
CD 2-25	25	2.25	38	6.0	0.8	10.0
CD 5-10	2x4x8	5	15	3.3	2.0	1.5
CD 5-10F[1]	2x4x8	5	9	3.5	2.2	1.5
CD 5-15	2x5x13	5	16	3.0	1.8	2.0
CD 5-20	20	5	25	4.0	1.3	5.0
CD 5-25	25	5	38	6.0	2.0	6.0
CD HT ✧						

* Equivalent distance in steel [1] = Short Focus

✧ High Temperature models are available for use on surface temperatures up to 750ºF (400ºC). A maximum of 5 seconds contact with 10 seconds water cooling



DIMENSIONS

Element Diameter	A	B
10 mm	**17**	**41**
15 mm	**22**	**48**
20 mm	**27**	**56**
25 mm	**35**	**66**

AVAILABLE CONNECTORS:

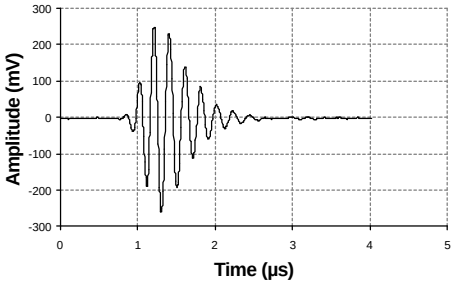
Microdot (D)
Subvis (S)
Lemo 00 (Z)

TWIN COMPRESSION—PROTECTIVE MEMBRANE (CDF)

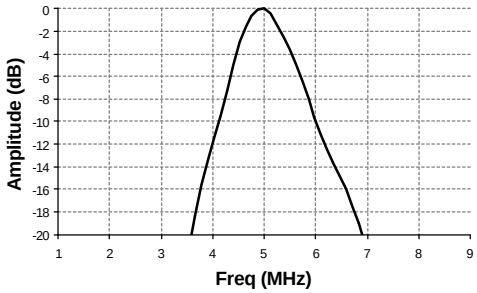
CDF FEATURES

- Medium damped, 0º, twin lead zirconate elements providing low noise with high gain.
- Replaceable protective membrane improves contact on rough surfaces and maximises transducer service life.
- Rugged stainless steel case, specially designed for fatigue free handling, providing firm grip and stability during hand scanning.
- All the advantages of a combined double transducer, with increased wear resistance and longer useful life.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

Used with or without the protective membrane for thickness gauging and near surface flaw detection on: plate, bar, tube & pipe, castings & forgings.

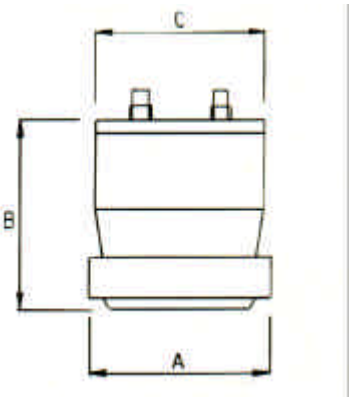
Code	Crystal Diameter (mm)	Frequency (MHz)	Focal Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
CDF 1-25	25	1.25	31	10.0	0.5	5.0
CDF 2-10	10	2.25	15	12.0	0.6	2.5
CDF 2-15	15	2.25	20	9.0	0.8	2.5
CDF 2-20	20	2.25	25	6.2	1.0	5.0
CDF 2-25	25	2.25	31	12.0	0.8	5.0
CDF 5-10	10	5	15	3.5	1.5	2.5
CDF 5-15	15	5	20	3.5	1.4	2.5
CDF 5-20	20	5	25	4.5	1.2	5.0
CDF 5-25	25	5	31	2.7	2.0	5.0

* Equivalent distance in steel

AVAILABLE CONNECTORS:
Microdot (D)
Subvis (S)

DIMENSIONS (mm)

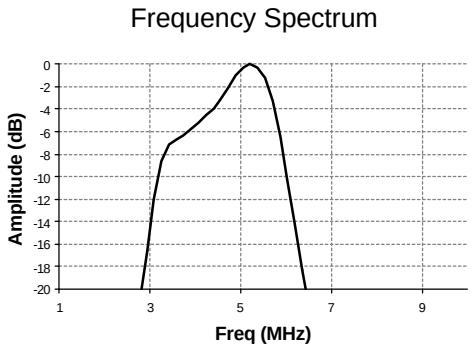
Element Diameter	A	B	C
10 mm	**21**	**34**	**19**
15 mm	**26**	**34**	**24**
20 mm	**36**	**40**	**34**
25 mm	**36**	**40**	**34**

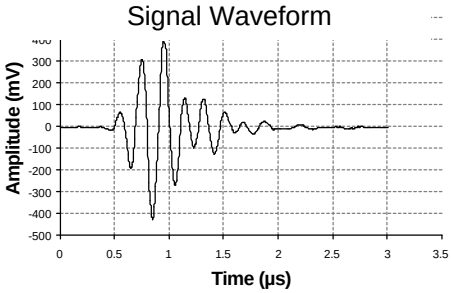


TWIN COMPRESSION—GEMINI (GEM)

GEM FEATURES

- Housed in an ergonomic case providing the user with fatigue free scanning.
- Flat front face allows close access to corners, weld caps and changes of section thickness.
- Suitable for use with most flaw detectors and wide band thickness meters.
- Available in three frequencies 2.0MHz, 4.0MHz and 5.0 MHz.
- Optional wear ring to increase useful life.





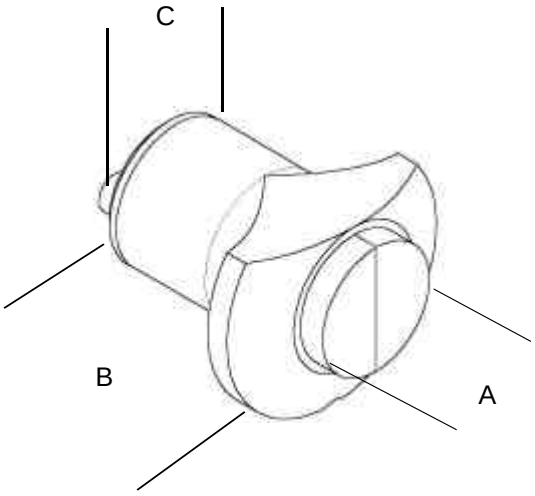
FREQUENT APPLICATIONS

Useful for corrosion inspection, thickness measurement and locations of the defects near the surface. Pipes & vessels, plate, small bore pipework, brazed joint inspection, bond testing on white metal bearings, aerospace applications.

Code	Crystal Diameter (mm)	Frequency (MHz)	Focal Length* (mm) N	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
GEM 2-10	2x4x8	2.25	15	7.0	0.9	2.0
GEM 4-10	10	4.0	15	4.2	1.3	1.5
GEM 5-10	2x4x8	5.0	15	3.3	2.0	1.0
GEM 5-10F	2x4x8	5.0	9	3.3	2.2	1.0
GEM HT✧						

* Equivalent distance in steel

✧ High Temperature models are available for use on surface temperatures up to 750ºF (400ºC). A maximum of 5 seconds contact with 10 seconds water cooling



DIMENSIONS (mm)

Element Diameter	A	B	C
10 mm	**17**	**32**	**19**

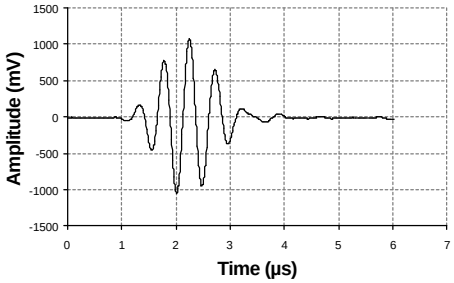
AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)

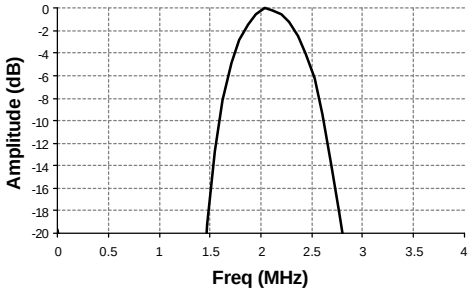
ORION FEATURES

- A high specification shear wave transducer incorporating round crystals to avoid side lobes.
- Orion series are high damped, with high output and excellent signal-to-noise ratio
- Housed in a stainless steel case with forward emission point to enable close access to weld cap, allowing more of the weld area to be inspected.
- Casing scaled in millimetres from the front of the transducer.
- Ergonomically designed for fatigue free scanning and ease of handling, with choice of top or rear connectors.
- Optimally designed shoe and excellent damping for very low internal noise.
- Wide frequency bandwidth provides a narrow pulse width and excellent resolution.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

Critical welds, forgings, components requiring accurate inspection.

