

Ultrasonic Transducers

For Flaw Detection and Sizing



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Transducer Selection Criteria and Performance

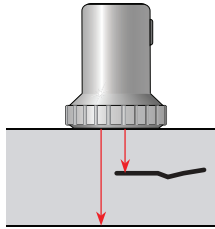
General Information

The ultrasonic transducers in this catalog are divided into two general categories, Contact and Immersion.

Transducers for the Contact Inspection Method

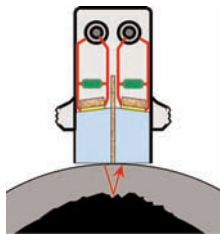
Straight Beam—Single Element

- Parts with regular geometry and relatively smooth contact surface
- Flat or curved contact surface
- Flaw or backwall parallel to surface or detectable with beam normal to surface
- Preferred for penetration of thick sections
- Delay line types improve near surface resolution
- Requires couplant layer, typically a gel, oil, or paste
- Typically used for manual inspection



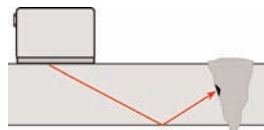
Straight Beam—Dual Element (TR)

- Transmit and receive elements separated by crosstalk barrier
- Flaw or backwall parallel to surface or detectable with beam normal to surface
- Best for thin sections, near surface resolution
- Requires couplant layer, typically a gel, oil, or paste
- Typically used for manual inspection



Angle Beam

- Element mounted on integral or replaceable wedge
- Uses refraction to transmit shear or longitudinal wave at a predetermined angle
- Most standard transducers generate shear waves by mode conversion
- Preferred for parts with inclined flaws, such as welds
- Available in both single and dual element types
- Requires couplant layer, typically a gel, oil, or paste
- Sometimes used in mechanized or automated testing



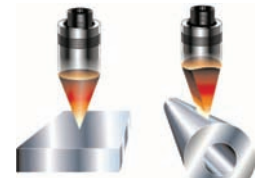
Transducers for the Immersion Method

Immersion Transducers

- Acoustically matched for best efficiency in water
- Suitable for parts with irregular geometries
- Commonly used in mechanized or automated testing
- Best method for consistent coupling and reproducible results
- Large parts can be tested using probe holders, bubblers, or water jets
- Transducers can be focused to improve results

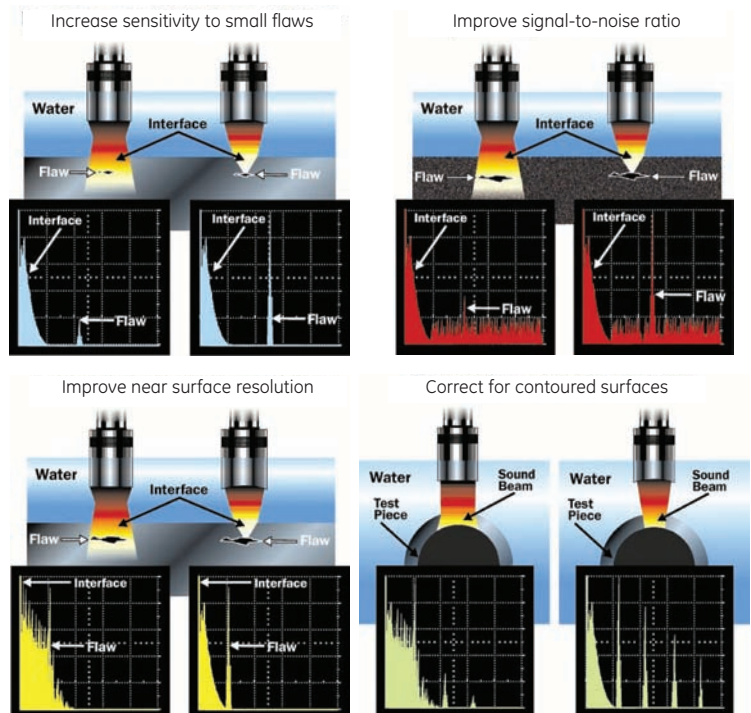
Focused Immersion Transducers

- Spherical focus forms a point or spot
- Cylindrical focus forms a line



Spherical (Spot, Point) Focus Cylindrical (Line) Focus

Advantages of Focusing



Transducer Selection Criteria—European Standards

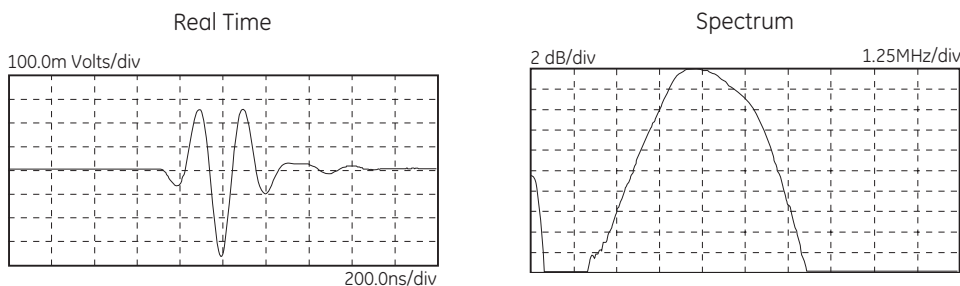
For transducers manufactured to European standards, technical and performance information is provided throughout this catalog based on the definitions below. A comprehensive data sheet is supplied with most flaw detection transducers at no charge.

| Description | Explanation |
|---|--|
| Element size D or a x b | Diameter D or length x width a x b of the transducer element. The size of the element strongly affects the shape of the transmitted sound field. Slight deviations, (e.g., imperfect shape or positions with reduced radiation due to poor bonding) cause considerable evaluation errors, even when calibrated to a reference flaw. |
| Nominal frequency f | The mean frequency of all probes of the same type. The frequency has a great influence on the evaluation of reflectors. Even the shape of the sound field and the reflection behaviour of angled reflectors are strongly dependent on the frequency. With increasing frequency, the echo height from non-vertically positioned reflectors to the sound beam decreases. This is why each probe is checked by our Quality Control to see if its frequency coincides with the nominal frequency, according to the identification label, within very narrow tolerances. This is entered into the probe data sheet. |
| Bandwidth B | <p>The range of frequencies in the echo pulse whose amplitude, at the most, is 6 dB less than the maximum amplitude.</p> $B = \frac{f_o - f_u}{f} \times 100\%$ <p>f_o = upper, f_u = lower frequency limit for a 6 dB drop in amplitude. With B = 100%, a 4 MHz, probe for example, has an f_o of 6 MHz and an f_u of 2 MHz. Large bandwidths mean shorter echo pulses, which mean high resolution and a good penetration power, because the lower frequencies of the pulse become less attenuated than the nominal frequency. At high attenuation, the frequency of reflected signals decreases, compared to the nominal frequency, as the distance increases. This must be taken into account with flaw evaluation. The bandwidth of each probe is therefore checked and must, within narrow tolerances, coincide with the mean value of all probes.</p> |
| Focal distance F | The distance of a small reflector from the probe producing the highest possible echo. Probes are focused in order to detect small reflectors and produce a high echo amplitude. Focusing is only possible within the near field of the probe. |
| Near field length N | <p>The near field length N is the focal distance of the unfocused probe which constitutes the sound pressure maximum at the largest distance from the probe. N is determined by D, c and f.</p> $\text{For } D \gg \lambda \text{ is: } N = \frac{D^2_{\text{eff}}}{4\lambda} = \frac{D^2_{\text{eff}} \cdot f}{4c}$ <p>λ = wave length c = sound velocity D_{eff} = effective element diameter Focal point and near field length are the distances with the best sound concentration and reflector recognition. Therefore, when a probe is selected for a critical test, the flaw expectancy range must be in the focal area or near field length. The data in the tables refers to steel with the exception of immersion testing in water.</p> |
| Focal diameter FD_6 | <p>Diameter of the sound field in the focal distance or near field length with a 6 dB drop of the echo indication.</p> $\text{For } D \gg \lambda \text{ is: } FD_6 = \frac{F \cdot c}{f - D_{\text{eff}}} = \frac{1}{4} k \cdot D_{\text{eff}} \quad \text{with } k = \frac{F}{N}$ |
| Pulse shape | The presentation of signals, as they are at the instrument input coming from plane reflectors. |
| Spectrum | Display of all the frequencies in the echo pulse. The frequency amplitudes are shown over the frequency. |
| Beam angle B | The angle between the main beam and the normal axis of the test surface. |

Transducer Selection Criteria—North American Standards

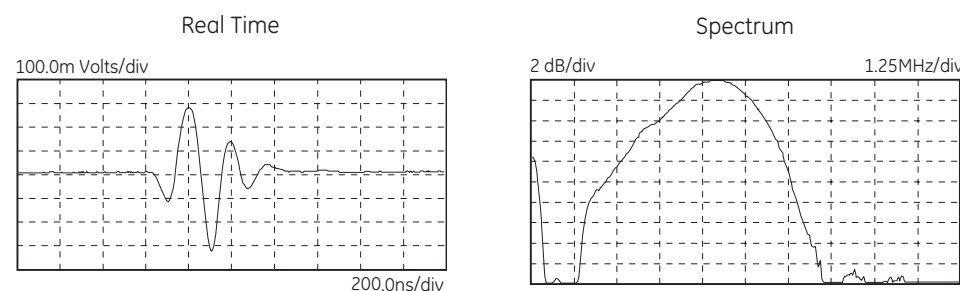
For transducers manufactured to North American standards, GE Inspection Technologies offers three performance ranges: **Alpha**, **Benchmark**, and **Gamma Series**. Waveform and frequency certification, per ASTM E-1065, are supplied with all flaw detection transducers at no charge.

Alpha Series Features



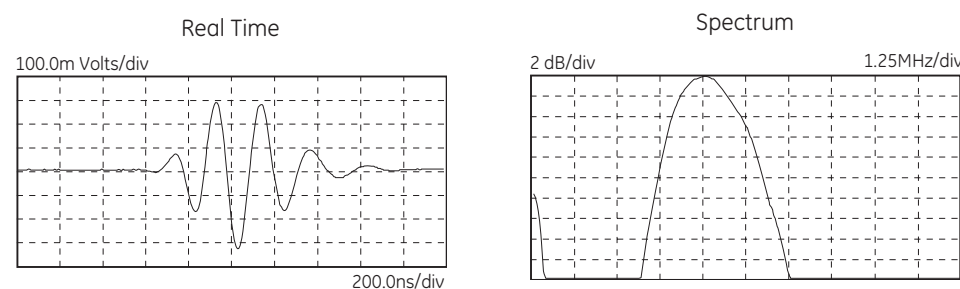
- Recommended for applications where resolution is the primary consideration.
- Suitable for applications such as thickness measurement and near-surface flaw detection.
- Very short pulse—mechanically damped to the limit of current technology.
- Gain is usually lower than that of the Gamma and Benchmark Series.
- Broadband—typical 6 dB bandwidths range from 50% to 100%.
- Typical Alpha waveforms (right) exhibit one to two full ring cycles, depending on frequency, size and other parameters.

Benchmark Series Features



- Proprietary **BENCHMARK COMPOSITE®** (piezocomposite) active elements.
- Penetration in attenuative materials is far superior to conventional transducers.
- High signal to noise on coarse grain metals, fiber reinforced composites, et al.
- Short pulse—resolution usually superior to Gamma Series.
- Gain is usually higher than that of the Gamma and Alpha Series.
- Very broadband—typical 6 dB bandwidths range from 60% to 120%.
- Low acoustic impedance element improves performance of angle beam, delay line, and immersion probes—excellent match to plastic and water.

Gamma Series Features



- General purpose transducers, recommended for the majority of applications.
- Medium pulse, medium damping—best combination of gain and resolution.
- Matching electrical network ensures maximum gain and optimum waveform for general use.
- Medium bandwidth—typical 6 dB bandwidths range from 30% to 50%.
- Typical Gamma waveform exhibits three to four full ring cycles, depending on frequency, size and other parameters.

Contact Transducers

Straight Beam Contact Transducers, Protective Face



Applications

- General purpose, larger parts with simple geometry
- Forgings, billets
- Plates, bars, square profiles
- Containers, machine components, shells
- Inspection at high temperature with delay line

Features and Benefits

- European models have replaceable membrane:
 - Improves coupling on uneven or curved surface
 - Extends transducer life.
 - Suitable for DGS flaw sizing method
 - High temperature delay lines also available
 - Lemo 1 (B..S) or Lemo 00 (MB..S) connector, side mount standard, top mount optional
- North American models can be used with three types of protective face:
 - Membrane improves coupling on uneven or curved surface.
 - Wear cap extends transducer life indefinitely when replaced periodically.
 - High temperature delay line enables testing on surfaces up to 400°F (200°C).
 - BNC connector, side or top mount

Protective Face Transducers—European Standards

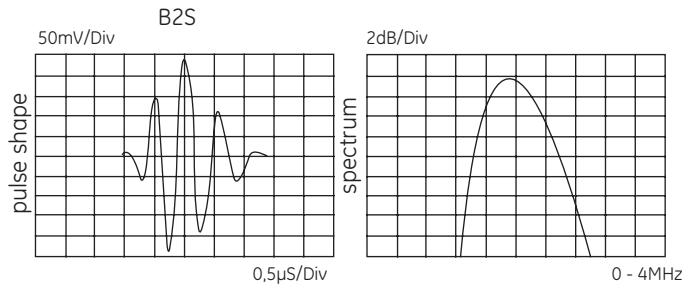


B.S

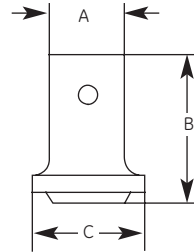


MB.S

Types B..S and MB..S



Typical waveform and frequency spectrum



| Case Type | A | | B | | C | |
|-----------|----|------|----|------|----|------|
| | mm | in | mm | in | mm | in |
| Type 2 | 30 | 1.18 | 59 | 2.32 | 45 | 1.69 |
| Type 3 | 20 | 0.79 | 43 | 1.77 | 25 | 0.98 |

| Type | Order Code | D | | f (MHz) | N | | Notes | Sketch |
|------------|------------|----|------|---------|-----|-----|---|--------|
| | | mm | in | | mm | in | | |
| B 1 S | 57744 | 24 | 0.94 | 1 | 23 | 0.9 | | Type 2 |
| B 1 S-EN | 500035 | 24 | 0.94 | 1 | 23 | 0.9 | DIN EN 12668-2 compliant | |
| B 1 S-O | 57755 | 24 | 0.94 | 1 | 23 | 0.9 | Top connector | |
| B 2 S | 57745 | 24 | 0.94 | 2 | 45 | 1.8 | | |
| B 2 S-EN | 500036 | 24 | 0.94 | 2 | 45 | 1.8 | DIN EN 12668-2 compliant | |
| B 2 S-O | 57756 | 24 | 0.94 | 2 | 45 | 1.8 | Top connector | |
| B 2 S-O-EN | 500267 | 24 | 0.94 | 2 | 45 | 1.8 | DIN EN 12668-2 compliant, top connector | |
| B 4 S | 57746 | 24 | 0.94 | 4 | 88 | 3.5 | | |
| B 4 S-EN | 500037 | 24 | 0.94 | 4 | 88 | 3.5 | DIN EN 12668-2 compliant | |
| B 4 S-O | 57757 | 24 | 0.94 | 4 | 88 | 3.5 | Top connector | |
| B 4 S-O-EN | 500268 | 24 | 0.94 | 4 | 88 | 3.5 | DIN EN 12668-2 compliant, top connector | |
| B 5 S | 57747 | 24 | 0.94 | 5 | 110 | 4.3 | | |
| <hr/> | | | | | | | | |
| MB 2 S | 57748 | 10 | 0.39 | 2 | 8 | 0.3 | | Type 3 |
| MB 2 S-EN | 500038 | 10 | 0.39 | 2 | 8 | 0.3 | DIN EN 12668-2 compliant | |
| MB 2 S-O | 57975 | 10 | 0.39 | 2 | 8 | 0.3 | Top connector | |
| MB 4 S | 57749 | 10 | 0.39 | 4 | 16 | 0.6 | | |
| MB 4 S-EN | 500039 | 10 | 0.39 | 4 | 16 | 0.6 | DIN EN 12668-2 compliant | |
| MB 4 S-O | 57976 | 10 | 0.39 | 4 | 16 | 0.6 | Top connector | |
| MB 5 S | 57750 | 10 | 0.39 | 5 | 20 | 0.8 | | |
| MB 5 S-O | 57977 | 10 | 0.39 | 5 | 20 | 0.8 | Top connector | |

Custom configurations are available by special order.

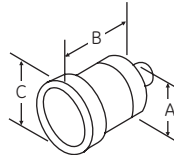
For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

Accessories

| Description | Type | Remark |
|---|---------------------------------|---|
| Protective membrane (1 set = 10 pcs) | ES45 (53756) ES24 (53769) | for B..S; for MB..S; |
| Delay line or delay wedges | Special order | e.g., for testing at high temperatures. |
| Cables | PKLL2 (50326) MPKLL2 (50486) | for B..S for MB..S |

Protective Face Transducers—North American Standards

| Element Ø | | A | | B | | C | |
|-----------|------|------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 13 | 0.50 | 19.1 | 0.75 | 30.5 | 1.20 | 23.9 | 0.94 |
| 19 | 0.75 | 25.4 | 1.00 | 30.5 | 1.20 | 30.2 | 1.19 |
| 25 | 1.00 | 31.8 | 1.25 | 30.5 | 1.20 | 36.6 | 1.44 |



Protective Face Combination Transducers—Type PFCR (Side Mount BNC), PFCS (Top Mount BNC)

| Freq. (MHz) | Element Ø | | Order Code | | Freq. (MHz) | Element Ø | | Order Code | |
|-------------|-----------|------|-------------------|-------------------|-------------|-----------|------|-------------------|-------------------|
| | mm | in | Gamma Series PFCR | Gamma Series PFCS | | mm | in | Gamma Series PFCR | Gamma Series PFCS |
| 1.0 | 13 | 0.50 | 241-240 | 241-260 | 3.50 | 13 | 0.50 | 243-240 | 243-260 |
| | 19 | 0.75 | 251-240 | 251-260 | | 19 | 0.75 | 253-240 | 253-260 |
| | 25 | 1.00 | 261-240 | 261-260 | | 25 | 1.00 | 263-240 | 263-260 |
| 2.25 | 13 | 0.50 | 242-240 | 242-260 | 5.0 | 13 | 0.50 | 244-240 | 244-260 |
| | 19 | 0.75 | 252-240 | 252-260 | | 19 | 0.75 | 254-240 | 254-260 |
| | 25 | 1.00 | 262-240 | 262-260 | | 25 | 1.00 | 264-240 | 264-260 |

Note: Protective face option kits sold separately. Custom configurations are available by special order.

Protective Face Option Kits—PFCR/PFCS

| Kit Styles | Order Code | | |
|-------------------------------|----------------------|----------------|-----------------|
| | Transducer Element Ø | | |
| | .5 in (13 mm) | .75 in (19 mm) | 1.00 in (25 mm) |
| PM | 118-450-120 | 118-450-140 | 118-450-160 |
| PWC | 118-450-220 | 118-450-240 | 118-450-260 |
| PHTD - 1.0 in (25.4 mm) Delay | 118-450-320 | 118-450-340 | 118-450-360 |
| PHTD - 1.5 in (38.1 mm) Delay | 118-450-420 | 118-450-440 | 118-450-460 |

Style PM Kit includes a knurled ring, gland nut, wrench, 12 membranes, and a 2 oz. bottle of couplant (transducer not included).

