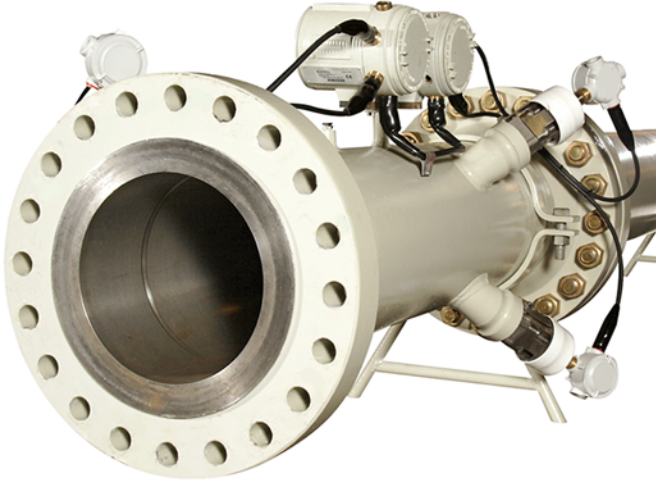


# Sound Speed & Pipe Size Data *(For Ultrasonic Flowmeters)*

## Reference Guide





GE

Measurement & Control

# Sound Speed & Pipe Size Data *(For Ultrasonic Flowmeters)*

## Reference Guide

916-119 Rev. A  
December 2014



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# Chapter 1. Sound Speed Tables

## 1.1 Sound Speeds in Solids

The values in *Table 1* below are reproduced with permission: shear wave values from the *American Institute of Physics Handbook*, Smithsonian Tables; longitudinal values from the *Nondestructive Testing Handbook*, 2nd edition, Volume 7, *Ultrasonic Testing*. ©1991, The American Society of Nondestructive Testing.

**Note:** *The values in Table 1 below are nominal values, as the solids may not be homogenous and isotropic. Also, the actual values depend on the exact composition, temperature, pressure and stress.*

**Table 1: Sound Speeds in Solids @25°C (77°F)**

Material	Shear Wave		Longitudinal Wave	
	m/s	ft/s	mm/μs	in./μs
Steel, 1% Carbon (hardened)	3,150	10,335	5.88	0.2315
Carbon Steel	3,230	10,598	5.89	0.2319
Mild Steel	3,235	10,614	5.89	0.2319
Steel, 1% Carbon	3,220	10,565		
302 Stainless Steel	3,120	10,236	5.690	0.224
303 Stainless Steel	3,120	10,236	5.640	0.222
304 Stainless Steel	3,141	10,306	5.920	0.233
304L Stainless Steel	3,070	10,073	5.790	0.228
316 Stainless Steel	3,272	10,735	5.720	0.225
347 Stainless Steel	3,095	10,512	5.720	0.225
Aluminum	3,100	10,171	6.32	0.2488
Aluminum (rolled)	3,040	9,974		
Copper	2,260	7,415	4.66	0.1835
Copper (annealed)	2,325	7,628		
Copper (rolled)	2,270	7,448		
CuNi (70%Cu, 30%Ni)	2,540	8,334	5.03	0.1980
CuNi (90%Cu, 10%Ni)	2,060	6,759	4.01	0.1579
Brass (Naval)	2,120	6,923	4.43	0.1744
Gold (hard-drawn)	1,200	3,937	3.24	0.1276
Inconel	3,020	9,909	5.82	0.2291

**Table 1: Sound Speeds in Solids @25°C (77°F) (cont.)**

Material	Shear Wave		Longitudinal Wave	
	m/s	ft/s	mm/ $\mu$ s	in./ $\mu$ s
Iron (electrolytic)	3,240	10,630	5.90	0.2323
Iron (Armco)	3,240	10,630	5.90	0.2323
Ductile Iron	3,000	9,843		
Cast Iron	2,500	8,203	4.55	0.1791
Monel	2,720	8,924	5.35	0.2106
Nickel	2,960	9,712	5.63	0.2217
Tin, rolled	1,670	5,479	3.32	0.1307
Titanium	3,125	10,253	6.10	0.2402
Tungsten, annealed	2,890	9,482	5.18	0.2039
Tungsten, drawn	2,640	8,661		
Tungsten, carbide	3,980	13,058		
Zinc, rolled	2,440	8,005	4.17	0.1642
Glass, Pyrex	3,280	10,761	5.61	0.2209
Glass, heavy silicate flint	2,380	7,808		
Glass, light borate crown	2,840	9,318	5.26	0.2071
Nylon	1,150	3,772	2.40	0.0945
Nylon, 6-6	1,070	3,510		
Polyethylene (HD)			2.31	0.0909
Polyethylene (LD)	540	1,772	1.94	0.0764
PVC, CPVC	1,060	3,477	2.40	0.0945
Acrylic	1,430	4,690	2.73	0.1075
Asbestos Cement			2.20	0.0866
Tar Epoxy			2.00	0.0787
Mortar			2.50	0.0984
Rubber			1.90	0.0748



## 1.2 Sound Speeds in Fluids

**Note:** For critical applications, the sources of sound speed data for pure liquids can be obtained from GE. Such requests must specify the temperature and pressure range, and the details of the liquid composition.

**Table 2: Sound Speeds in Fluids @25°C (77°F)**

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s	m/s/ $^\circ\text{C}$	m <sup>2</sup> /s	ft <sup>2</sup> /s
Acetic anhydride (22)	(CH <sub>3</sub> CO) <sub>2</sub> O	1.082 (20°C)	1,180	3,871.4	2.5	0.769	8.274
Acetic acid, anhydride (22)	(CH <sub>3</sub> CO) <sub>2</sub> O	1.082 (20°C)	1,180	3,871.4	2.5	0.769	8.274
Acetic acid, nitrile	C <sub>2</sub> H <sub>3</sub> N	0.783	1,290	4,232.3	4.1	0.441	4.745
Acetic acid, ethyl ester (33)	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	0.901	1,085	3,559.7	4.4	0.467	5.025
Acetic acid, methyl ester	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	0.934	1,211	3,973.1		0.407	4.379
Acetone	C <sub>3</sub> H <sub>6</sub> O	0.791	1,174	3,851.7	4.5	0.399	4.293
Acetonitrile	C <sub>2</sub> H <sub>3</sub> N	0.783	1,290	4,232.3	4.1	0.441	4.745
Acetylacetone	C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	0.729	1,399	4,589.9	3.6		
Acetylen dichloride	C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	1.26	1,015	3,330.1	3.8	0.400	4.304
Acetylene tetrabromide (47)	C <sub>2</sub> H <sub>2</sub> Br <sub>4</sub>	2.966	1,027	3,369.4			
Acetylene tetrachloride (47)	C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub>	1.595	1,147	3,763.1		1.156 (15°C)	12.438 (59°F)
Alcohol	C <sub>2</sub> H <sub>6</sub> O	0.789	1,207	3,960	4.0	1.396	15.02
Alkazene-13	C <sub>15</sub> H <sub>24</sub>	0.86	1,317	4,320.9	3.9		
Alkazene-25	C <sub>10</sub> H <sub>12</sub> Cl <sub>2</sub>	1.20	1,307	4,288.1	3.4		
2-Amino-ethanol	C <sub>2</sub> H <sub>7</sub> NO	1.018	1,724	5,656.2	3.4		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
2-Aminotolidine (46)	C <sub>7</sub> H <sub>9</sub> N	0.999 (20°C)	1,618	5,308.4		4.394 (20°C)	47.279 (68°F)
4-Aminotolidine (46)	C <sub>7</sub> H <sub>9</sub> N	0.966 (45°C)	1,480	4,855.6		1.863 (50°C)	20.045 (122°F)
Ammonia (35)	NH <sub>3</sub>	0.771	1,729 (-33°C)	5,672.6 (-27°F)	6.68	0.292 (-33°C)	3.141 (-27°F)
Amorphous Polyolefin		0.98	962.6 (190°C)	3158.2 (374°F)		26,600	286,000
t-Amyl alcohol	C <sub>5</sub> H <sub>12</sub> O	0.81	1,204	3,950.1		4.374	47.064
Aminobenzene (41)	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	1.022	1,639	5,377.3	4.0	3.63	39.058
Aniline (41)	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	1.022	1,639	5,377.3	4.0	3.63	39.058
Argon (45)	Ar	1.400 (-188°C)	853 (-188°C)	2798.6 (-306°F)			
Azine	C <sub>6</sub> H <sub>5</sub> N	0.982	1,415	4,642.4	4.1	0.992 (20°C)	10.673 (68°F)
Benzene (29, 40, 41)	C <sub>6</sub> H <sub>6</sub>	0.879	1,306	4,284.8	4.65	0.711	7.65
Benzol (29, 40, 41)	C <sub>6</sub> H <sub>6</sub>	0.879	1,306	4,284.8	4.65	0.711	7.65
Bromine (21)	Br <sub>2</sub>	2.928	889	2,916.7	3.0	0.323	3.475
Bromo-benzene (46)	C <sub>6</sub> H <sub>5</sub> Br	1.522	1,170 (20°C)	3,838.6 (68°F)		0.693	7.456
1-Bromo-butane (46)	C <sub>4</sub> H <sub>9</sub> Br	1.276 (20°C)	1,019 (20°C)	3,343.2 (68°F)		0.49 (15°C)	5.272 (59°F)
Bromo-ethane (46)	C <sub>2</sub> H <sub>5</sub> Br	1.460 (20°C)	900 (20°C)	2,952.8 (68°F)		0.275	2.959
Bromoform (46, 47)	CHBr <sub>3</sub>	2.89 (20°C)	918	3,011.8	3.1	0.654	7.037
n-Butane (2)	C <sub>4</sub> H <sub>10</sub>	0.601 (0°C)	1,085 (-5°C)	3,559.7 (23°F)	5.8		
2-Butanol	C <sub>4</sub> H <sub>10</sub> O	0.81	1,240	4,068.2	3.3	3.239	34.851
sec-Butylalcohol	C <sub>4</sub> H <sub>10</sub> O	0.81	1,240	4,068.2	3.3	3.239	34.851