Code	Crystal Diameter (mm)	Frequency (MHz)	Beam Angle (deg)	Near Field Length*	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
Orion 2-38	10	2	38	5	3.4	0.8	1.0
Orion 2-45	10	2	45	5	3.4	0.8	1.0
Orion 2-60	10	2	60	7	3.4	0.8	1.0
Orion 2-70	10	2	70	6	3.4	0.8	1.0
Orion 4-38	10	4	38	21	2.0	1.7	1.0
Orion 4-45	10	4	45	24	2.0	1.7	1.0
Orion 4-60	10	4	60	23	2.0	1.7	1.0
Orion 4-70	10	4	70	21	2.0	1.7	1.0

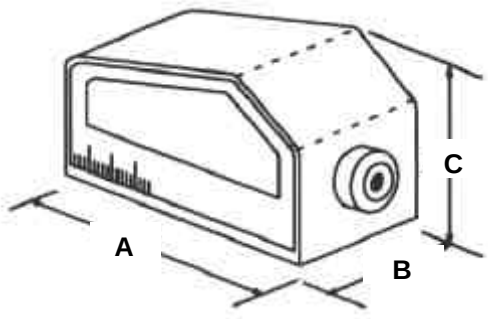
* Equivalent distance in steel

AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)
Top or Rear

DIMENSIONS (mm)

Element Diameter	A	B	C
10mm	**34**	**17**	**26**

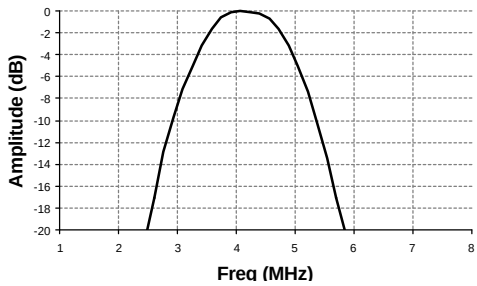


SINGLE ANGLE SHEAR WAVE—SAO

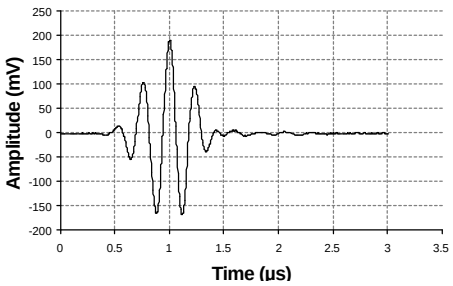
SAO FEATURES

- Medium damped, lead zirconate titanate (PZT) elements tuned to provide optimum gain and resolution for general use.
- Housed in a stainless steel case with the emission point close to the front edge, enabling closer access to the weld cap without affecting the beam and covering even a greater area of the weld under inspection.
- Casing scaled in millimetres from the front of the transducer.
- Ergonomically designed for fatigue free scanning and ease of handling.
- A centre line mark for length measurement provides consistency and accuracy when sizing defects.
- Colour coded labels enable recognition of the angle.
- Acrylic wear plates allow shaping for curvature or repair when worn.
- Sets of 10 plexiglass wear plates 2 mm thick (plus acoustically matched adhesive) are available as a kit and can be ordered separately: code SASK 10/2

Frequency Spectrum



Signal Waveform

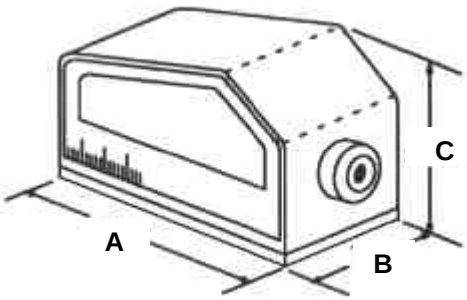


FREQUENT APPLICATIONS

Welds, components requiring inspection by transverse shear wave techniques.

Code	Crystal Size (mm)	Frequency (MHz)	Beam Angle (deg)	Near Field Length*	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SAO 2-38	10x10	2.25	38	19	3.2	0.9	1.0
SAO 2-45	10x10	2.25	45	18	3.2	0.9	1.0
SAO 2-60	10x10	2.25	60	16	3.2	0.9	1.0
SAO 2-70	10x10	2.25	70	14	3.2	0.9	1.0
SAO 2-90	10x10	2.25	90	10	3.2	0.9	0.0
SAO 4-38	8x10	4	38	31	1.3	2.2	1.0
SAO 4-45	8x10	4	45	30	1.3	2.2	1.0
SAO 4-60	8x10	4	60	28	1.3	2.2	1.0
SAO 4-70	8x10	4	70	27	1.3	2.2	1.0
SAO 4-90	8x10	4	90	23	1.3	2.2	0.0

* Equivalent distance in steel



DIMENSIONS (mm)

Element Diameter	A	B	C
All	34	17	27.5

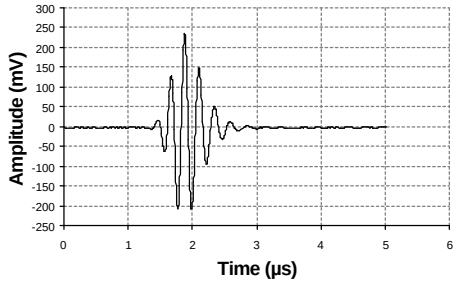
AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)
Top or Rear

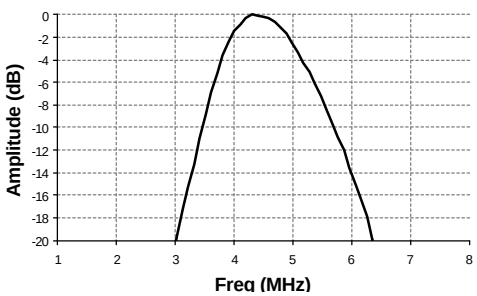
SA FEATURES

- Medium damped lead zirconate titanate element tuned to provide optimum gain and resolution for general purpose use.
- DGS graticules available for 45º, 60º and 70º angle transducers.
- Low internal noise level enhances near surface resolution.
- Stainless steel case for durability, colour coded labels for instant angle recognition.
- 2mm perspex wear plate allowing shaping for curvatures, easy replacement when worn.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

Welds and components requiring inspection by transverse wave techniques.

Code	Crystal Size (mm)	Frequency (MHz)	Beam Angle (deg)	Near Field Length*	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
SA 2-35	10x10	2.3	35	20	4.5	0.6	5.0
SA 2-38	10x10	2.3	38	19	4.0	0.7	5.0
SA 2-45	10x10	2.3	45	18	4.0	0.7	1.0
SA 2-60	10x10	2.3	60	16	4.0	0.7	1.0
SA 2-70	10x10	2.3	70	15	3.0	0.8	1.0
SA 2-80	10x10	2.3	80	14	4.5	0.6	1.0
SA 2-90	10x10	2.3	90	13	1.8	1.5	0.0
SA 5-35	8x10	4.3	35	34	1.5	1.8	1.0
SA 5-38	8x10	4.3	38	34	1.5	1.8	1.0
SA 5-45	8x10	4.3	45	33	1.5	1.8	1.0
SA 5-60	8x10	4.3	60	31	1.5	1.8	1.0
SA 5-70	8x10	4.3	70	30	1.5	1.8	1.0
SA 5-80	8x10	4.3	80	29	1.8	1.8	1.0
SA 5-90	8x10	4.3	90	28	1.8	1.5	0.0