Style PWC Kit includes a knurled ring, three wear caps, and a 2 oz. bottle of couplant (transducer not included). This option may not be usable if near surface resolution is critical.

Style PHTD Kit includes a knurled ring, high temperature delay line, and a 2 oz. bottle of couplant (transducer not included).

| | Order Code | | |
|--|----------------------|----------------|-----------------|
| | Transducer Element Ø | | |
| | .5 in (13 mm) | .75 in (19 mm) | 1.00 in (25 mm) |
| Spare Membranes pkg. of 12 pcs. | 118-220-020 | 118-220-021 | 118-220-022 |
| Spare Wear Caps pkg. of 12 pcs. | 118-240-123 | 118-240-122 | 118-240-121 |
| Hi-Temp. Delay Line* 1.0 in (25.4 mm) length | 118-440-027 | 118-440-031 | 118-440-035 |
| Hi-Temp. Delay Line* 1.5 in (38.1 mm) length | 118-440-029 | 118-440-033 | 118-440-037 |
| BNC Cable | 118-140-016 | | |
| Membrane, Wear Cap and Delay Line Couplant | 118-300-740 | | |

* High Temp (PHTD) delay line: maximum temperature 400°F (200°C), maximum contact time 10 seconds; cool to ambient before reuse.

Straight Beam Contact Transducers, Wear Resistant



Applications

- General purpose, metal parts with simple geometry
- Manual inspection of plate, large forgings, billets, castings
- Smaller models for pipe and tube, tanks, bars, small forgings
- Lamination, delamination
- Bond testing
- Thick sections or difficult to penetrate materials

Features and Benefits

- Permanent, abrasion—resistant wear plate
- Best match to metals
- Higher gain reserve than protective face models
- Fingertip models for access to tight spaces
- Comfortable grip
- European models have side mounted Lemo 00 connectors, side mounted Microdot on K..K and G..K types.
- North American models have BNC connectors (side or top mount), side mounted Microdot on F type.

Wear Resistant Transducers—European Standards



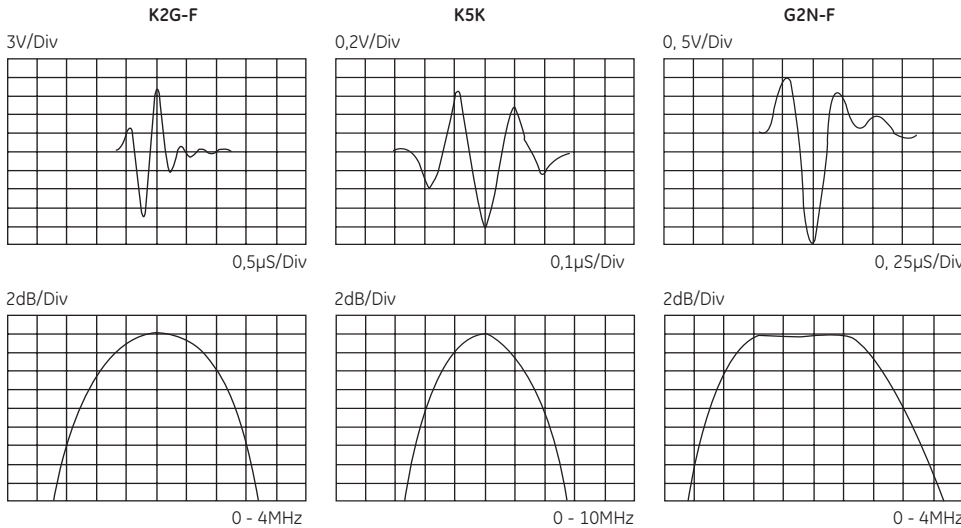
K..G, G..N

K..N, G..KB



K..K, G..K

Types K..G, K..N, K..K, G..N, G..KB and G..K



| Case Type | A | | B | | C | |
|-----------|----|------|----|------|----|------|
| | mm | in | mm | in | mm | in |
| Type 5 | 30 | 1.18 | 37 | 1.46 | 40 | 1.57 |
| Type 6 | 15 | 0.59 | 31 | 1.22 | 26 | 1.02 |
| Type 7 | 10 | 0.39 | 17 | 0.67 | | |

| Type | Order Code | D | f | N | Notes | Sketch | | |
|-----------|------------|----|------|-------|-------|--------|--------|--------------------------|
| | | mm | in | (MHz) | mm | in | | |
| K 1 G | 58506 | 24 | 0.94 | 1 | 23 | 0.9 | Type 5 | |
| K 2 G | 58507 | 24 | 0.94 | 2 | 45 | 1.8 | | |
| K 2 G-EN | 500071 | 24 | 0.94 | 2 | 45 | 1.8 | | DIN EN 12668-2 compliant |
| K 4 G | 58508 | 24 | 0.94 | 4 | 88 | 3.5 | | |
| K 4 G-EN | 500072 | 24 | 0.94 | 4 | 88 | 3.5 | | DIN EN 12668-2 compliant |
| K 1 N | 67620 | 10 | 0.39 | 1 | 4 | 0.2 | Type 6 | |
| K 2 N | 58509 | 10 | 0.39 | 2 | 8 | 0.3 | | |
| K 4 N | 58510 | 10 | 0.39 | 4 | 16 | 0.6 | | |
| K 5 N | 58511 | 10 | 0.39 | 5 | 20 | 0.8 | | |
| K 5 K | 52831 | 5 | 0.20 | 5 | 5 | 0.2 | Type 7 | |
| K 5 K-EN | 500061 | 5 | 0.20 | 5 | 5 | 0.2 | | DIN EN 12668-2 compliant |
| K 10 K | 52832 | 5 | 0.20 | 10 | 10 | 0.4 | | |
| K 10 K-EN | 500062 | 5 | 0.20 | 10 | 10 | 0.4 | | DIN EN 12668-2 compliant |
| G 1 N | 58500 | 24 | 0.94 | 1 | 23 | 0.9 | Type 5 | |
| G 2 N | 58501 | 24 | 0.94 | 2 | 45 | 1.8 | | |
| G 4 N | 58502 | 24 | 0.94 | 4 | 88 | 3.5 | | |
| G 2 KB | 58503 | 10 | 0.39 | 2 | 8 | 0.3 | Type 6 | |
| G 5 KB | 58504 | 10 | 0.39 | 5 | 20 | 0.8 | | |
| G 5 K | 53057 | 5 | 0.20 | 5 | 5 | 0.2 | Type 7 | |
| G 10 K | 53052 | 5 | 0.20 | 10 | 10 | 0.4 | | |

Custom configurations are available by special order.

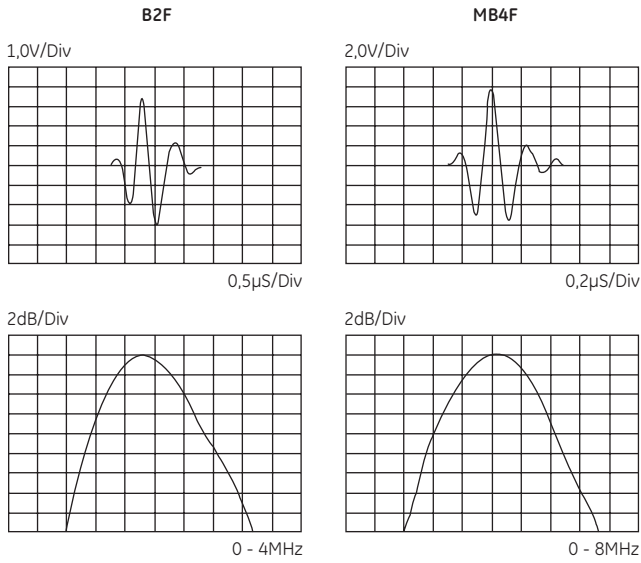
For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

Accessories

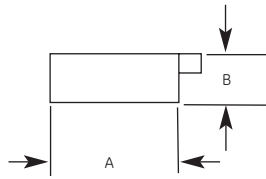
| Description | Type | Remark |
|-------------|---------------|---------------------------------|
| Probe Cable | MPKL2 (50486) | for K..G, K..N, G..N, and G..KB |
| | MPKM2 (52999) | for K..K and G..K |

Wear Resistant Transducers—European Standards

Types B..F and MB..F



Typical waveform and frequency spectrum



| Case Type | A | | B | |
|-----------|----|------|----|------|
| | mm | in | mm | in |
| Type 8 | 31 | 1.22 | 16 | 0.63 |
| Type 9 | 19 | 0.75 | 16 | 0.63 |



| Type | Order Code | D | f | N | Notes | Sketch | | |
|------------|------------|----|------|-------|-------|--------|--------|--------------------------|
| | | mm | in | (MHz) | mm | in | | |
| B 1 F | 57899 | 20 | 0.79 | 1 | 16 | 0.6 | Type 8 | |
| B 2 F | 57900 | 20 | 0.79 | 2 | 31 | 1.2 | | |
| B 4 F | 57901 | 20 | 0.79 | 4 | 62 | 2.4 | | |
| B 5 F | 57902 | 20 | 0.79 | 5 | 76 | 3.0 | | |
| MB 2 F | 57904 | 10 | 0.39 | 2 | 8 | 0.3 | Type 9 | |
| M B 4 F | 57905 | 10 | 0.39 | 4 | 16 | 0.6 | | |
| M B 4 F-EN | 500073 | 10 | 0.39 | 4 | 16 | 0.6 | | DIN EN 12668-2 compliant |
| MB 5 F | 57906 | 10 | 0.39 | 5 | 19 | 0.8 | | |
| MB 10 F | 57903 | 10 | 0.39 | 10 | 32 | 1.4 | | |

Custom configurations are available by special order.

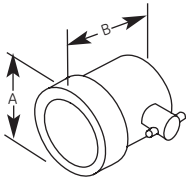
For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

Accessories

| Description | Type | Remark |
|-------------|---------------|--------------------|
| Cable | MPKL2 (50486) | for B..F and MB..F |

Wear Resistant Transducers—North American Standards

Type RHP



| Element Ø | | A | | B | |
|-----------|------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 13 | 0.50 | 29.2 | 1.15 | 38.1 | 1.50 |
| 25 | 0.75 | 35.6 | 1.40 | 38.1 | 1.50 |
| 19 | 1.00 | 41.9 | 1.65 | 38.1 | 1.50 |

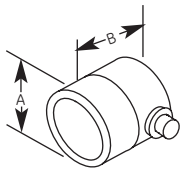


Standard Contact Transducers—Type RHP-CR (Side Mount BNC), RHP-CS (Top Mount BNC)

| Freq. (MHz) | Element Ø | | Order Code | | | Freq. (MHz) | Element Ø | | Order Code | | |
|-------------|-----------|------|--------------------------|--------------------------|---|-------------|-----------|--------------------------|--------------------------|--------------------------|---|
| | mm | in | Alpha Series | Gamma Series | Accessories | | mm | in | Alpha Series | Gamma Series | Accessories |
| .5 | 19 | 0.75 | | 250-043-CR 250-123-CS | Cables BNC 118-140-016 LEMO-1 118-140-018 | 3.5 | 13 | 0.50 | | 243-043-CR 243-123-CS | Cables BNC 118-140-016 LEMO-1 118-140-018 |
| | 25 | 1.00 | | 260-043-CR 260-123-CS | | | 19 | 0.75 | | 253-043-CR 253-123-CS | |
| 1.0 | 13 | 0.50 | | 241-043-CR 241-123-CS | | | 25 | 1.00 | | 263-043-CR 263-123-CS | |
| | 19 | 0.75 | | 251-043-CR 251-123-CS | | 5.0 | 13 | 0.50 | 144-043-CR 144-123-CS | 244-043-CR 244-123-CS | |
| 25 | 1.00 | | 261-043-CR 261-123-CS | 19 | | | 0.75 | 154-043-CR 154-123-CS | 254-043-CR 254-123-CS | | |
| 2.25 | 13 | 0.50 | 142-043-CR 142-123-CS | 242-043-CR 242-123-CS | | 10.0 | 25 | 1.00 | 164-043-CR 164-123-CS | 264-043-CR 264-123-CS | |
| | 19 | 0.75 | 152-043-CR 152-123-CS | 252-043-CR 252-123-CS | 13 | | 0.50 | | 246-043-CR 246-123-CS | | |
| | 25 | 1.00 | 162-043-CR 162-123-CS | 262-043-CR 262-123-CS | | | | | | | |

Custom configurations are available by special order.

Type F



| Element Ø | | A | | B | |
|-----------|-------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | 0.25 | 12.7 | 0.50 | 16.8 | 0.66 |
| 10 | 0.375 | 16.0 | 0.63 | 16.8 | 0.66 |
| 13 | 0.50 | 19.1 | 0.75 | 16.8 | 0.66 |



Fingertip Contact Transducers—Type F

| Freq. (MHz) | Element Ø | | Order Code | | | | Freq. (MHz) | Element Ø | | Order Code | | | |
|-------------|-----------|------|------------------|--------------|--------------|------------------------------|-------------|-----------|------|------------------|--------------|--------------|------------------------------|
| | mm | in | Benchmark Series | Alpha Series | Gamma Series | Accessories | | mm | in | Benchmark Series | Alpha Series | Gamma Series | Accessories |
| 2.25 | 6 | .250 | 822-000 | 122-000 | 222-000 | Cables BNC 118-140-012 | 5.0 | 6 | .250 | 824-000 | 124-000 | 224-000 | Cables BNC 118-140-012 |
| | 10 | .375 | 832-000 | 132-000 | 232-000 | | | 10 | .375 | 834-000 | 134-000 | 234-000 | |
| | 13 | .500 | 842-000 | 142-000 | 242-000 | | | 13 | .500 | 844-000 | 144-000 | 244-000 | |
| 3.5 | 6 | .250 | | 123-000 | 223-000 | LEMO-1 118-140-022 | 10.0 | 6 | .250 | | 126-000 | 226-000 | LEMO-1 118-140-022 |
| | 10 | .375 | | 133-000 | 233-000 | | | 10 | .375 | | 136-000 | 236-000 | |
| | 13 | .500 | | 143-000 | 243-000 | | | 13 | .500 | | 146-000 | 246-000 | |

Custom configurations are available by special order.

Straight Beam Contact Transducers, Delay Line



Applications

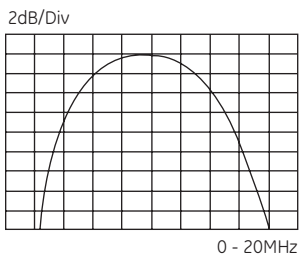
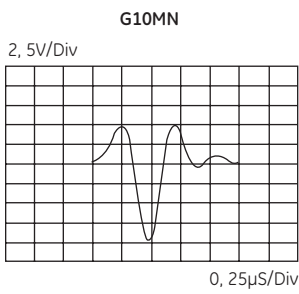
- Thickness measurement
- Near surface flaw detection
- Inspection of thin sections
- Curved parts, tubing, pipe
- Composites and plastics
- Turbine blades

Features and Benefits

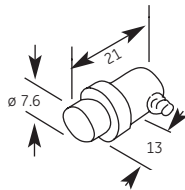
- Excellent near surface resolution.
- Replaceable delay line—long life and versatility.
- Higher frequencies improve resolution and small flaw detectability.
- All models have side mounted Microdot connector.

Delay Line Transducers—European Standards

Type G..MN



Typical waveform and frequency spectrum



| Type | Order Code | D | | f | N | | Sketch |
|---------|------------|----|------|-------|----|-----|---------|
| | | mm | in | (MHz) | mm | in | |
| G 5 MN | 53046 | 5 | 0.20 | 5 | 5 | 0.2 | Type 14 |
| G 10 MN | 53047 | 5 | 0.20 | 10 | 10 | 0.4 | |
| G 15 MN | 53058 | 5 | 0.20 | 15 | 15 | 0.6 | |

Custom configurations are available by special order.

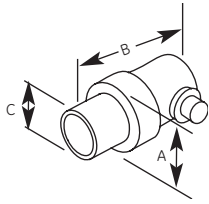
Accessories

| Description | Type | Remark |
|---------------------------|--------------------------------|---|
| Cable | MPKM2 (52999) | |
| Delay Line (exchangeable) | CLFV1 (54258) CLFV3 (54262) | .37 in (9.5 mm) for G.MN .49 in (12.5 mm) for G.MN |

Delay Line Transducers—North American Standards

Types DFR and K-PEN

Removable Delay Line—Type DFR

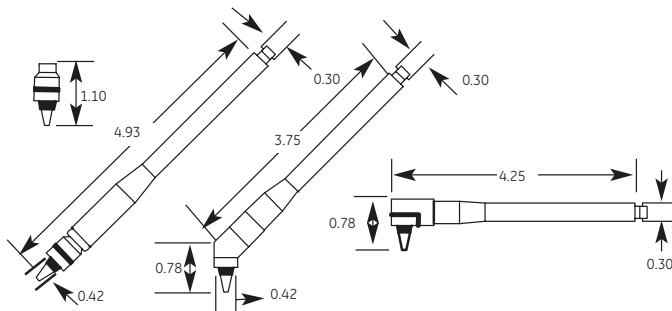


| Element Ø | | A | | B | | C | |
|-----------|---------------|-------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 3 or 6 | 0.125 or 0.25 | 13 | 0.51 | 21.3 | 0.84 | 7.6 | 0.30 |
| 13 | 0.50 | 22.4 | 0.88 | 35.1 | 1.38 | 15.2 | 0.60 |
| Mini-DFR | | | | | | | |
| 3 | 0.125 | 10.41 | 0.41 | 19.6 | 0.77 | 4.8 | 0.19 |



K-PEN Replaceable Delay Line Pencil Probe

- Focused, high resolution pencil probe
- Interchangeable delay lines, two tip diameters
- Extremely small contact area
- Tightly curved surfaces, such as turbine blades
- Wall thickness measurement from the bottom of an external pit
- Straight, right angle and 45° handles
- Straight model has removable handle



| Freq. (MHz) | Element Ø | | Alpha Series | Order Codes | | Accessories |
|------------------|-----------|------|--------------|-------------------------------------|-------------------------------------|---|
| | mm | in | | Delay Line 10-PK .38 in (9.5 mm) Lg | Delay Line 10-PK .5 in (12.7 mm) Lg | |
| 2.25 | 6 | .250 | 122-660 | 118-440-050 | 118-440-051 | Cables |
| | 13 | .500 | 140-500 | | 118-440-052 | |
| 3.5 | 6 | .250 | 123-660 | 118-440-050 | 118-440-051 | BNC 118-140-012 |
| | 13 | .500 | 144-660 | | 118-440-052 | |
| 5.0 | 6 | .250 | 124-660 | 118-440-050 | 118-440-051 | LEMO-1 118-140-022 |
| | 13 | .500 | 140-602 | | 118-440-052 | |
| 10.0 | 6 | .250 | 126-660 | 118-440-050 | 118-440-051 | Delay Line Couplant 118-300-740 |
| | 13 | .500 | 140-602 | | 118-440-052 | |
| 15.0 | 6 | .250 | 127-660 | 118-440-050 | 118-440-051 | Spring Loaded VEE Block 118-480-007 |
| 22.0 | 3 | .125 | 118-660 | 118-440-050 | 118-440-051 | |
| Mini-DFR 20.0 | 3 | .125 | 518-650 | 118-440-502 | | |

