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Operating Manual

UTEGEMTT2

Ultrasonic Thickness Gauges

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1) GENERAL

1.1) APPLICATIONS

The Ultrasonic Thickness Gauge, Model are designed for measuring the thickness of metals, plastics, ceramics, glass and other ultrasonic wave conducting materials with two parallel surfaces (top & bottom).

The can be used in industrial applications to perform precise measurements on various kinds of materials, parts and components. Additionally, it can be used to monitor various kinds of pipes and pressure vessels for decreasing thickness due to corrosion and/or erosion.

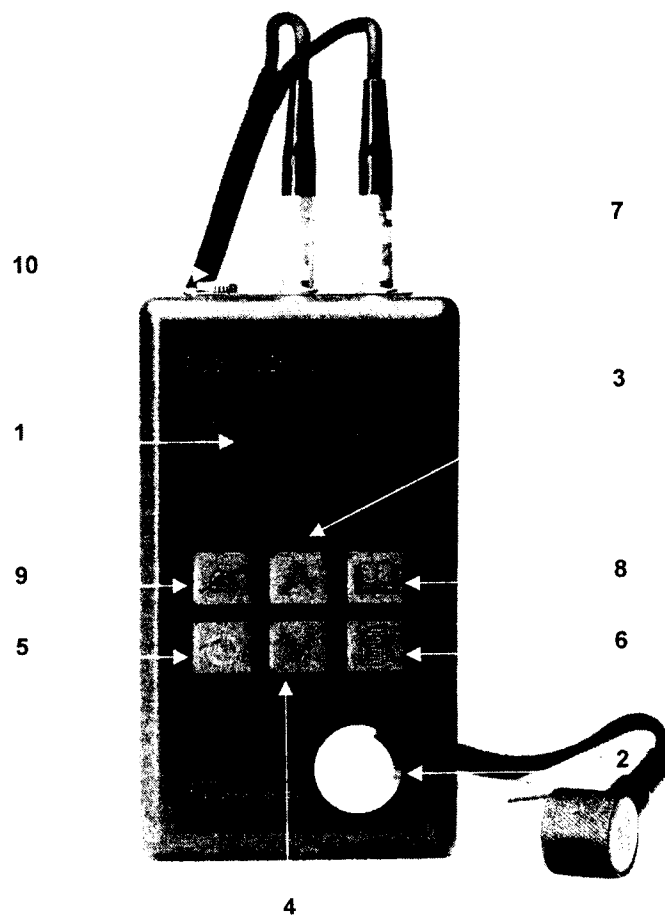
1.2) BASIC WORKING PRINCIPLE

The basic principle of the ultrasonic wave in a thickness measurement is similar to that of an optical wave. The ultrasonic wave pulses are transmitted by the probe face and are coupled to the object to be measured using a viscous fluid called "couplant". These ultrasonic pulses propagate through the measured object and reflect back to the transducer when they encounter the back surface. The thickness of the object is determined by precisely measuring the time the ultrasonic wave travels in the object.

2) SPECIFICATIONS

DISPLAY:	FOUR DIGIT LCD DISPLAY
RESOLUTION:	0.01in / 0.1mm & 0.001" / 0.01MM
WORKING FREQUENCY:	2.0MHz ~ 7.5 MHz
MEASURING RANGE:	0.028in - 8.0 in (0.7 - 200.0 MM) (STEEL)
LOWER MEASURING LIMIT FOR PIPES:	0.8 X 0.08" or 20 X 2mm (STEEL)
MEASURING ERROR:	± (1%H+0.004") or ±(1%H+0.1) MM H = actual thickness of the object to be measured
ADJUSTING RANGE OF SOUND VELOCITY	
MEASUREMENT OF SOUND VELOCITY WITH	
KNOWN THICKNESS VALUE:	0.039 to 0.3937in/μs or (1000-9999 M/S)
MEASUREMENT RANGE:	37-373 MILES/MIN (1000-9999 M/S)
IF THICKNESS IS LESS	
THAN 0.8" (20mm):	± 0.004"H x 100% or ± 1mm/HX100%
IF THICKNESS IS GREATER	
THAN 0.8" (20mm)	± 5%
RANGE OF OPERATING TEMPERATURE:	32°F -104 °F (-10°C -40 °C)
POWER SUPPLY:	TWO AAA BATTERIES
POWER CONSUMPTION:	3 Volts at less than 20MA
Auto Power Off	5 Minutes
DIMENSIONS:	4.3 X 2.4 X 0.9IN
WEIGHT:	4.7oz