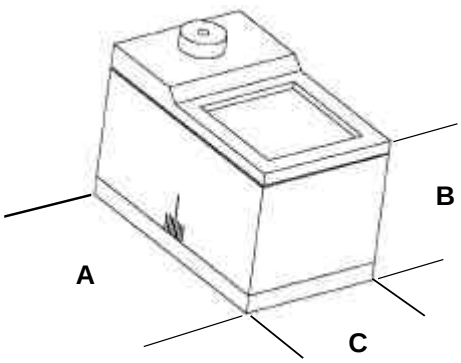
* Equivalent distance in steel
High temperature models of the SA probe are also available

AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)
Top or Rear

DIMENSIONS (mm)

Connector Type	A	B	C
S&D	**27**	**19**	**16**
Z	**27**	**24**	**16**

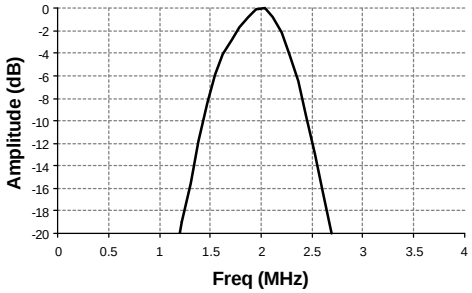


LARGE SINGLE ANGLE SHEAR WAVE— LSA

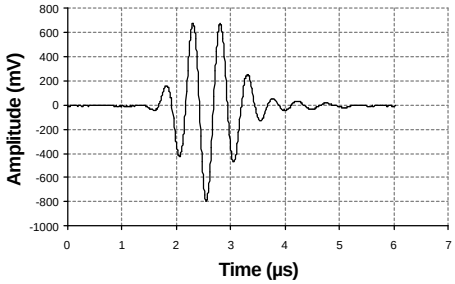
LSA FEATURES

- Large single angle shear wave transducers appropriate for large testing areas or where extra penetration is required.
- Medium damped, lead zirconate titanate circular elements provide low noise and high output.
- Housed in stainless steel case with epoxy tops and finger push.
- Colour coded labels enable recognition of the incidence angle in steel.
- Acrylic wear plates allowing shaping for curvature and ease of replacement when worn.
- Sets of 10 plexiglass wear plates 2 mm thick plus acoustically matched adhesive is available as a kit and can be ordered separately: code SASK 20/1.

Frequency Spectrum



Signal Waveform

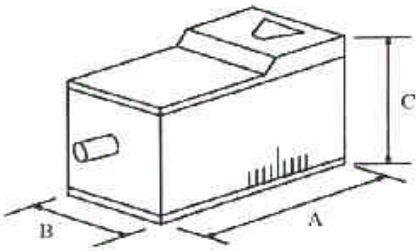


FREQUENT APPLICATIONS

Large workpieces, weldments, forgings, castings, shafts.

Code	Crystal Diameter (mm)	Frequency (MHz)	Beam Angle (deg)	Near Field Length*	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
LSA 1-35	20	1.25	35	30	6.0	0.4	5.0
LSA 1-45	20	1.25	45	28	6.0	0.4	2.0
LSA 1-60	20	1.25	60	24	6.0	0.4	1.0
LSA 1-70	20	1.25	70	21	6.0	0.4	1.0
LSA 2-35	20	2.25	35	61	3.0	0.8	2.0
LSA 2-45	20	2.25	45	59	3.0	0.8	1.0
LSA 2-60	20	2.25	60	55	3.0	0.8	1.0
LSA 2-70	20	2.25	70	52	3.0	0.8	1.0
LSA 2-80	20	2.25	80	49	3.0	0.8	1.0
LSA 2-90	20	2.25	90	47	3.0	0.9	0.0
LSA 4-35	20	4	35	115	1.8	1.4	1.0
LSA 4-45	20	4	45	113	1.8	1.4	1.0
LSA 4-60	20	4	60	110	1.8	1.4	1.0
LSA 4-70	20	4	70	107	1.8	1.4	1.0

* Equivalent distance in steel



DIMENSIONS (mm)

Element Diameter	A	B	C
All	**50**	**26**	**34**

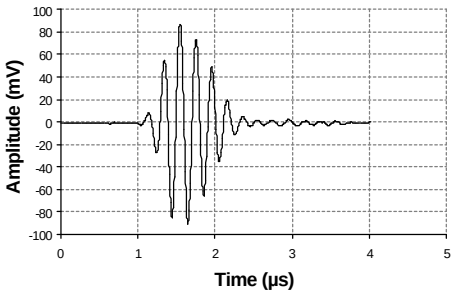
AVAILABLE CONNECTORS:

Lemo 00 (Z)
Microdot (D)
Subvis (S)
Top (on request)
Rear as standard

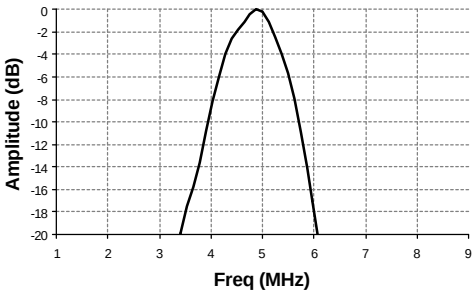
CDA FEATURES

- Combined double shear wave transducers for general purpose use.
- Medium damped lead zirconate titanate (PZT) elements with a 6° toe-in angle for optimum near surface resolution and tuned to provide maximum gain.
- 2mm perspex wear plate allowing shaping for curved surfaces.
- Replacement shoes available when worn: code CDASK 10/1.

Signal Waveform



Frequency Spectrum



FREQUENT APPLICATIONS

- The detection and evaluation of small flaws which occur directly under the surface of the test object or in areas not accessible with compression probes.
- Testing of small components with low attenuation to transverse or shear waves, such as radial cracks or corrosion cracks on the inside of thin-walled containers.
- Detection of transverse cracks on heat exchanger tubes.

Code	Crystal Diameter (mm)	Frequency (MHz)	Beam Angle (deg)	Near Field Length*	Pulse Length* (mm)	Band-width (MHz)	Near Surface Resolution* (mm)
CDA 2-45	2x10x5	2.1	45	22	5	0.6	5.0
CDA 2-60	2x10x5	2.1	60	20	5	0.6	2.0
CDA 2-70	2x10x5	2.1	70	19	5	0.6	1.0
CDA 5-45	2x8x5	4.6	45	22	2	1.3	3.0
CDA 5-60	2x8x5	4.6	60	21	2	1.3	2.0
CDA 5-70	2x8x5	4.6	70	20	2	1.3	1.0

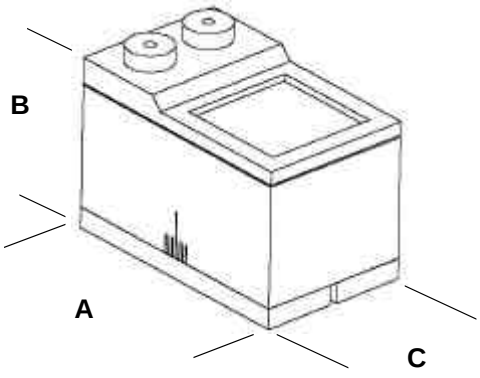
* Equivalent distance in steel

AVAILABLE CONNECTORS:

Microdot (D)
Subvis (S)
Top (T)
Rear (R)

DIMENSIONS (mm)

Element Diameter	A	B	C
All	**27**	**19**	**16**

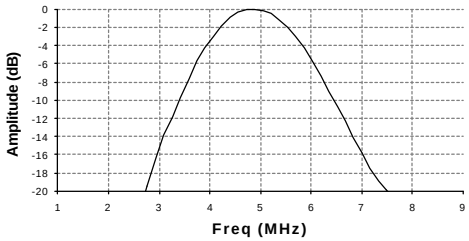


IMMERSION TRANSDUCERS - SLIH & SLIM

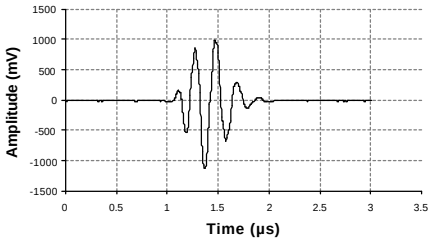
FEATURES

- Single longitudinal (compression) wave transducers medium damped and high damped.
- Medium damped elements provide an optimum combination of resolution and superior gain.
- High damped elements give excellent resolution with optimum sensitivity.
- Stainless steel case with UHF connectors.
- Epoxy face acoustically matched to water, lead metaniobate elements.
- Flat faced or focussed for spherical or line focussing (available at extra cost).

