

STIASA

Suministros Industriales del Tajo, S.A.

TUBERIA DE COBRE

TRABAJAR CON TUBOS DE COBRE

DATOS TECNICOS



DATOS TECNICOS

Tabla de conversiones

| | | |
|------------------|--------------------|--------------------------|
| Presión | psi | 6.89 kPa |
| | kg/cm ² | 10 m.c.a. |
| | 1 psi | 0.070 kg/cm ² |
| Peso | 1 libra | 453.59 gr |
| | 1 libra | 0.453 kg |
| | 1 onza | 28.38 gr |
| | 1 onza | 0.283 kg |
| Fluido | 1 galón/min | 4.546 lt/min |
| Distancia | 1 pulgada | 2.54 cm |
| | 1 pie | 30.48 cm |

| Temperatura °C | Temperatura °F |
|---|--|
| $^{\circ}\text{C} = \left(\frac{5}{9}\right) (T^{\circ}\text{F} - 32)$ | $^{\circ}\text{F} = (1.8) (T^{\circ}\text{C}) + 32$ |
| Por ejemplo: $^{\circ}\text{C} = \left(\frac{5}{9}\right) (86 - 32)$ | Por ejemplo: $^{\circ}\text{F} = (1.8) (30) + 32$ |
| $^{\circ}\text{C} = \left(\frac{5}{9}\right) (54)$ | $^{\circ}\text{F} = 54 + 32$ |
| $^{\circ}\text{C} = \left(\frac{270}{9}\right) = 30^{\circ}\text{C}$ | $^{\circ}\text{F} = 86^{\circ}\text{F}$ |

TABLA 1. Tipos y aplicaciones de tubería de cobre (NORMA ASTM-B-88)

| | Código internacional de identificación | | Diámetros nominales | Usos y aplicaciones |
|--|--|--------------|---------------------|--|
| | Tipo | Color | milímetros (pulg) | |
| | M | Rojo | 6 (1/4") 10 (3/8") | Casas de interés social Casas de interés medio Edificios habitacionales Edificios comerciales |
| | | | 13 (1/2") 19 (3/4") | |
| | | | 25 (1") 32 (1 1/4") | |
| | | | 38 (1 1/2") 51 (2") | |
| | | | 64 (2 1/2") 75 (3") | |
| | | | 100 (4") | |
| | L | Azul | 6 (1/4") 10 (3/8") | Los mismos que el tipo "M", además de: Instalaciones de gas combustible y medicinal, tomas domiciliarias de agua potable |
| | | | 13 (1/2") 19 (3/4") | |
| | | | 25 (1") 32 (1 1/4") | |
| | | | 38 (1 1/2") 51 (2") | |
| | | | 64 (2 1/2") 75 (3") | |
| | | | 100 (4") | |
| | K | Verde | 6 (1/4") 10 (3/8") | Los mismos que el tipo "L", además de: Uso industrial donde las presiones y temperaturas de trabajo son severas |
| | | | 13 (1/2") 19 (3/4") | |
| | | | 25 (1") 32 (1 1/4") | |
| | | | 38 (1 1/2") 51 (2") | |

*Para el uso de gas medicinal
deberá cumplir con pruebas de
limpieza según las Normas
CGA-G-41
(Asociación de Gas Comprimido)
CSA-Z 3051
(Canadian Standards Association)
NFPA-99C
(National Fire Protection Association)*

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TABLA 2. Dimensiones y características de tubería rígida de cobre