*H-007 fits .125 in (3 mm) and .25 in (6 mm) units only with exception of Mini DFR. Custom configurations are available by special order.

| Freq. (MHz) | Order Code | | | | | |
|-------------|----------------|-------------|-------------------|----------------------------------|----------------------------------|-------------|
| | Straight K-PEN | 45° K-PEN | Right Angle K-PEN | .065 in (1.7 mm) Tip Delay 10-PK | .090 in (2.3 mm) Tip Delay 10-PK | BNC Cable |
| 7.5 | 389-042-200 | 389-042-880 | 389-042-870 | 387-003-109 | 387-003-110 | 118-140-012 |
| 20.0 | 389-030-290 | 389-041-270 | 389-040-660 | | | |

Straight-Beam Contact Transducers, Dual Element (TR)



Applications

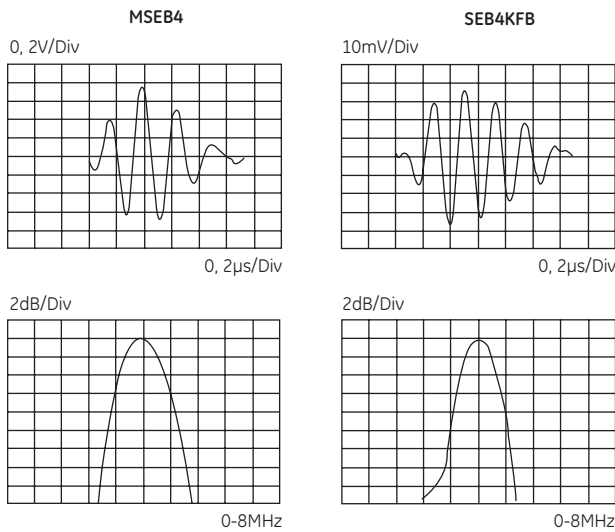
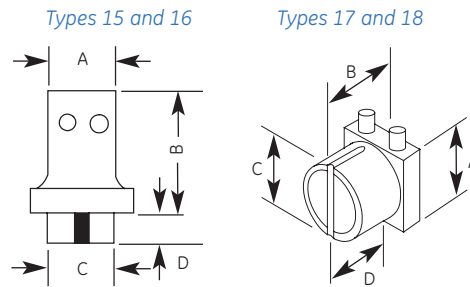
- Remaining wall thickness, corrosion, erosion
- Near surface flaw detection
- Small parts—screws, bolts, pins
- Cladding and weld overlay
- Bond testing
- Railroad wheels
- Core flaws in shafts, bars, billets
- Coarse grain materials

Features and Benefits

- Excellent near surface resolution
- Improved coupling on curved and rough surfaces
- Reduce noise caused by scattering
- Can be contoured for curved parts
- European models have side mounted Lemo 00 connectors, side mounted Microdot SEB..KF types
- North American models have fixed BNC cable (ADP) or side mounted MMD (FDU)

Dual Element (TR) Contact Transducers—European Standards

Types SEB and MSEB



| Case Type | A | | B | | C | | D | |
|-----------|----|------|----|------|------|------|-----|------|
| | mm | in | mm | in | mm | in | mm | in |
| Type 15 | 30 | 1.18 | 65 | 2.56 | 28.5 | 1.12 | 10 | 0.39 |
| Type 16 | 20 | 0.79 | 45 | 1.77 | 16.5 | 0.65 | 5 | 0.20 |
| Type 17 | 14 | 0.55 | 17 | 0.67 | 13 | 0.51 | 6.4 | 0.25 |
| Type 18 | 14 | 0.55 | 17 | 0.67 | 7.5 | 0.30 | 6.4 | 0.25 |

Typical waveform and frequency spectrum

Accessories

| Type | Order Code | a x b | | f (MHz) | F | | Notes | Sketch |
|--------------|------------|----------------------|-----------|---------|----|------|---|---------|
| | | mm | in | | mm | in | | |
| SEB 1 | 57466 | 21 / 2 \varnothing | 0.83 | 1 | 20 | 0.8 | | Type 15 |
| SEB 1-EN | 500176 | 21 / 2 \varnothing | 0.83 | 1 | 20 | 0.8 | DIN EN 12668-2 compliant | |
| SEB 2 | 57467 | 7 x 18 | .28 x .71 | 2 | 15 | 0.6 | | |
| SEB 2-EN | 500063 | 7 x 18 | .28 x .71 | 2 | 15 | 0.6 | DIN EN 12668-2 compliant | |
| SEB 2-0° | 57468 | 7 x 18 | .28 x .71 | 2 | 30 | 1.2 | Elements at 0° included angle | |
| SEB 2-EN-0° | 500065 | 7 x 18 | .28 x .71 | 2 | 30 | 1.2 | Elements at 0° included angle DIN EN 12668-2 compliant | |
| SEB 4 | 57469 | 6 x 20 | .24 x .79 | 4 | 12 | 0.5 | | |
| SEB 4-EN | 500064 | 6 x 20 | .24 x .79 | 4 | 12 | 0.5 | DIN EN 12668-2 compliant | |
| SEB 4-0° | 57470 | 6 x 20 | .24 x .79 | 4 | 25 | 1.0 | Elements at 0° included angle | |
| SEB 4-EN-0° | 500066 | 6 x 20 | .24 x .79 | 4 | 25 | 1.0 | Elements at 0° included angle DIN EN 12668-2 compliant | |
| MSEB 2 | 57461 | 11 / 2 \varnothing | 0.43 | 2 | 8 | 0.3 | | Type 16 |
| MSEB 2-EN | 500067 | 11 / 2 \varnothing | 0.43 | 2 | 8 | 0.3 | DIN EN 12668-2 compliant | |
| MSEB 4 | 57462 | 3.5 x 10 | .14 x .39 | 4 | 10 | 0.4 | | |
| MSEB 4-EN | 500068 | 3.5 x 10 | .14 x .39 | 4 | 10 | 0.4 | DIN EN 12668-2 compliant | |
| MSEB 4-0° | 57463 | 3.5 x 10 | .14 x .39 | 4 | 18 | 0.7 | Elements at 0° included angle | |
| MSEB 5 | 57464 | 9 / 2 \varnothing | 0.35 | 5 | 10 | 0.4 | Typical bandwidth 100% | |
| SEB 2 KF5 | 56464 | 8 / 2 \varnothing | 0.31 | 2 | 6 | 0.24 | | Type 17 |
| SEB 4 KF8 | 56465 | 8 / 2 \varnothing | 0.31 | 4 | 6 | 0.24 | | |
| SEB 4 KF8-EN | 500069 | 8 / 2 \varnothing | 0.31 | 4 | 6 | 0.24 | DIN EN 12668-2 compliant | |
| SEB 5 KF3 | 56466 | 8 / 2 \varnothing | 0.31 | 5 | 3 | 0.12 | | Type 18 |
| SEB10 KF3 | 56867 | 5 / 2 \varnothing | 0.20 | 10 | 3 | 0.12 | | |
| SEB10 KF3-EN | 500070 | 5 / 2 \varnothing | 0.20 | 10 | 3 | 0.12 | DIN EN 12668-2 compliant | |

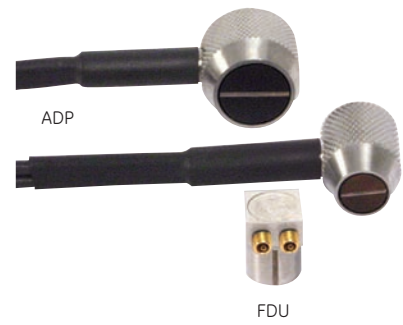
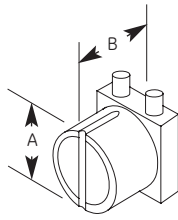
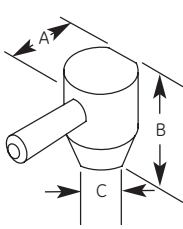
Custom configurations are available by special order.

For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

| Description | Type | Remark |
|-------------|-------------------------------|---------------------------------|
| Cable | SEK2 (53887) SEKM2 (53001) | for SEB., MSEB., for SEB..KF |

Dual Element (TR) Contact Transducers—North American Standards

Types ADP and FDU



ADP

| Element Ø | | A | | B | | C | |
|-----------|-------|------|-----|------|-----|------|-----|
| mm | in | mm | in | mm | in | mm | in |
| 6 | 0.25 | 12.7 | .50 | 16.3 | .64 | 9.1 | .36 |
| 10 | 0.375 | 16.0 | .63 | 16.3 | .64 | 11.9 | .47 |
| 13 | 0.50 | 19.1 | .75 | 17.3 | .68 | 15.2 | .60 |

FDU

| Element Ø | | A | | B | |
|-----------|------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | .25 | 9.7 | 0.38 | 12.7 | 0.50 |
| 10 | .375 | 12.7 | 0.50 | 12.7 | 0.50 |

Dual Element Transducers—Types ADP and FDU

| Freq. (MHz) | Element Ø | | Order Code | | Freq. (MHz) | Element Ø | | Order Code | |
|-------------|-----------|------|------------|-----------|-------------|-----------|------|-------------|-----------|
| | mm | in | ADP Dual | FDU Dual† | | mm | in | ADP Dual | FDU Dual† |
| 2.25 | 6 | .250 | 222-700 | 222-680 | 5.0 | 6 | .250 | 224-700 | 224-680 |
| | 10 | .375 | 232-700 | 232-680 | | 10 | .375 | 234-700 | 234-680 |
| | 13 | .500 | 242-700 | | | 13 | .500 | 244-700 | |
| 3.5 | 6 | .250 | 223-700 | 223-680 | 7.5 | 8 | .300 | 135-700 | |
| | 10 | .375 | 233-700 | 233-680 | 10.0 | 6 | .250 | 389-002-771 | |
| | 13 | .500 | 243-700 | | | 13 | .500 | 389-021-830 | |

† Standard MMD to BNC dual cable (118-140-014) sold separately. Custom configurations are available by special order.

Angle Beam Transducers—Large Sizes



Applications

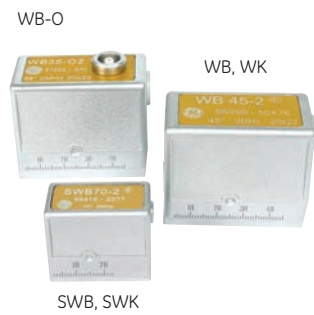
- General weld inspection, larger objects, thicker sections
- Pipes, tanks, pressure vessels
- Axles, forgings, castings
- Bridges and other structures
- Railroad wheels and rail

Features and Benefits

- European models have integral wedge
 - Maximum precision and repeatability for DGS flaw sizing method
 - Durable, ergonomically designed die cast housing
 - Replacement soles (sold separately) for extended service life
 - Lemo 1 connector on WB and WK types, side mount standard, top mount optional
 - Lemo 00 connector on SWB and SWK types, side mount
- North American models have interchangeable wedges (sold separately)
 - Maximum versatility and service life
 - Custom wedge angles and curvatures can be special ordered
 - AWS models available for AWS Structural Welding Code D1.1
 - High temperature wedges available for testing to 200°C (400°F)
 - BNC connector, top mount

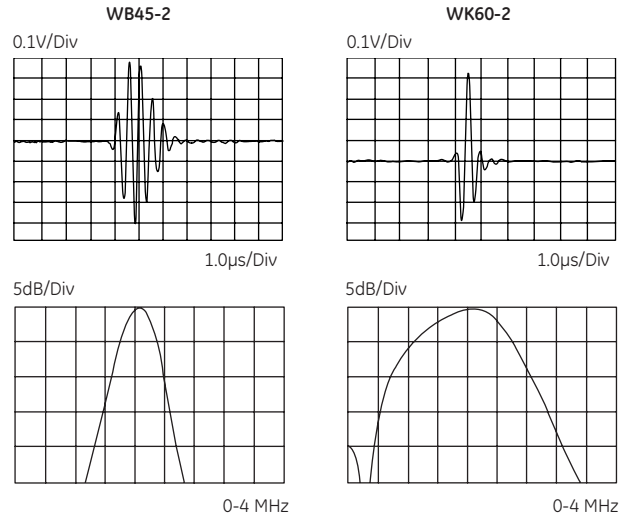
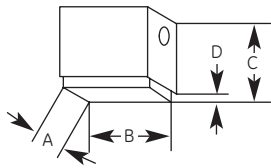
Large Angle Beam Transducers—European Standards

Types WB/WK and SWB/SWK



Types WB/WK and SWB/SWK

| Case Type | A | | B | | C | | D | |
|-----------|------|------|------|------|----|------|----|------|
| | mm | in | mm | in | mm | in | mm | in |
| Type 20 | 21.5 | 0.85 | 37 | 1.46 | 31 | 1.22 | 3 | 0.12 |
| Type 21 | 29 | 1.14 | 53.5 | 2.11 | 45 | 1.77 | 5 | 0.20 |



Typical waveform and frequency spectrum

| Type | Order Code | a x b | | f (MHz) | B (Steel) | N | | Notes | Sketch |
|------------|------------|---------|-----------|---------|-----------|----|-----|--------------------------|---------|
| | | mm | in | | | mm | in | | |
| WB 45-1 | 56993 | 20 x 22 | .79 x .87 | 1 | 45 | 45 | 1.8 | | Type 21 |
| WB 45-1-EN | 500207 | 20 x 22 | .79 x .87 | 1 | 45 | 45 | 1.8 | DIN EN 12668-2 compliant | |
| WB 45-01 | 57217 | 20 x 22 | .79 x .87 | 1 | 45 | 45 | 1.8 | Top connector | |
| WB 60-1 | 56994 | 20 x 22 | .79 x .87 | 1 | 60 | 45 | 1.8 | | |
| WB 60-1-EN | 500208 | 20 x 22 | .79 x .87 | 1 | 60 | 45 | 1.8 | DIN EN 12668-2 compliant | |
| WB 60-01 | 57218 | 20 x 22 | .79 x .87 | 1 | 60 | 45 | 1.8 | Top connector | |
| WB 70-1 | 56995 | 20 x 22 | .79 x .87 | 1 | 70 | 45 | 1.8 | | |
| WB 70-1-EN | 500209 | 20 x 22 | .79 x .87 | 1 | 70 | 45 | 1.8 | DIN EN 12668-2 compliant | |
| WB 70-01 | 57219 | 20 x 22 | .79 x .87 | 1 | 70 | 45 | 1.8 | Top connector | |
| WB 35-2 | 56998 | 20 x 22 | .79 x .87 | 2 | 38 | 90 | 3.5 | | |
| WB 35-2-EN | 500054 | 20 x 22 | .79 x .87 | 2 | 38 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 35-02 | 57222 | 20 x 22 | .79 x .87 | 2 | 38 | 90 | 3.5 | Top connector | |
| WB 35-02EN | 500058 | 20 x 22 | .79 x .87 | 2 | 38 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 45-2 | 56999 | 20 x 22 | .79 x .87 | 2 | 45 | 90 | 3.5 | | |
| WB 45-2-EN | 500055 | 20 x 22 | .79 x .87 | 2 | 45 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 45-02 | 57223 | 20 x 22 | .79 x .87 | 2 | 45 | 90 | 3.5 | Top connector | |
| WB 45-02EN | 500059 | 20 x 22 | .79 x .87 | 2 | 45 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 60-2 | 57000 | 20 x 22 | .79 x .87 | 2 | 60 | 90 | 3.5 | | |
| WB 60-2-EN | 500056 | 20 x 22 | .79 x .87 | 2 | 60 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 60-02 | 57224 | 20 x 22 | .79 x .87 | 2 | 60 | 90 | 3.5 | Top connector | |
| WB 60-02EN | 500060 | 20 x 22 | .79 x .87 | 2 | 60 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 70-2 | 57001 | 20 x 22 | .79 x .87 | 2 | 70 | 90 | 3.5 | | |
| WB 70-2-EN | 500057 | 20 x 22 | .79 x .87 | 2 | 70 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 70-02 | 57225 | 20 x 22 | .79 x .87 | 2 | 70 | 90 | 3.5 | Top connector | |
| WB 70-02EN | 500280 | 20 x 22 | .79 x .87 | 2 | 70 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 80-2 | 57002 | 20 x 22 | .79 x .87 | 2 | 77 | 90 | 3.5 | | |
| WB 80-2-EN | 500278 | 20 x 22 | .79 x .87 | 2 | 77 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 80-02 | 57226 | 20 x 22 | .79 x .87 | 2 | 77 | 90 | 3.5 | Top connector | |
| WB 90-2 | 57003 | 20 x 22 | .79 x .87 | 2 | 90 | 90 | 3.5 | | |
| WB 90-2-EN | 500266 | 20 x 22 | .79 x .87 | 2 | 90 | 90 | 3.5 | DIN EN 12668-2 compliant | |
| WB 90-02 | 57227 | 20 x 22 | .79 x .87 | 2 | 90 | 90 | 3.5 | Top connector | |

Large Angle Beam Transducers—European Standards

| Type | Order Code | a x b | | f (MHz) | β (Steel) | N | | Notes | Sketch |
|------------|------------|---------|-----------|---------|-----------|-----|-----|--------------------------|---------|
| | | mm | in | | | mm | in | | |
| WB 35-4 | 57004 | 20 x 22 | .79 x .87 | 4 | 38 | 180 | 7.1 | | Type 21 |
| WB 35-04 | 57228 | 20 x 22 | .79 x .87 | 4 | 38 | 180 | 7.1 | Top connector | |
| WB 45-4 | 57005 | 20 x 22 | .79 x .87 | 4 | 45 | 180 | 7.1 | | |
| WB 45-4-EN | 500200 | 20 x 22 | .79 x .87 | 4 | 45 | 180 | 7.1 | DIN EN 12668-2 compliant | |
| WB 45-04 | 57229 | 20 x 22 | .79 x .87 | 4 | 45 | 180 | 7.1 | Top connector | |
| WB 60-4 | 57006 | 20 x 22 | .79 x .87 | 4 | 60 | 180 | 7.1 | | |
| WB 60-4-EN | 500201 | 20 x 22 | .79 x .87 | 4 | 60 | 180 | 7.1 | DIN EN 12668-2 compliant | |
| WB 60-04 | 57230 | 20 x 22 | .79 x .87 | 4 | 60 | 180 | 7.1 | Top connector | |
| WB 70-4 | 57007 | 20 x 22 | .79 x .87 | 4 | 70 | 180 | 7.1 | | |
| WB 70-4-EN | 500202 | 20 x 22 | .79 x .87 | 4 | 70 | 180 | 7.1 | DIN EN 12668-2 compliant | |
| WB 70-04 | 57231 | 20 x 22 | .79 x .87 | 4 | 70 | 180 | 7.1 | Top connector | |
| WB 80-4 | 57008 | 20 x 22 | .79 x .87 | 4 | 77 | 180 | 7.1 | | |
| WB 80-04 | 57232 | 20 x 22 | .79 x .87 | 4 | 77 | 180 | 7.1 | Top connector | |
| SWB 45-2 | 58414 | 14 x 14 | .55 x .55 | 2 | 45 | 39 | 1.5 | | |
| SWB 60-2 | 58415 | 14 x 14 | .55 x .55 | 2 | 60 | 39 | 1.5 | | |
| SWB 70-2 | 58416 | 14 x 14 | .55 x .55 | 2 | 70 | 39 | 1.5 | | |
| SWB 45-5 | 58420 | 14 x 14 | .55 x .55 | 5 | 45 | 98 | 3.9 | | |
| SWB 60-5 | 58421 | 14 x 14 | .55 x .55 | 5 | 60 | 98 | 3.9 | | |
| SWB 70-5 | 58422 | 14 x 14 | .55 x .55 | 5 | 70 | 98 | 3.9 | | |
| WK 45-1 | 67889 | 20 x 22 | .79 x .87 | 1 | 45 | 45 | 1.8 | Piezocomposite element | Type 21 |
| WK 60-1 | 67890 | 20 x 22 | .79 x .87 | 1 | 60 | 45 | 1.8 | | |
| WK 70-1 | 67891 | 20 x 22 | .79 x .87 | 1 | 70 | 45 | 1.8 | | |
| WK 45-2 | 57011 | 20 x 22 | .79 x .87 | 2 | 45 | 90 | 3.5 | | |
| WK 60-2 | 57012 | 20 x 22 | .79 x .87 | 2 | 60 | 90 | 3.5 | | |
| WK 70-2 | 57013 | 20 x 22 | .79 x .87 | 2 | 70 | 90 | 3.5 | | |
| SWK 45-2 | 58843 | 14 x 14 | .55 x .55 | 2 | 45 | 39 | 1.5 | Piezocomposite element | Type 20 |
| SWK 60-2 | 58844 | 14 x 14 | .55 x .55 | 2 | 60 | 39 | 1.5 | | |
| SWK 70-2 | 58845 | 14 x 14 | .55 x .55 | 2 | 70 | 39 | 1.5 | | |

Custom configurations are available by special order.