Frequency Spectrum



Signal Waveform



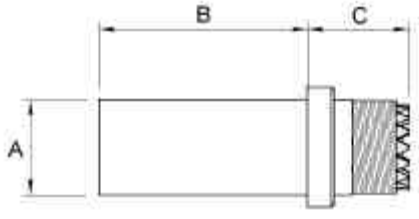
Code	Crystal Diameter (mm)	Frequency (MHz)	Near Field Length (in water)	Focal Distance SF or CF (mm) Min	Max
SLIM 2-10	10	2.25	38	21	34
SLIM 2-15	15	2.25	85	28	76
SLIM 2-25	25	2.25	237	56	210
SLIM 5-5	5	5.0	21	No focussing available	
SLIM 5-10	10	5.0	84	21	76
SLIM 5-15	15	5.0	190	28	170
SLIM 5-25	25	5.0	527	56	210
SLIM 10-5	5	10.0	42	21	37
SLIM 10-10	10	10.0	168	21	110
SLIH 2-10	10	2.25	38	21	34
SLIH 2-15	15	2.25	85	28	76
SLIH 2-25	25	2.25	237	56	210
SLIH 5-10	10	5.0	84	21	76
SLIH 5-15	15	5.0	190	28	170
SLIH 5-25	25	5.0	527	56	210
SLIH 10-5	5	10.0	42	21	37
SLIH 10-10	10	10.0	168	21	110
SLIH 15-5	5	15.0	63	21	56
SLIH 15-10	10	15.0	253	21	210

FREQUENT APPLICATIONS
For use in semi–automatic or fully-automatic testing for critical components using a water path to detect small flaws, with reproducibility of test results for the scanning of metal and composite parts for flaw detection, bond testing or on-line thickness gauging. C-scan or B-scan imaging of components.

- SLIM for medium damped and SLIH for high damped.
- Order by transducer code followed by SF for Spherical focussing or CF for Cylindrical focussing.

AVAILABLE CONNECTORS:

UHF



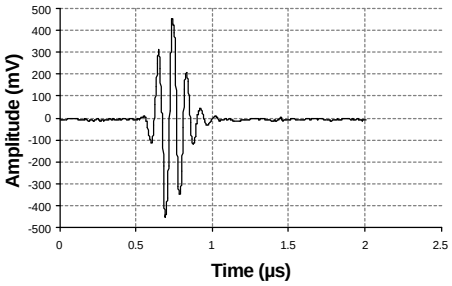
DIMENSIONS (mm)

Element Diameter	A	B	C
5 mm	**16**	**35**	**13**
10 mm	**16**	**35**	**13**
15 mm	**25**	**35**	**13**
25 mm	**35**	**35**	**13**

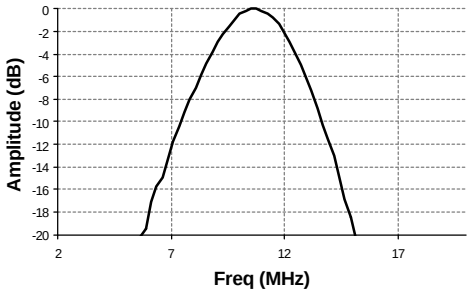
FEATURES

- All TOFD transducers are highly damped with short pulse length, broad bandwidth and high sensitivity, utilising lead metaniobate crystals.
- There are four different waves involved in a TOFD image:
  - A longitudinal wave generated by the transmitter and partially transformed into a spherical wave when the beam crosses the tip of the defect.
  - The lateral wave that flows on the surface between the two transducers.
  - The longitudinal wave reflected by the backwall.
  - The shear waves generated by the mode conversion L/T on the interface of discontinuities.

Signal Waveform



Frequency Spectrum



20 mm

12 mm

6 mm

TRANSDUCERS

Code	Crystal Diameter (mm)	Frequency (MHz)
TF2-6	6.25	2
TF2-12	12.5	2
TF2-20	20.0	2
TF5-6	6.25	5
TF5-12	12.5	5
TF5-20	20.0	5
TF10-6	6.25	10
TF10-12	12.5	10

FREQUENT APPLICATIONS

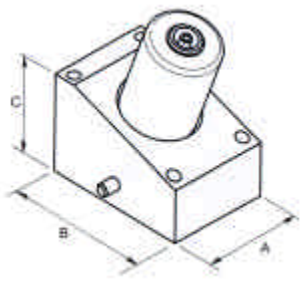
One of the major applications of TOFD is the ultrasonic examination of welds after final heat treatment and/or hydraulic testing, to verify the absence of cracks not detectable by radiography and to prove conformity with prior ultrasonic manual examination carried out during construction.

Another current application of TOFD is its use in monitoring welds during the service life of components. Stored data acquired from initial examinations, made during the final stage of construction, can be compared with new data obtained from in-service inspection.

WEDGES

Code	Crystal Diameter (mm)	Frequency	Wedge Dimensions		
			A	B	C
TFW6-XX	6	2, 5, 10	20	24	17
TFW12-XX	12	2, 5, 10	25	36	25
TFW20-XX	20	2, 5	35	40	35

Where XX equals the angle required



AVAILABLE CONNECTORS:
Lemo 00 (Z)
Subvis (S)

APPLICATION SPECIFIC TRANSDUCERS

Sonatest Plc are capable of manufacturing a wide range of transducers to suit any application. If you cannot find the appropriate transducer in the catalogue, Sonatest Plc will develop a "Special" transducer specifically for your application requirements. EMATS are now available.

Over the last 40 years Sonatest Plc have manufactured Special Transducers for many different applications ranging from the rail industry to the aerospace industry.

THE RAIL PROBE

One example of our capabilities with "Specials" is the Rail Probe. The Rail Probe was specifically designed to have two angle probes (2MHz, 70°) at either end and a compression probe in the middle (2MHz). This probe is used in combination with a flaw detector on a railcart to scan rails. The Rail Probe has proved to be a very successful transducer which is manufactured today exclusively by Sonatest Plc.

HIGH FREQUENCY WHEEL PROBE

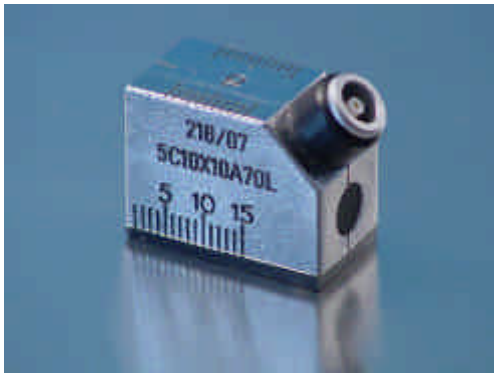
Applications include thickness measurement, composite inspection, delamination detection and general flaw detection.

A new high frequency dry coupled wheel probe developed and patented by Sonatest Plc.

This new dry coupled solid contact wheel probe, overcomes problems with couplant contamination, application and removal, plus the impracticalities of immersion systems. The "tyre" or delay material is constructed from specific hydrophilic polymers which demonstrate acoustic properties that ideally lend themselves to the implementation of Ultrasonic NDT. Frequencies of 2 to over 10 MHz are possible—offering higher sensitivity and resolution. Also capable of employing pulse echo mode this enables depth measurements and examination options where access is limited. The HF Wheel Probe can be used in situ, reducing inspection time and eliminating the need for immersion tanks.

BOILER TUBE PROBES (BTPs)

Small low profile twin angle beam transducers with integral cables for the inspection of welds in steam boilers in power stations. Axially radiused to suit 50mm boiler tubes. 5MHz, with an increased toe in angle to produce a short focal length to suit these welds and available as 70° and 60° with BNC or LEMO 1 connectors to fit flaw detectors.