| Medida nominal | Diámetro exterior | Diámetro interno | | | Espesor de pared | | | Peso por tramo de 6.10 mts | | | Presión máxima | | |
|----------------|-------------------|------------------|-----------|-----------|------------------|----------|----------|----------------------------|------------|-----------|----------------------------|----------------------------|----------------------------|
| | | M | L | K | M | L | K | M | L | K | M | L | K |
| 1/4" | 0.375" | 0.324" | 0.314" | 0.276" | 0.025" | 0.030" | 0.049" | 2.132 lb | 2.524 lb | 5.385 lb | 6,133 lb/pulg ² | 7,200 lb/pulg ² | 8,820 lb/pulg ² |
| 6.35 mm | 9.525 mm | 8.255 mm | 8.001 mm | 7.035 mm | 0.635 mm | 0.762 mm | 1.245 mm | 0.968 kg | 1.146 kg | 2.445 kg | 431.15 kg/cm ² | 506.16 kg/cm ² | 620.04 kg/cm ² |
| 3/8" | 0.500" | 0.449" | 0.429" | 0.401" | 0.025" | 0.035" | 0.049" | 2.903 lb | 3.965 lb | 6.890 lb | 4,500 lb/pulg ² | 6,300 lb/pulg ² | 7,056 lb/pulg ² |
| 9.50 mm | 12.700 mm | 11.43 mm | 10.922 mm | 10.21 mm | 0.635 mm | 0.889 mm | 1.245 mm | 1.318 kg | 1.800 kg | 3.128 kg | 316.35 kg/cm ² | 442.89 kg/cm ² | 496.03 kg/cm ² |
| 1/2" | 0.625" | 0.572" | 0.544" | 0.494" | 0.028" | 0.040" | 0.065" | 4.083 lb | 5.705 lb | 12.813 lb | 4,032 lb/pulg ² | 5,760 lb/pulg ² | 6,685 lb/pulg ² |
| 12.7 mm | 15.875 mm | 14.453 mm | 13.843 mm | 12.573 mm | 0.711 mm | 1.016 mm | 1.651 mm | 1.854 kg | 2.590 kg | 5.817 kg | 283.45 kg/cm ² | 404.92 kg/cm ² | 469.95 kg/cm ² |
| 3/4" | 0.875" | 0.811" | 0.784" | 0.744" | 0.032" | 0.045" | 0.065" | 6.566 lb | 9.110 lb | 16.799 lb | 3,291 lb/pulg ² | 4,632 lb/pulg ² | 5,200 lb/pulg ² |
| 19 mm | 22.225 mm | 20.601 mm | 19.939 mm | 18.923 mm | 0.812 mm | 1.143 mm | 1.651 mm | 2.981 kg | 4.136 kg | 7.627 kg | 231.35 kg/cm ² | 325.62 kg/cm ² | 209.00 kg/cm ² |
| 1" | 1.125" | 1.054" | 1.024" | 0.994" | 0.035" | 0.050" | 0.065" | 9.310 lb | 13.114 lb | 20.824 lb | 2,800 lb/pulg ² | 4,000 lb/pulg ² | 4,260 lb/pulg ² |
| 25 mm | 28.575 mm | 26.797 mm | 26.035 mm | 25.273 mm | 0.889 mm | 1.270 mm | 1.651 mm | 4.227 kg | 5.954 kg | 9.454 kg | 196.84 kg/cm ² | 281.20 kg/cm ² | 299.47 kg/cm ² |
| 1 1/4" | 1.375" | 1.290" | 1.264" | 1.230" | 0.042" | 0.055" | 0.072" | 13.656 lb | 17.700 lb | 27.231 lb | 2,749 lb/pulg ² | 3,600 lb/pulg ² | 3,988 lb/pulg ² |
| 32 mm | 34.925 mm | 32.791 mm | 32.131 mm | 31.267 mm | 1.067 mm | 1.397 mm | 1.829 mm | 6.200 kg | 8.036 kg | 12.363 kg | 193.25 kg/cm ² | 253.08 kg/cm ² | 280.35 kg/cm ² |
| 1 1/2" | 1.625" | 1.526" | 1.504" | 1.459" | 0.049" | 0.060" | 0.083" | 18.821 lb | 22.826 lb | 41.249 lb | 2,713 lb/pulg ² | 3,323 lb/pulg ² | 3,515 lb/pulg ² |
| 38 mm | 41.275 mm | 38.785 mm | 38.227 mm | 37.059 mm | 1.245 mm | 1.524 mm | 2.108 mm | 8.545 kg | 10.363 kg | 18.727 kg | 190.72 kg/cm ² | 233.60 kg/cm ² | 247.10 kg/cm ² |
| 2" | 2.125" | 2.016" | 1.984" | | 0.058" | 0.070" | | 29.233 lb | 35.042 lb | | 2,470 lb/pulg ² | 2,965 lb/pulg ² | |
| 51 mm | 53.975 mm | 51.029 mm | 50.419 mm | | 1.473 mm | 1.778 mm | | 13.272 kg | 15.909 kg | | 173.65 kg/cm ² | 208.43 kg/cm ² | |
| 2 1/2" | 2.625" | 2.494" | 2.464" | | 0.065" | 0.080" | | 40.647 lb | 49.658 lb | | 2,228 lb/pulg ² | 2,742 lb/pulg ² | |
| 64 mm | 66.675 mm | 63.373 mm | 62.611 mm | | 1.651 mm | 2.032 mm | | 18.454 kg | 22.545 kg | | 156.62 kg/cm ² | 192.76 kg/cm ² | |
| 3" | 3.125" | 2.976" | 2.944" | | 0.072" | 0.090" | | 53.663 lb | 66.645 lb | | 2,073 lb/pulg ² | 2,592 lb/pulg ² | |
| 76 mm | 79.375 mm | 75.597 mm | 74.803 mm | | 1.889 mm | 2.286 mm | | 24.363 kg | 30.257 kg | | 145.73 kg/cm ² | 182.21 kg/cm ² | |
| 4" | 4.125" | 3.934" | 3.904" | | 0.095" | 0.110" | | 93.310 lb | 107.729 lb | | 2,072 lb/pulg ² | 2,400 lb/pulg ² | |
| 102 mm | 104.775 mm | 99.949 mm | 99.187 mm | | 2.413 mm | 2.794 mm | | 42.363 kg | 48.909 kg | | 145.65 kg/cm ² | 168.72 kg/cm ² | |