3) DIAGRAM



1. LCD Screen
2. Calibration Pad
3. Increase/Change Setting/Backlight
4. Decrease/Change Setting/Auto Calibration
5. Power On/Off
6. Menu Program/Save
7. Probe Port
8. Memory Recall
9. Store Data
10. RS-232/Printer Port

4) MAIN FUNCTIONS

- Automatic error correction capabilities
- Automatic linear compensation to improve accuracy (involves the correction of non-linear errors resulting from the probe).
- Up and down keys allow for quick adjustment of sound velocity and thickness, as well as fast checking of memory unit.
- Automatic coupling icon indicates the coupling state: stable/unstable.
- Direct determination of the sound velocity according to the thickness of the master testing block.
- Low battery indicator
- Automatic instrument shut down during idle use period

4.1) PREPARING FOR MEASUREMENT

Place the probe into the probe socket of the unit, push  to turn the unit on. After a few seconds, the screen will display 0.00in, 0.000in, 0.0mm, or 0.00mm (depending on previous setting), the sound velocity used during the last testing procedure along with the probe type and location. (See Below)

0.000IN

VEL:0.230 PT-08

0.00mm

VEL:5920m/s PT-08

5) SETTING PARAMETERS

A) Press the  button. The screen will display as follows:

1. Measurement
2. Velocity
3. Probe Setting
4. Resolution
5. Location
6. Limitation
7. Average
8. Print
9. Default

Note: 1. Measurement = Main test screen

5.1) Velocity

Press the  button once to select **2. Velocity**. Press the  button to enter into the velocity parameter. The screen will display as follows:

1. Vel. Setting
 2. Vel. Measuring

a) Vel. Setting

Press the  button to enter **VEL SETTING**. Use the  button to move the cursor from column to column. Use the  button to change the number value. When the parameter has been set, press the  button to save entry.

INPUT VELOCITY
5920 m/s

b) Vel. Measuring

In the normal measurement mode, take a thickness reading on the sample to be tested.

Press the  button to enter the menu mode. Press the  button to move the cursor to the **2. Velocity** menu. Press the  button to enter this mode. Then press the



button to move the cursor to **2. Velocity Measuring**. Next press the  button to enter this mode. The screen looks similar to this.

INPUT THICKNESS	
2.016in	0.2340



Press the button or the button to change the sound velocity parameter such that the thickness number agrees with the actual thickness of the sample being measured.



Press the button to accept this velocity and exit the Velocity menu.

**** To measure the sound velocity of a specific material, use a testing block with a known thickness value. Similar to the measurement of the materials thickness, use a vernier caliper or micrometer to obtain an accurate measurement of the testing block. Then couple the probe to the testing block until a thickness value is displayed. Remove the probe and use the keypad to adjust the displayed value to match the actual thickness of the testing block.**

5.2 PROBE SELECTION



Press the button and scroll down to: **3. Probe Sitting**. Press the  button to enter parameter. Using the arrow keys, select your probe type and highlight the number. Press



the button to select and store in memory. (This gage is supplied with a PT-08 probe)

Visible on first screen: *Visible on 2nd screen:*

1. PT-08 1.0-200
2. PT-06 0.8-50

3. ZT-12 2.0-250
4. GT-13 3.0-100

5.3 RESOLUTION



Press the button and scroll down to: **4. Resolution**. Press the  button to enter

parameter. Using the arrow keys, select resolution type. Press the  button to select and store in memory.

Visible on first screen: *Visible on 2nd screen:*

1. 0.1MM
2. 0.01MM

3. 0.01IN
4. 0.001IN

5.4 LOCATION (Memory Groups)

- Model EMTT-2DL has a memory capacity of 4000 measurements. These can be stored in any group from 0000 to 3999.

To choose a specific memory location, you must go to the main menu and scroll down to:

5. LOCATION. Press the  button to enter location parameter. The screen will display input location and show the four digits for entering and recording your desired memory location.

INPUT LOCATION
0001

Using the  button, choose your desired numeral for the first column. Using the  button, change the column. Continue to change numerals and columns in this manner.

When the desired memory location has been chosen, press the  button to save this entry.