ASIA SINGLE ANGLE RANGE

A high specification transducer with high signal to noise ratio and a very small dead zone. Employs a lead zirconate 10 x10 crystal, with the standard Japanese reference number engraved on the side of the brass/nickel plated casing—5C10x10A70L. Also has an engraved scale. The index point is 10 mm from the front edge with an angle tolerance of >69º <70º.
Connectors are Mini Lemo 00 or G-Plug.
Part No: ASA5-70ZT or GT. Also at available 45º and 60º.

THICKNESS METER PROBES (TMPs)

Code	Crystal Diameter	Frequency	Type	Size	Connector
TMP1	2x8x4	5.0	Twin	17Ø x 41	S or D
TMP1HT	2x8x4	5.0	Twin	17Ø x 41	S or D
TMP2	2x13x5	2.25	Twin	22Ø x 48	S or D
TMP2HT	2x13x5	2.25	Twin	22Ø x 48	S or D
TMP3	6 mm Ø	10.0	Single Delay	12.5Ø x 22	S or D
TMP4	2x5x2.5	5.0	Twin	12Ø x 15	Integral Lead
TMP5	2x8x4	2.25	Twin	17Ø x 41	S or D
TMP6	15 mm Ø	1.25	Twin	22Ø x 48	S or D

A range of transducers that were made for use with older style thickness meters. These are still suitable for use with modern wideband amplifier thickness meters. TMPs may also be used with flaw detectors where thin sections are to be tested.

SOFT TIP PROBES (STPs)

Code	Contact Diameter	Frequency	Dimensions	Spare Tips
STP5-1	5	1.25	9.8 x 30	RST/5
STP5-2	5	0.5	9.8 x 30	RST/5
STP10-1	10	1.25	20 x 36	RST/10
STP10-2	10	0.5	20 x 36	RST/10
STP15-1	15	1.25	25 x 36	RST/15
STP20-1	20	1.25	30 x 36	RST/20
STP25-1	25	1.25	35 x 36	RST/25

Soft tipped transducers, as well as roller probes, are for use with Sonatest dry contact flaw detectors, UFDS and the Masterscan 310D.

Applications include the testing of composites, rubber, wood, ceramics and friction material. No surface preparation is required for the majority of applications. Ideally suited for test specimens with complex shapes. Operating in through transmission mode using two transducers

ROLLER PROBES

Code	Frequency	Roller Diameter	Dimensions	Spare Tyres
RP25HS-1	1.25	25	36 x 113	PT25
RP25HS-2	0. 5	25	36 x 113	PT25

Dry contact roller probes are used where automated testing is required. Roller probes have miniature BNC connectors.

If there is not a transducer available here for your application, we can build one that will be.

CABLES & ADAPTERS

CABLE TYPE		PART NUMBER	ORDER CODE
Lemo 1 to Subvis	Single Twin	PC-LS TPC-LS	152056 152061
Lemo 1 to Microdot	Single Twin	PC-LD TPC-LD	152057 152026
Lemo 1 to Lemo 00	Single Twin	PC-LZ TPC-LZ	152076 152088
Lemo 1 to Lemo 1	Single Twin	PC-LL N/A	152074 N/A
Lemo 1 to UHF*	Single Twin	PC-LU N/A	152059 N/A
Lemo1 to BNC	Single Twin	PC-BL N/A	152055 N/A
BNC to Subvis	Single Twin	PC-BS TPC-BS	152022 152023
BNC to Microdot	Single Twin	PC-BD TPC-BD	152052 152060
BNC to Lemo 00	Single Twin	PC-BZ TPC-BZ	152086 152087
BNC to BNC	Single Twin	PC-BB N/A	152053 N/A
BNC to UHF*	Single Twin	PC-BU N/A	152058 N/A
BNC to Lemo 1	Single Twin	PC-BL N/A	152055 N/A
BNC to mini BNC	Single Twin	PC-BN N/A	152054 N/A
Lemo 00 to Lemo 00	Single Twin	PC-ZZ TPC-ZZ	152122 RFQ
Fischer to Lemo 00	Single Twin	PC-FZ TPC-FZ	152124 152129
Fischer to Lemo 1	Single Twin	PC-FL N/A	152126 N/A
Fischer to Microdot	Single Twin	PC-FD TPC-FD	152128 152131
Lemo 00 to Microdot	Single Twin	PC-ZD TPC-ZD#	152102 152115 #
Lemo 00 to Subvis	Single Twin	PC-ZS TPC-ZS	152123 152108
Fischer to Subvis	Single Twin	PC-FS TPC-FS	152125 152130
Fischer to BNC	Single Twin	PC-FB N/A	152127 N/A

LEMO-1

LEMO-00

SUBVIS

MICRODOT

BNC

MINI BNC

FISCHER

UHF

*** Waterproof**

ADAPTERS	ORDER CODE
UHF (M) to BNC (F)	136166
UHF (F) to UHF(F)	136167
BNC (M) to BNC (F)	136168
BNC (F) to LEMO 1 (M)	136169
BNC (M) to LEMO 1 (F)	152018
BNC (M) to UHF (F)	136178

(F) FEMALE
(M) MALE

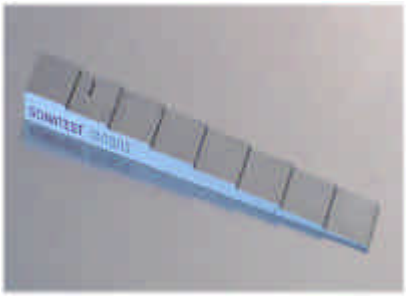
All cables are 2 meters in length, except where marked #, these are 1 metre in length. Specific cable lengths can be manufactured, to order, and are designated "SPC/STPC".

Other connector types are available on reques

Calibration Block 1 (EN12223) A steel block for the calibration of ultrasonic flaw detection and inspection equipment used in material testing. Used for the calibration of shear and longitudinal transducers, determination of shear wave emission point, refracted angle. Also for measurement of sensitivity and resolution.
Product Code V1.

Calibration Block 2 (EN27963) For the ultrasonic examination of welds. To check angle transducers for beam angle and index point. Available in 12.5mm and 20mm thickness.
Product Code V2

Sonatest Universal CBU Calibration Block. For calibration of small shear wave and longitudinal transducers, determination of shear wave emission point, refracted angle and measurement of sensitivity and depth resolution. 50 mm radius.
Product Code CBU



Steel Step Wedge
1mm to 8mm in 1mm steps. Each step is 20mm x 20mm. Used for checking the sensitivity of twin transducers on thin sections when using a flaw detector.
Product Code VW

Steel Pipe Wedge
Made from 50mm diameter pipe with thickness steps of 10, 8, 6, 4 and 2mm. This pipe wedge simulates steam boiler tubes in power stations and is used to calibrate flaw detectors for thin tube inspection.
Product Code PW

Calibration Step Wedge Metric Series of steel discs set into a perspex block for calibration and linearity checking of thickness meters and flaw detectors. Wedge thicknesses 1.5, 2.5, 5.0, 10.0, 15.0, 20.0 mm.
Product Code CBM

Calibration Step Wedge Imperial Series of steel discs set into a perspex block for calibration and linearity checking of thickness meters and flaw detectors. Wedge thicknesses 0.05, 0.1, 0.2, 0.3, 0.4, 0.6 in..
Product Code CBI

Velocity Block. Equivalent to a 1µs thickness of a known velocity in steel. The block is mounted on perspex. Used to check the velocity of other materials with thickness meters.
Product Code CBV

SONAGEL

Sonatest present a full range of stable gels specifically designed for ultrasonic inspection. Thixotropic properties provide excellent wetting and acoustic transmission. The Sonagel range is non-corrosive to metals, non-toxic and safe to the user and the environment.

SONAGEL W

- A stable clear yellow gel specifically designed for the ultrasonic inspection of all types of surfaces and is especially suited to solving the problems of rough, pitted and uneven surfaces.
- Sonagel W is non-flammable and operates in the temperature range of –10ºC to 60ºC.
- Contains a special tracer dye to enable areas to be checked for coverage and is easily removed with water, alcohol or similar solvent.

SONAGEL WT

- Is similar to Sonagel W but is a stable clear thixotropic gel specially designed to be odourless and colourless for specific applications

SONAGEL O

- Sonagel O is a stable semi-transparent orange gel and is intended as a replacement for mineral oils and greases. It is hydrocarbon-based and retains its gel state without causing corrosion or drying on the test surface. Sonagel O has a flash point of 175ºC (PM) and operates in the temperature range of –10ºC to 160ºC.