TABLA 2a. Dimensiones y características de tubería de cobre tipo ACR

| Diámetro exterior | Diámetro exterior | Espesor de pared | Presión máxima permitida | | Peso aproximado |
|-------------------|-------------------|------------------|--------------------------|-------|-----------------|
| | | | pulg | mm | |
| 1/8 | 3,18 | 0.76 | 250 | 3,554 | 0.051 |
| 3/16 | 4,76 | 0.76 | 154 | 2,198 | 0.085 |
| 1/4 | 6,35 | 0.76 | 112 | 1,589 | 0.119 |
| 5/16 | 7,94 | 0.81 | 94 | 1,334 | 0.162 |
| 3/8 | 9,53 | 0.81 | 77 | 1,095 | 0.198 |
| 1/2 | 12,70 | 0.81 | 57 | 807 | 0.270 |
| 5/8 | 15,90 | 0.89 | 49 | 704 | 0.374 |
| 3/4 | 19,10 | 1.07 | 50 | 704 | 0.540 |
| 7/8 | 22,22 | 1.14 | 45 | 642 | 0.673 |

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TABLA 2b. Presiones de trabajo interno (kg/cm²) de tubo tipo M, L y K

| Diámetro nominal | Diámetro exterior | | Temperatura de servicio | | | | | | | | | | | | | | | | | | |
|------------------|-------------------|-------|--|--------|---------|---|--------|--------|---|--------|--------|---|--------|--------|--|--------|--------|--|--------|--------|--------|
| | | | 10°C (50°F) S=682.14 kg/cm ² | | | 38°C (100°F) S=421.94 kg/cm ² | | | 65°C (150°F) S=358.65 kg/cm ² | | | 93°C (200°F) S=337.55 kg/cm ² | | | 149°C (300°F) S=330.52 kg/cm ² | | | 205°C (400°F) S=210.97 kg/cm ² | | | |
| | | | Tipo de tubería | | | | | | | | | | | | | | | | | | |
| pulg | mm | pulg | mm | M | L | K | M | L | K | M | L | K | M | L | K | M | L | K | M | L | K |
| 1/4 | 6 | 3/8 | 9.525 | 67.961 | 104.264 | 122.839 | 54.409 | 64.493 | 75.983 | 46.248 | 54.819 | 64.585 | 43.527 | 51.594 | 60.786 | 42.620 | 50.520 | 59.520 | 27.205 | 32.247 | 37.991 |
| 3/8 | 10 | 1/2 | 12.700 | 65.131 | 88.952 | 129.198 | 40.287 | 55.022 | 79.916 | 34.244 | 46.769 | 67.929 | 32.230 | 44.017 | 63.933 | 31.568 | 43.100 | 62.601 | 20.144 | 27.511 | 39.958 |
| 1/2 | 13 | 5/8 | 15.875 | 56.375 | 82.340 | 101.818 | 34.871 | 50.932 | 62.979 | 29.640 | 43.292 | 53.532 | 27.897 | 40.748 | 50.383 | 27.316 | 39.897 | 19.33 | 17.436 | 25.466 | 31.489 |
| 3/4 | 19 | 7/8 | 22.225 | 46.473 | 68.389 | 97.264 | 28.748 | 41.065 | 60.163 | 24.434 | 34.906 | 51.138 | 22.997 | 32.852 | 48.131 | 22.518 | 32.158 | 47.128 | 14.373 | 20.533 | 30.082 |
| 1 | 25 | 1 1/8 | 28.575 | 38.421 | 58.375 | 74.703 | 23.765 | 34.871 | 46.208 | 20.201 | 29.640 | 39.277 | 19.012 | 27.897 | 36.966 | 18.616 | 27.316 | 36.196 | 11.883 | 17.436 | 23.104 |
| 1 1/4 | 32 | 1 3/8 | 34.925 | 38.548 | 50.081 | 60.638 | 23.844 | 30.966 | 37.508 | 20.267 | 26.321 | 31.882 | 19.075 | 24.773 | 30.006 | 18.678 | 24.256 | 29.381 | 11.922 | 15.483 | 18.754 |