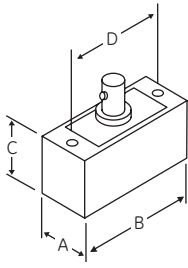
For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

Accessories

| Description | Type | Remark |
|--------------------------------|---------------|------------------|
| Cable | PKLL2 (50326) | for WB.., WK.. |
| | MPKL2 (50486) | for SWB.., SWK.. |
| Spare sole (1 set = 10 pcs) | WP(E) (57276) | for WB.., WK.. |
| | SWP (58514) | for SWB.., SWK |

Large Angle Beam Transducers—North American Standards

Types SWS and AWS



| Element Size | | A | | B | | C | | D | |
|--------------|-----------|------|------|------|------|------|-----|------|------|
| mm | in | mm | in | mm | in | mm | in | mm | in |
| 13 Ø | .50 Ø | 18.3 | .72 | 25.4 | 1.00 | 19.1 | .75 | 20.6 | .81 |
| 13 x 25 | .50 x 1.0 | 18.5 | .725 | 38.4 | 1.51 | 19.1 | .75 | 33.3 | 1.31 |
| 19 x 25 | .75 x 1.0 | 25.4 | 1.00 | 38.1 | 1.5 | 19.1 | .75 | 33.3 | 1.31 |
| 25 Ø | 1.0 | 31.0 | 1.22 | 41.9 | 1.65 | 19.1 | .75 | 35.1 | 1.38 |
| 16 x 16 | .63 x .63 | 18.5 | .73 | 31.8 | 1.25 | 19.1 | .75 | 25.4 | 1.00 |
| 16 x 19 | .63 x .75 | 18.5 | .73 | 31.8 | 1.25 | 19.1 | .75 | 25.4 | 1.00 |
| 19 x 19 | .75 x .75 | 21.6 | .85 | 31.8 | 1.25 | 19.1 | .75 | 25.4 | 1.00 |



Angle Beam Transducers—Types SWS and AWS

| Freq. (MHz) | Element Ø | | Order Codes | | | | | Freq. (MHz) | Element Ø | | Order Codes | | | | |
|-------------|-----------|-----------|--------------|------------------|------------------------------|------------------------------|-----------------|-------------|-----------|---------|--------------|------------------|------------------------------|------------------------------|-------------|
| | | | Gamma Series | Benchmark Series | Standard Wedge (W = 118-340) | Hi-Temp Wedge* (W = 118-340) | Accessories | | | | Gamma Series | Benchmark Series | Standard Wedge (W = 118-340) | Hi-Temp Wedge* (W = 118-340) | Accessories |
| 0.50 | 25 | 1.0 | 260-600 | | W-021 45° | W-081 45° | 2.25 AWS Series | 16 | .63 x .63 | 292-603 | 892-603 | W-104 45° | | | |
| | | | | | W-022 60° | W-082 60° | | | | | | W-105 60° | | | |
| | W-023 70° | W-083 70° | W-106 70° | | | | | | | | | | | | |
| | W-025 90° | | | | | | | | | | | | | | |
| 1.0 | 13 | 0.5 | 241-600 | 841-600 | W-009 45° | W-076 45° | 3.5 | 16 | .63 x .75 | 292-601 | 892-601 | W-104 45° | | | |
| | | | | | W-010 60° | W-077 60° | | | | | | W-105 60° | | | |
| | W-011 70° | W-078 70° | W-106 70° | | | | | | | | | | | | |
| | W-013 90° | | | | | | | | | | | | | | |
| 13 x 25 | 0.5 x 1 | 291-600 | 891-600 | W-015 45° | W-070 45° | 5.0 | 19 | .75 x .75 | 292-604 | 892-604 | W-104 45° | | | | |
| | | | | W-016 60° | W-086 60° | | | | | | W-105 60° | | | | |
| W-017 70° | W-071 70° | W-106 70° | | | | | | | | | | | | | |
| W-019 90° | | | | | | | | | | | | | | | |
| 2.25 | 19 x 25 | .75 x 1 | 291-605 | 891-605 | W-051 45° | | 5.0 | 13 | 0.5 x 1 | 293-600 | 893-600 | W-009 45° | | W-076 45° | |
| | | | | | W-052 60° | | | | | | | W-010 60° | | | W-077 60° |
| | W-053 70° | | W-011 70° | W-078 70° | | | | | | | | | | | |
| | W-054 90° | | W-013 90° | | | | | | | | | | | | |
| 2.25 | 25 | 1.0 | 261-600 | 861-600 | W-021 45° | W-081 45° | 5.0 | 19 | .75 x 1 | 293-605 | 893-605 | W-051 45° | | | |
| | | | | | W-022 60° | W-082 60° | | | | | | W-052 60° | | | |
| | W-023 70° | W-083 70° | W-053 70° | | | | | | | | | | | | |
| | W-025 90° | | W-054 90° | | | | | | | | | | | | |
| 2.25 | 13 | 0.5 | 242-600 | 842-600 | W-009 45° | W-076 45° | 5.0 | 25 | 1.0 | 263-600 | 863-600 | W-021 45° | | W-081 45° | |
| | | | | | W-010 60° | W-077 60° | | | | | | W-022 60° | | | W-082 60° |
| | W-011 70° | W-078 70° | W-023 70° | W-083 70° | | | | | | | | | | | |
| | W-013 90° | | W-025 90° | W-083 70° | | | | | | | | | | | |
| 2.25 | 13 x 25 | 0.5 x 1 | 292-600 | 892-600 | W-015 45° | W-070 45° | 5.0 | 13 | .5 x 1 | 294-600 | 894-600 | W-009 45° | | W-076 45° | |
| | | | | | W-016 60° | W-086 60° | | | | | | W-010 60° | | | W-077 60° |
| | W-017 70° | W-071 70° | W-011 70° | W-078 70° | | | | | | | | | | | |
| | W-019 90° | | W-013 90° | | | | | | | | | | | | |
| 2.25 | 19 x 25 | .75 x 1 | 292-605 | 892-605 | W-051 45° | | 5.0 | 19 | .75 x 1 | 294-605 | 894-605 | W-051 45° | | | |
| | | | | | W-052 60° | | | | | | | W-052 60° | | | |
| | W-053 70° | | W-053 70° | | | | | | | | | | | | |
| | W-054 90° | | W-054 90° | | | | | | | | | | | | |
| 2.25 | 25 | 1.0 | 262-600 | 862-600 | W-021 45° | W-081 45° | 5.0 | 25 | 1.0 | 264-600 | 864-600 | W-021 45° | | W-081 45° | |
| | | | | | W-022 60° | W-082 60° | | | | | | W-022 60° | | | W-082 60° |
| | W-023 70° | W-083 70° | W-023 70° | W-083 70° | | | | | | | | | | | |
| | W-025 90° | | W-025 90° | W-083 70° | | | | | | | | | | | |

* Duty Cycle: at 400°F (200°C), maximum contact time is 10 seconds; cool to ambient before reuse. Note: Standard wedge angles are specified for carbon steel. Custom configurations are available by special order.

Angle Beam Transducers—Small Sizes



Applications

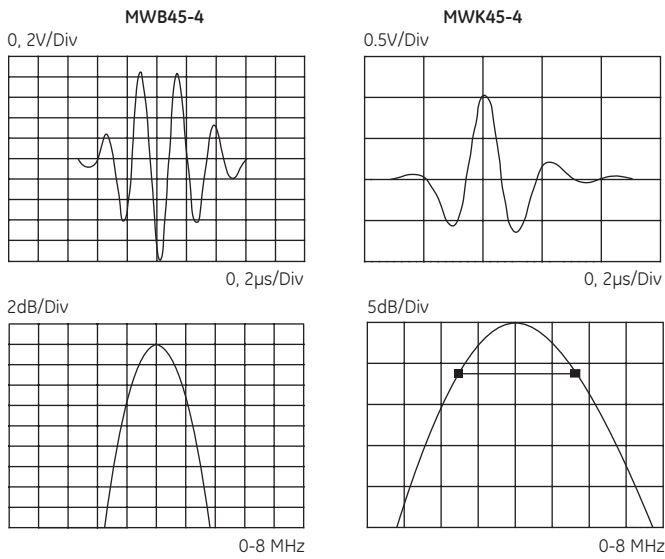
- General weld inspection, smaller objects, thinner sections
- Tubes, pipes, pressure vessels, containers
- Pumps, valve housings
- Turbine blades, shafts
- Wheel rims

Features and Benefits

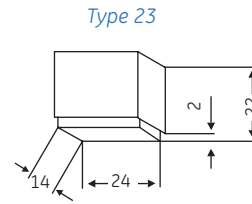
- European models have integral wedge
 - Maximum precision and repeatability for DGS flaw sizing method
 - Durable, ergonomically-designed die cast housing
 - Replacement soles (sold separately) for extended service life
 - Lemo 00 connector on MWB and MWK types, side mount standard, top mount optional
- North American models have interchangeable wedges (sold separately)
 - Maximum versatility and service life
 - Custom wedge angles and curvatures can be special ordered
 - Both quick change and screw mounted styles available
 - Microdot connector on MSW-QC and MSWS types, MMD on SMSWS

Small Angle Beam Transducers—European Standards

Type MWB/MWK



Typical waveform and frequency spectrum



| Type | Order Code | a x b | | f (MHz) | β (Steel) | N | | Notes | Sketch |
|-------------|------------|-------|-----------|---------|-----------|----|-----|---|---------|
| | | mm | in | | | mm | in | | |
| MWB 35-2 | 56920 | 8 x 9 | .31 x .35 | 2 | 38 | 15 | 0.6 | DIN EN 12668-2 compliant Top connector DIN EN 12668-2 compliant | Type 23 |
| MWB 35-2EN | 500040 | 8 x 9 | .31 x .35 | 2 | 38 | 15 | 0.6 | | |
| MWB 35-O2 | 57204 | 8 x 9 | .31 x .35 | 2 | 38 | 15 | 0.6 | | |
| MWB 35-O2EN | 500044 | 8 x 9 | .31 x .35 | 2 | 38 | 15 | 0.6 | | |
| MWB 45-2 | 56921 | 8 x 9 | .31 x .35 | 2 | 45 | 15 | 0.6 | DIN EN 12668-2 compliant Top connector DIN EN 12668-2 compliant | |
| MWB 45-2EN | 500041 | 8 x 9 | .31 x .35 | 2 | 45 | 15 | 0.6 | | |
| MWB 45-O2 | 57205 | 8 x 9 | .31 x .35 | 2 | 45 | 15 | 0.6 | | |
| MWB 45-O2EN | 500045 | 8 x 9 | .31 x .35 | 2 | 45 | 15 | 0.6 | | |
| MWB 60-2 | 56922 | 8 x 9 | .31 x .35 | 2 | 60 | 15 | 0.6 | DIN EN 12668-2 compliant Top connector DIN EN 12668-2 compliant | |
| MWB 60-2EN | 500042 | 8 x 9 | .31 x .35 | 2 | 60 | 15 | 0.6 | | |
| MWB 60-O2 | 57206 | 8 x 9 | .31 x .35 | 2 | 60 | 15 | 0.6 | | |
| MWB 60-O2EN | 500046 | 8 x 9 | .31 x .35 | 2 | 60 | 15 | 0.6 | | |
| MWB 70-2 | 56923 | 8 x 9 | .31 x .35 | 2 | 70 | 15 | 0.6 | DIN EN 12668-2 compliant Top connector DIN EN 12668-2 compliant | |
| MWB 70-2EN | 500043 | 8 x 9 | .31 x .35 | 2 | 70 | 15 | 0.6 | | |
| MWB 70-O2 | 57207 | 8 x 9 | .31 x .35 | 2 | 70 | 15 | 0.6 | | |
| MWB 70-O2EN | 500234 | 8 x 9 | .31 x .35 | 2 | 70 | 15 | 0.6 | | |
| MWB 80-2 | 56924 | 8 x 9 | .31 x .35 | 2 | 77 | 15 | 0.6 | Top connector Surface wave | |
| MWB 80-O2 | 57208 | 8 x 9 | .31 x .35 | 2 | 77 | 15 | 0.6 | | |
| MWB 90-2 | 56925 | 8 x 9 | .31 x .35 | 2 | 90 | 15 | 0.6 | | |

Small Angle Beam Transducers—European Standards

| Type | Order Code | a x b | | f (MHz) | β (Steel) | N | | Notes | Sketch | |
|-------------|------------|-------|-----------|---------|-----------|----|-----|--------------------------|---------|---------|
| | | mm | in | | | mm | in | | | |
| MWB 35-4 | 56926 | 8 x 9 | .31 x .35 | 4 | 38 | 30 | 1.2 | | Type 23 | |
| MWB 35-4EN | 500047 | 8 x 9 | .31 x .35 | 4 | 38 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 35-04 | 57210 | 8 x 9 | .31 x .35 | 4 | 38 | 30 | 1.2 | Top connector | | |
| MWB 35-04EN | 500235 | 8 x 9 | .31 x .35 | 4 | 38 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 45-4 | 56927 | 8 x 9 | .31 x .35 | 4 | 45 | 30 | 1.2 | | | |
| MWB 45-4EN | 500048 | 8 x 9 | .31 x .35 | 4 | 45 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 45-04 | 57211 | 8 x 9 | .31 x .35 | 4 | 45 | 30 | 1.2 | Top connector | | |
| MWB 45-04EN | 500236 | 8 x 9 | .31 x .35 | 4 | 45 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 60-4 | 56928 | 8 x 9 | .31 x .35 | 4 | 60 | 30 | 1.2 | | | |
| MWB 60-4EN | 500049 | 8 x 9 | .31 x .35 | 4 | 60 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 60-04 | 57212 | 8 x 9 | .31 x .35 | 4 | 60 | 30 | 1.2 | Top connector | | |
| MWB 60-04EN | 500237 | 8 x 9 | .31 x .35 | 4 | 60 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 70-4 | 56929 | 8 x 9 | .31 x .35 | 4 | 70 | 30 | 1.2 | | | |
| MWB 70-4EN | 500050 | 8 x 9 | .31 x .35 | 4 | 70 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 70-04 | 57213 | 8 x 9 | .31 x .35 | 4 | 70 | 30 | 1.2 | Top connector | | |
| MWB 70-04EN | 500238 | 8 x 9 | .31 x .35 | 4 | 70 | 30 | 1.2 | DIN EN 12668-2 compliant | | |
| MWB 80-4 | 56930 | 8 x 9 | .31 x .35 | 4 | 7 | 30 | 1.2 | | | |
| MWB 80-04 | 57214 | 8 x 9 | .31 x .35 | 4 | 77 | 30 | 1.2 | Top connector | | |
| MWB 90-4 | 56931 | 8 x 9 | .31 x .35 | 4 | 90 | 30 | 1.2 | Surface wave | | |
| MWK 45-2 | 67488 | 8 x 9 | .31 x .35 | 2 | 45 | 15 | 0.6 | Piezocomposite element | | Type 23 |
| MWK 60-2 | 67489 | 8 x 9 | .31 x .35 | 2 | 60 | 15 | 0.6 | | | |
| MWK 70-2 | 67490 | 8 x 9 | .31 x .35 | 2 | 70 | 15 | 0.6 | | | |
| MWK 45-4 | 58938 | 8 x 9 | .31 x .35 | 4 | 45 | 30 | 1.2 | | | |
| MWK 60-4 | 58939 | 8 x 9 | .31 x .35 | 4 | 60 | 30 | 1.2 | | | |
| MWK 70-4 | 58940 | 8 x 9 | .31 x .35 | 4 | 70 | 30 | 1.2 | | | |

Custom configurations are available by special order.