SONAGEL HT1

- HT1 is a thick translucent paste designed for ultrasonic inspection up to 300ºC. It is non-toxic and safe to the environment, does not generate any toxic fumes at elevated temperatures and is free from volatile organic compounds.
- This product is also available in a number of different liquid viscosities.

SONAGEL OP

- Sonagel OP is a hydrocarbon based, low viscosity product specifically created for pump systems where water-based products are not suitable due to corrosion.

SONAGEL LCW

- Sonagel LCW is a liquid corrosion inhibi-tor concentrate for water-based systems which improves wetting in a large dip tank or spray system.

All of the above products are available in bulk plastic containers of 25 litres down to 0.125 litre bottles.

All products conform to relevant military, automotive and aerospace specifications as well as meeting the sulphur and halogen requirements of nuclear and industrial specifications.

FEATURES OF A TRANSDUCER

▪ FREQUENCY

Frequency selection involves a trade-off between penetration, small flaw detectability and sensitivity. Lowering frequencies increase penetration and raising the frequency increases the ability to detect small flaws. By increasing the bandwidth of a transducer, penetration can usually be increased without sacrificing resolution. Generally, flaws as small as one-half wavelength can be reliably detected.

▪ ELEMENT SIZE

The best aim is to select the smallest element size that is consistent with the frequency/beam spread characteristics that are compatible with your scan rate requirements. In flat faced transducers, element size indicates the width of material that can be inspected with one pass. In focused immersion transducers, the element size will be relative to the 'depth of field' of the focused unit. In low frequency transducers a very small element diameter will cause excessive beam divergence. In any given element size, these effects of divergence can be lessened by increasing the frequency.

▪ BANDWIDTH

Performing over a large frequency range, broadband highly damped (shock wave) transducers are responsive to frequencies extending above and below their nominal values. Their advantage lies in the inspection of materials which have large acoustical absorption or scattering effects, or wherever high resolution flaw testing is a prime consideration. Generally used for high resolution thickness gauging of thin materials while utilizing contact, delay – line and immersion testing techniques, broadband transducers afford maximum resolution in detecting flaws near the front and far surfaces of test materials.

Broadband highly damped transducers exhibit critically damped pulse characteristics which are essential for error-free thickness gauging and high resolution flaw detection. Narrowband, moderately damped, transducers provide maximum material penetration and sensitivity. Recommended for the majority of flaw detection applications these transducers are ideal where known frequency specifications exist. Since the sensitivity bandwidth is limited in a narrowband transducer, it has greater output at the centre frequency. Narrowband transducers generally contain tuning networks as an integral part of the transducer assembly and this optimizes the transducer frequency characteristics of the flaw detector, maximizing bandwidth sensitivity. Sonatest narrowband transducers are tuned to within ± 10% of the nominal frequency.

▪ LENS CONFIGURATION

To give optimum and reliable performance on a range of testing materials under a range temperatures, Sonatest Plc provide transducer lens configurations.

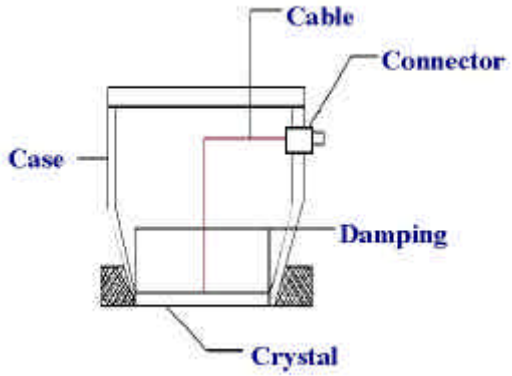
Contact transducers have flat aluminium oxide wear surfaces to enable resistance to abrasion. Some models feature removable membranes to increase coupling on rough surfaces. The epoxy covering on angle beam transducers allows an improved acoustical match into the lucite wedge for added sensitivity. Delay line transducers have either fixed or removable delay tips made of polystyrene or special high temperature resistant materials that retard wear. To match surface curvatures and maximize test reliability, the surface of these delay tips maybe contoured. In immersion testing the transducer lens configuration determines whether the beam will focus to a single spot or line configuration in the test material. Choosing an optimal focal length and shape (line or spot) while considering their relationship to element size and 'depth of field' is crucial to proper immersion transducer selection.

TYPES OF TRANSDUCER

SINGLE COMPRESSION TRANSDUCERS
(pages 6-12)

Single element or straight beam transducers are used to measure thickness and to detect flaws on plates, bars, forgings, castings and extrusions. During testing they are applied directly to the flat surfaces of the test material or object. Transducers with smaller diameters can be applied to test slightly curved materials.

Single element contact transducers work by emitting compression (longitudinal) waves into the test material. Due to the fact that this type of transducer comes into direct contact with test materials when being used, the wear plates are constructed with highly durable material.

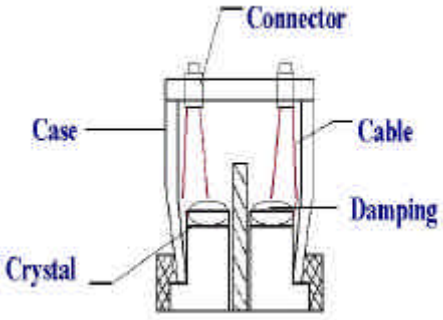


TWIN COMPRESSION TRANSDUCERS
(pages 13-16)

Dual element contact (pitch-catch) transducers measure thickness and detect flaws and corrosion in thin materials, especially where near surface resolution is required. They focus very close to the front surface, making them ideal for pitting and corrosion tests, braze inspection and lamination evaluation. This focusing effect of the dual transducer makes it ideal for pipes and other curved surfaces.

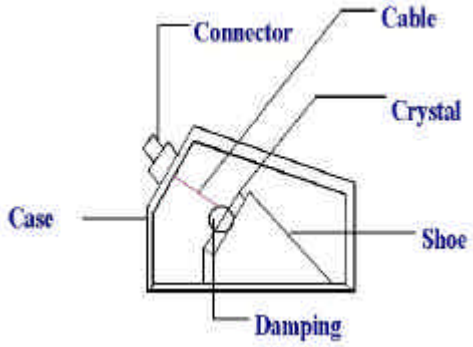
Dual element transducers utilise separate transmitting and receiving elements, mounted on delay lines that are usually cut at an angle. This configuration improves near surface resolution by eliminating recovery problems. In addition, the “crossed beam” design provides a pseudo-focus that makes duals more sensitive to echoes from irregular reflectors such as corrosion and pitting.

One consequence of the dual element design is a sharply defined distance-amplitude curve. In general a decrease in the roof angle to an increase in the transducer element size will result in longer pseudo-focal distance and an increase in useful range.



ANGLE BEAM TRANSDUCERS
(pages 17-21)

Angle beam transducers allow the soundbeam to be introduced into the test material at an angle. Plastic wedges of controlled geometry are attached to the transducer active element in order to establish the desired angle. Sonatest wedges are precision engineered to produce a refracted shear wave within the test object at specific angles, as indicated on the wedge or transducer housing. The refracted beam angle should be selected to ensure that the sound beam angle will be, as much as possible, perpendicular to the plane of expected flaws.



In some cases, the geometry of the test object will dictate the selection of beam angle. With regard to frequency however, the same general rule applies—which is to select the lowest frequency which provides adequate flaw sensitivity. Both material noise and attenuation are minimised at lower frequencies.

IMMERSION TRANSDUCERS
(page 22)

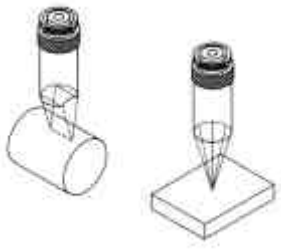
Immersion transducers are usually used for mechanised or automatic systems and, in principle, operate the same way as normal contact compression transducers.

Most applications take place in immersion tanks filled with water, where the test object is placed on a turntable or roller system so that the object is moved at a constant speed past the probe. This technique offers the best coupling conditions to provide reproducible results.