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
n-Butyl bromide (46)	C <sub>4</sub> H <sub>9</sub> Br	1.276 (20°C)	1,019 (20°C)	3,343.2 (68°F)		0.49 (15°C)	5.272 (59°F)
n-Butyl chloride (22, 46)	C <sub>4</sub> H <sub>9</sub> Cl	0.887	1,140	3,740.2	4.57	0.529 (15°C)	5.692 (59°F)
tert Butyl chloride	C <sub>4</sub> H <sub>9</sub> Cl	0.84	984	3,228.3	4.2	0.646	6.95
Butyl oleate	C <sub>22</sub> H <sub>42</sub> O <sub>2</sub>		1,404	4,606.3	3.0		
2, 3 Butylene glycol	C <sub>4</sub> H <sub>10</sub> O <sub>2</sub>	1.019	1,484	4,868.8	1.51		
Cadmium (7)	Cd		2,237.7 (400°C)	7,341.5 (752°F)		1.355cp (440°C)	14.579 (824°F)
Carbinol (40, 41)	CH <sub>4</sub> O	0.791 (20°C)	1,076	3,530.2	2.92	0.695	7.478
Carbitol	C <sub>6</sub> H <sub>14</sub> O <sub>3</sub>	0.988	1,458	4,783.5			
Carbon dioxide (26)	CO <sub>2</sub>	1.101 (-37°C)	839 (-37°C)	2,752.6 (-35°F)	7.71	0.137 (-37°C)	1.474 (-35°F)
Carbon disulphide	CS <sub>2</sub>	1.261 (22°C)	1,149	3,769.7		0.278	2.991
Carbon tetrachloride (33, 35, 47)	CCl <sub>4</sub>	1.595 (20°C)	926	3038.1	2.48	0.607	6.531
Carbon tetrafluoride (14) (Freon 14)	CF <sub>4</sub>	1.75 (-150°C)	875.2 (-150°C)	2,871.5 (-238°F)	6.61		
Cetane (23)	C <sub>16</sub> H <sub>34</sub>	0.773 (20°C)	1,338	4,389.8	3.71	4.32	46.483
Chloro-benzen e	C <sub>6</sub> H <sub>5</sub> Cl	1.106	1,273	4,176.5	3.6	0.722	7.768
1-Chloro-butane (22, 46)	C <sub>4</sub> H <sub>9</sub> Cl	0.887	1,140	3,740.2	4.57	0.529 (15°C)	5.692 (59°F)
Chloro-diFluoro methane (3) (Freon 22)	CHClF <sub>2</sub>	1.491 (-69°C)	893.9 (-50°C)	2,932.7 (-58°F)	4.79		
Chloroform (47)	CHCl <sub>3</sub>	1.489	979	3,211.9	3.4	0.55	5.918

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
1-Chloro-propane (47)	C <sub>3</sub> H <sub>7</sub> Cl	0.892	1,058	3,471.1		0.378	4.067
Chlorotrifluoro methane (5)	CClF <sub>3</sub>		724 (-82°C)	2,375.3 (-116°F)	5.26		
Cinnamaldehyde	C <sub>9</sub> H <sub>8</sub> O	1.112	1,554	5,098.4	3.2		
Cinnamic aldehyde	C <sub>9</sub> H <sub>8</sub> O	1.112	1,554	5,098.4	3.2		
Colamine	C <sub>2</sub> H <sub>7</sub> NO	1.018	1,724	5,656.2	3.4		
o-Cresol (46)	C <sub>7</sub> H <sub>8</sub> O	1.047 (20°C)	1,541 (20°C)	5,055.8 (68°F)		4.29 (40°C)	46.16 (104°F)
m-Cresol (46)	C <sub>7</sub> H <sub>8</sub> O	1.034 (20°C)	1,500 (20°C)	4,921.3 (68°F)		5.979 (40°C)	64.334 (104°F)
Cyanomethane	C <sub>2</sub> H <sub>3</sub> N	0.783	1,290	4,232.3	4.1	0.441	4.745
Cyclohexane (15)	C <sub>6</sub> H <sub>12</sub>	0.779 (20°C)	1,248	4,094.5	5.41	1.31 (17°C)	14.095 (63°F)
Cyclohexanol	C <sub>6</sub> H <sub>12</sub> O	0.962	1,454	4,770.3	3.6	0.071 (17°C)	0.764 (63°F)
Cyclohexanone	C <sub>6</sub> H <sub>10</sub> O	0.948	1,423	4,668.6	4.0		
Decane (46)	C <sub>10</sub> H <sub>22</sub>	0.730	1,252	4,107.6		1.26 (20°C)	13.55 (68°F)
1-Decene (27)	C <sub>10</sub> H <sub>20</sub>	0.746	1,235	4,051.8	4.0		
n-Decylene (27)	C <sub>10</sub> H <sub>20</sub>	0.746	1,235	4,051.8	4.0		
Diacetyl	C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	0.99	1,236	4,055.1	4.6		
Diamylamine	C <sub>10</sub> H <sub>23</sub> N		1,256	4,120.7	3.9		
1,2 Dibromo-ethane (47)	C <sub>2</sub> H <sub>4</sub> Br <sub>2</sub>	2.18	995	3,264.4		0.79 (20°C)	8.5 (68°F)
trans-1,2-Dibromoethene (47)	C <sub>2</sub> H <sub>2</sub> Br <sub>2</sub>	2.231	935	3,067.6			
Dibutyl phthalate	C <sub>8</sub> H <sub>22</sub> O <sub>4</sub>		1,408	4,619.4			