For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

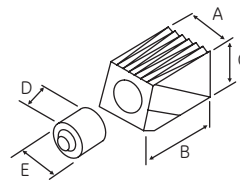
Accessories

| Description | Type | Remark |
|-----------------------------|----------------|------------------|
| Cable | MPKL2 (50486) | for MWB.., MWK.. |
| Spare sole (1 set = 10 pcs) | MWP(E) (57277) | for MWB.., MWK.. |

Small Angle Beam Transducers—North American Standards

Type MSW-QC

| Replaceable Wedge 6 mm (.25 in) | | | | | | | | | | | |
|---------------------------------|------|-----|------|------|------|-----|------|------|------|------|----------|
| Wedge Angle | A | | B | | C | | D | | E | | Thread |
| | mm | in | mm | in | mm | in | mm | in | mm | in | |
| 45° | 11.4 | .45 | 19.1 | .75 | 9.4 | .37 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |
| 60° | 11.4 | .45 | 21.3 | .84 | 11.2 | .44 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |
| 70° | 11.4 | .45 | 25.4 | 1.00 | 12.7 | .50 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |
| 90° | 11.4 | .45 | 24.1 | .95 | 12.7 | .50 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |



| Replaceable Wedge 10 mm (.375 in) | | | | | | | | | | | |
|-----------------------------------|------|-----|------|------|------|-----|------|------|------|------|----------|
| Wedge Angle | A | | B | | C | | D | | E | | Thread |
| | mm | in | mm | in | mm | in | mm | in | mm | in | |
| 45° | 14.0 | .55 | 22.6 | .89 | 11.9 | .47 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |
| 60° | 14.0 | .55 | 26.4 | 1.04 | 14.0 | .55 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |
| 70° | 14.0 | .55 | 30.2 | 1.19 | 14.7 | .58 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |
| 90° | 14.0 | .55 | 29.2 | 1.15 | 15.5 | .61 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |

| Replaceable Wedge 13 mm (.50 in) | | | | | | | | | | | |
|----------------------------------|------|-----|------|------|------|-----|------|------|------|------|----------|
| Wedge Angle | A | | B | | C | | D | | E | | Thread |
| | mm | in | mm | in | mm | in | mm | in | mm | in | |
| 45° | 17.8 | .70 | 26.7 | 1.05 | 14.0 | .55 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |
| 60° | 17.8 | .70 | 31.5 | 1.24 | 16.3 | .64 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |
| 70° | 17.8 | .70 | 35.8 | 1.41 | 17.3 | .68 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |
| 90° | 17.8 | .70 | 35.3 | 1.39 | 18.5 | .73 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |

Miniature Angle Beam Transducers—Type MSW-QC (Quick Change)

| Freq. (MHz) | Element Ø mm | Element Ø in | Order Codes | | | | | Accessories | Freq. (MHz) | Element Ø mm | Element Ø in | Order Code | | | | | Accessories | | | | |
|-------------|--------------|--------------|--------------|------------------|--------------|------------------------------|----------------------------|-------------|-------------|--------------|--------------|--------------|------------------|------------------------|------------------------------|-----------|-------------|-----------|-----------|-----------|-----------|
| | | | Gamma Series | Benchmark Series | Alpha Series | Standard Wedge (W = 118-340) | | | | | | Gamma Series | Benchmark Series | Alpha Series | Standard Wedge (W = 118-340) | | | | | | |
| 1.0 | 13 | .500 | 241-590 | 241-591 | | W-210 30° | Cables BNC 118-140-012 | 6 | .250 | | | W-200 30° | 124-591 | | W-201 45° | W-202 60° | W-203 70° | W-204 90° | | | |
| | | | | | | W-211 45° | | | | | | W-212 60° | | | | | | | W-213 70° | W-214 90° | |
| | | | | | | W-220 30° | | | | | | W-221 45° | | | | | | | W-222 60° | W-223 70° | W-224 90° |
| 1.5 | 10 | .375 | 231-590 | 231-596 | | W-220 30° | LEMO-1 118-140-022 | 5.0 | 10 | .375 | 234-590 | W-220 30° | 134-591 | | W-221 45° | W-222 60° | W-223 70° | W-224 90° | | | |
| | | | | | | W-221 45° | | | | | | W-222 60° | | | | | | | W-223 70° | W-224 90° | |
| | | | | | | W-210 30° | | | | | | W-211 45° | | | | | | | W-212 60° | W-213 70° | W-214 90° |
| 2.25 | 10 | .375 | 232-590 | 232-591 | 132-591 | W-220 30° | Wedge Couplant 118-300-740 | 6 | .250 | | 225-591 | W-200 30° | 125-591 | Cables BNC 118-140-012 | W-201 45° | W-202 60° | W-203 70° | W-204 90° | | | |
| | | | | | | W-210 30° | | | | | | W-211 45° | | | | | | | W-212 60° | W-213 70° | W-214 90° |
| | | | | | | W-220 30° | | | | | | W-221 45° | | | | | | | W-222 60° | W-223 70° | W-224 90° |
| 3.5 | 10 | .375 | 233-590 | 233-591 | 133-591 | W-220 30° | | 6 | .250 | 226-590 | W-200 30° | | | W-201 45° | W-202 60° | W-203 70° | W-204 90° | | | | |
| | | | | | | W-210 30° | | | | | W-211 45° | | | | | | | W-212 60° | W-213 70° | W-214 90° | |
| | | | | | | W-220 30° | | | | | W-221 45° | | | | | | | W-222 60° | W-223 70° | W-224 90° | |
| 10 | 13 | .500 | 243-590 | 243-591 | 143-591 | W-210 30° | | 10 | .375 | 236-590 | W-220 30° | | | W-221 45° | W-222 60° | W-223 70° | W-224 90° | | | | |
| | | | | | | W-211 45° | | | | | W-212 60° | | | | | | | W-213 70° | W-214 90° | | |
| | | | | | | W-210 30° | | | | | W-211 45° | | | | | | | W-212 60° | W-213 70° | W-214 90° | |

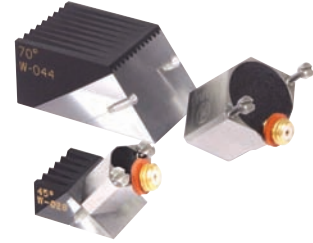
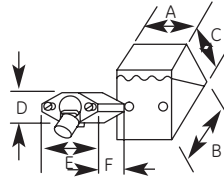
Note: Standard wedge angles are specified for carbon steel. Custom configurations are available by special order.

Small Angle Beam Transducers—North American Standards

Type MSWS

| Replaceable Wedge .25 in (6 mm) | | | | | | | | | | | | |
|---------------------------------|------|-----|------|-----|-----|-----|-----|-----|------|-----|-----|-----|
| Wedge Angle | A | | B | | C | | D | | E | | F | |
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| 45° | 11.9 | .47 | 15.2 | .60 | 7.6 | .30 | 7.9 | .31 | 12.2 | .48 | 8.6 | .34 |
| 60° | 11.9 | .47 | 16.5 | .65 | 8.9 | .35 | 7.9 | .31 | 12.2 | .48 | 8.6 | .34 |
| 70° | 11.9 | .47 | 17.8 | .70 | 9.7 | .38 | 7.9 | .31 | 12.2 | .48 | 8.6 | .34 |
| 90° | 11.9 | .47 | 22.9 | .90 | 9.7 | .38 | 7.9 | .31 | 12.2 | .48 | 8.6 | .34 |

| Replaceable Wedge .50 in (13 mm) | | | | | | | | | | | | |
|----------------------------------|------|-----|------|------|------|-----|------|-----|------|-----|------|-----|
| Wedge Angle | A | | B | | C | | D | | E | | F | |
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| 45° | 18.5 | .73 | 24.4 | .96 | 10.7 | .42 | 14.2 | .56 | 18.5 | .73 | 12.7 | .50 |
| 60° | 18.5 | .73 | 27.4 | 1.08 | 12.7 | .50 | 14.2 | .56 | 18.5 | .73 | 12.7 | .50 |
| 70° | 18.5 | .73 | 29.5 | 1.16 | 13.7 | .54 | 14.2 | .56 | 18.5 | .73 | 12.7 | .50 |
| 90° | 18.5 | .73 | 39.6 | 1.56 | 14.7 | .58 | 14.2 | .56 | 18.5 | .73 | 12.7 | .50 |



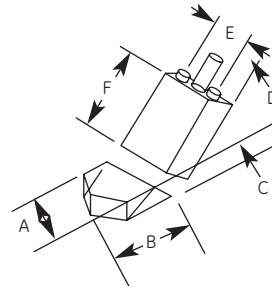
Miniature Angle Beam Transducers—Type MSWS (Captive Screw Mount)

| Freq. (MHz) | Element Ø (mm) | Element Ø (in) | Order Codes | | | Freq. (MHz) | Element Ø (mm) | Element Ø (in) | Order Codes | | |
|-------------|----------------|----------------|--------------|------------------------------|----------------------------------|-------------|----------------|----------------|--------------|------------------------------|----------------------------------|
| | | | Gamma Series | Standard Wedge (W = 118-340) | Accessories | | | | Gamma Series | Standard Wedge (W = 118-340) | Accessories |
| 1.0 | 13 | .500 | 241-580 | W-040 45° | Cables BNC 118-140-012 | 5.0 | 6 | .250 | 224-580 | W-028 45° | Wedge Couplant 118-300-740 |
| | | | | W-042 60° | | | | | | W-030 60° | |
| W-044 70° | W-032 70° | | | | | | | | | | |
| W-046 80° | W-034 80° | | | | | | | | | | |
| W-048 90° | W-036 90° | | | | | | | | | | |
| W-040 45° | W-042 60° | | | | | | | | | | |
| 2.25 | 6 | .250 | 222-580 | W-028 45° | LEMO-1 118-140-022 | 10.0 | 13 | .500 | 244-580 | W-040 45° | |
| | | | | W-030 60° | | | | | | W-032 70° | |
| W-032 70° | W-034 80° | | | | | | | | | | |
| W-034 80° | W-036 90° | | | | | | | | | | |
| W-040 45° | W-042 60° | | | | | | | | | | |
| W-042 60° | W-044 70° | | | | | | | | | | |
| 3.5 | 13 | .500 | 242-580 | W-040 45° | Wedge Couplant 118-300-740 | 10.0 | 6 | .250 | 226-580 | W-028 45° | |
| | | | | W-042 60° | | | | | | W-030 60° | |
| W-044 70° | W-032 70° | | | | | | | | | | |
| W-046 80° | W-034 80° | | | | | | | | | | |
| W-048 90° | W-036 90° | | | | | | | | | | |
| W-040 45° | W-042 60° | | | | | | | | | | |
| W-042 60° | W-044 70° | | | | | | | | | | |
| 3.5 | 6 | .250 | 223-580 | W-028 45° | Wedge Couplant 118-300-740 | 10.0 | 13 | .500 | 246-580 | W-040 45° | |
| | | | | W-030 60° | | | | | | W-032 70° | |
| W-032 70° | W-034 80° | | | | | | | | | | |
| W-034 80° | W-036 90° | | | | | | | | | | |
| W-040 45° | W-042 60° | | | | | | | | | | |
| W-042 60° | W-044 70° | | | | | | | | | | |
| W-044 70° | W-046 80° | | | | | | | | | | |
| W-046 80° | W-048 90° | | | | | | | | | | |

Note: Standard wedge angles are specified for carbon steel. Custom configurations are available by special order.

Small Angle Beam Transducers—North American Standards

| Angle | A | | B | | C | | D | | E | | F | |
|-------|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| 45° | 7.9 | .31 | 6.4 | .25 | 5.3 | .21 | 4.8 | .19 | 5.8 | .23 | 7.1 | .28 |
| 60° | 7.9 | .31 | 10.7 | .42 | 5.3 | .21 | 4.8 | .19 | 5.8 | .23 | 7.1 | .28 |
| 70° | 7.9 | .31 | 10.7 | .42 | 5.3 | .21 | 4.8 | .19 | 5.8 | .23 | 7.1 | .28 |
| 90° | 7.9 | .31 | 18.3 | .72 | 8.6 | .34 | 4.8 | .19 | 5.8 | .23 | 7.1 | .28 |



Subminiature Angle Beam Type SMSWS (Screw Mount)

| Freq. (MHz) | Element Ø | | Gamma Series | Order Codes | |
|-------------|-----------|------|--------------|------------------------------|---|
| | mm | in | | Standard Wedge (W = 118-340) | Accessories |
| 2.25 | 3 | .125 | 212-585 | W-120 45° | Cable BNC 118-140-047 Wedge Couplant 118-300-740 |
| | | | | W-121 60° | |
| | | | | W-122 70° | |
| | | | | W-123 90° | |
| 5.0 | 3 | .125 | 214-585 | W-120 45° | |
| | | | | W-121 60° | |
| | | | | W-122 70° | |
| | | | | W-123 90° | |
| 10.0 | 3 | .125 | 216-585 | W-120 45° | |
| | | | | W-121 60° | |
| | | | | W-122 70° | |
| | | | | W-123 90° | |

Note: Standard wedge angles are specified for carbon steel. Custom configurations are available by special order.

Angle Beam Transducers, Dual Element (TR)



Applications

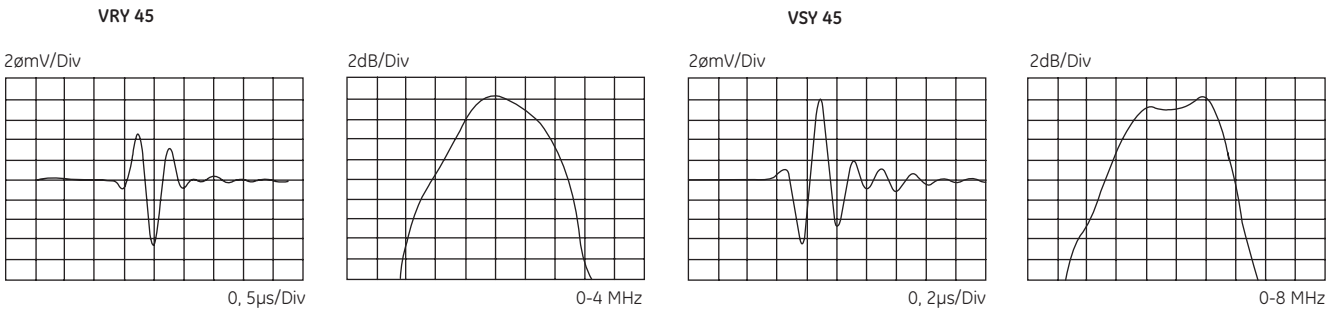
- VS shear wave type
 - Detection of small, near surface flaws
 - Thin-walled tubes and containers
 - Rings
- VRY and VSY longitudinal wave types
 - Coarse grain weld inspection
 - Attenuative materials
 - Austenitic welds
 - "Creeping wave" applications with 70° models

Features and Benefits

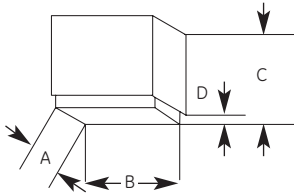
- Excellent near surface resolution
- Reduce noise caused by scattering
- Durable, ergonomically-designed die cast housing
- Types VS and VSY have side mounted Microdot connectors
- Type VRY has Lemo 00 connectors

Angle Beam Transducers, Dual Element (TR)

Types VS, VRY and VSY



Typical waveform and frequency spectrum



| Case Type | A | | B | | C | | D | |
|-----------|----|------|------|------|----|------|----|------|
| | mm | in | mm | in | mm | in | mm | in |
| Type 30 | 14 | 0.55 | 24 | 0.94 | 22 | 0.87 | 2 | 0.08 |
| Type 31 | 29 | 1.14 | 53.5 | 2.1 | 45 | 1.77 | 5 | 0.20 |
| Type 32 | 15 | 0.59 | 30 | 1.8 | 27 | 1.06 | | |

| Type | Order Code | a x b | | f (MHz) | β (Steel) | F | | Notes | Sketch |
|----------|------------|----------|-----------|---------|-----------|----|-----|---|---------|
| | | mm | in | | | mm | in | | |
| VS 45 | 57660 | 3.5 x 10 | .14 x .39 | 4 | 45 | 10 | 0.4 | DIN EN 12668-2 compliant | Type 30 |
| VS 45-EN | 500194 | 3.5 x 10 | .14 x .39 | 4 | 45 | 10 | 0.4 | | |
| VS 60 | 57661 | 3.5 x 10 | .14 x .39 | 4 | 60 | 10 | 0.4 | | |
| VS 60-EN | 500195 | 3.5 x 10 | .14 x .39 | 4 | 60 | 10 | 0.4 | | |
| VS 70 | 57662 | 3.5 x 10 | .14 x .39 | 4 | 70 | 10 | 0.4 | | |
| VS 70-EN | 500196 | 3.5 x 10 | .14 x .39 | 4 | 70 | 10 | 0.4 | DIN EN 12668-2 compliant | |
| VRY 45 | 57663 | 10 x 22 | .39 x .87 | 1.8 | 45 | 40 | 1.6 | VRY and VSY angles are longitudinal (compression) wave suitable for testing coarse grain materials. | Type 31 |
| VRY 60 | 57664 | 10 x 22 | .39 x .87 | 1.8 | 60 | 35 | 1.4 | | |
| VRY 70 | 57665 | 10 x 22 | .39 x .87 | 1.8 | 70 | 35 | 1.4 | | |
| VSY 45-2 | 67154 | 5 x 10 | .20 x .39 | 2 | 45 | 16 | 0.6 | 70° models suitable for creeping wave excitation in mild steel. | Type 32 |
| VSY 60-2 | 67155 | 5 x 10 | .20 x .40 | 2 | 60 | 16 | 0.6 | | |
| VSY 70-2 | 67156 | 5 x 10 | .20 x .41 | 2 | 70 | 16 | 0.6 | | |
| VSY 45-4 | 54577 | 5 x 10 | .20 x .42 | 4 | 45 | 20 | 0.8 | | |
| VSY 60-4 | 54578 | 5 x 10 | .20 x .43 | 4 | 60 | 20 | 0.8 | | |
| VSY 70-4 | 54579 | 5 x 10 | .20 x .44 | 4 | 70 | 20 | 0.8 | | |

Custom configurations are available by special order.

For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

| Accessories Description | Type | Remark |
|-------------------------|---------------|---------|
| Cable | SEKM2 (53001) | for VS |
| | SEKL2 (50710) | for VRY |
| | SEKN2 (53775) | for VSY |

Immersion Transducers



Applications

- Parts with irregular or complex geometry, such as gears and valves
- Automated or mechanized scanning
- Applications requiring very high near surface resolution or detection of very small flaws
- Scanning pipes, tubes and tanks
- Plates, billets and bars
- Disks, axles and shafts

Features and Benefits

- Acoustically matched for best efficiency in water
- Can be focused to a point (spherical) or to a line (cylindrical) for improved resolution, sensitivity and signal-to-noise ratio (refer to Selection Criteria on pages 2 through 4)
- European models have fixed cable with LEMO-1 connector.
- North American models have waterproof UHF connector, except IPS type, which has non-waterproof Microdot.