Compared to contact transducers where all the parameters are defined “as in steel”, immersion transducer parameters are defined in water. Since the speed of sound in steel is approx. 5920 m per sec and in water is 1480m per sec. This gives a ratio of 4 to 1, which means it takes the same time to travel through 10 mm of water as it does to travel through 40 mm of steel.

Focusing Types

Line Focus

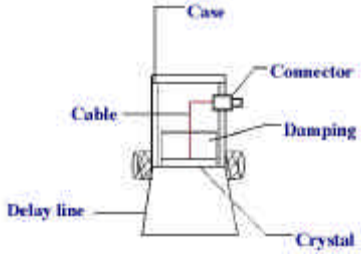


Spot Focus

Immersion transducers are available as flat faced or focussed. There are two types of focussing - spherical and line. Spherical, spot or point focussing gives a reduced but concentrated beam width, which provides the best possible flaw detection capability , but takes longer to scan because of the reduced beam width. Line focussed probes give larger beam width in one axis with a concentrated reduced beam in the other axis. The working range of the focussed probes is much less than the flat-faced probes and in fact the focal length occurs within the near field length.

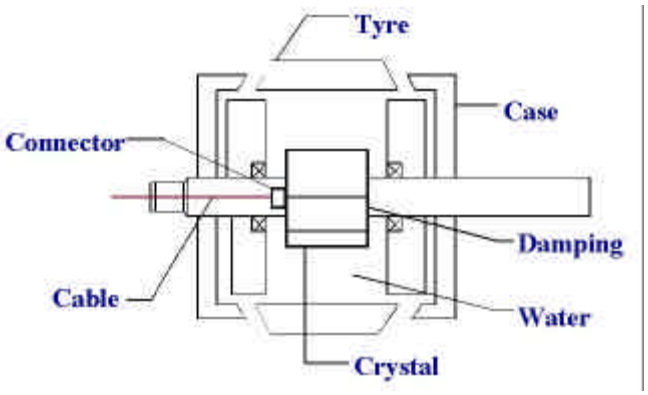
DELAY LINE TRANSDUCERS

Delay line transducers transmit and receive sound waves with one element, coupled to the surface as with compression transducers. The crystal is held off from the test piece surface by a delay block. This permits inspection very close to the test piece surface.



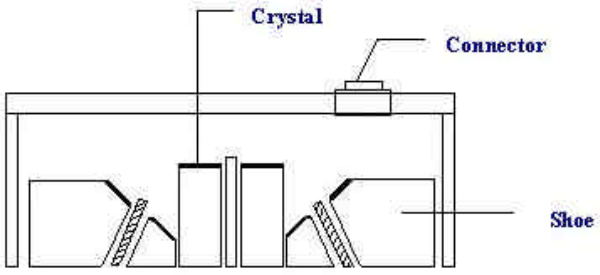
WHEEL TRANSDUCERS
(pages 24-25)

Wheel transducers operate in a similar fashion to delay line models. They are typically used in applications where a large area must be scanned and/or where the test piece material is sensitive to conventional ultrasonic couplants.



CUSTOM TRANSDUCERS
(pages 24-25)

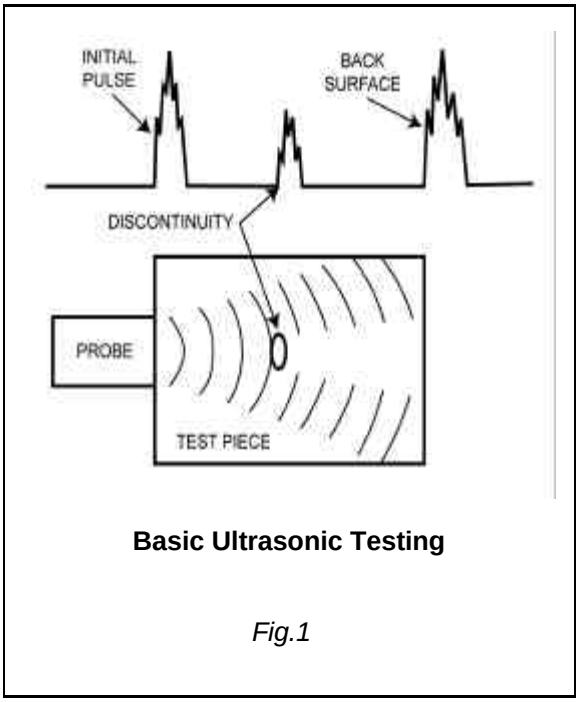
Custom transducers are often required for specialist applications. These often contain a number of elements for specific locations and angles. An example of this is the probe used to test railway tracks that incorporates both forward and backward facing twin element arrangements either side of a conventional twin crystal arrangement. Complex transducers such as this are designed in-house for a variety of specific applications.



Fundamentals of Ultrasound

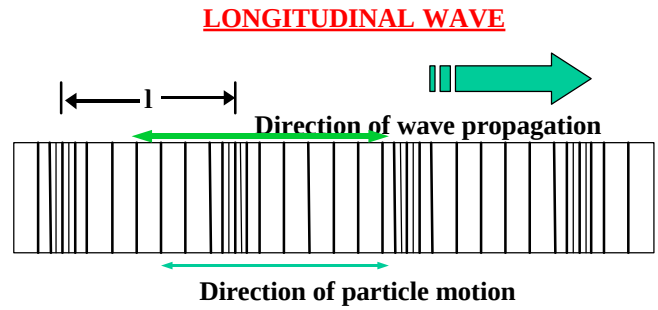
High frequency sound waves are introduced into the test material from a transducer, that is usually coupled to the test part by water or another suitable liquid based coupling method. The transducer converts the electrical impulses of the instrument into high frequency sound energy. A short burst of ultrasonic energy is introduced into the test material and some or all of the energy is reflected by discontinuities. Some may also be reflected by the far surface of the test part.

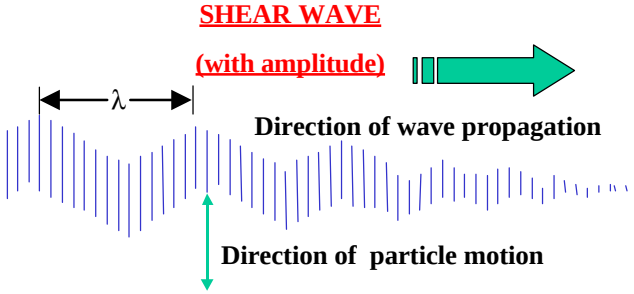
The reflection of sound energy is a function of the ratio between the acoustic impedance of the discontinuity and the base material. The acoustic impedance of a given material is the product of the density and velocity of sound in the material. The greater the impedance ratio, the more sound energy will be reflected. The principle of ultrasonic testing is illustrated in *Fig.1*. Here it shows the ultrasonic energy in the test piece and the resulting instrument display.



Basic Ultrasonic Testing

Fig.1





Wave Modes

Longitudinal waves consist of particle vibration along the direction of travel of the wave. Such waves may be propagated in solids, liquids and gasses.

In solid materials it is also possible for the particle movement to be at right angles to the direction of travel of the wave. These are known as Shear Waves.

$$l = \frac{c}{f}$$

l = Wave length (mm)

c = Sound velocity (m^{-1})

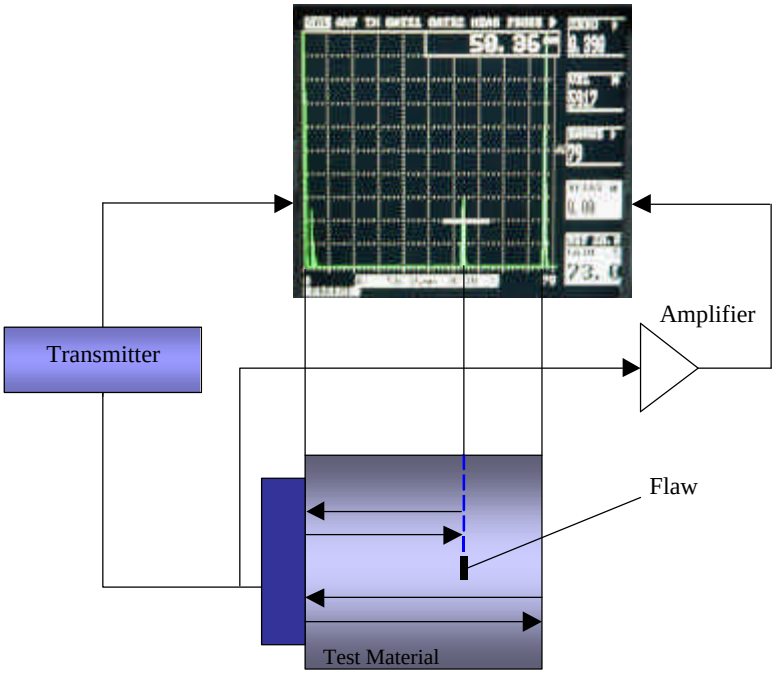
f = Frequency (MHz)

The velocity of sound in a material for shear and longitudinal wave modes is often different .