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Dichloro-t-butyl alcohol	C <sub>4</sub> H <sub>8</sub> Cl <sub>2</sub> O		1,304	4,278.2	3.8		
2,3 Dichlorodioxane	C <sub>2</sub> H <sub>6</sub> Cl <sub>2</sub> O <sub>2</sub>		1,391	4,563.6	3.7		
Dichlorodifluoro methane (3) (Freon 12)	CCl <sub>2</sub> F <sub>2</sub>	1.516 (40°C)	774.1	2,539.7	4.24		
1,2 Dichloro ethane (47)	C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	1.253	1,193	3,914		0.61	6.563
cis1,2-Dichloro-ethene (3, 47)	C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	1.284	1,061	3,481			
trans1,2-Dichloro-ethene (3, 47)	C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	1.257	1,010	3,313.6			
Dichloro-fluoro methane (3) (Freon 21)	CHCl <sub>2</sub> F	1.426 (0°C)	891 (0°C)	2,923.2 (32°F)	3.97		
1-2-Dichlorohexafluoro-cyclobutane (47)	C <sub>4</sub> Cl <sub>2</sub> F <sub>6</sub>	1.654	669	2,194.9			
1-3-Dichloro-isobutane	C <sub>4</sub> H <sub>8</sub> Cl <sub>2</sub>	1.14	1,220	4,002.6	3.4		
Dichloro methane (3)	CH <sub>2</sub> Cl <sub>2</sub>	1.327	1,070	3,510.5	3.94	0.31	3.335
1,1-Dichloro-1,2,2,2 tetra fluoroethane	CClF <sub>2</sub> -CClF <sub>2</sub>	1.455	665.3 (-10°C)	2,182.7 (14°F)	3.73		
Diethyl ether	C <sub>4</sub> H <sub>10</sub> O	0.713	985	3,231.6	4.87	0.311	3.346
Diethylene glycol	C <sub>4</sub> H <sub>10</sub> O <sub>3</sub>	1.116	1,586	5,203.4	2.4		
Diethylene glycol, monoethyl ether	C <sub>6</sub> H <sub>14</sub> O <sub>3</sub>	0.988	1,458	4,783.5			
Diethylenimide oxide	C <sub>4</sub> H <sub>9</sub> NO	1.00	1,442	4,731	3.8		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		$\text{m}^2/\text{s}$	$\text{ft}^2/\text{s}$
1,2-bis(DiFluor amino) butane (43)	$\text{C}_4\text{H}_8(\text{NF}_2)_2$	1.216	1,000	3,280.8			
1,2-bis(DiFluor amino)-2-methyl propane (43)	$\text{C}_4\text{H}_9(\text{NF}_2)_2$	1.213	900	2,952.8			
1,2-bis(DiFluor amino) propane (43)	$\text{C}_3\text{H}_6(\text{NF}_2)_2$	1.265	960	3,149.6			
2,2-bis(DiFluor amino propane (43)	$\text{C}_3\text{H}_6(\text{NF}_2)_2$	1.254	890	2920			
2,2-Dihydroxydi ethyl ether	$\text{C}_4\text{H}_{10}\text{O}_3$	1.116	1,586	5,203.4	2.4		
Dihydroxy ethane	$\text{C}_2\text{H}_6\text{O}_2$	1.113	1,658	5,439.6	2.1		
1,3-Dimethyl-benzene (46)	$\text{C}_8\text{H}_{10}$	0.868 (15°C)	1,343 (20°C)	4,406.2 (68°F)		0.749 (15°C)	8.059 (59°F)
1,2-Dimethyl-benzene (29, 46)	$\text{C}_8\text{H}_{10}$	0.897 (20°C)	1,331.5	4,368.4	4.1	0.903 (20°C)	9.716 (68°F)
1,4-Dimethyl-benzene (46)	$\text{C}_8\text{H}_{10}$		1,334 (20°C)	4,376.6 (68°F)		0.662	7.123
2,2-Dimethyl-butane (29, 33)	$\text{C}_6\text{H}_{14}$	0.649 (20°C)	1,079	3,540			
Dimethyl ketone	$\text{C}_3\text{H}_6\text{O}$	0.791	1,174	3,851.7	4.5	0.399	4.293
Dimethyl pentane (47)	$\text{C}_7\text{H}_{16}$	0.674	1,063	3,487.5			
Dimethyl phthalate	$\text{C}_8\text{H}_{10}\text{O}_4$	1.2	1,463	4,799.9			
Diiodo-methane	$\text{CH}_2\text{I}_2$	3.235	980	3,215.2			
Dioxane	$\text{C}_4\text{H}_8\text{O}_2$	1.033	1,376	4,514.4			
Dodecane (23)	$\text{C}_{12}\text{H}_{26}$	0.749	1,279	4,196.2	3.85	1.80	19.368
1,2-Ethanediol	$\text{C}_2\text{H}_6\text{O}_2$	1.113	1,658	5,439.6	2.1		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Ethanenitrile	C <sub>2</sub> H <sub>3</sub> N	0.783	1,290	4,232.3		0.441	4.745
Ethanoic anhydride (22)	(CH <sub>3</sub> CO) <sub>2</sub> O	1.082	1,180	3,871.4		0.769	8.274
Ethanol	C <sub>2</sub> H <sub>6</sub> O	0.789	1,207	3,960	4.0	1.39	14.956
Ethanol amide	C <sub>2</sub> H <sub>7</sub> NO	1.018	1,724	5,656.2	3.4		
Ethoxyethane	C <sub>4</sub> H <sub>10</sub> O	0.713	985	3,231.6	4.87	0.311	3.346
Ethyl acetate (33)	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	0.901	1,085	3,559.7	4.4	0.489	5.263
Ethyl alcohol	C <sub>2</sub> H <sub>6</sub> O	0.789	1,207	3,960	4.0	1.396	15.020
Ethyl benzene (46)	C <sub>8</sub> H <sub>10</sub>	0.867 (20°C)	1,338 (20°C)	4,389.8 (68°F)		0.797 (17°C)	8.575 (63°F)
Ethyl Bromide (46)	C <sub>2</sub> H <sub>5</sub> Br	1.461 (20°C)	900 (20°C)	2,952.8 (68°F)		0.275 (20°C)	2.959 (68°F)
Ethyl iodide (46)	C <sub>2</sub> H <sub>5</sub> I	1.950 (20°C)	876 (20°C)	2874 (68°F)		0.29	3.12
Ether	C <sub>4</sub> H <sub>10</sub> O	0.713	985	3231.6	4.87	0.311	3.346
Ethyl ether	C <sub>4</sub> H <sub>10</sub> O	0.713	985	3231.6	4.87	0.311	3.346
Ethylene bromide (47)	C <sub>2</sub> H <sub>4</sub> Br <sub>2</sub>	2.18	995	3264.4		0.79	8.5
Ethylene chloride (47)	C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	1.253	1,193	3914		0.61	6.563
Ethylene glycol	C <sub>2</sub> H <sub>6</sub> O <sub>2</sub>	1.113	1,658	5439.6	2.1	17.208 (20°C)	185.158 (68°F)
d-Fenochone	C <sub>10</sub> H <sub>16</sub> O	0.947	1,320	4330.7		0.22	2.367
d-2-Fenecanone	C <sub>10</sub> H <sub>16</sub> O	0.947	1,320	4330.7		0.22	2.367
Fluorine	F	0.545 (-143°C)	403 (-143°C)	1322.2 (-225°F)	11.31		
Fluoro-benzene (46)	C <sub>6</sub> H <sub>5</sub> F	1.024 (20°C)	1,189	3900.9		0.584 (20°C)	6.283 (68°F)
Formaldehyde, methyl ester	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	0.974	1,127	3697.5	4.02		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s	m/s/ $^\circ\text{C}$	m <sup>2</sup> /s	ft <sup>2</sup> /s
Formamide	CH <sub>3</sub> NO	1.134 (20°C)	1,622	5321.5	2.2	2.91	31.311
Formic acid, amide	CH <sub>3</sub> NO	1.134 (20°C)	1,622	5321.5		2.91	31.311
Freon R12			774.2	2540			
Furfural	C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	1.157	1,444	4737.5	3.7		
Furfuryl alcohol	C <sub>5</sub> H <sub>6</sub> O <sub>2</sub>	1.135	1,450	4757.2	3.4		
Fural	C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	1.157	1,444	4737.5	3.7		
2-Furaldehyde	C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	1.157	1,444	4737.5	3.7		
2-Furancarbox aldehyde	C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	1.157	1,444	4737.5	3.7		
2-Furyl-Methanol	C <sub>5</sub> H <sub>6</sub> O <sub>2</sub>	1.135	1,450	4757.2	3.4		
Gallium	Ga	6.095	2,870 (30°C)	9416 (86°F)			
Glycerin	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.26	1,904	6246.7	2.2	757.1	8,081.83 6
Glycerol	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.26	1,904	6246.7	2.2	757.1	8,081.83 6
Glycol	C <sub>2</sub> H <sub>6</sub> O <sub>2</sub>	1.113	1658	5439.6	2.1		
50% Glycol / 50% H <sub>2</sub> O			1,578	5,177			
Helium (45)	He <sub>4</sub>	0.125 (-269°C)	183 (-269°C)	600.4 (-452°F)		0.025	.269
Heptane (22, 23)	C <sub>7</sub> H <sub>16</sub>	0.684 (20°C)	1,131	3,710.6	4.25	0.598 (20°C)	6.434 (68°F)
n-Heptane (29, 33)	C <sub>7</sub> H <sub>16</sub>	0.684 (20°C)	1,180	3,871.3	4.0		
Hexachloro- Cyclopentadiene (47)	C <sub>5</sub> Cl <sub>6</sub>	1.7180	1,150	3,773			



Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Hexadecane (23)	C <sub>16</sub> H <sub>34</sub>	0.773 (20°C)	1,338	4,389.8	3.71	4.32 (20°C)	46.483 (68°F)
Hexalin	C <sub>6</sub> H <sub>12</sub> O	0.962	1,454	4,770.3	3.6	70.69 (17°C)	760.882 (63°F)
Hexane (16, 22, 23)	C <sub>6</sub> H <sub>14</sub>	0.659	1,112	3,648.3	2.71	0.446	4.798
n-Hexane (29, 33)	C <sub>6</sub> H <sub>14</sub>	0.649 (20°C)	1,079	3,540	4.53		
2,5-Hexanedione	C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	0.729	1,399	4,589.9	3.6		
n-Hexanol	C <sub>6</sub> H <sub>14</sub> O	0.819	1,300	4,265.1	3.8		
Hexahydro benzene (15)	C <sub>6</sub> H <sub>12</sub>	0.779	1,248	4,094.5	5.41	1.31 (17°C)	14.095 (63°F)
Hexahydro phenol	C <sub>6</sub> H <sub>12</sub> O	0.962	1,454	4,770.3	3.6		
Hexamethylene (15)	C <sub>6</sub> H <sub>12</sub>	0.779	1,248	4,094.5	5.41	1.31 (17°C)	14.095 (63°F)
Hydrogen (45)	H <sub>2</sub>	0.071 (-256°C)	1,187 (-256°C)	3,894.4 (-429°F)		0.003 (-256°C)	0.032 (-429°F)
2-Hydroxy- toluene (46)	C <sub>7</sub> H <sub>8</sub> O	1.047 (20°C)	1,541 (20°C)	5,055.8 (68°F)		4.29 (40°C)	46.16 (104°F)
3-Hydroxy- toluene (46)	C <sub>7</sub> H <sub>8</sub> O	1.034 (20°C)	1,500 (20°C)	4,921.3 (68°F)		5.979 (40°C)	64.334 (104°F)
Iodo-benzene (46)	C <sub>6</sub> H <sub>5</sub> I	1.823	1,114 (20°C)	3,654.9 (68°F)		0.954	
Iodo-ethane (46)	C <sub>2</sub> H <sub>5</sub> I	1.950 (20°C)	876 (20°C)	2,874 (68°F)		0.29	3.12
Iodo-methane	CH <sub>3</sub> I	2.28 (20°C)	978	3,208.7		0.211	2.27
Isobutyl acetate (22)	C <sub>6</sub> H <sub>12</sub> O		1,180 (27°C)	3,871.4 (81°F)	4.85		
Isobutanol	C <sub>4</sub> H <sub>10</sub> O	0.81 (20°C)	1,212	3,976.4			
Iso-Butane			1,219.8	4002			

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Isopentane (36)	C <sub>5</sub> H <sub>12</sub>	0.62 (20°C)	980	3,215.2	4.8	0.34	3.658
Isopropanol (46)	C <sub>3</sub> H <sub>8</sub> O	0.785 (20°C)	1,170 (20°C)	3,838.6 (68°F)		2.718	29.245
Isopropyl alcohol (46)	C <sub>3</sub> H <sub>8</sub> O	0.785 (20°C)	1,170 (20°C)	3,838.6 (68°F)		2.718	29.245
Kerosene		0.81	1,324	4,343.8	3.6		
Ketohexa methylene	C <sub>6</sub> H <sub>10</sub> O	0.948	1,423	4,668.6	4.0		
Lithium fluoride (42)	LiF		2,485 (900°C)	8,152.9 (1652°F)	1.29		
Mercury (45)	Hg	13.594	1,449 (24°C)	4,753.9 (75°F)		0.114	1.226
Mesityloxide	C <sub>6</sub> H <sub>16</sub> O	0.85	1,310	4,297.9			
Methane (25, 28, 38, 39)	CH <sub>4</sub>	0.162 (-89°C)	405 (-89°C)	1,328.7 (-128°F)	17.5		
Methanol (40, 41)	CH <sub>4</sub> O	0.791 (20°C)	1,076	3,530.2	2.92	0.695	7.478
Methyl acetate	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	0.934	1,211	3,973.1		0.407	4.379
o-Methylaniline (46)	C <sub>7</sub> H <sub>9</sub> N	0.999 (20°C)	1,618	5,308.4		4.394 (20°C)	47.279 (68°F)
4-Methylaniline (46)	C <sub>7</sub> H <sub>9</sub> N	0.966 (45°C)	1,480	4,855.6		1.863 (50°C)	20.095 (122°F)
Methyl alcohol (40, 44)	CH <sub>4</sub> O	0.791 (20°C)	1,076	3,530.2	2.92	0.695	7.478
Methyl benzene (16, 52)	C <sub>7</sub> H <sub>8</sub>	0.867	1,328 (20°C)	4,357 (68°F)	4.27	0.644	7.144
2-Methyl-butane (36)	C <sub>5</sub> H <sub>12</sub>	0.62 (20°C)	980	3,215.2		0.34	3.658
Methyl carbinol	C <sub>2</sub> H <sub>6</sub> O	0.789	1,207	3,960	4.0	1.396	
Methyl-chloroform (47)	C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub>	1.33	985	3,231.6		0.902 (20°C)	9.705 (68°F)
Methyl-cyanide	C <sub>2</sub> H <sub>3</sub> N	0.783	1,290	4,232.3		0.441	4.745

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/ $^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
3-Methyl cyclohexanol	C <sub>7</sub> H <sub>14</sub> O	0.92	1,400	4,593.2			
Methylene chloride (3)	CH <sub>2</sub> Cl <sub>2</sub>	1.327	1,070	3,510.5	3.94	0.31	3.335
Methylene iodide	CH <sub>2</sub> I <sub>2</sub>	3.235	980	3,215.2			
Methyl formate (22)	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	0.974 (20°C)	1,127	3,697.5	4.02		
Methyl iodide	CH <sub>3</sub> I	2.28 (20°C)	978	3,208.7		0.211	2.27
a-Methyl naphthalene	C <sub>11</sub> H <sub>10</sub>	1.090	1,510	4,954.1	3.7		
2-Methylphenol (46)	C <sub>7</sub> H <sub>8</sub> O	1.047 (20°C)	1,541 (20°C)	5,055.8 (68°F)		4.29 (40°C)	46.16 (104°F)
3-Methylphenol (46)	C <sub>7</sub> H <sub>8</sub> O	1.034 (20°C)	1,500 (20°C)	4,921.3 (68°F)		5.979 (40°C)	64.334 (104°F)
Milk, homogenized			1,548	5,080			
Morpholine	C <sub>4</sub> H <sub>9</sub> NO	1.00	1,442	4,731	3.8		
Naphtha		0.76	1,225	4,019			
Natural Gas (37)		0.316 (-103°C)	753 (-103°C)	2,470.5 (-153°F)			
Neon (45)	Ne	1.207 (-246°C)	595 (-246°C)	1,952.1 (-411°F)			
Nitrobenzene (46)	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	1.204 (20°C)	1,415 (20°C)	4,642.4 (68°F)		1.514	16.29
Nitrogen (45)	N <sub>2</sub>	0.808 (-199°C)	962 (-199°C)	3,156.2 (-326°F)		0.217 (-199°C)	2.334 (-326°F)
Nitromethane (43)	CH <sub>3</sub> NO <sub>2</sub>	1.135	1,300	4,265.1	4.0	0.549	5.907
Nonane (23)	C <sub>9</sub> H <sub>2</sub> O	0.718 (20°C)	1,207	3,960	4.04	0.99 (20°C)	10.652 (68°F)
1-Nonene (27)	C <sub>9</sub> H <sub>18</sub>	0.736 (20°C)	1,207	3,960	4.0		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		$\text{m}^2/\text{s}$	$\text{ft}^2/\text{s}$
Octane (23)	$\text{C}_8\text{H}_{18}$	0.703	1,172	3,845.1	4.14	0.73	7.857
n-Octane (29)	$\text{C}_8\text{H}_{18}$	0.704 (20°C)	1,212.5	3,978	3.50	0.737	.930)
1-Octene (27)	$\text{C}_8\text{H}_{16}$	0.723 (20°C)	1,175.5	3,856.6	4.10		
Oil of Camphor Sassafrassy			1,390	4,560.4	3.8		
Oil, Car (SAE 20a.30)		1.74	870	2,854.3		190	2,045.09 3
Oil, Castor	$\text{C}_{11}\text{H}_{10}\text{O}_{10}$	0.969	1,477	4,845.8	3.6	0.670	7.209
Oil, Diesel		0.80	1,250	4,101			
Oil, Fuel AA gravity		0.99	1,485	4,872	3.7		
Oil (Lubricating X200)			1,530	5,019.9			
Oil (Olive)		0.912	1,431	4,694.9	2.75	100	1,076.36 5
Oil (Peanut)		0.936	1,458	4,783.5			
Oil (Sperm)		0.88	1,440	4,724.4			
Oil, 6			1,509 (22°C)	4,951 (72°F)			
2,2-Oxydi ethanol	$\text{C}_4\text{H}_{10}\text{O}_3$	1.116	1,586	5,203.4	2.4		
Oxygen (45)	$\text{O}_2$	1.155 (-186°C)	952 (-186°C)	3,123.4 (-303°F)		0.173	1.861
Pentachloro- ethane (47)	$\text{C}_2\text{HCl}_5$	1.687	1,082	3,549.9			
Pentalin (47)	$\text{C}_2\text{HCl}_5$	1.687	1,082	3,549.9			
Pentane (36)	$\text{C}_5\text{H}_{12}$	0.626 (20°C)	1,020	3,346.5		0.363	3.905
n-Pentane (47)	$\text{C}_5\text{H}_{12}$	0.557	1,006	3,300.5		0.41	4.413