Method of saving your measurement:

- Take a measurement of the sample piece to be tested. As soon as the measurement is displayed on the LCD screen, you must push the  button to save the measurement in your chosen memory location. For each time you save a measurement, the gauge will automatically store the chosen value in the next consecutive memory location.

For instance, if you chose your first memory location to be 0560. That number will be your first saved value. The next saved measurement value will be stored in location number 0561 and so on. You can always change your location group at any time by following the instructions in the previous paragraph.

3.02mm
VEL:5920 PT-08 LOC: 0002

Test#1

3.02mm
VEL:5920 PT-08 LOC: 0003

Test#2

5.5 MEMORY RECALL

If you need to start retrieving measurements starting from 0001, you should be in the main test screen. Press the  button and the gauge will display the measurement saved in memory location 0001. You can press the  button as many times as you need to display the saved values in ascending order.

Example: push the  button and the display will show location 0001. Push the same button again and the display will show the saved value from location 0002, etc.

5.6 LIMITATION

Press the  button and return to the main menu. Scroll down until you see the

6. LIMITATION Press the  button to enter the limitation parameter. Set your lower

limit by pressing the  button to advance the numerals. Press the  button to change your column. Proceed to enter upper limit using the same method. When the data

has been entered to your requirements, you must press the  button to save the entry. While taking measurements, if your value is lower than the set limit, the letter "L" will be displayed in the top right corner of the LCD screen. If the value is greater than the set limit, the letter "H" will appear in the top right corner of the screen.

LO. LIM.	00.00mm
UP. LIM.	99.00mm

5.7 AVERAGE

The mean value can be achieved by programming from 2 to 9 times.

Example: If you need to show an average after 3 tests, you would enter 3 as your average number. You then perform 3 tests(SEE DIRECTIONS BELOW) and the gauge will then

display the average of those 3 tests. If you need an average displayed after 9 tests(maximum), you should enter 9 as your average number.

Press the  button and proceed to **7. AVERAGE**. Press the  button to enter parameter. Using the  button, change the number from 2 to 9. Press the  button to save entry.

AVERAGE TIMES

3

a) Directions for testing for averages:

- 1) Place the probe on your test sample. Get your measurement value.
- 2) Remove the probe from the test sample. Wait for 3 seconds. The gauge will "beep" and the average number shown on the LCD screen will descend from 3 to 2.
- 3) Perform this procedure again. Wait for the beep and the gauge will change the average number from 2 to 1.
- 4) Perform the 3rd and final test. Remove the probe from the test sample. The gauge will beep and automatically show the average of the 3 tests you just performed.

Note: a new average time must be entered before each set to be performed.

5.8 PRINTING

If you want to print the stored values, you must first determine the initial location number and the last location number to be printed.

- Press the  button to enter main menu. Scroll down to the **8.PRINT**.
- Press the  button to enter parameter.
- The display will show a start location and an end location.
- Use the  button to change the numerals
- Use the  button to change the columns.
- When the data entry has been set, press the  button to save this entry.
- The gauge will automatically begin displaying and printing all values stored in the entered location numbers.

START LOC. 0000
END LOC. 0000

a) Printing to your PC

- Follow the instructions noted above. Instead of printing to your mini-printer, the values will be displayed on your PC screen.

NOTE: Use supplied cables to connect the gauge to the PC.

6) TESTING PROCEDURE

- Assuming all parameters have been entered, **place a small drop of coupling gel** (supplied) to the surface of the sample to be tested.

NOTE: Do not apply Gel to the probe as that may result in attempted measurements with no sample touching the probe.

- Place the probe directly on the gel spot holding steady and firm. Do not move the probe until the measured value has been displayed. At this time, you can remove the probe from the test sample.

NOTE: Coupling gel must be used to perform all ultrasonic tests.

7) CALIBRATION

Each time the probe or battery is changed, a calibration should be performed in order to guarantee measuring accuracy. If necessary, repeat the calibration several times. Adjust the sound velocity to **2330in/us** (5918m/s) (steel/iron).

- Apply the coupling gel to the testing block (see fig. 1, #6) (**metallic disc on face of gage**), which is built into the unit, and couple the probe to the testing block. At this time, the screen displays **.157in(4mm)**. This indicates that the calibration is over. If

the screen displays something other than **.157in (4mm)**, you should press the  button and the gauge will automatically calibrate itself to **.157in(4mm)**. At that time, you can begin to perform your testing.

- At any time, you can calibrate the gage, only coupling the probe to the testing block, and then press the button .