| 1 1/2 | 38 | 1 5/8 | 41.275 | 37.772 | 46.588 | 56.375 | 23.364 | 28.617 | 34.871 | 19.860 | 24.495 | 29.640 | 18.591 | 23.054 | 27.897 | 18.302 | 22.574 | 27.316 | 11.682 | 14.409 | 17.436 |
| 2 | 51 | 2 1/8 | 53.975 | 34.056 | 41.424 | 53.550 | 21.066 | 25.623 | 30.649 | 17.906 | 21.780 | 26.052 | 16.853 | 20.499 | 24.520 | 16.502 | 20.071 | 24.009 | 10.022 | 12.812 | 15.325 |
| 2 1/2 | 64 | 2 3/8 | 66.675 | 31.234 | 38.264 | 45.351 | 19.320 | 23.666 | 28.052 | 16.422 | 20.118 | 23.845 | 15.456 | 18.935 | 22.442 | 15.134 | 18.540 | 21.974 | 9.660 | 11.834 | 14.026 |
| 3 | 78 | 3 1/8 | 79.375 | 28.857 | 36.104 | 43.881 | 17.850 | 22.332 | 27.143 | 15.172 | 18.982 | 23.071 | 14.280 | 17.666 | 21.714 | 13.982 | 17.401 | 21.262 | 8.925 | 11.186 | 13.571 |
| 4 | 102 | 4 1/8 | 104.775 | 28.584 | 33.389 | 40.975 | 17.681 | 20.653 | 25.345 | 15.028 | 17.555 | 21.544 | 14.144 | 16.522 | 20.278 | 13.850 | 16.178 | 19.854 | 8.840 | 10.326 | 12.673 |

TABLA 2b. Presiones de trabajo interno (kg/cm²), USOS GENERALES

| Diámetro nominal | Diámetro exterior | | Temperatura de servicio | | | | | | | | | | | | |
|------------------|-------------------|------|--|---------|---|---------|---|---------|--|---------|--|---------|--|---------|--------|
| | | | 10°C (50°F) S=682.14 kg/cm ² | | 38°C (100°F) S=421.94 kg/cm ² | | 65°C (150°F) S=358.65 kg/cm ² | | 121°C (250°F) S=334.74 kg/cm ² | | 177°C (350°F) S=286.22 kg/cm ² | | 205°C (400°F) S=210.97 kg/cm ² | | |
| | | | Tipo de tubería | | | | | | | | | | | | |
| pulg | mm | pulg | mm | Refrig. | U. Gen | Refrig. | U. Gen | Refrig. | U. Gen | Refrig. | U. Gen | Refrig. | U. Gen | Refrig. | U. Gen |
| 1/8 | 3.175 | 1/8 | 3.175 | 356.37 | 356.37 | 220.43 | 220.43 | 187.37 | 187.37 | 176.35 | 176.35 | 172.67 | 172.67 | 110.22 | 110.22 |
| 3/16 | 4.763 | 3/16 | 4.763 | 211.11 | 211.11 | 137.39 | 137.39 | 116.78 | 116.78 | 109.91 | 109.91 | 107.62 | 107.62 | 68.69 | 68.69 |
| 1/4 | 6.350 | 1/4 | 6.350 | 161.33 | 161.33 | 99.79 | 99.79 | 84.82 | 84.82 | 79.83 | 79.83 | 78.17 | 78.17 | 49.90 | 49.90 |
| 5/16 | 7.938 | 5/16 | 7.938 | 136.84 | 136.84 | 84.64 | 84.64 | 71.95 | 71.95 | 67.71 | 67.71 | 66.30 | 66.30 | 42.32 | 42.32 |
| 3/8 | 9.525 | 3/8 | 9.525 | 112.53 | 112.53 | 69.60 | 69.60 | 59.16 | 59.16 | 55.68 | 55.68 | 54.52 | 54.52 | 34.80 | 34.80 |
| 1/2 | 12.700 | 1/2 | 12.700 | 83.03 | 83.03 | 51.36 | 51.36 | 43.65 | 43.65 | 41.08 | 41.08 | 40.23 | 40.23 | 25.68 | 25.68 |
| 5/8 | 15.675 | 5/8 | 15.675 | 70.43 | 70.43 | 43.56 | 43.56 | 37.03 | 37.03 | 34.85 | 34.85 | 34.12 | 34.12 | 21.78 | 21.78 |
| 3/4 | 19.050 | 3/4 | 19.050 | 58.29 | 58.29 | 36.05 | 36.05 | 30.65 | 30.65 | 28.84 | 28.84 | 28.24 | 28.24 | 18.03 | 18.03 |