Minimum and Maximum Standard Focal Lengths (Longer or Shorter Focal Lengths May Be Available By Special Order)

| | | Element Diameter: mm (in) | | | | | | | | | | | | | | | |
|-----------------|-----|---------------------------|-------------|-------------|------------|-------------|-------------|------------|-----------|--|--|--|--|--|--|--|--|
| Frequency (MHz) | | 25.4 (1.0) | 20.0 (0.79) | 19.1 (0.75) | 12.7 (0.5) | 10.0 (0.39) | 9.5 (0.375) | 6.4 (0.25) | 5.0 (0.2) | | | | | | | | |
| 1.0 | N | 109 (4.3) | 67 (2.7) | 61 (2.4) | 28 (1.1) | | | | | | | | | | | | |
| | Min | 50 (2) | 40 (1.5) | 40 (1.5) | 25 (1) | | | | | | | | | | | | |
| | Max | 75 (3) | 50 (2) | 50 (2) | 25 (1) | | | | | | | | | | | | |
| 2.0 | N | | 135 (5.3) | | | 34 (1.3) | | | | | | | | | | | |
| | Min | | 40 (1.5) | | | 20 (0.8) | | | | | | | | | | | |
| | Max | | 100 (4) | | | 25 (1) | | | | | | | | | | | |
| 2.25 | N | 245 (9.6) | | 138 (5.4) | 61 (2.4) | | 34 (1.4) | 16 (0.6) | | | | | | | | | |
| | Min | 50 (2) | | 40 (1.5) | 25 (1) | | 20 (0.8) | 13 (0.5) | | | | | | | | | |
| | Max | 150 (6) | | 100 (4) | 50 (2) | | 25 (1) | 13 (0.5) | | | | | | | | | |
| 3.5 | N | 381 (15) | | 215 (8.4) | 94 (3.7) | | 53 (2.1) | 24 (0.9) | | | | | | | | | |
| | Min | 50 (2) | | 40 (1.5) | 25 (1) | | 20 (0.8) | 13 (0.5) | | | | | | | | | |
| | Max | 200 (8) | | 150 (6) | 60 (2.5) | | 40 (1.5) | 17 (0.7) | | | | | | | | | |
| 4.0 | N | | 270 (10.7) | | | 67 (2.6) | | | | | | | | | | | |
| | Min | | 40 (1.5) | | | 20 (0.8) | | | | | | | | | | | |
| | Max | | 200 (8) | | | 50 (2) | | | | | | | | | | | |
| 5.0 | N | 544 (21.4) | 337 (13.4) | 307 (12.0) | 137 (5.4) | 84 (3.3) | 76 (3.0) | 35 (1.3) | 21 (0.9) | | | | | | | | |
| | Min | 50 (2) | 40 (1.5) | 40 (1.5) | 25 (1) | 20 (0.8) | 20 (0.8) | 13 (0.5) | 10 (0.4) | | | | | | | | |
| | Max | 200 (8) | 200 (8) | 200 (8) | 100 (4) | 60 (2.4) | 50 (2) | 25 (1.0) | 15 (0.6) | | | | | | | | |
| 10.0 | N | | | 615 (24.1) | 272 (10.7) | | 152 (6.0) | 69 (2.7) | 42 (1.7) | | | | | | | | |
| | Min | | | 40 (1.5) | 25 (1) | | 20 (0.8) | 13 (0.5) | 10 (0.4) | | | | | | | | |
| | Max | | | 200 (8) | 150 (6) | | 100 (4) | 50 (2) | 30 (1.2) | | | | | | | | |
| 15.0 | N | | | | 406 (16) | | 228 (9.0) | 104 (4.0) | | | | | | | | | |
| | Min | | | | 25 (1) | | 20 (0.8) | 13 (0.5) | | | | | | | | | |
| | Max | | | | 150 (6) | | 150 (6) | 60 (2.5) | | | | | | | | | |

Notes:

N = Near field length in water

Min = Minimum recommended focal length in water

Max = Maximum recommended focal length in water

Distances in steel are approximately 1/4 the distances given for water. Longer or shorter focal lengths may be available by special order.

Immersion Transducers—European Standards

Types Z, H and L



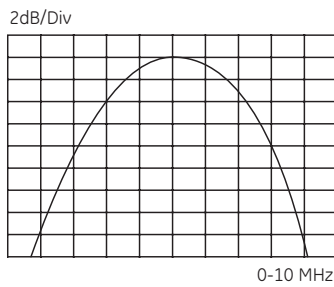
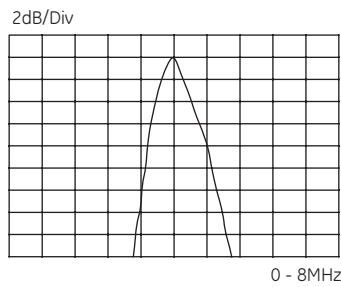
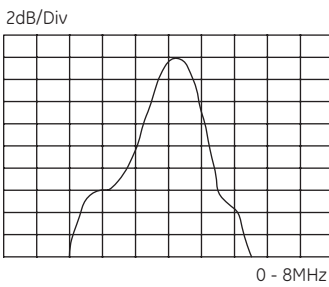
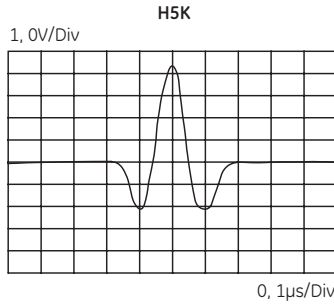
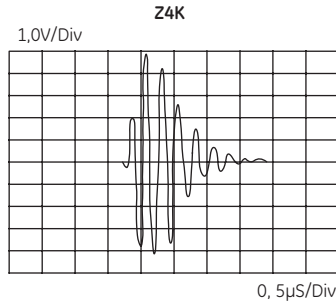
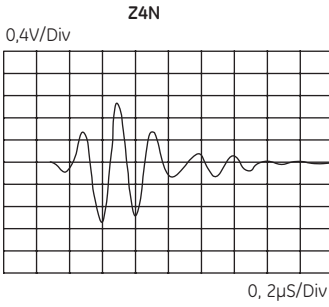
Z..N, H..N and L..N



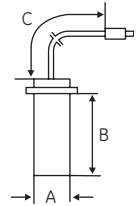
Z..K, H..K and L..K



Z..M, H..M and L..M



Typical waveform and frequency spectrum



| Type | Order Code | D | f | N | Notes | Sketch | | |
|--------|------------|----|------|-------|-------|--------|--|---|
| | | mm | in | (MHz) | mm | in | | |
| Z 1 N | 53317 | 20 | 0.79 | 1 | 64 | 2.5 | Type 33 | |
| Z 2 N | 53318 | 20 | 0.79 | 2 | 127 | 5.0 | | |
| Z 4 N | 53319 | 20 | 0.79 | 4 | 254 | 10.0 | | |
| Z 5 N | 54705 | 20 | 0.79 | 5 | 318 | 12.5 | | |
| Z 2 K | 53341 | 10 | 0.39 | 2 | 32 | 1.3 | | High sensitivity (gain reserve) for testing small to mid-size objects. Type 34 |
| Z 4 K | 53342 | 10 | 0.39 | 4 | 64 | 2.5 | | |
| Z 5 K | 53732 | 10 | 0.39 | 5 | 80 | 3.1 | | |
| Z 10 K | 54704 | 10 | 0.39 | 10 | 160 | 6.3 | | |
| Z 5 M | 55468 | 5 | 0.20 | 5 | 20 | 0.8 | Type 35 | |
| Z 10 M | 53367 | 5 | 0.20 | 10 | 40 | 1.6 | | |
| Z 15 M | 55576 | 5 | 0.20 | 15 | 60 | 2.4 | | |
| H 1 N | 53042 | 20 | 0.79 | 1 | 64 | 2.5 | Shock wave transducers especially suitable for thickness measurement or other applications requiring high resolution. Type 33 | |
| H 2 N | 53043 | 20 | 0.79 | 2 | 127 | 5.0 | | |
| H 2 K | 53300 | 10 | 0.39 | 2 | 32 | 1.3 | | |
| H 5 K | 53032 | 10 | 0.39 | 5 | 80 | 3.1 | | |
| H 10 K | 55818 | 10 | 0.39 | 10 | 160 | 6.3 | | |
| H 5 M | 53258 | 5 | 0.20 | 5 | 20 | 0.8 | | |
| H 10 M | 53041 | 5 | 0.20 | 10 | 40 | 1.6 | | |
| L 1 N | 53133 | 20 | 0.79 | 1 | 63 | 2.5 | | Broadband for applications requiring high resolution. Type 33 |
| L 2 N | 53134 | 20 | 0.79 | 2 | 127 | 5.0 | | |
| L 2 K | 53137 | 10 | 0.39 | 2 | 32 | 1.3 | | |
| L 5 K | 53139 | 10 | 0.39 | 5 | 80 | 3.1 | | |
| L 5 M | 53143 | 5 | 0.20 | 5 | 20 | 0.8 | | |

| Case Type | A | | B | | C | |
|-----------|-----|------|----|------|-----|------|
| | mm | in | mm | in | m | feet |
| Type 33 | 24 | 0.94 | 60 | 2.36 | 2.5 | 8.2 |
| Type 34 | 13 | 0.51 | 60 | 2.36 | 2.5 | 8.2 |
| Type 35 | 9.5 | 0.37 | 25 | 0.98 | 1.5 | 3.9 |

Also available with spherical (point) and cylindrical (line) focusing. Specify focal length. For available focal lengths, refer to the table at beginning of the Immersion Transducers section.

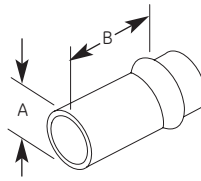
Custom configurations are available by special order.

For explanations to the table data, refer to Selection Criteria on pages 2 through 4.

Immersion Transducers—North American Standards

Types ISS and IS

| Element Ø | | A | | B | |
|-----------|------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | .25 | 16 | 0.63 | 39.4 | 1.55 |
| 10 | .375 | 16 | 0.63 | 39.4 | 1.55 |
| 13 | .50 | 16 | 0.63 | 39.4 | 1.55 |
| 19 | .75 | 25.4 | 1.00 | 45.0 | 1.77 |
| 25 | 1.0 | 31.8 | 1.25 | 46.2 | 1.82 |



Immersion Transducers—Types ISS and IS

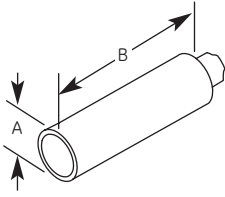
| Freq. (MHz) | Element Ø | | Order Code | | | | Freq. (MHz) | Element Ø | | Order Code | | | |
|-------------|-----------|------|------------|--------------|--------------|------------------|-------------|-----------|------|------------|-------------------|--------------|------------------|
| | | | *Focus | Alpha Series | Gamma Series | Benchmark Series | | | | *Focus | Alpha Series | Gamma Series | Benchmark Series |
| 1.0 | 19 | .750 | S | | 251-360 | | 6 | .250 | S | 124-280 | 224-280 | | |
| | | | C | | 251-370 | | | | C | 124-290 | 224-290 | | |
| | | | N | | 251-380 | | | | N | 124-300 | 224-300 | 824-300 | |
| 2.25 | 10 | .375 | S | | 261-360 | 861-360 | 10.0 | 10 | .375 | S | 134-280 | 234-280 | 834-280 |
| | | | C | | 261-370 | 861-370 | | | | C | 134-290 | 234-290 | 834-290 |
| | | | N | | 261-380 | 861-380 | | | | N | 134-300 | 234-300 | 834-300 |
| 3.5 | 6 | .250 | S | | 222-280 | | 5.0 | 13 | .500 | S | 144-280 | 244-280 | 844-280 |
| | | | C | | 222-290 | | | | | C | 144-290 | 244-290 | 844-290 |
| | | | N | 122-300 | 222-300 | 822-300 | | | | N | 144-300 | 244-300 | 844-300 |
| 5.0 | 10 | .375 | S | 132-280 | 232-280 | | 10.0 | 19 | .750 | S | 154-360 | 254-360 | 854-360 |
| | | | C | 132-290 | 232-290 | | | | | C | 154-370 | 254-370 | 854-370 |
| | | | N | 132-300 | 232-300 | 832-300 | | | | N | 154-380 | 254-380 | 854-380 |
| 7.5 | 13 | .500 | S | 142-280 | 242-280 | 842-280 | 10.0 | 25 | 1.00 | S | 164-360 | 264-360 | 864-360 |
| | | | C | 142-290 | 242-290 | 842-290 | | | | C | 164-370 | 264-370 | 864-370 |
| | | | N | 142-300 | 242-300 | 842-300 | | | | N | 164-380 | 264-380 | 864-380 |
| 10.0 | 19 | .750 | S | 152-360 | 252-360 | 852-360 | 10.0 | 6 | .250 | S | 126-280 | 226-280 | |
| | | | C | 152-370 | 252-370 | 852-370 | | | | C | 126-290 | 226-290 | |
| | | | N | 152-380 | 252-380 | 852-380 | | | | N | 126-300 | 226-300 | |
| 15.0 | 25 | 1.00 | S | 162-360 | 262-360 | 862-360 | 10.0 | 10 | .375 | S | 136-280 | 236-280 | |
| | | | C | 162-370 | 262-370 | 862-370 | | | | C | 136-290 | 236-290 | |
| | | | N | 162-380 | 262-380 | 862-380 | | | | N | 136-300 | 236-300 | |
| 20.0 | 13 | .500 | S | 143-280 | 243-280 | 843-280 | 10.0 | 13 | .500 | S | 146-280 | 246-280 | |
| | | | C | 143-290 | 243-290 | 843-290 | | | | C | 146-290 | 246-290 | |
| | | | N | 143-300 | 243-300 | 843-300 | | | | N | 146-300 | 246-300 | |
| 25.0 | 19 | .750 | S | 153-360 | 253-360 | 853-360 | 10.0 | 19 | .750 | S | 156-360 | 256-360 | |
| | | | C | 153-370 | 253-370 | 853-370 | | | | C | 156-370 | 256-370 | |
| | | | N | 153-380 | 253-380 | 853-380 | | | | N | 156-380 | 256-380 | |
| 30.0 | 25 | 1.00 | S | 163-360 | 263-360 | 863-360 | 15.0 | 6 | .250 | S | 127-280 | | |
| | | | C | 163-370 | 263-370 | 863-370 | | | | C | 127-290 | | |
| | | | N | 163-380 | 263-380 | 863-380 | | | | N | 127-300 | | |
| 40.0 | 6 | .250 | S | | | | 15.0 | 6 | .250 | 1.5 in S | 127-302 (TTC-100) | | |
| | | | C | | | | | | | C | 137-280 | | |
| | | | N | | | | | | | N | 137-290 | | |
| 50.0 | 10 | .375 | S | | | | 15.0 | 10 | .375 | S | 147-280 | | |
| | | | C | | | | | | | C | 147-290 | | |
| | | | N | | | | | | | N | 147-300 | | |

Note: Waterproof cables are in the Accessories Section.

* Focus: S = Spherical, C = Cylindrical, N = Non-focus. Focal length must be specified. For available focal lengths, refer to the table at the beginning of the Immersion Transducers section. Custom configurations are available by special order.

Immersion Transducers—North American Standards

Type IPS



| Element Ø | | A | | B | |
|-----------|------|-----|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | .250 | 9.7 | 0.38 | 36.8 | 1.45 |

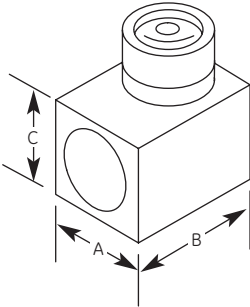


Immersion Transducers—Type IPS

| Freq. (MHz) | Element Ø | | Order Code | | | | Freq. (MHz) | Element Ø | | Order Code | | | |
|-------------|-----------|------|------------|--------------|--------------|--|-------------|-----------|------|------------|--------------|-------------------------------|--|
| | mm | in | *Focus | Alpha Series | Gamma Series | Accessories | | mm | in | *Focus | Alpha Series | Gamma Series | Accessories |
| 2.25 | 6 | 0.25 | N | 122-340 | 222-340 | Cable BNC 118-140-012 Non-waterproof | 10.0 | 6 | 0.25 | S | 126-320 | 226-320 | Cable BNC 118-140-012 Non-waterproof |
| | | | | | | | | | | C | 126-330 | 226-330 | |
| | | | | | | | | | | N | 126-340 | 226-340 | |
| 5.0 | 6 | 0.25 | S | 124-320 | 224-320 | 15.0 | 6 | 0.25 | S | 127-320 | | 118-140-012 Non-waterproof | |
| | | | C | 124-330 | 224-330 | | | | C | 127-330 | | | |
| | | | N | 124-340 | 224-340 | | | | N | 127-340 | | | |

* Focus: S = Spherical, C = Cylindrical, N = Non-focus. Focal length must be specified. For available focal lengths, refer to the table at the beginning of the Immersion Transducers section. Custom configurations are available by special order.

Type IR



| Element Ø | | A | | B | | C | |
|-----------|------|------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 6 | .250 | 19.1 | 0.75 | 23.9 | 0.94 | 19.1 | 0.75 |
| 10 | .375 | 19.1 | 0.75 | 23.9 | 0.94 | 19.1 | 0.75 |
| 13 | .500 | 19.1 | 0.75 | 23.9 | 0.94 | 19.1 | 0.75 |



Immersion Transducers—Type IR

| Freq. (MHz) | Element Ø | | Order Code | | | Freq. (MHz) | Element Ø | | Order Code | | |
|-------------|-----------|-------|------------|--------------|--------------|-------------|-----------|------|------------|--------------|--------------|
| | mm | in | *Focus | Alpha Series | Gamma Series | | mm | in | *Focus | Alpha Series | Gamma Series |
| 2.25 | 6 | 0.25 | N | 122-420 | 222-420 | 5.0 | 6 | 0.25 | S | 124-400 | 224-400 |
| | | | | | | | | | C | 124-410 | 224-410 |
| | | | | | | | | | N | 124-420 | 224-420 |
| | 10 | 0.375 | S | 132-400 | 232-400 | | | | | | |
| | | | C | 132-410 | 232-410 | | | | | | |
| | | | N | 132-420 | 232-420 | | | | | | |
| | 13 | 0.50 | S | 142-400 | 242-400 | | | | | | |
| | | | C | 142-410 | 242-410 | | | | | | |
| | | | N | 142-420 | 242-420 | | | | | | |
| | | S | 134-400 | 234-400 | | | | | | | |
| | | C | 134-410 | 234-410 | | | | | | | |
| | | N | 134-420 | 234-420 | | | | | | | |
| | | S | 144-400 | 244-400 | | | | | | | |
| | | C | 144-410 | 244-410 | | | | | | | |
| | | N | 144-420 | 244-420 | | | | | | | |

* Focus: S = Spherical, C = Cylindrical, N = Non-focus. Focal length must be specified. For available focal lengths, refer to the table at the beginning of the Immersion Transducers section. Waterproof cables can be found in the Transducers Accessories Section. Custom configurations are available by special order.

Transducers for Specific Applications

GE Inspection Technologies' Application Centers provide a broad spectrum of services to users of nondestructive testing applications. Our mission is to bring together worldwide knowledge and experience across multiple industries and modalities to help customers quickly solve their inspection application problems.

With an unsurpassed track record, our highly skilled engineers, technicians and specialists are a key asset for our customers. Their experience is broad, encompassing many NDT modalities and many industry segments—from the development of a radiographic solution to inspect aerospace parts on the manufacturing floor to the design of customized ultrasound transducers or eddy current probes for field inspection in the power, oil, gas and automotive industries.

New materials, manufacturing processes, and joining technologies often require customized ultrasonic transducers and accessories, designed specifically for the particular application. We offer a wide range of special application transducers, some of which are shown on these pages. Our special transducer teams are ready to address new application problems quickly and effectively. For more information and an inquiry form, visit GE Inspection Technologies on the Internet at www.ge.com/inspectiontechnologies.

Special Application Transducers

Roller (Wheel) Transducers

Ultrasonic roller transducers and systems for the inspection of overlapped and butt laser welds or brazed joints and welds on tailored blanks with dry coupling.



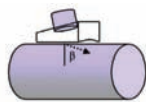
Low Frequency Transducers

Ultrasonic transducers for the inspection of coarse materials such as concrete, refractory bricks, stones, and wood.



Axle Transducers

Ultrasonic transducers for the inspection of railway axles and wheel sets.



Transducer Holders

Ultrasonic transducer holders for special fixtures for the inspection of gas bottles and tubes.



Transverse (Shear) Wave Straight Beam Transducers

Normal incidence transverse wave transducers typically used for characterization of materials.