8) MEASURING THICKNESS

Apply the coupling gel to the material to be measured and then couple the probe to the material. This will begin the measurement, and the screen will then display the thickness of the material (see fig.2).

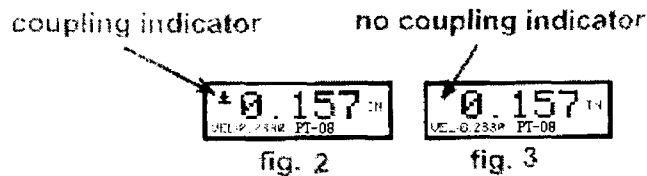
NOTE: when the probe is coupled to the material, a coupling indicator will be displayed on the LCD screen. If the coupling indicator flickers or does not appear, the coupling process

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is erroneous or incomplete.

Once a thickness measurement has been obtained, remove the probe. The thickness value will remain on the LCD screen, however, the coupling indicator will disappear (see fig.3)

NOTE: Do not apply Gel to the probe as that may result in attempted measurements with no sample touching the probe.



*AUTOMATIC SHUT-OFF

If the EMTT-2DL remains idle for 2 minutes, the unit will automatically shut off.

* PRECAUTIONS

The surface of the probe is made of Polypropylene resin and is very sensitive to heavy scratches and rough surfaces. Therefore, it is recommended to apply only a light to moderate amount of pressure on the probe during testing.

The temperature of the surface of the object to be measured should not exceed 140°F (60°C).

Keep the EMTT-2DL clean and avoid exposure to dust, iron chips, carbon particles

9) MAINTENANCE

9.1) REPLACING THE BATTERIES

Once the low battery indicator appears on the screen, the batteries should be replaced.

Use the following procedure when replacing the batteries.

- Power unit off or wait until the unit turns off automatically.
- Open the battery compartment by pressing your thumb down on the cover and sliding it outwards.
- Remove the used batteries and insert new batteries into the compartment, paying close attention to the polarity of the battery.

9.2) STORING

Be sure to clean the probe and cable after each use. Grease, oil and dust will cause the cable of the probe to age and crack.

If the unit is not to be used for a long period of time, remove the batteries to avoid battery

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leakage and corrosion of the battery contacts.

Avoid storing the unit in a damp or extremely hot environment.

APPENDIX A:

Inch to Millimeter Conversion Table

Decimals to Millimeters				Fractions to Decimals to Millimeters					
Decimal	mm	Decimal	mm	Fraction	Decimal	mm	Fraction	Decimal	mm
0.001	0.0254	0.500	12.7000	1/64	0.0156	0.3969	33/64	0.5156	13.0969
0.002	0.0508	0.510	12.9540	1/32	0.0312	0.7938	17/32	0.5312	13.4938
0.003	0.0762	0.520	13.2080	3/64	0.0469	1.1906	35/64	0.5469	13.8906
0.004	0.1016	0.530	13.4620						
0.005	0.1270	0.540	13.7160						
0.006	0.1524	0.550	13.9700	1/16	0.0625	1.5875	9/16	0.5625	14.2875
0.007	0.1778	0.560	14.2240						
0.008	0.2032	0.570	14.4780	5/64	0.0781	1.9844	37/64	0.5781	14.6844
0.009	0.2286	0.580	14.7320	3/32	0.0938	2.3812	19/32	0.5938	15.0812
		0.580	14.7320	7/64	0.1094	2.7781	39/64	0.6094	15.4781
0.010	0.2540	0.590	14.9860						
0.020	0.5080								
0.030	0.7620								
0.040	1.0160	0.600	15.2400						
0.050	1.2700	0.610	15.4940	1/8	0.1250	3.1750	5/8	0.6250	15.8750
0.060	1.5240	0.620	15.7480						
0.070	1.7780	0.630	16.0020						
0.080	2.0320	0.640	16.2560	9/64	0.1406	3.5719	41/64	0.6406	16.2719
0.090	2.2860	0.650	16.5100	5/32	0.1562	3.9688	21/32	0.6562	16.6688
		0.660	16.7640	11/64	0.1719	4.3656	43/64	0.6719	17.0656
0.100	2.5400	0.670	17.0180						
0.110	2.7940	0.680	17.2720						
0.120	3.0480	0.690	17.5260	3/16	0.1875	4.7625	11/16	0.6875	17.4625
0.130	3.3020								
0.140	3.5560								
0.150	3.8100			13/64	0.2031	5.1594	45/64	0.7031	17.8594
0.160	4.0640	0.700	17.7800	7/32	0.2188	5.5562	23 8/25	0.7188	18.2562
0.170	4.3180	0.710	18.0340	15/64	0.2344	5.9531	47/64	0.7344	18.6531
0.180	4.5720	0.720	18.2880						
0.190	4.8260	0.730	18.5420	1/4	0.2500	6.3500	3/4	0.7500	19.0500
		0.740	18.7960						
0.200	5.0800	0.750	19.0500						
2.210	5.3340	0.760	19.3040	17/64	0.2656	6.7469	49/64	0.7656	19.4469
0.220	5.5880	0.770	19.5580	9/32	0.2812	7.1438	25/32	0.7812	19.8438
0.230	5.8420	0.780	19.8120	19/64	0.2969	7.5406	51/64	0.7969	20.2406