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Perchlorocyclopentadiene (47)	C <sub>5</sub> Cl <sub>6</sub>	1.718	1,150	3,773			
Perchloroethylene (47)	C <sub>2</sub> Cl <sub>4</sub>	1.632	1,036	3,399			
Perfluoro-1-Hepten (47)	C <sub>7</sub> F <sub>14</sub>	1.67	583	1,912.7			
Perfluoro-n-Hexane (47)	C <sub>6</sub> F <sub>14</sub>	1.672	508	1,666.7			
Phene L(29, 40, 41)	C <sub>6</sub> H <sub>6</sub>	0.879	1,306	4,284.8	4.65	0.711	7.65
<b>b</b> -Phenyl acrolein	C <sub>9</sub> H <sub>8</sub> O	1.112	1,554	5,098.4	3.2		
Phenylamine (41)	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	1.022	1,639	5,377.3	4.0	3.63	39.058
Phenyl bromide (46)	C <sub>6</sub> H <sub>5</sub> Br	1.522	1,170 (20°C)	3,838.6 (68°F)		0.693	7.456
Phenyl chloride	C <sub>6</sub> H <sub>5</sub> Cl	1.106	1,273	4,176.5	3.6	0.722	7.768
Phenyl iodide (46)	C <sub>6</sub> H <sub>5</sub> I	1.823	1,114 (20°C)	3,654.9 (68°F)		0.954 (15°C)	10.265 (59°F)
Phenyl methane (16, 52)	C <sub>7</sub> H <sub>8</sub>	0.867 (20°C)	1,328 (20°C)	4,357 (68°F)	4.27	0.644	6.929
3-Phenyl propenal	C <sub>9</sub> H <sub>8</sub> O	1.112	1,554	5,098.4	3.2		
Phthalardione	C <sub>8</sub> H <sub>4</sub> O <sub>3L</sub>		1,125 (152°C)	3,691 (306°F)			
Phthalic acid, anhydride	C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>		1,125 (152°C)	3,691 (306°F)			
Pthalic anhydride	C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>		1,125 (152°C)	3,691 (306°F)			
Pimelic ketone	C <sub>6</sub> H <sub>10</sub> O	0.948	1,423	4,668.6	4.0		
Plexiglas, Lucite, Acrylic			2,651	8,698			

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Polyterpene Resin		0.77	1,099.8 (190°C)	3,608.4 (374°F)		39,000	419,500
Potassium bromide (42)	KBr		1,169 (900°C)	3,835.3 (1652°F)	0.71	.715cp (900°C)	7.693 (1652°F)
Potassium fluoride (42)	KF		1,792 (900°C)	5,879.3 (1652°F)	1.03		
Potassium iodide (42)	KI		985 (900°C)	3,231.6 (1652°F)	0.64		
Potassium nitrate (48)	KNO <sub>3</sub>	1.859 (352°C)	1,740.1 (352°C)	5,709 (666°F)	1.1	1.19 (327°C)	12.804 (621°F)
Propane (2, 13) (-45° to -130°C)	C <sub>3</sub> H <sub>8</sub>	0.585 (-45°C)	1,003 (-45°C)	3,290.6 (-49°F)	5.7		
1,2,3-Propanetriol	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.26	1,904	6,246.7	2.2	.000757	
1-Propanol (46)	C <sub>3</sub> H <sub>8</sub> O	0.78 (20°C)	1,222 (20°C)	4,009.2 (68°F)			
2-Propanol (46)	C <sub>3</sub> H <sub>8</sub> O	0.785 (20°C)	1,170 (20°C)	3,838.6 (68°F)		2.718	29.245
2-Propanone	C <sub>3</sub> H <sub>6</sub> O	0.791	1,174	3,851.7	4.5	0.399	4.293
Propene (17, 18, 35)	C <sub>3</sub> H <sub>6</sub>	0.563 (-13°C)	963 (-13°C)	3,159.4 (9°F)	6.32		
n-Propyl acetate (22)	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>		1,280 (2°C)	4,199 (36°F)	4.63		
n-Propyl-alcohol	C <sub>3</sub> H <sub>8</sub> O	0.78 (20°C)	1,222 (20°C)	4,009.2 (68°F)		2.549	27.427
Propylchloride (47)	C <sub>3</sub> H <sub>7</sub> Cl	0.892	1,058	3,471.1		0.378	4.067
Propylene (17, 18, 35)	C <sub>3</sub> H <sub>6</sub>	0.563 (-13°C)	963 (-13°C)	(3159.4) (9°F)	6.32		
Pyridine	C <sub>6</sub> H <sub>5</sub> N	0.982	1,415	4,642.4	4.1	0.992 (20°C)	10.673 (68°F)
Refrigerant 11 (3, 4)	CCl <sub>3</sub> F	1.49	828.3 (0°C)	2,717.5 (32°F)	3.56		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Refrigerant 12 (3)	CCl <sub>2</sub> F <sub>2</sub>	1.516 (-40°C)	774.1 (-40°C)	2,539.7 (-40°F)	4.24		
Refrigerant 14 (14)	CF <sub>4</sub>	1.75 (-150°C)	875.24 (-150°C)	2,871.5 (-238°F)	6.61		
Refrigerant 21 (3)	CHCl <sub>2</sub> F	1.426 (0°C)	891 (0°C)	2,923.2 (32°F)	3.97		
Refrigerant 22 (3)	CHClF <sub>2</sub>	1.491 (-69°C)	893.9 (50°C)	2,932.7 (122°F)	4.79		
Refrigerant 113 (3)	CCl <sub>2</sub> F-CClF <sub>2</sub>	1.563	783.7 (0°C)	2,571.2 (32°F)	3.44		
Refrigerant 114 (3)	CClF <sub>2</sub> -CClF <sub>2</sub>	1.455	665.3 (-10°C)	2,182.7 (14°F)	3.73		
Refrigerant 115 (3)	C <sub>2</sub> ClF <sub>5</sub>		656.4 (-50°C)	2,153.5 (-58°F)	4.42		
Refrigerant C318 (3)	C <sub>4</sub> F <sub>8</sub>	1.62 (-20°C)	574 (-10°C)	1,883.2 (14°F)	3.88		
Selenium (8)	Se		1,072 (250°C)	3,517.1 (482°F)	0.68		
Silicone (30 cp)		0.993	990	3,248		30	322.8
Sodium fluoride (42)	NaF	0.877	2,082 (1000°C)	6,830.7 (1832°F)	1.32		
Sodium nitrate (48)	NaNO <sub>3</sub>	1.884 (336°C)	1,763.3 (336°C)	5,785.1 (637°F)	0.74	1.37 (336°C)	14.74 (637°F)
Sodium nitrite (48)	NaNO <sub>2</sub>	1.805 (292°C)	1,876.8 (292°C)	6,157.5 (558°F)			
Solvesso #3		0.877	1,370	4,494.8	3.7		
Spirit of wine	C <sub>2</sub> H <sub>6</sub> O	0.789	1,207	3,960	4.0	1.396	15.02
Sulfur (7, 8, 10)	S		1,177 (250°C)	3,861.5 (482°F)	-1.13		
Sulfuric Acid (1)	H <sub>2</sub> SO <sub>4</sub>	1.841	1,257.6	4,126	1.43	11.16	120.081
Tellurium (7)	Te		991 (450°C)	3,251.3 (842°F)	0.73		

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
1,1,2,2-Tetra bromo-ethane (47)	C <sub>2</sub> H <sub>2</sub> Br <sub>4</sub>	2.966	1,027	3,369.4			
1,1,2,2-Tetra chloro-ethane (67)	C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub>	1.595	1,147	3,763.1		1.156 (15°C)	12.438 (59°F)
Tetrachloro ethane (46)	C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub>	1.553 (20°C)	1,170 (20°C)	3,838.6 (68°F)		1.19	12.804
Tetrachloro-ethene (47)	C <sub>2</sub> Cl <sub>4</sub>	1.632	1,036	3,399			
Tetrachloro-Methane (33, 47)	CCl <sub>4</sub>	1.595 (20°C)	926	3,038.1		0.607	6.531
Tetradecane (46)	C <sub>14</sub> H <sub>30</sub>	0.763 (20°C)	1,331 (20°C)	4,366.8 (68°F)		2.86 (20°C)	30.773 (68°F)
Tetraethylene glycol	C <sub>8</sub> H <sub>18</sub> O <sub>5</sub>	1.123	1,586	5,203.4	3.0		
Tetrafluoro-methane (14) (Freon 14)	CF <sub>4</sub>	1.75 (-150°C)	875.24 (-150°C)	2,871.5 (-238°F)	6.61		
Tetrahydro-1,4-isoxazine	C <sub>4</sub> H <sub>9</sub> NO	1.000	1,442	4,731	3.8		
Toluene (16, 52)	C <sub>7</sub> H <sub>8</sub>	0.867 (20°C)	1,328 (20°C)	4,357 (68°F)	4.27	0.644	6.929
o-Toluidine (46)	C <sub>7</sub> H <sub>9</sub> N	0.999 (20°C)	1,618	5,308.4		4.394 (20°C)	47.279 (68°F)
p-Toluidine (46)	C <sub>7</sub> H <sub>9</sub> N	0.966 (45°C)	1,480	4,855.6		1.863 (50°C)	20.053 (122°F)
Toluol	C <sub>7</sub> H <sub>8</sub>	0.866	1,308	4,291.3	4.2	0.58	6.24
Tribromo-methane (46, 47)	CHBr <sub>3</sub>	2.89 (20°C)	918	3,011.8		0.654	7.037
1,1,1-Trichloro-ethane (47)	C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub>	1.33	985	3,231.6		0.902 (20°C)	9.705 (68°F)



Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$ m/s/°C	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s		m <sup>2</sup> /s	ft <sup>2</sup> /s
Trichloro-ethene (47)	C <sub>2</sub> HCl <sub>3</sub>	1.464	1,028	3,372.7			
Trichloro-fluoro methane (3) (Freon 11)	CCl <sub>3</sub> F	1.49	828.3 (0°C)	2,717.5 (32°F)	3.56		
Trichloro-methane (47)	CHCl <sub>3</sub>	1.489	979	3,211.9	3.4	0.55	5.918
1,1,2-Trichloro-1,2,2-Trifluoro-Ethane	CCl <sub>2</sub> F-CClF <sub>2</sub>	1.563	783.7 (0°C)	2,571.2 (32°F)			
Triethyl-amine (33)	C <sub>6</sub> H <sub>15</sub> N	0.726	1,123	3,684.4	4.47		
Triethylene glycol	C <sub>6</sub> H <sub>14</sub> O <sub>4</sub>	1.123	1,608	5,275.6	3.8		
1,1,1-Trifluoro-2-Chloro-2-Bromo-Ethane	C <sub>2</sub> HClBrF <sub>3</sub>	1.869	693	2,273.6			
1,2,2-Trifluoro trichloro-ethane (Freon 113)	CCl <sub>2</sub> F-CClF <sub>2</sub>	1.563	783.7 (0°C)	2,571.2 (32°F)	3.44		
d-1,3,3-Tri methylnor camphor	C <sub>10</sub> H <sub>16</sub> O	0.947	1,320	4,330.7		0.22	2.367
Trinitrotoluene (43)	C <sub>7</sub> H <sub>5</sub> (NO <sub>2</sub> ) <sub>3</sub>	1.64	1,610 (81°C)	5,282.2 (178°F)			
Turpentine		0.88	1,255	4,117.5		1.4	15.064
Unisis 800		0.87	1,346	4,416			
Water, distilled (49, 50)	H <sub>2</sub> O	0.996	1,498	4,914.7	-2.4	1.00	10.76
Water, heavy	D <sup>2</sup> O		1,400	4,593			
Water, sea		1.025	1,531	5,023	-2.4	1.00	10.76
Wood Alcohol (40, 41)	CH <sub>4</sub> O	0.791 (20°C)	1,076	3,530.2	2.92	0.695	7.478

Table 2: Sound Speeds in Fluids @25°C (77°F) (cont.)

Substance	Chemical Formula	Specific Gravity	Sound Speed		$\Delta v/^\circ\text{C}$	Kinematic Viscosity $\times 10^{-6}$	
			m/s	ft/s	m/s/ $^\circ\text{C}$	m <sup>2</sup> /s	ft <sup>2</sup> /s
Xenon (45)	Xe		630 (-109°C)	2,067 (-164°F)			
m-Xylene (46)	C <sub>8</sub> H <sub>10</sub>	0.868 (15°C)	1,343 (20°C)	4,406.2 (68°F)		0.749 (15°C)	8.059 (59°F)
o-Xylene (29, 46)	C <sub>8</sub> H <sub>10</sub>	0.897 (20°C)	1,331.5	4,368.4	4.1	0.903 (20°C)	9.716 (68°F)
p-Xylene (46)	C <sub>8</sub> H <sub>10</sub>		1,334 (20°C)	4,376.6 (68°F)		0.662	7.123
Xylene hexafluoride	C <sub>8</sub> H <sub>4</sub> F <sub>6</sub>	1.37	879	2,883.9		0.613	6.595
Zinc (7)	Zn		3,298 (450°C)	10,820.2 (842°F)			

### 1.3 Sound Speeds in Water

**Note:** *The values in Table 3 below are reproduced with permission from American Institute of Physics Handbook, ©McGraw-Hill Book Co.*

**Table 3: Sound Speeds in Water**

Water Temperature		Sound Speed	
°C	°F	m/s	ft/s
0	32.0	1,402	4,600
1	33.8	1,407	4,616
2	35.6	1,412	4,633
3	37.4	1,417	4,649
4	39.2	1,421	4,662
5	41.0	1,426	4,679
6	42.8	1,430	4,692
7	44.6	1,434	4,705
8	46.4	1,439	4,721
9	48.2	1,443	4,734
10	50.0	1,447	4,748
11	51.8	1,451	4,761
12	53.6	1,455	4,774
13	55.4	1,458	4,784
14	57.2	1,462	4,797
15	59.0	1,465	4,807
16	60.8	1,469	4,820
17	62.6	1,472	4,830
18	64.4	1,476	4,843
19	66.2	1,479	4,853
20	68.0	1,482	4,862
21	69.8	1,485	4,872
22	71.6	1,488	4,882
23	73.4	1,491	4,892
24	75.2	1,493	4,899
25	77.0	1,496	4,908
26	78.8	1,499	4,918

Table 3: Sound Speeds in Water (cont.)

Water Temperature		Sound Speed	
°C	°F	m/s	ft/s
27	80.6	1,501	4,925
28	82.4	1,504	4,935
29	84.2	1,506	4,941
30	86.0	1,509	4,951
31	87.8	1,511	4,958
32	89.6	1,513	4,964
33	91.4	1,515	4,971
34	93.2	1,517	4,977
35	95.0	1,519	4,984
36	96.8	1,521	4,990
37	98.6	1,523	4,997
38	100.4	1,525	5,004
39	102.2	1,527	5,010
40	104.0	1,528	5,013
41	105.8	1,530	5,020
42	107.6	1,532	5,026
43	109.4	1,534	5,033
44	111.2	1,535	5,036
45	113.0	1,536	5,040
46	114.8	1,538	5,046
47	116.6	1,539	5,049
48	118.4	1,540	5,053
49	120.2	1,541	5,056
50	122.0	1,543	5,063
51	123.8	1,543	5,063
52	125.6	1,544	5,066
53	127.4	1,545	5,069
54	129.2	1,546	5,072
55	131.0	1,547	5,076
56	132.8	1,548	5,079

**Table 3: Sound Speeds in Water (cont.)**

Water Temperature		Sound Speed	
°C	°F	m/s	ft/s
57	134.6	1,548	5,079
58	136.4	1,549	5,082
59	138.2	1,550	5,086
60	140.0	1,550	5,086
61	141.8	1,551	5,089
62	143.6	1,552	5,092
63	145.4	1,552	5,092
64	147.2	1,553	5,095
65	149.0	1,553	5,095
66	150.8	1,553	5,095
67	152.6	1,554	5,099
68	154.4	1,554	5,099
69	156.2	1,554	5,099
70	158.0	1,554	5,099
71	159.8	1,554	5,099
72	161.6	1,555	5,102
73	163.4	1,555	5,102
74	165.2	1,555	5,102
75	167.0	1,555	5,102
76	168.8	1,555	5,102
77	170.6	1,554	5,099
78	172.4	1,554	5,099
79	174.2	1,554	5,099
80	176.0	1,554	5,099
81	177.8	1,554	5,099
82	179.6	1,553	5,095
83	181.4	1,553	5,095
84	183.2	1,553	5,095
85	185.0	1,552	5,092
86	186.8	1,552	5,092

Table 3: Sound Speeds in Water (cont.)