Spot Weld Transducers

Ultrasonic transducers with a flexible acoustic interface for inspection of resistance welded spot welds on automotive bodies.



MIG/MAG Transducers

Ultrasonic transducers for the inspection of MIG and MAG welds using the ultrasonic transmission technique.



Tube Testing Transducers

Ultrasonic transducers for the inspection of tubes and hollow railway axles and wheel sets.



High Temperature Transducers

Ultrasonic transducers for inspection at higher temperatures with heat resistant delays.



High Frequency Immersion Transducers

Very high resolution immersion transducers, 25 MHz to 50 MHz.



RL Transducers

Refracted longitudinal wave angle beam transducers, single and dual element, for inspection of coarse grain materials such as austenitic steel pipe welds.



Boreside Arrays

Multi-element ultrasonic transducers, with water feed, for the inspection of tubing from the ID.



ZIP Probes

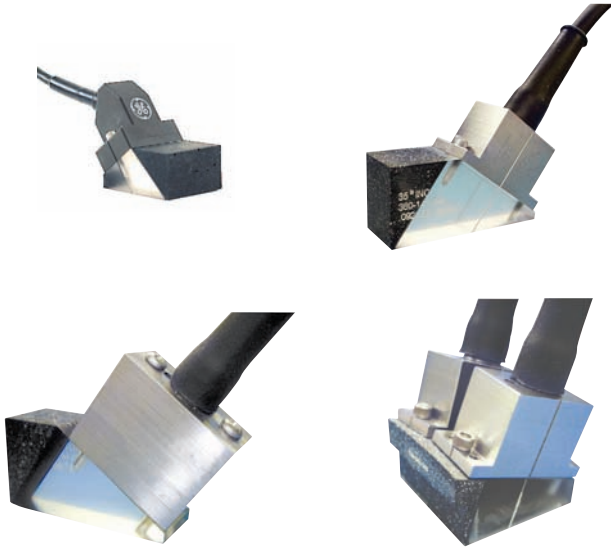
"Zero Interface" delay line transducers for manual inspection of composite materials.



Phased Array Transducers

GE Inspection Technologies manufactures a wide variety of phased array transducers for use with Phasor and other instruments. Phasor transducers with the Dialog feature recognize physical connection and automatically download transducer information to Phasor. More information on our full range of phased array transducers is available at www.ge.com/inspectiontechnologies.

Small and Mid-Sized Phased Arrays for General Angle and Straight Beam Applications



Applications

- Power: General weld inspection, austenitic welds, pressure vessels and piping, turbine blades, rotors
- Oil and Gas: Pipeline girth welds, tanks, general weld inspection
- Aerospace: Weld inspection, landing gear
- Automotive: Axles, shafts, spindles, brake discs, wheels
- General: Welds, forgings, castings, tubular goods, bridges and structures

Features and Benefits

- Electronic control of beam angle, focus, and scanning index
- Eliminate multiple inspections with fixed angle and fixed focus probes.
- Inspect hard to access areas from a single contact point.
- Replaceable angle beam wedges and 0° delay lines, flat or curved
- Probes with internal wedges and delay lines are also available.

Typical Specifications (Others Available Upon Request)

| Frequency (MHz) | Element Count | Pitch mm (in) | Elevation mm (in) |
|-----------------|-----------------|--------------------------|------------------------|
| 1.0 | 16, 32, 64, 128 | 1 to 3 (.04 to .12) | 10 to 25 (0.4 to 1.0) |
| 1.5 | 16, 32, 64, 128 | 0.75 to 3 (.03 to .12) | 10 to 25 (0.4 to 1.0) |
| 2.25 | 16, 32, 64, 128 | 0.5 to 2 (.02 to .08) | 6 to 20 (0.25 to 0.8) |
| 3.5 | 16, 32, 64, 128 | 0.5 to 2 (.02 to .08) | 6 to 20 (0.25 to 0.8) |
| 5.0 | 16, 32, 64, 128 | 0.25 to 1.5 (.01 to .06) | 6 to 20 (0.25 to 0.8) |
| 7.5 | 16, 32, 64, 128 | 0.25 to 1 (.01 to .04) | 6 to 16 (0.25 to 0.63) |

Phased Array for Scanning and Wide Area Coverage, Immersion or Delay Line



Applications

- Power Generation: Pressure vessels, piping
- Oil and Gas: Piping, tanks
- Aerospace: Composite delamination and disbond, weld inspection, landing gear
- Transportation: Composite delamination and disbond, plates
- General: Large area scanning, plate, bar, tubular goods, in-line thickness measurement

Features and Benefits

- Electronic control of beam angle, focus, and scanning index
- Reduce set-up and scan times.
- Increase sensitivity and signal-to-noise ratio with electronic focusing.
- Reduce or eliminate mechanical and manual manipulation.
- Use immersion method or with replaceable delay line.

Typical Specifications (Others Available Upon Request)

| Frequency (MHz) | Element Count | Pitch/mm (in) | Elevation/mm (in) |
|-----------------|---------------|--------------------------|------------------------|
| 1.0 | 32, 64, 128 | 1 to 3 (.04 to .12) | 10 to 25 (0.4 to 1.0) |
| 1.5 | 32, 64, 128 | 0.75 to 3 (.03 to .12) | 10 to 25 (0.4 to 1.0) |
| 2.25 | 32, 64, 128 | 0.5 to 2 (.02 to .08) | 6 to 20 (0.25 to 0.8) |
| 3.5 | 32, 64, 128 | 0.5 to 2 (.02 to .08) | 6 to 20 (0.25 to 0.8) |
| 5.0 | 32, 64, 128 | 0.25 to 1.5 (.01 to .06) | 6 to 20 (0.25 to 0.8) |
| 7.5 | 32, 64, 128 | 0.25 to 1 (.01 to .04) | 6 to 16 (0.25 to 0.63) |
| 10.0 | 32, 64, 128 | 0.25 to 1 (.01 to .04) | 6 to 13 (0.25 to 0.5) |

Transducer Accessories

Cables and Adapters

Plug Type

| Cable Type | Order Code | Length m (ft) | Impedance (ohms) | Transducer | Instrument |
|--------------|-------------|---------------|------------------|-----------------------------------|------------|
| CL 331 | 58160 | 2 (6.5) | 50 | Microdot | LEMO-00 |
| MPKLL 2 | 58791 | 2 (6.5) | 50 | LEMO-00 | LEMO-00 |
| MPKL 2 | 50486 | 2 (6.5) | 50 | LEMO-00 | LEMO-1 |
| MPKM 2 | 52999 | 2 (6.5) | 50 | Microdot | LEMO-1 |
| PKP 2 | 66709 | 2 (6.5) | 75 | LEMO-03 Waterproof | LEMO-1 |
| PKI 2 | 57694 | 2 (6.5) | 75 | UHF Waterproof | LEMO-1 |
| PKLL 2 | 50326 | 2 (6.5) | 75 | LEMO-1 | LEMO-1 |
| PKTL 2 | 52642 | 2 (6.5) | 50 | LEMO-1 Waterproof | LEMO-1 |
| SEKG 2 | 53887 | 2 (6.5) | 50 | LEMO-00 Dual Plug | 2x LEMO-1 |
| SEKL 2 | 50710 | 2 (6.5) | 50 | 2x LEMO-00 | 2x LEMO-1 |
| SEKM 2 | 53001 | 2 (6.5) | 50 | 2x Microdot | 2x LEMO-1 |
| SEKN 2 | 53775 | 2 (6.5) | 50 | 1x Microdot 1x Microdot, Large | 2x LEMO-1 |
| VKLL 5 | 50484 | 5 (16.4) | 75 | LEMO-1 Coupling | LEMO-1 |
| MD-BNC | 118-140-012 | 1.8 (6) | 50 | Microdot | BNC |
| MD-BNC 12 | 118-140-011 | 3.6 (12) | 50 | Microdot | BNC |
| MMD-BNC | 118-140-047 | 1.8 (6) | 50 | MMD | BNC |
| MD/RA-BNC | 118-140-033 | 1.8 (6) | 50 | Right Angle Microdot | BNC |
| BNC-BNC | 118-140-016 | 1.8 (6) | 50 | BNC | BNC |
| BNC-BNC 12 | 118-140-021 | 3.6 (12) | 50 | BNC | BNC |
| UHF-BNC | 118-140-027 | 1.8 (6) | 50 | UHF Non-waterproof | BNC |
| L1-BNC | 118-140-018 | 1.8 (6) | 50 | LEMO-1 | BNC |
| UHF/WP-BNC | 118-140-013 | 1.8 (6) | 75 | UHF Waterproof | BNC |
| Dual MMD-BNC | 118-140-014 | 1.8 (6) | 50 | 2x MMD | 2x BNC |
| Dual MD-BNC | 118-140-024 | 1.8 (6) | 50 | 2x Microdot | 2x BNC |



Plug Type

| Adaptor Type | Order Code | Transducer | Instrument |
|------------------------|-------------|---------------------|-----------------------|
| PKLB1 | 53013 | BNC Socket | LEMO-1 Plug |
| PKBL1 | 53014 | LEMO-1 Socket | BNC Plug |
| STUHF-RA (Right Angle) | 118-560-032 | UHF Plug Waterproof | UHF Socket Waterproof |
| DM-BNC (Dual) | 118-560-045 | D-Meter Plug | 2x BNC |

Couplants

General Purpose Couplants

| Couplant Type | Container Size | Description | Order Code | Features |
|---------------|----------------------------------|---|-------------|---|
| ZG-F | 2.5 kg(5.5 lb) | General Purpose | 50469 | <ul style="list-style-type: none"> • Thixotropic paste • Non-drip, washable, non-corrosive • Temperature range -4°F to 212°F (-20°C to 100°C) • Safety data sheet per 91/155/EEC |
| | 5 bottles 250 ml (8.5 fl oz.) | General Purpose | 54558 | |
| ZGT | 100 g Tube (3.5 oz.) | Multigrade Couplant | 50472 | <ul style="list-style-type: none"> • Medium viscosity paste • Water resistant, non-corrosive • Temperature range -22°F to 480°F (-30°C to 250°C) • Safety data sheet per 91/155/EEC |
| Exosen 20 | 3.8 liter (1 gal) | General Purpose, Medium Viscosity | 118-300-420 | <ul style="list-style-type: none"> • Water soluble • Non-toxic • Non-flammable • Non-irritating • Rust preventative added • Temperature range 32°F to 212°F (0°C to 100°C) • Material Safety Data Sheet per 29 CFR 1910.1200 |
| | Case of 4 3.8 liter (1 gal) | | 118-300-425 | |
| | 18.9 liter (5 gal) | | 118-300-440 | |
| | 208 liter (55 gal) | | 118-300-460 | |
| Exosen 30 | 3.8 liter (1 gal) | General Purpose, High Viscosity, Pourable | 118-300-520 | <ul style="list-style-type: none"> • Rust preventative added • Temperature range 32°F to 212°F (0°C to 100°C) • Material Safety Data Sheet per 29 CFR 1910.1200 |
| | Case of 4 3.8 liter (1 gal) | | 118-300-525 | |
| | 18.9 liter (5 gal) | | 118-300-540 | |
| | 208 liter (55 gal) | | 118-300-560 | |

Specialty Couplants

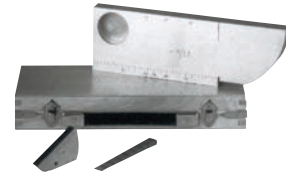
| Couplant Type | Container Size | Description | Order Code | Notes |
|---------------|-------------------------|---|-------------|---|
| ZGM | 100 g Tube (3.5 oz.) | High Temperature Coupling Paste | 56567 | <ul style="list-style-type: none"> • High viscosity paste • Solid filler melts at elevated temperature • Specially formulated for thickness measurement on hot parts • Temperature range 390°F to 1100°F (200°C to 600°C) |
| Hitempco | 79 g Tube (2.8 oz.) | High Temperature Coupling Grease | 118-300-010 | <ul style="list-style-type: none"> • High viscosity grease • Thickness measurement and flaw detection on hot parts • Temperature range 50°F to 550°F (10°C to 290°C) • Material Safety Data Sheet per 29 CFR 1910.1200 |
| | 12 Tubes 79 g (2.8 oz.) | | 118-300-015 | |
| SLC | 113 g (4 oz.) | High Viscosity, High Attenuation | 118-300-080 | <ul style="list-style-type: none"> • Extremely high viscosity • Allows transmission of transverse (shear) waves • High attenuation reduces noise on rough or curved surface • Material Safety Data Sheet per 29 CFR 1910.1200 |
| XD-740 | 59 ml (2 fl oz.) | Wedge, Delay Line, Protective Face Couplant | 118-300-740 | <ul style="list-style-type: none"> • Applied between transducer face and accessory • Material Safety Data Sheet per 29 CFR 1910.1200 |
| XL | 236 ml (8 fl oz.) | Low Viscosity Laboratory Couplant | 118-300-820 | <ul style="list-style-type: none"> • For smooth surface, 1.6 µm (62 µin) RMS or better • Suitable for performance testing of ultrasonic transducers • Material Safety Data Sheet per 29 CFR 1910.1200 |
| | 3.78 liter (1 gal) | | 118-300-860 | |

Calibration Blocks

Calibration blocks provide known targets that produce echo indications that are used for instrument setup, transducer evaluation, and reference for evaluating flaw size.

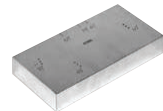
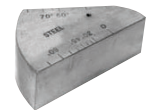
Calibration Blocks—European Standards

| Block Type (Steel) | Order Code | Description |
|-------------------------|------------|--|
| K1 EN 12223 | 59108 | <ul style="list-style-type: none"> Large angle beam calibration block, 100 mm radius Calibrate range with an angle beam transducer Measure beam index point and refracted angle |
| K2 EN 27963/ISO 7963 | 50434 | <ul style="list-style-type: none"> Small angle beam calibration block, 25 and 50 mm radii Calibrate range with an angle beam transducer Measure beam index point and refracted angle |
| VW | 50441 | <ul style="list-style-type: none"> Step block for calibrating thickness range Eight .039 in (1 mm) steps, .039 in (1 mm) through .039 in (9 mm) to .315 in (8 mm) |
| N30 | 58474 | <ul style="list-style-type: none"> Ultrasonic reference standard Connect directly to flaw detector Produces multiple echoes at precise intervals in steel Check instrument gain over long time periods |



Calibration Blocks—North American Standards

| Block Type (Steel) | Order Code | Description |
|-----------------------|-------------|---|
| IW Type 1 | 118-540-270 | <ul style="list-style-type: none"> Large angle beam calibration block 4.0 in (101.6 mm) radius for angle beam range calibration Measure beam index point and refracted angle Also used to check resolution and sensitivity |
| IW Type 2 | 118-540-280 | <ul style="list-style-type: none"> Same as IW Type 1 with 2 in (50.8 mm) and 4 in (101.6 mm) radii for range calibration Side drilled holes also added for resolution check |
| DSC | 118-540-300 | <ul style="list-style-type: none"> Small block for angle beam distance and sensitivity calibration 1.0 in (25.4 mm) radius opposite a 3.0 in (76.2 mm) radius 0.375 in (9.5 mm) slot in the 3.0 in (76.2 mm) radius Also used to check beam index point and refracted angle |
| Angle Beam, Miniature | 118-540-260 | <ul style="list-style-type: none"> Substitute for DSC block 1.0 in (25.4 mm) radius opposite a 2.0 in (50.8 mm) radius Side drilled hole to check beam index point and refracted angle |
| AWS Resolution | 118-540-350 | <ul style="list-style-type: none"> Evaluate angle beam transducer resolution capability Three sets of side drilled holes for 45°, 60° and 70° angles Three 0.062 in (1.6 mm) diameter holes in each set of holes |
| NAVSHIPS Test Block | 118-540-370 | <ul style="list-style-type: none"> For NAVSHIPS specification 0900-006-3010, Section 6 Distance amplitude correction, sensitivity, and flaw depth |
| 4-Step Block | 118-540-320 | <ul style="list-style-type: none"> Step block for calibrating thickness range Steps .250, .500, .750, 1.00 in (6.35, 12.70, 19.05, 25.40 mm) |
| 5-Step Block | 118-540-310 | <ul style="list-style-type: none"> Step block for calibrating thickness range Steps .100, .200, .300, .400, .500 in (2.54, 5.08, 7.62, 10.06, 12.70 mm) |



Transducer Kits

Our transducer kits combine the most commonly used transducers and accessories necessary for general, and some specific, ultrasonic testing applications. Each kit includes a hard shell carrying case for easy access, convenient storage and transportation.