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TABLA 2b. Presiones de trabajo interno (kg/cm²) en tubo tipo "L" flexible

| Diámetro nominal | | Diámetro exterior | | Temperatura de servicio | | | | | |
|------------------|------|-------------------|--------|--|---|---|--|--|--|
| pulg | mm | pulg | mm | 10°C (50°F) S=682.14 kg/cm ² | 38°C (100°F) S=421.94 kg/cm ² | 65°C (150°F) S=358.65 kg/cm ² | 121°C (250°F) S=334.74 kg/cm ² | 177°C (350°F) S=286.22 kg/cm ² | 205°C (400°F) S=210.97 kg/cm ² |
| 1/4 | 6.35 | 3/8 | 9.525 | 114.3 | 64.5 | 54.8 | 51.6 | 50.5 | 32.2 |
| 3/8 | 9.5 | 1/2 | 12.700 | 89.0 | 55.0 | 46.8 | 44.0 | 43.1 | 27.5 |
| 1/2 | 12.7 | 5/8 | 15.875 | 82.3 | 50.9 | 43.3 | 40.7 | 39.9 | 25.5 |
| 3/4 | 19 | 7/8 | 22.225 | 66.4 | 41.1 | 34.9 | 32.9 | 32.2 | 20.5 |
| 1 | 25 | 1 1/8 | 28.575 | 56.4 | 34.9 | 29.6 | 27.9 | 27.3 | 17.4 |

TABLA 3. Presiones de trabajo en uniones soldadas (kg/cm²)

| Tipo de soldadura | Temperatura de servicio | Diametros nominales | | | Vapor saturado |
|-----------------------------------|-------------------------|---------------------|------------|------------|----------------|
| | | 1/4 a 1" | 1 1/2 a 2" | 2 1/2 a 4" | |
| No. 50 50% Estaño 50% Plomo | 38°C | 14.06 | 12.30 | 10.55 | - |
| | 65°C | 10.55 | 8.79 | 7.03 | - |
| | 93°C | 7.03 | 6.33 | 5.27 | - |
| | 121°C | - | - | - | 0.5 |
| No. 95 95% Estaño 5% Plomo | 38°C | 35.15 | 28.12 | 21.09 | - |
| | 65°C | 28.12 | 24.61 | 19.33 | - |
| | 93°C | 21.09 | 17.58 | 14.06 | - |
| | 121°C | - | - | - | 1.05 |

TABLA 4. Presión de ruptura (lb/pulg² y kg/cm²)