Water Temperature		Sound Speed	
°C	°F	m/s	ft/s
87	188.6	1,552	5,092
88	190.4	1,551	5,089
89	192.2	1,551	5,089
90	194.0	1,550	5,086
91	195.8	1,549	5,082
92	197.6	1,549	5,082
93	199.4	1,548	5,079
94	201.2	1,547	5,076
95	203.0	1,547	5,076
96	204.8	1,546	5,072
97	206.6	1,545	5,069
98	208.4	1,544	5,066
99	210.2	1,543	5,063
100	212.0	1,543	5,063
104	220.0	1,538	5,046
110	230.0	1,532	5,026
116	240.0	1,524	5,000
121	250.0	1,526	5,007
127	260.0	1,507	4,944
132	270.0	1,497	4,912
138	280.0	1,487	4,879
143	290.0	1,476	4,843
149	300.0	1,465	4,807
154	310.0	1,453	4,767
160	320.0	1,440	4,725
166	330.0	1,426	4,679
171	340.0	1,412	4,633
177	350.0	1,398	4,587
182	360.0	1,383	4,538
188	370.0	1,368	4,488

**Table 3: Sound Speeds in Water (cont.)**

Water Temperature		Sound Speed	
°C	°F	m/s	ft/s
193	380.0	1,353	4,439
199	390.0	1,337	4,387
204	400.0	1,320	4,331
210	410.0	1,302	4,272
216	420.0	1,283	4,210
221	430.0	1,264	4,147
227	440.0	1,244	4,082
232	450.0	1,220	4,003
238	460.0	1,200	3,937
243	470.0	1,180	3,872
249	480.0	1,160	3,806
254	490.0	1,140	3,740
260	500.0	1,110	3,642

## 1.4 Sound Speeds in Gases

The speeds of sound in some common gases, at 0°C and atmospheric pressure, are listed in *Table 4* below. To estimate the speed of sound in the gases listed in the table at other temperatures, use the following equation:

$$v = v_0 \times \sqrt{\frac{T}{273} + 1}$$

In the above equation,  $v_0$  is the speed of sound in the gas at 0°C,  $v$  is the speed of sound in m/s and  $T$  is the gas temperature in °C. For example, the sound speed in air at 100°C = 331 x 1.169 = 387 m/s.

**Note:** *Parameters other than the gas temperature do influence the sound speed, but temperature is by far the predominant factor.*

**Table 4: Sound Speeds in Gases**

Gas	Sound Speed (0°C, atmospheric pressure)	
	m/s	ft/s
Air (dry)	331	1086
Argon	307	1007
Carbon Dioxide	259	850
Carbon Monoxide	338	1109
Helium	972	3189
Hydrogen	1286	4219
Methane	430	1411
Neon	435	1427
Nitrogen	334	1096
Oxygen	315	1033
Water Vapor (100°C)	405	1329



## 1.5 Sound Speeds in Air

Using the equation on the previous page to calculate the speed of sound in air at various temperatures, the results listed in *Table 5* below were obtained.

**Table 5: Sound Speeds in Air**

Air Temperature		Sound Speed	
°C	°F	m/s	ft/s
-40	-40	306	1004
-30	-22	313	1026
-20	-4	319	1047
-10	14	325	1067
0	32	331	1087
10	50	337	1107
20	68	343	1126
30	86	349	1145
40	104	355	1164
50	122	360	1183
60	140	366	1201
70	158	371	1219
80	176	377	1236
90	194	382	1254
100	212	387	1271
110	230	392	1288
120	248	398	1304
130	266	403	1321
140	284	408	1337
150	302	412	1353
160	320	417	1369
170	338	422	1385
180	356	427	1400
190	374	431	1416
200	392	436	1431

[no content intended for this page]

## Chapter 2. Pipe Size Tables

### 2.1 Steel Pipe Data - ANSI

Table 6: Steel Pipe Data - ANSI

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
1/8	0.405	0.049			10S
		0.068	STD	40	40S
		0.095	XS	80	80S
1/4	0.540	0.065			10S
		0.088	STD	40	40S
		0.119	XS	80	80S
3/8	0.675	0.065			10S
		0.091	STD	40	40S
		0.126	XS	80	80S
1/2	0.840	0.065			5S
		0.083			10S
		0.109	STD	40	40S
		0.147	XS	80	80S
		0.187		160	
		0.294	XXS		
3/4	1.050	0.065			5S
		0.083			10S
		0.113	STD	40	40S
		0.154	XS	80	80S
		0.218		160	
		0.308	XXS		
1	1.315	0.065			5S
		0.109			10S
		0.133	STD	40	40S
		0.179	XS	80	80S
		0.250		160	
		0.358	XXS		

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
1 1/4	1.660	0.065			5S
		0.109			10S
		0.140	STD	40	40S
		0.191	XS	80	80S
		0.250		160	
		0.382	XXS		
1 1/2	1.900	0.065			5S
		0.109			10S
		0.145	STD	40	40S
		0.200	XS	80	80S
		0.281		160	
		0.400	XXS		
2	2.375	0.065			5S
		0.109			10S
		0.154	STD	40	40S
		0.218	XS	80	80S
		0.344		160	
		0.436	XXS		
2 1/2	2.875	0.083	-	-	5S
		0.120	-	-	10S
		0.203	STD	40	40S
		0.276	XS	80	80S
		0.375	-	160	-
		0.552	XXS	-	-
3	3.500	0.083	-	-	5S
		0.120	-	-	10S
		0.216	STD	40	40S
		0.300	XS	80	80S
		0.438	-	160	-
		0.600	XXS	-	-

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
3 1/2	4.000	0.083			5S
		0.120			10S
		0.226	STD	40	40S
		0.318	XS	80	80S
		0.636	XXS		-
4	4.500	0.083			5S
		0.120			10S
		0.237	STD	40	40S
		0.337	XS	80	80S
		0.438		120	
		0.531		160	
		0.674	XXS		
5	5.536	0.109			5S
		0.134			10S
		0.258	STD	40	40S
		0.375	XS	80	80S
		0.500		120	
		0.625		160	
		0.750	XXS		
6	6.625	0.109			5S
		0.134			10S
		0.280	STD	40	40S
		0.432	XS	80	80S
		0.562		120	
		0.719		160	
		0.864	XXS		

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
8	8.625	0.109			5S
		0.148			10S
		0.250		20	
		0.277		30	
		0.322	STD	40	40S
		0.406		60	
		0.500	XS	80	80S
		0.594		100	
		0.719		120	
		0.812		140	
		0.875	XXS		
	0.906		160		
10	10.750	0.134			5S
		0.165			10S
		0.250		20	
		0.307		30	
		0.365	STD	40	40S
		0.500	XS	60	80S
		0.594		80	
		0.719		100	
		0.844		120	
		1.000	XXS	140	

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number	
12	12.750	0.156			5S	
		0.180			10S	
		0.250			20	
		0.330			30	
		0.375	STD			40S
		0.406			40	
		0.500	XS			80S
		0.562			60	
		0.688			80	
		0.844			100	
		1.000	XXS		120	
		1.125			140	
1.312			160			
14	14.000	0.156			5S	
		0.188			10S	
		0.250			10	
		0.312			20	
		0.375	STD		30	
		0.438			40	
		0.500	XS			
		0.594	-		60	
		0.625	XXS		-	
		0.750			80	
		0.938			100	
		1.094			120	
		1.250			140	
		1.406			160	

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
16	16.000	0.165			5S
		0.188			10S
		0.250		10	-
		0.312		20	
		0.375	STD	30	
		0.500	XS	40	
		0.656		60	
		0.844		80	
		1.031		100	
		1.219		120	
		1.439		140	
		1.594		160	
18	18.000	0.165			5S
		0.188			10S
		0.250		10	
		0.312		20	
		0.375	STD		
		0.438		30	
		0.500	XS		
		0.562		40	
		0.750		60	
		0.938		80	
		1.156		100	
		1.375		120	
		1.562		140	
		1.781		160	



Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
20	20.000	0.188			5S
		0.218			10S
		0.250		10	
		0.375	STD	20	
		0.500	XS	30	
		0.594		40	
		0.812		60	
		1.031		80	
		1.281		100	
		1.500		120	
		1.750		140	
1.969		160			
22	22.000	0.188			5S
		0.218			10S
		0.250		10	
		0.375	STD	20	
		0.500	XS	30	
		0.875		60	
		1.125		80	
		1.375		100	
		1.625		120	
		1.875		140	
		2.125		160	

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
24	24.000	0.218			5S
		0.250		10	10S
		0.375	STD	20	
		0.500	XS		
		0.562		30	
		0.688		40	
		0.969		60	
		1.219		80	
		1.531		100	
		1.812		120	
		2.062		140	
26	26.000	0.312		10	
		0.375	STD	-	
		0.500	XS	20	
28	28.000	0.312		10	
		0.375	STD		
		0.500	XS	20	
		0.625		30	
30	30.000	0.250			5S
		0.312		10	10S
		0.375	STD		
		0.500	XS	20	
		0.625		30	
		0.750		40	
32	32.000	0.312		10	
		0.375	STD		
		0.500	XS	20	
		0.625		30	
		0.688		40	

Table 6: Steel Pipe Data - ANSI (cont.)