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0.240	6.0690	0.790	20.0660						
0.250	6.3500								
0.260	6.6040								
0.270	6.8580	0.800	20.3200	5/16	0.3125	7.9375	13/16	0.8125	20.6375
0.280	7.1120	0.810	20.5740	21/64	0.3281	8.3344	53/64	0.8281	21.0344
0.290	7.3660	0.820	20.8280	11/32	0.3438	8.7312	27/32	0.8438	21.4312
0.300	7.6200	0.830	21.0820	23/64	0.3594	9.1281	55/64	0.8594	21.8281
0.310	7.8740	0.840	21.3360						
0.320	8.1280	0.850	21.5900	3/8	0.3850	9.5250	7/8	0.8750	22.2250
0.330	8.3820	0.860	21.8440						
0.340	8.6360	0.870	22.0980	25/64	0.3906	9.9219	57/64	0.8906	22.6219
0.350	8.8900	0.880	22.3520	13/32	0.4062	10.3188	29/32	0.9062	23.0188
0.360	9.1440	0.890	22.6060	27/64	0.4219	10.7156	59/64	0.9219	23.4156
0.370	9.3980								
0.380	9.6520								
0.390	9.9060	0.900	22.8600						
0.400	10.1600	0.910	23.1140	7/16	0.4375	11.1125	15/16	0.9375	23.8125
0.410	10.4140	0.920	23.3680						
0.420	10.6680	0.930	23.6220						
0.430	10.9220	0.940	23.8760						
0.440	11.1760	0.950	24.1300	29/64	0.4531	11.5094	61/64	0.9531	24.3094
0.450	11.4300	0.960	24.3840	15/32	0.4688	11.9062	31/32	0.9688	24.6062
0.460	11.6840	0.970	24.6380	31/64	0.4844	12.3031	63/64	0.9844	25.0031
0.470	11.9380	0.980	24.8920						
0.480	12.1920	0.990	25.1460						
0.490	12.4460	1.000	25.4000	1/2	0.5000	12.7000	1	1.0000	25.4000

APPENDIX B:

Millimeter to Inch Conversion Table

mm	Decimal	mm	Decimal	mm	Decimal	mm	Decimal	mm	Decimal
0.01	0.00039	0.41	0.01614	0.81	0.03189	21	0.82677	61	2.40157
0.02	0.00079	0.42	0.01654	0.82	0.03228	22	0.86614	62	2.44094
0.03	0.00118	0.43	0.01693	0.83	0.03268	23	0.90551	63	2.48031
0.04	0.00157	0.44	0.01732	0.84	0.03307	24	0.94488	64	2.51969
0.05	0.00197	0.45	0.01772	0.85	0.03346	25	0.98425	65	2.5591
0.06	0.00236	0.46	0.01811	0.86	0.03386	26	1.02362	66	2.59843
0.07	0.00276	0.47	0.01850	0.87	0.03425	27	1.06299	67	2.63780
0.08	0.00315	0.48	0.01890	0.88	0.03465	28	1.10236	68	2.67717
0.09	0.00354	0.49	0.01929	0.89	0.03504	29	1.14173	69	2.71654
0.10	0.00394	0.50	0.01969	0.90	0.03543	30	1.18110	70	2.75591
0.11	0.00433	0.51	0.02008	0.91	0.03583	31	1.22047	71	2.79528
0.12	0.00472	0.52	0.02047	0.92	0.03622	32	1.25984	72	2.83465
0.13	0.00512	0.53	0.02087	0.93	0.03661	33	1.29921	73	2.87402
0.14	0.00551	0.54	0.02126	0.94	0.03701	34	1.33858	74	2.91339
0.15	0.00591	0.55	0.02165	0.95	0.03740	35	1.37795	75	2.95276
0.16	0.00630	0.56	0.02205	0.96	0.03780	36	1.41732	76	2.99213
0.17	0.00669	0.57	0.02244	0.97	0.03819	37	1.45669	77	3.03150
0.18	0.00709	0.58	0.02283	0.98	0.03858	38	1.49606	78	3.07087
0.19	0.00748	0.59	0.02323	0.99	0.03898	39	1.53543	79	3.11024
0.20	0.00787	0.60	0.02362	1.00	0.03937	40	1.57480	80	3.14961
0.21	0.00827	0.61	0.02402	1	0.03937	41	1.61417	81	3.18898
0.22	0.00866	0.62	0.02441	2	0.07874	42	1.65354	82	3.22835
0.23	0.00906	0.63	0.02480	3	0.11811	43	1.69291	83	3.26772
0.24	0.00945	0.64	0.02520	4	0.15748	44	1.73228	84	3.30709
0.25	0.00984	0.65	0.02559	5	0.19685	45	1.77165	85	3.34646
0.26	0.01024	0.66	0.02598	6	0.23622	46	1.81102	86	3.38583
0.27	0.01063	0.67	0.02638	7	0.27559	47	1.85039	87	3.42520
0.28	0.01102	0.68	0.02677	8	0.31496	48	1.88976	88	3.46457
0.29	0.01142	0.69	0.02717	9	0.35433	49	1.92913	89	3.50394
0.30	0.01181	0.70	0.02756	10	0.39370	50	1.96850	90	3.54331

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0.31	0.01220	0.71	0.02795	11	0.43307	51	2.00787	91	3.58268
0.32	0.01260	0.72	0.02835	12	0.47244	52	2.04724	92	3.62205
0.33	0.01299	0.73	0.02874	13	0.51181	53	2.08661	93	3.66142
0.34	0.01339	0.74	0.02913	14	0.55118	54	2.12598	94	3.70079
0.35	0.01378	0.75	0.02953	15	0.59055	55	2.16535	95	3.74016
0.36	0.01417	0.76	0.02992	16	0.62992	56	2.20472	96	3.77953
0.37	0.01457	0.77	0.03032	17	0.66929	57	2.24409	97	3.81890
0.38	0.01496	0.78	0.03071	18	0.70866	58	2.28346	98	3.85827
0.39	0.01535	0.79	0.03110	19	0.74803	59	2.32283	99	3.89764
0.40	0.01575	0.80	0.03150	20	0.78740	60	2.36220	100	3.93701

APPENDIX C :

All velocities are approximations:

SOUND VELOCITY MEASUREMENT CHART

Material	Sound Velocity	
	Inch/ μ S	M/s
Air	0.013	330
Aluminum	0.250	6300
Alumina Oxide	0.390	9900
Beryllium	0.510	12900
Boron Carbide	0.430	11000
Brass	0.170	4300
Cadmium	0.110	2800
Copper	0.180	4700
Glass(crown)	0.210	5300
Glycerin	0.075	1900
Gold	0.130	3200
Ice	0.160	4000
Inconel	0.220	5700
Iron	0.230	5900
Iron (cast)	0.180	4600
Lead	0.085	2200
Magnesium	0.230	5800
Mercury	0.057	1400
Molybdenum	0.250	6300
Monel	0.210	5400
Neoprene	0.063	1600
Nickel	0.220	5600
Nylon, 6.6	0.100	2600
Oil (SAE 30)	0.067	1700
Platinum	0.130	3300
Plexiglass	0.110	1700
Polythylene	0.070	1900
Polystyrene	0.0930	2400
Polyurethane	0.0700	1900
Quartz	0.230	5800

UTEGEMTT2 Ultrasonic Thickness Gauge

Rubber, Butyl	0.070	1800
Silver	0.140	3600
Steel, Mild	0.230	5900
Steel, Stainless	0.228	5800
Teflon	0.060	1400
Tin	0.130	3300
Titanium	0.240	6100
Tungsten	0.200	5200
Uranium	0.130	3400
Water	0.584	1480
Zinc	0.170	4200