Transducer Kits—European Standards

| Type | Order Code | Description | Probe contents |
|-------|------------|------------------|--|
| PKS 1 | 57281 | Coarse Grain Set | K0,5S; K1SM; WRY45; WRY70; WB45-1; WSY45-4, WSY70-4 |
| PKS 2 | 57282 | Aircraft Set | B4S; K4G; G5KB; MSEB4; K5K; CLF4; SEB10KF3; 2x MWB45-4; MWB70-4; MWB90-4 |
| PKS 3 | 57283 | Steel Set | B4S; SEB2; G5KB; MSEB4; MB4F; WK45-2; WK70-2; 2x MWB45-4; MWB70-4 |
| PKS 4 | 57284 | Welding Set | MB4S; SEB4; WB45-2; WB70-2; MWB45-2; 2x MWB45-4; MWB60-4; 2x MWB70-4 |
| PKS 5 | 57285 | Casting Set | B2S; SEB2; K1S; MB2S; SEB4KF8; G5KB; WB45-1; WB70-1; MWB45-2 |
| PKS 6 | 57286 | Forging Set | B4S; B2S; SEB2; MB4S; K2N; SEB4KF8; MB4F; WB45-2; MWB45-4; MWB70-4 |

Transducer Kits—North American Standards

Basic Contact Kit

Product Order Code 118-450-020

Wide assortment for weld inspection, lamination detection, corrosion/erosion and thin gauge materials.

| Qty. | Product Codes | Description |
|------|---------------|---|
| 1 | 113-292-603 | 2.25 MHz, .63 in x .63 in AWS Style, Single Element |
| 1 | 113-242-591 | 2.25 MHz, .5 in MSW-QC Style, BMC Single Element Angle Beam Probe |
| 1 | 113-262-043 | 2.25 MHz, 1 in CR Style, Single Element Contact Probe |
| 1 | 113-544-000 | 5 MHz, .5 in CA211A Style, Single Element Contact Probe |
| 1 | 113-252-240 | 2.25 MHz, .75 in PFCR Style, Single Element Membrane Probe |

| Qty. | Product Codes | Description |
|------|---------------|---|
| 1 | 113-527-660 | 15 MHz, .25 in ALPHA 2 DFR Style, Single Element Delay Line Probe |
| 1 | 113-292-751 | 2.25 MHz, .5 in x .5 in DU-F Style, Dual Element Contact Probe |
| 1 | 113-224-681 | 5 MHz, .25 in RC Style, Dual Element Contact Probe |
| 1 | C-012 | BNC-MD Coaxial Cable |
| 1 | C-016 | BNC-BNC Coaxial Cable |
| 1 | C-024 | BNC-MD Dual Coaxial Cable |
| 1 | C-088 | BNC-RC Dual Coaxial Cable |

| Qty. | Product Codes | Description |
|------|-----------------|---|
| 1 | D-050 | Delay Lines for 113-527-660 (10 pcs.) |
| 1 | PK-140 | Protective Membrane Kit for 113-252-240 PFCR probe. |
| 1 | W-104, 106 | 45° and 70° Lucite Wedge |
| 1 | W-211, 212, 213 | 45°, 60° and 70° Lucite Wedge |
| 1 | XD-740 | Wedge/Delay Line Couplant |
| 1 | 118-540-198 | Calibration Block .1 in-.5 in |
| 1 | 118-800-025 | Diced Foam Carrying Case |

Basic AWS Weld Inspection Kit

Order Code 118-450-500

Transducers and accessories for testing weldments to specification AWS D1.1.

| Qty. | Product Codes | Description |
|------|---------------|--|
| 1 | 113-292-603 | 2.25 MHz, .63 in x .63 in AWS Style, Single Element Angle Beam Probe |
| 1 | 113-292-601 | 2.25 MHz, .63 in x .75 in AWS Style, Single Element Angle Beam Probe |
| 1 | 113-292-604 | 2.25 MHz, .75 in x .75 in AWS Style, Single Element Angle Beam Probe |
| 1 | 113-262-043 | 2.25 MHz, .1 in dia. CR-RHP, L-Wave Contact Probe |
| 1 | W-104 | 45° Lucite Wedge |
| 1 | W-105 | 60° Lucite Wedge |
| 1 | W-106 | 70° Lucite Wedge |
| 1 | C-016 | BNC-BNC Coaxial Cable |
| 1 | B-196 | DSC Reference Standard |
| 1 | XL-820 | 8 oz. Couplant |
| 1 | 118-800-025 | Diced Foam Carrying Case |

Multi-Purpose Contact Kit

Order Code 118-450-510

Commonly used transducers for a variety of angle beam, lamination, corrosion, general flaw, and thickness testing.

| Qty. | Product Codes | Description |
|------|---------------|--|
| 1 | 113-544-000 | 5 MHz, .5 in dia. CA211A Style, Single Element Contact Probe |
| 1 | 113-262-043 | 2.25 MHz, 1 in dia. CR Style, Single Element Contact Probe |
| 1 | 113-527-660 | 15 MHz, .25 in Alpha 2 DFR Style, Delay Line Probe |
| 1 | 113-224-700 | 5 MHz, .25 in dia. ADP Style, Dual Element Probe |
| 1 | 113-244-591 | 5 MHz, .5 in dia. MSW-QC Style, Benchmark Angle Beam Probe |
| 2 | W-211 | 45° Lucite Wedge |
| 2 | W-212 | 60° Lucite Wedge |
| 2 | W-213 | 70° Lucite Wedge |
| 2 | C-016 | BNC-BNC Coaxial Cable |
| 2 | C-012 | BNC-MD Coaxial Cable |
| 1 | 118-540-198 | 5 Step Reference Standard, 1 in-.5 in |
| 1 | XL-820 | 8 oz. Couplant |
| 1 | 118-800-025 | Diced Foam Carrying Case |

Basic Angle Beam Kit

Order Code 118-450-030

Assortment for weld and other angle beam inspections.

| Qty. | Product Codes | Description |
|-------|-----------------|---|
| 1 | 113-294-642 | 5 MHz, 70° ABFP-SM, Single Element Angle Beam Probe |
| 1 | 113-216-585 | 10 MHz, .125 in SMSWS Style, Single Element Angle Beam Probe |
| 1 | 113-294-600 | 5 MHz, 5 in x 1 in SWS Style, Single Element Angle Beam Probe |
| 1 | 113-224-591 | 5 MHz, .25 in MSWQC-Style, Benchmark Angle Beam Probe |
| 1 | 118-540-196 | DSC Reference Standard |
| 1 | C-047 | BNC-MMD Coaxial Cable |
| 1 | C-016 | BNC-BNC Coaxial Cable |
| 1 | C-012 | BNC-MD Coaxial Cable |
| 1 ea. | W-120, 122 | 45° and 70° Lucite Wedge |
| 1 ea. | W-015, 017 | 45° and 70° Lucite Wedge |
| 1 ea. | W-201, 202, 203 | 45°, 60° and 70° Lucite Wedge |
| 1 | XL-820 | 8 oz. Couplant |
| 1 | 118-800-025 | Diced Foam Carrying Case |

Transducer Certification

European Standards

Each delivered probe is subjected to a very strict quality test that makes certain all probes of the same type identically evaluate flaws. The corresponding probe data sheet contains proof of the data reliability. We store the data of every numbered probe for a number of years, enabling probe certificates (PZ) to also be produced at a later date.

GE Sensing & Inspection Technologies Ultrasonics

Technische Daten/Technical data

| Symbol | Bezeichnung / Description | Min. Toleranz Tolerance | Max. Toleranz Tolerance | Einheit Unit |
|----------------|--|-------------------------|-------------------------|--------------|
| T ₀ | Erfahrungswert / Echo pulse duration | 0,9 | 1,24 | µs |
| T ₁ | Pulsbreite / Pulse width | 1,67 | 4,15 | µs |
| P ₀ | Reflexionsbreite @ 4dB / Reflexion bandwidth @ 4dB | 30 | 31,7 | dB |
| α | Einschulenkung / Beam angle | 58 | 60,5 | ° |
| Z ₀ | Einstimmfrequenz / Resonance frequency | 64,3 | 10,50 | kHz |
| Δz | Resonanzbandbreite / Resonance pulse width | 65 | 66,5 | dB |

Referenzliste der verwendeten Messgeräte / Reference of calibrated instruments used

| Hersteller / Manufacturer | Modell / Model | Serial No. | Prozessnr. / Process No. | Kalibrierdatum / Calibration Date | Gültig bis / Valid Until |
|---------------------------|------------------|------------|--------------------------|-----------------------------------|--------------------------|
| Agilent | Impedanzanalyzer | 8163 | 26.07.2008 | 26.07.2009 | |
| GE/IT | 100 | 1000 | 29.06.2008 | 29.06.2007 | |
| GE/IT | 100 | 1000 | 11.08.2004 | 11.08.2005 | |
| GE/IT | 1000 | 1000 | 05.08.2008 | 05.08.2009 | |
| Tektronix | Oszilloskop | 801916 | 09.01.2005 | 20.02.2007 | |

Qualitätsmanagement / Instrument setting

| | |
|------------------------------------|---------------|
| Standardabweichung | group-high |
| PA-Anpassung/Compung | group-high |
| RF-Attenu / Att | 10 |
| Filter | 10, 20, 30 Hz |
| Testblock | V100 |
| Material | Stahl / Steel |
| Schulenkungswinkel / Beam velocity | 5000 m/s |
| Reflexionsreflektor | 20° / 10° |
| Reflektor | 100 mm |
| Anschlußkabel / Connecting cable | SP12 |

Elektrische Impedanz/Electrical impedance

HP-Signal/PF Signal

Spektrum/Spectrum

6 MONTH

021-247-287, Rev. D

Transducer Certificate PZ-E

GE Sensing & Inspection Technologies Ultrasonics

Kalibrier-Zertifikat Certificate of calibration

MWB 45-4 EN

021-247-287, Rev. D

Transducer Certificate PZ-EN

| Certificate | Order Code | Description |
|-------------|------------|--|
| PZ-E | 57682 | Waveform and frequency spectrum for standard catalog flow transducers, including amplitude, frequency, bandwidth, and pulse duration |
| PZ-EN | 59969 | Detailed certificate of calibration according to standard EN 12668-2, "Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes", ratified by European Committee for Standardization (CEN) |

North American Standards

GE Sensing & Inspection Technologies

Transducer Certificate of Conformity
Compliant to ASTM E-1065 Guidelines

Date: 11/09/2007
Product Code: 113-126-660
Serial Number: 021909
Description: FOCUS-HOCK 010, 015 HD

Test Setup: 375° Poly Delay
Test Target: 2
Energy: 50 J

UTA SN: 119402113
UTA Cal Due Date: 4/30/2008
O-scope SN: 6012004
O-scope Cal Due Date: 10/31/2008

Software: FN10040 Rev: H

Test Data: Sensitivity/Att dB: -8.60 dB
Peak Duration@-20dB: 1.75E-07 Sec
Peak Frequency: 5.77E+06 Hz
Center Frequency: 5.77E+06 Hz
% Bandwidth@-6dB: 80.0 %

Inspector: VR

The accuracy of the transducer described above has been confirmed by factory standard test equipment and laboratory reference standards traceable to the National Institute of Standards and Technology. This factory Quality System is registered to ISO 9001:2008, and is compliant to EN 12668-2 and ASTM E1065, Class 5, Class 6.

6 MONTH

GE Sensing and Inspection Technologies
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Lewisburg, PA 17044
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Waveform/Frequency Certificate

GE Sensing & Inspection Technologies

ULTRASONIC TRANSDUCER TRANSVERSE BEAM PROFILE
Per ASTM E1065

System: ULTRAFAC™ Software: TCFAC™ Version: E2.21

Beam Profile X Transverse Profile

Beam Profile Y Transverse Profile

Distance in inches from 1.258 [in] of test sets

X-3 dB width: 0.819 [in] X-6 dB width: 0.827 [in]
Y-3 dB width: 0.828 [in] Y-6 dB width: 0.838 [in]

021-247-287, Rev. D

Beam Profile

| Certificate | Order Code | Description |
|--------------------|-------------|--|
| Waveform/Frequency | 113-900-911 | Waveform and frequency spectrum for standard catalog flow transducers, including amplitude, frequency, bandwidth, and pulse duration |
| Beam Profile | 113-900-913 | Plot is made by moving the transducer across a ball or rod reflector in an immersion tank. The beam profile gives the relative intensity and width of the sound beam at a given distance from the transducer face. |

Tables and Formulas

dB vs. Amplitude Ratio Chart

| dB | Ratio | dB | Ratio | dB | Ratio | dB | Ratio |
|----|--------|----|--------|----|--------|----|-----------|
| 0 | 1.00:1 | 5 | 1.78:1 | 11 | 3.55:1 | 17 | 7.08:1 |
| .5 | 1.06:1 | 6 | 2.00:1 | 12 | 3.98:1 | 18 | 7.94:1 |
| 1 | 1.12:1 | 7 | 2.24:1 | 13 | 4.47:1 | 19 | 8.91:1 |
| 2 | 1.26:1 | 8 | 2.51:1 | 14 | 5.01:1 | 20 | 10.00:1 |
| 3 | 1.41:1 | 9 | 2.82:1 | 15 | 5.62:1 | 40 | 100.00:1 |
| 4 | 1.58:1 | 10 | 3.16:1 | 16 | 6.31:1 | 60 | 1000.00:1 |

Near Field Length (N) in Water

Element Diameter

| Frequency (MHz) | mm 25.4 | | (in) (1.0) | | mm 19.1 | | (in) (0.75) | | mm 12.7 | | (in) (0.50) | | mm 6.3 | | (in) (0.25) | |
|-----------------|---------|-------|------------|-------|---------|----|-------------|-------|---------|------|-------------|--------|--------|-----|-------------|--------|
| | 1.0 | 109.2 | | (4.3) | | 61 | | (2.4) | | 27.2 | | (1.07) | | 6.8 | | (0.27) |
| 2.25 | 243.8 | | (9.6) | | 137.1 | | (5.4) | | 61.0 | | (2.4) | | 15.3 | | (0.60) | |
| 5.0 | 543.5 | | (21.4) | | 304.8 | | (12.0) | | 137.1 | | (5.4) | | 33.0 | | (1.3) | |
| 10.0 | 1092.2 | | (43) | | 609.6 | | (24) | | (271.8) | | (10.7) | | 68.6 | | (2.7) | |

To find approx. length in steel, divide the above values by 4.

Velocity and Acoustic Impedance of Common Materials

| Material | Longitudinal Velocity | | Shear Velocity | | Acoustic Impedance MRayl |
|----------------|------------------------|------|------------------------|------|-----------------------------|
| | in/s x 10 ⁶ | km/s | in/s x 10 ⁶ | km/s | |
| Air | .013 | .33 | - | - | .0004 |
| Aluminum | .25 | 6.3 | .12 | 3.1 | 17.0 |
| Aluminum Oxide | .39 | 9.9 | .23 | 5.8 | 32.0 |
| Beryllium | .51 | 12.9 | .35 | 8.9 | 23.0 |
| Boron Carbide | .43 | 11.0 | - | - | 26.4 |
| Brass | .17 | 4.3 | .08 | 2.0 | 36.7 |
| Cadmium | .11 | 2.8 | .059 | 1.5 | 24.0 |
| Copper | .18 | 4.7 | .089 | 2.3 | 41.6 |
| Glass (Crown) | .21 | 5.3 | .12 | 3.0 | 18.9 |
| Glycerin | .075 | 1.9 | - | - | 2.42 |
| Gold | .13 | 3.2 | .047 | 1.2 | 62.6 |
| Ice | .16 | 4.0 | .08 | 2.0 | 3.5 |
| Inconel | .22 | 5.7 | .12 | 3.0 | 47.2 |
| Iron | .23 | 5.9 | .13 | 3.2 | 45.4 |
| Iron (Cast) | .18 | 4.6 | .10 | 2.6 | 33.2 |
| Lead | .085 | 2.2 | .03 | .7 | 24.6 |
| Magnesium | .23 | 5.8 | .12 | 3.0 | 10.0 |
| Mercury | .057 | 1.4 | - | - | 19.6 |
| Molybdenum | .25 | 6.3 | .13 | 3.4 | 64.2 |
| Monel | .21 | 5.4 | .11 | 2.7 | 47.6 |
| Neoprene | .063 | 1.6 | - | - | 2.1 |

| Material | Longitudinal Velocity | | Shear Velocity | | Acoustic Impedance MRayl |
|------------------|------------------------|------|------------------------|------|-----------------------------|
| | in/s x 10 ⁶ | km/s | in/s x 10 ⁶ | km/s | |
| Nickel | .22 | 5.6 | .12 | 3.0 | 49.5 |
| Nylon, 6-6 | .10 | 2.6 | .043 | 1.1 | 2.9 |
| Oil (SAE 30) | .067 | 1.7 | - | - | 1.5 |
| Platinum | .13 | 3.3 | .067 | 1.7 | 69.8 |
| Plexiglass | .11 | 2.7 | .043 | 1.1 | 3.1 |
| Polythylene | .07 | 1.9 | .02 | .5 | 1.7 |
| Polystyrene | .093 | 2.4 | .04 | 1.1 | 2.5 |
| Polyurethane | .070 | 1.9 | - | - | 1.9 |
| Quartz | .23 | 5.8 | .087 | 2.2 | 15.2 |
| Rubber, Butyl | .07 | 1.8 | - | - | 2.0 |
| Silver | .14 | 3.6 | .06 | 1.6 | 38.0 |
| Steel, mild | .23 | 5.9 | .13 | 3.2 | 46.0 |
| Steel, stainless | .23 | 5.8 | .12 | 3.1 | 45.4 |
| PTFE | .06 | 1.4 | - | - | 3.0 |
| Tin | .13 | 3.3 | .07 | 1.7 | 24.2 |
| Titanium | .24 | 6.1 | .12 | 3.1 | 27.3 |
| Tungsten | .20 | 5.2 | .11 | 2.9 | 101.0 |
| Uranium | .13 | 3.4 | .08 | 2.0 | 63.0 |
| Water | .0584 | 1.48 | - | - | 1.48 |
| Zinc | .17 | 4.2 | .09 | 2.4 | 29.6 |

Useful Formulas

| | |
|-------------------------------|---|
| Near Field Length | $D^2F/4C$ or $D^2/4\lambda$ |
| Beam Spread | $SIN_\gamma C/DF \times 1.22$ or $1.22\lambda/D$ |
| Snell's Law | $SIN\alpha / SIN\beta = C_1/C_2$ |
| Skip Distance | $2T \times TAN\beta$ |
| V-Path | $2T/COS\beta$ |
| Surface Distance (Projected) | $S.P. \times SIN\beta$ |
| Depth (1st Leg) | $S.P. \times COS\beta$ |
| Depth (2nd Leg) | $2T - (S.P. \times COS\beta)$ |
| Depth (3rd Leg) | $(S.P. \times COS\beta) - 2T$ |
| Wavelength | C/F |
| Frequency | C/λ |
| Acoustic Impedance | $Z = C \times d$ |
| % of Reflected Sound Pressure | $R_p = (Z_2 - Z_1)/(Z_2 + Z_1)$ |
| Coefficient of Transmission | $T_p = 2Z_2/(Z_2 + Z_1)$ |
| Total Beam Width | $TBW = (\text{Depth} - N) (2TAN_\gamma) + T \times \text{Element Diameter}$ |

| | |
|--------------------------------|--|
| Transit Time | $TT = 2T/C$ |
| Center Frequency | $F_c = (F_1 + F_2)/2$ |
| % Bandwidth | $(F_1 - F_2)/F_c \times 100\%$ |
| Q Factor | $F_c/(F_1 - F_2)$ |
| Distance | Speed x Time |
| RPM | Speed/Circumference |
| Maximum Scanning Speed (x, y) | (Min. Flaw Length + EBW) x PRR |
| Maximum Scanning Speed (polar) | RPM x Diameter x Clock interval (ft per min.) |
| dB Difference | $20 \text{ Log } (A1/A2)$ |
| dB Ratio | $\text{Inv log } dB/20$ |
| Water Equivalent = (Steel) | $WE = F(\text{water}) \times (C(\text{water})/C(\text{steel}))$ (F = Focal length) |
| MAXB | $SIN^{-1}(ID/OD)$ |
| Focal Length | $R = F(n - 1)/n$ |
| Cylinder Offset Technique | Offset (X) = Outside Radius x SINα |

Symbol Key

| | |
|-----------|------------------------|
| λ | = Wavelength |
| D | = Probe Diameter |
| F | = Probe Frequency |
| C | = Acoustic Velocity |
| d | = Density |
| α | = Incident Angle |
| β | = Refracted Angle |
| T | = Part Thickness |
| S.P. | = Sound Path |
| N | = Near Field |
| γ | = Divergence 1/2 Angle |

GE Sensing & Inspection Technologies couples a legacy of more than 130 years of GE leadership and innovation with world-class technology from the leading names in ultrasonic nondestructive testing—AGFA NDT, Krautkramer and Nutronik.

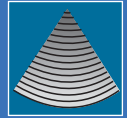
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GE Sensing & Inspection Technologies provides technology-driven inspection solutions that deliver productivity, quality and safety. We design, manufacture and service ultrasonic, remote visual, radiographic and eddy current equipment to inspect, monitor and test materials and equipment without disassembling, deforming or damaging them.

We offer specialized products and services that will help improve productivity in a wide range of industries including aerospace, power generation, oil and gas, automotive and metals.

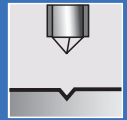
Ultrasonic



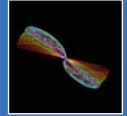
Radiography



Hardness Testing



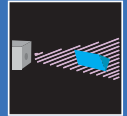
Eddy Current



Remote Visual



Metrology



Software