Nominal Pipe Size (in.)	Outside Diameter (in.)	Wall Thickness (in.)	ANSI B36.10 Carbon Steel Wall Thickness Designation	ANSI B36.10 Carbon Steel Pipe Schedule Number	ANSI B36.19 Stainless Steel Pipe Schedule Number
34	34.000	0.344		10	
		0.375	STD	-	
		0.500	XS	20	
		0.625		30	
		0.688		40	
36	36.000	0.312		10	
		0.375	STD		
		0.500	XS	20	
		0.625		30	
		0.750		40	
42	42.000	0.375	STD		
		0.500	XS	20	
		0.625		30	
		0.750		40	
48	48.000	0.375	STD		
		0.500	XS		

## 2.2 Steel Pipe Data - DIN

Table 7: Steel Pipe Data - DIN

Nominal Pipe Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)		
		DIN 2448	DIN 2440	DIN 2441
6	10.2	1.6	2.00	2.65
8	13.5	1.8	2.35	2.90
10	17.2	1.8	2.65	2.90
15	21.3	2.0	2.65	3.25
20	26.9	2.3	2.65	3.25
25	33.7	2.6	3.25	4.05
32	42.4	2.6	3.25	4.05
40	48.3	2.6	3.25	4.05
50	60.3	2.9	3.65	4.50
65	76.1	2.9	3.65	4.50
80	88.9	3.2	4.05	4.85
100	114.3	3.6	4.50	5.40
125	139.7	4.0	4.85	5.40
150	168.3	4.5	4.85	5.40
200	219.1	6.3		
250	273.0	6.3		
300	323.9	7.1		
350	355.6	8.0		
400	406.4	8.8		
450	457.0	10.0		
500	508.0	11.0		
600	610.0	12.5		

## 2.3 Cast Iron Pipe Data - Inches

**Table 8: Cast Iron Pipe Data (ANSI A21.6) - Inches**

Nom. Pipe Size (in.)	Class 50		Class 100		Class 150		Class 200		Class 250	
	O.D. (in.)	Wall (in.)	O.D. (in.)	Wall (in.)	O.D. (in.)	Wall (in.)	O.D. (in.)	Wall (in.)	O.D. (in.)	Wall (in.)
3	3.96	0.32	3.96	0.32	3.96	0.32	3.96	0.32	3.96	0.32
4	4.80	0.35	4.80	0.35	4.80	0.35	4.80	0.35	4.80	0.35
6	6.90	0.38	6.90	0.38	6.90	0.38	6.90	0.38	6.90	0.38
8	9.05	0.41	9.05	0.41	9.05	0.41	9.05	0.41	9.05	0.41
10	11.10	0.44	11.10	0.44	11.10	0.44	11.10	0.44	11.10	0.44
12	13.20	0.48	13.20	0.48	13.20	0.48	13.20	0.48	13.20	0.52
14	15.30	0.48	15.30	0.51	15.65	0.51	15.65	0.55	15.65	0.59
16	17.40	0.54	17.40	0.54	17.80	0.54	17.80	0.58	17.80	0.63
18	19.50	0.54	19.50	0.58	19.92	0.58	19.92	0.63	19.92	0.68
20	21.60	0.57	21.60	0.62	22.06	0.62	22.06	0.67	22.06	0.72
24	25.80	0.63	25.80	0.68	26.32	0.73	26.32	0.79	26.32	0.79
30	32.00	0.79	32.00	0.79	32.00	0.85	32.00	0.92	32.00	0.99
36	38.30	0.87	38.30	0.87	38.30	0.94	38.30	1.02	38.30	1.10
42	44.50	0.97	44.50	0.97	44.50	1.05	44.50	1.13	44.50	1.22
48	50.80	1.06	50.80	1.06	50.80	1.14	50.80	1.23	50.80	1.33

## 2.4 Cast Iron Pipe Data - Millimeters

**Table 9: Cast Iron Pipe Data (ANSI A21.6) - Millimeters**

Nom. Pipe Size (mm)	Class 50		Class 100		Class 150		Class 200		Class 250	
	O.D. (mm)	Wall (mm)	O.D. (mm)	Wall (mm)	O.D. (mm)	Wall (mm)	O.D. (mm)	Wall (mm)	O.D. (mm)	Wall (mm)
80	100.6	8.1	100.6	8.1	100.6	8.1	100.6	8.1	100.6	8.1
100	121.9	8.9	121.9	8.9	121.9	8.9	121.9	8.9	121.9	8.9
150	175.3	9.7	175.3	9.7	175.3	9.7	175.3	9.7	175.3	9.7
200	229.9	10.4	229.9	10.4	229.9	10.4	229.9	10.4	229.9	10.4
250	281.9	11.2	281.9	11.2	281.9	11.2	281.9	11.2	281.9	11.2
300	335.3	12.2	335.3	12.2	335.3	12.2	335.3	12.2	335.3	13.2
350	388.6	12.2	388.6	13.0	397.5	13.0	397.5	14.0	397.5	15.0
400	442.0	13.7	442.0	13.7	452.1	13.7	452.1	14.7	452.1	16.0
450	495.3	13.7	495.3	14.7	506.0	14.7	506.0	16.0	506.0	17.3
500	548.6	14.5	548.6	15.7	560.3	15.7	560.3	17.0	560.3	18.3
600	655.3	16.0	655.3	17.3	668.5	18.5	668.5	20.1	668.5	20.1
750	812.8	20.1	812.8	20.1	812.8	21.6	812.8	23.4	812.8	25.1
900	972.8	22.1	972.8	22.1	972.8	23.9	972.8	25.9	972.8	27.9
1050	1130.3	24.6	1130.3	24.6	1130.3	26.7	1130.3	28.7	1130.3	31.0
1200	1290.3	26.9	1290.3	26.9	1290.3	29.0	1290.3	31.2	1290.3	33.8

## 2.5 Ductile Iron Pipe Data - Inches

**Table 10: Ductile Iron Pipe Data (ANSI A21.5) - Inches**

Nominal Pipe Size (in.)	Outside Diameter (in.)	Pipe Wall Thickness (in.)						
		Class 50	Class 51	Class 52	Class 53	Class 54	Class 55	Class 56
3	4.02	N/A	0.25	0.28	0.31	0.34	0.37	0.40
4	4.80	N/A	0.26	0.29	0.32	0.35	0.38	0.41
6	6.90	0.25	0.28	0.31	0.34	0.37	0.40	0.43
8	9.05	0.27	0.30	0.33	0.36	0.39	0.42	0.45
10	11.10	0.29	0.32	0.35	0.38	0.41	0.44	0.47
12	13.20	0.31	0.34	0.37	0.40	0.43	0.46	0.49
14	15.30	0.33	0.36	0.39	0.42	0.45	0.48	0.51
16	17.40	0.34	0.37	0.40	0.43	0.46	0.49	0.52
18	19.50	0.35	0.38	0.41	0.44	0.47	0.50	0.53
20	21.60	0.36	0.39	0.42	0.45	0.48	0.51	0.54
24	25.80	0.38	0.41	0.44	0.47	0.50	0.53	0.56
30	32.00	0.39	0.43	0.47	0.51	0.55	0.59	0.63
36	38.30	0.43	0.48	0.53	0.58	0.63	0.68	0.73
42	44.50	0.47	0.53	0.59	0.65	0.71	0.77	0.83
48	50.80	0.51	0.58	0.65	0.72	0.79	0.86	0.93
54	57.56	0.57	0.65	0.73	0.81	0.89	0.97	1.05

## 2.6 Ductile Iron Pipe Data - Millimeters

**Table 11: Ductile Iron Pipe Data (ANSI A21.5) - Millimeters**

Nominal Pipe Size (mm)	Outside Diameter (mm)	Pipe Wall Thickness (mm)						
		Class 50	Class 51	Class 52	Class 53	Class 54	Class 55	Class 56
80	102.1	N/A	6.4	7.1	7.9	8.6	9.4	10.2
100	121.9	N/A	6.6	7.4	8.1	8.9	9.7	10.4
150	175.2	6.4	7.1	7.9	8.6	9.4	10.2	10.9
200	229.9	6.9	7.6	8.4	9.1	9.9	10.7	11.4
250	281.9	7.4	8.1	8.9	9.7	10.4	11.2	11.9
300	335.3	7.9	8.6	9.4	10.2	10.9	11.7	12.5
350	388.6	8.4	9.1	9.9	10.7	11.4	12.2	13.0
400	441.9	8.6	9.4	10.2	10.9	11.7	12.5	13.2
450	495.3	8.9	9.7	10.4	11.2	11.9	12.7	13.5
500	548.6	9.1	9.9	10.7	11.4	12.2	13.0	13.7
600	655.3	9.7	10.4	11.2	11.9	12.7	13.5	14.2
750	812.8	9.9	10.9	11.9	13.0	14.0	15.0	16.0
900	972.8	10.9	12.2	13.5	14.7	16.0	17.3	18.5
1050	1130.3	11.9	13.5	15.0	16.5	18.0	19.6	21.1
1200	1290.3	13.0	14.7	16.5	18.3	20.1	21.8	23.6
1350	1462.0	14.5	16.5	18.5	20.6	22.6	24.6	26.7





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