Technical Implementation

Short electrical pulses (typically 50—500 volts) are generated and used to drive a piezoelectric transducer. The resulting pulse of ultrasound travels through the test piece and may be reflected back to the transducer, producing an electrical signal.

This can be amplified and displayed on an oscilloscope (or analyzed electronically).



Ultrasonic Pulses

A piezoelectric element (crystal) is used to transform electrical energy into mechanical vibrations and vice versa. Due to mechanical damping of the transducer element a damped oscillation is produced—the ultrasonic pulse. In turn, when the transducer element receives an ultrasonic pulse, it converts it into an electronic RF pulse. The frequency of the pulse is determined by the element thickness, whereas the pulse length and frequency spectrum (bandwidth) is determined by the element damping.

$$B_6 = \frac{f_u - f_1}{f_m}$$

$B_6 = \text{bandwidth}$

$f_u = \text{upper frequency}$

$f_1 = \text{lower frequency}$

$f_m = \text{centre frequency}$

HIGH DAMPING

High damping generates a short pulse, which results in a wide frequency spectrum (large bandwidth). Such devices demonstrate high resolution,

MEDIUM DAMPING

LOW DAMPING

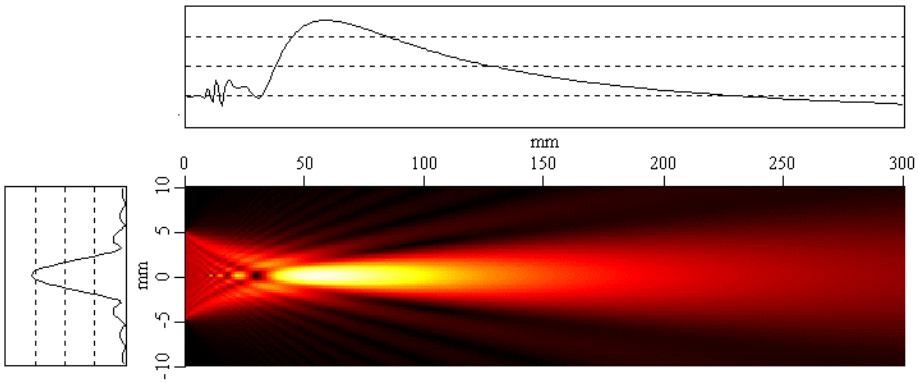
Low damping results in long pulse duration with distinctive frequency and narrow spectrum (small bandwidth).

Soundfield

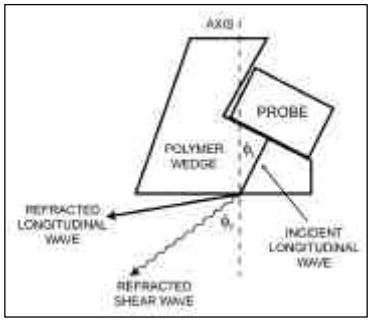
The sound field (or beam shape) is defined by the diameter and frequency of the crystal together with the sound velocity in the test piece. The sound pressure drops to 50% (-6dB) of the centre line, defining the diameter of the sound field. Maximum sensitivity is achieved at the near field length where the beam is at its narrowest. In the far field, the beam diameter is seen to increase in accordance with the divergence angle.

$$N = \frac{D^2 f}{4c} \qquad \sin g_6 = \frac{0.51c}{Df}$$

D = Crystal diameter (mm)
f = Frequency (MHz)
C = Sound Velocity (ms^{-1})
g_6 = Divergence angle to 6dB drop (degrees)



Typical angle probe arrangement



Reflection and Refraction

If ultrasound hits an interface at an angle other than 90º, reflection, refraction and mode conversion occur according to Snell's Law. As the velocity of longitudinal waves is greater than the velocity of shear waves in a given material, the angles of reflection and refraction of longitudinal waves are greater than those of shear waves. Ultrasound incident at 90º onto an interface between two dissimilar materials will be partly reflected back from the interface. The amplitudes of the transmitted and reflected components are defined by the acoustic impedance mismatch between the two materials.

$$Z = pc$$

$$T = \frac{2Z_2}{Z_2 + Z_1}$$

$$R = \frac{Z_2 - Z_1}{Z_2 + Z_1}$$

Snell's law

$$\frac{Sin\,q_i}{C_i} = \frac{Sin\,q_r}{C_r}$$

Z = Acoustic impedance $(kgm^{-2}S)$
P = Density (kgm^{-2})
Subscript 1 = material 1
2 = material 2

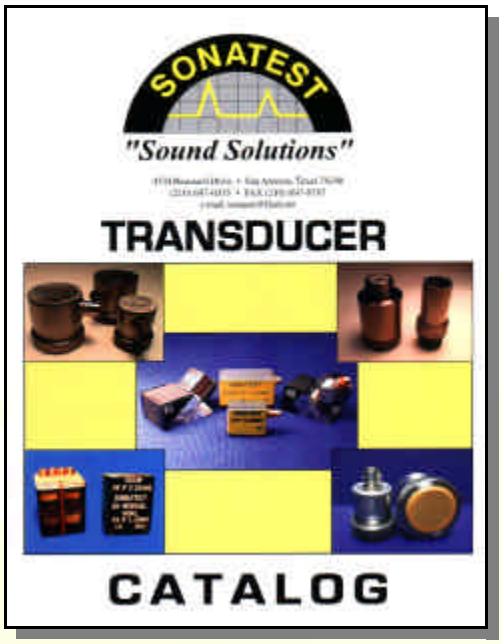
The incident angle necessary to produce a desired refracted wave can be calculated from Snell's Law.

θ_i = incident angle of the transducer wedge

θ_r = desired refracted angle
C_i = sound velocity of the wedge
C_r = sound velocity of a shear wave in the test material

VELOCITY & ACOUSTIC IMPEDANCE TABLE

MATERIAL	LONGITUDINAL VELOCITY m/sec	SHEAR VELOCITY m/sec	ACOUSTIC IMPEDANCE
Air	331	-	0.0004
Aluminium	6320	3100	17.0
Berylium	0.12900	8900	23.0
Brass	3830	2100	31.0
Copper	4660	2300	41.6
Glass	6800	2800	11.4
Glycerin	1920	-	24.6
Gold	3240	1200	62.6
Inconel	5720	3000	47.2
Iron	5900	3200	45.4
Iron (cast)	4800	2600	33.2
Lead	2160	700	24.6
Magnesium	6310	3000	10.0
Molybdenum	6290	3400	63.1
Monel	6020	2700	47.6
Nickel	5630	3000	49.5
Platinum	3960	1700	69.8
Plexiglass	2760	1100	3.1
Polyethylene	2670	500	1.7
Polyurethane	1900	-	1.9
Quartz	5750	2200	5.2
Rubber, Butyl	1850	-	2.0
Silver	3600	1600	38.0
Steel, mild	5920	3230	46.0
Steel, stainless	5800	3100	45.4
Teflon	1350	-	3.0
Tin	3320	1700	24.2
Titanium	6070	3100	27.3
Tungsten	5180	2900	101.0
Uranium	3370	2000	63.0
Water	1480	-	1.48
Zinc	4170	2400	29.6



Sonatest Inc, based in San Antonio, Texas is our USA subsidiary, distributing equipment, designing/ manufacturing transducers and offering a transducer repair service. Through Sonatest Inc we can offer a different range of transducers appropriate for a broad scope of applications, including “specials” on request.

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