| Diámetro nominal | Diámetro exterior | | M | | L | | K | |
|------------------|-------------------|----|--------|----------|--------|----------|--------|----------|
| | | | Rígido | Flexible | Rígido | Flexible | Rígido | Flexible |
| 1/2" | 5/8" | lb | 6135 | - | 7765 | 3885 | 9840 | 4535 |
| | | kg | 431 | - | 546 | 273 | 692 | 319 |
| 3/4" | 7/8" | lb | 4715 | - | 5900 | 2935 | 9300 | 4200 |
| | | kg | 331 | - | 415 | 206 | 654 | 295 |
| 1" | 1 1/8" | lb | 3865 | - | 5115 | 2650 | 7200 | 3415 |
| | | kg | 271 | - | 360 | 186 | 506 | 240 |
| 1 1/4" | 1 3/8" | lb | 3875 | - | 4550 | 2400 | 5525 | 2800 |
| | | kg | 272 | - | 320 | 169 | 388 | 197 |
| 1 1/2" | 1 5/8" | lb | 3550 | - | 4100 | 2200 | 5000 | 2600 |
| | | kg | 250 | - | 288 | 155 | 352 | 183 |
| 2" | 2 1/8" | lb | 2935 | - | 3365 | 1910 | 3915 | 2235 |
| | | kg | 206 | - | 237 | 134 | 275 | 157 |
| 2 1/2" | 2 5/8" | lb | 2800 | - | 3215 | - | 2575 | - |
| | | kg | 197 | - | 226 | - | 181 | - |
| 3" | 3 1/8" | lb | 2665 | - | 2865 | - | 3450 | - |
| | | kg | 187 | - | 201 | - | 243 | - |
| 4" | 4 1/8" | lb | 2215 | - | 2865 | - | 3415 | - |
| | | kg | 156 | - | 201 | - | 240 | - |

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Tabla 5. Pérdida de presión por fricción para tubería de cobre tipo K,L y M (kg/cm²)

| Flujo LPM | Diámetro nominal o estándar (pulgadas) | | | | | | | | | | | | | | |
|--------------|--|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1/4 | | | 3/8 | | | 1/2 | | | 3/4 | | | 1 | | |
| | K | L | M | K | L | M | K | L | M | K | L | M | K | L | M |
| 3.78 | 0.318 | 0.272 | N/A | 0.083 | 0.053 | 0.048 | 0.023 | 0.018 | 0.016 | 0.004 | 0.002 | 0.002 | | | |
| 7.57 | | | N/A | 0.299 | 1.937 | 1.730 | 0.080 | 0.069 | 0.055 | 0.013 | 0.011 | 0.009 | 0.004 | 0.002 | 0.006 |
| 11.36 | | | N/A | 0.634 | 0.408 | 3.667 | 0.170 | 0.143 | 0.117 | 0.032 | 0.025 | 0.020 | 0.006 | 0.006 | 0.002 |
| 15.14 | | | N/A | | | | 0.288 | 0.244 | 0.198 | 0.053 | 0.041 | 0.034 | 0.013 | 0.011 | 0.009 |
| 18.93 | | | N/A | | | | 0.435 | 0.371 | 0.299 | 0.080 | 0.062 | 0.053 | 0.020 | 0.016 | 0.013 |
| 37.85 | | | N/A | | | | | | | 0.290 | 0.226 | 0.193 | 0.071 | 0.062 | 0.053 |
| 56.78 | | | | | | | | | | | | | 0.149 | 0.131 | 0.113 |
| 75.7 | | | | | | | | | | | | | | 0.221 | 0.193 |
| 94.63 | | | | | | | | | | | | | | | |
| 113.6 | | | | | | | | | | | | | | | |
| 132.5 | | | | | | | | | | | | | | | |
| 151.4 | | | | | | | | | | | | | | | |
| 170.3 | | | | | | | | | | | | | | | |
| 189.3 | | | | | | | | | | | | | | | |
| 227.1 | | | | | | | | | | | | | | | |
| 265 | | | | | | | | | | | | | | | |
| 302.8 | | | | | | | | | | | | | | | |
| 340.7 | | | | | | | | | | | | | | | |
| 378.5 | | | | | | | | | | | | | | | |
| 454.2 | | | | | | | | | | | | | | | |
| 529.9 | | | | | | | | | | | | | | | |
| 605.6 | | | | | | | | | | | | | | | |
| 681.3 | | | | | | | | | | | | | | | |
| 757 | | | | | | | | | | | | | | | |
| 946.3 | | | | | | | | | | | | | | | |
| 1136 | | | | | | | | | | | | | | | |
| 1325 | | | | | | | | | | | | | | | |
| 1514 | | | | | | | | | | | | | | | |
| 1703 | | | | | | | | | | | | | | | |

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| Flujo LPM | Diámetro nominal o estándar (pulgadas) | | | | | | | | | | | | | | | | | |
|--------------|--|-------|-------|-------------------------------|-------|-------|-------|-------|-------|-------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1 ¹ / ₄ | | | 1 ¹ / ₂ | | | 2 | | | 2 ¹ / ₂ | | | 3 | | | 4 | | |
| | K | L | M | K | L | M | K | L | M | K | L | M | K | L | M | K | L | M |
| 3.78 | | | | | | | | | | | | | | | | | | |
| 7.57 | 0.002 | | | | | | | | | | | | | | | | | |
| 11.36 | 0.002 | 0.002 | 0.002 | | | | | | | | | | | | | | | |
| 15.14 | 0.004 | 0.004 | 0.004 | 0.002 | 0.002 | 0.002 | | | | | | | | | | | | |
| 18.93 | 0.006 | 0.006 | 0.004 | 0.002 | 0.002 | 0.002 | | | | | | | | | | | | |
| 37.85 | 0.023 | 0.023 | 0.020 | 0.009 | 0.092 | 0.009 | 0.002 | 0.002 | 0.002 | | | | | | | | | |
| 56.78 | 0.050 | 0.046 | 0.041 | 0.020 | 0.020 | 0.018 | 0.004 | 0.004 | 0.004 | 0.002 | 0.002 | 0.002 | | | | | | |
| 75.7 | 0.085 | 0.080 | 0.071 | 0.036 | 0.034 | 0.032 | 0.009 | 0.009 | 0.009 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | | | |
| 94.63 | 0.131 | 0.119 | 0.108 | 0.055 | 0.050 | 0.048 | 0.013 | 0.013 | 0.011 | 0.004 | 0.004 | 0.004 | 0.002 | 0.002 | 0.002 | | | |
| 113.6 | 0.182 | 0.168 | 0.152 | 0.078 | 0.071 | 0.066 | 0.020 | 0.018 | 0.018 | 0.006 | 0.006 | 0.006 | 0.002 | 0.002 | 0.002 | | | |
| 132.5 | | | | 0.103 | 0.096 | 0.089 | 0.027 | 0.025 | 0.023 | 0.009 | 0.009 | 0.009 | 0.004 | 0.004 | 0.002 | | | |
| 151.4 | | | | 0.133 | 0.124 | 0.115 | 0.034 | 0.032 | 0.030 | 0.011 | 0.011 | 0.011 | 0.004 | 0.004 | 0.004 | 0.002 | 0.002 | |
| 170.3 | | | | | | 0.143 | 0.041 | 0.039 | 0.036 | 0.013 | 0.013 | 0.013 | 0.006 | 0.006 | 0.004 | 0.002 | 0.002 | 0.002 |
| 189.3 | | | | | | | 0.050 | 0.048 | 0.046 | 0.018 | 0.016 | 0.016 | 0.006 | 0.006 | 0.006 | 0.002 | 0.002 | 0.002 |
| 227.1 | | | | | | | 0.071 | 0.069 | 0.064 | 0.025 | 0.023 | 0.023 | 0.011 | 0.009 | 0.009 | 0.002 | 0.002 | 0.002 |
| 265 | | | | | | | 0.096 | 0.089 | 0.085 | 0.032 | 0.032 | 0.030 | 0.013 | 0.013 | 0.011 | 0.004 | 0.002 | 0.002 |
| 302.8 | | | | | | | | | | 0.043 | 0.039 | 0.036 | 0.018 | 0.016 | 0.016 | 0.004 | 0.004 | 0.004 |
| 340.7 | | | | | | | | | | 0.053 | 0.050 | 0.046 | 0.023 | 0.020 | 0.020 | 0.046 | 0.004 | 0.004 |
| 378.5 | | | | | | | | | | 0.064 | 0.060 | 0.057 | 0.027 | 0.025 | 0.023 | 0.069 | 0.006 | 0.006 |
| 454.2 | | | | | | | | | | | | 0.080 | 0.039 | 0.036 | 0.034 | 0.009 | 0.009 | 0.009 |
| 529.9 | | | | | | | | | | | | | 0.050 | 0.084 | 0.043 | 0.013 | 0.011 | 0.011 |
| 605.6 | | | | | | | | | | | | | 0.064 | 0.060 | 0.057 | 0.016 | 0.016 | 0.013 |
| 681.3 | | | | | | | | | | | | | | | | 0.020 | 0.018 | 0.018 |
| 757 | | | | | | | | | | | | | | | | 0.025 | 0.023 | 0.023 |
| 946.3 | | | | | | | | | | | | | | | | 0.036 | 0.034 | 0.034 |
| 1136 | | | | | | | | | | | | | | | | | | 0.048 |
| 1325 | | | | | | | | | | | | | | | | | | |
| 1514 | | | | | | | | | | | | | | | | | | |
| 1703 | | | | | | | | | | | | | | | | | | |

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Tabla 6. Longitud equivalente de conexiones a tubería en mts

| Diámetro (pulgadas) | Codo 90° | Codo 45° | Tee giro de 90° | Tee paso recto | Válvula de compuerta | Válvula de globo | Válvula angular |
|---------------------|----------|----------|-----------------|----------------|----------------------|------------------|-----------------|
| 3/8 | 0.30 | 0.30 | 0.45 | 0.10 | 0.06 | 2.45 | 1.20 |
| 1/2 | 0.60 | 0.40 | 0.90 | 0.20 | 0.12 | 4.40 | 2.45 |
| 3/4 | 0.75 | 0.45 | 1.20 | 0.25 | 0.15 | 6.10 | 3.65 |
| 1 | 0.90 | 0.55 | 1.50 | 0.27 | 0.20 | 7.60 | 4.60 |
| 1 1/4 | 1.20 | 0.80 | 1.80 | 0.40 | 0.25 | 10.50 | 5.50 |
| 1 1/2 | 1.50 | 0.90 | 2.15 | 0.45 | 0.30 | 13.50 | 6.70 |
| 2 | 2.15 | 1.20 | 3.05 | 0.60 | 0.40 | 16.50 | 8.50 |
| 2 1/2 | 2.45 | 1.50 | 3.65 | 0.75 | 0.50 | 19.50 | 10.50 |
| 3 | 3.05 | 1.80 | 4.60 | 0.90 | 0.60 | 24.50 | 12.20 |
| 3 1/2 | 3.65 | 2.15 | 5.50 | 1.10 | 0.70 | 30.00 | 15.00 |
| 4 | 4.25 | 2.45 | 6.40 | 1.20 | 0.80 | 37.50 | 16.50 |
| 5 | 5.20 | 3.05 | 7.60 | 1.50 | 1.00 | 42.50 | 21.00 |
| 6 | 6.10 | 3.65 | 9.15 | 1.80 | 1.20 | 50.00 | 24.50 |

Tabla 7. Radios recomendados para liras de dilatación con tubería de cobre

| Pulgadas de expansión esperada | | Radio "R", en pulgadas, diámetro nominal o estándar de tubo Longitud "L", en pulgadas, diámetro nominal o estándar de tubo | | | | | | | | | | | |
|--------------------------------|---|---|-----|-----|-----|-----|-------|-------|-----|-------|-----|-------|-----|
| | | 1/4 | 3/8 | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 3 1/2 | 4 |
| 1/2 | R | 6 | 7 | 8 | 9 | 11 | 12 | 13 | 15 | 16 | 18 | 19 | 20 |
| | L | 38 | 44 | 50 | 59 | 67 | 74 | 80 | 91 | 102 | 111 | 120 | 128 |
| 1 | R | 9 | 10 | 11 | 13 | 15 | 17 | 18 | 21 | 23 | 25 | 27 | 29 |
| | L | 54 | 63 | 70 | 83 | 94 | 104 | 113 | 129 | 144 | 157 | 169 | 180 |
| 1 1/2 | R | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 25 | 28 | 30 | 33 | 35 |
| | L | 66 | 77 | 86 | 101 | 115 | 127 | 138 | 158 | 176 | 191 | 206 | 220 |
| 2 | R | 12 | 14 | 16 | 19 | 21 | 23 | 25 | 29 | 32 | 35 | 38 | 41 |
| | L | 77 | 89 | 99 | 117 | 133 | 147 | 160 | 183 | 203 | 222 | 239 | 255 |
| 2 1/2 | R | 14 | 16 | 18 | 21 | 24 | 26 | 29 | 33 | 36 | 40 | 43 | 45 |
| | L | 86 | 99 | 111 | 131 | 149 | 165 | 179 | 205 | 227 | 248 | 267 | 285 |
| 3 | R | 15 | 17 | 19 | 23 | 26 | 29 | 31 | 36 | 40 | 43 | 47 | 50 |
| | L | 94 | 109 | 122 | 143 | 163 | 180 | 196 | 224 | 249 | 272 | 293 | 312 |
| 3 1/2 | R | 16 | 19 | 21 | 25 | 28 | 31 | 34 | 39 | 43 | 47 | 50 | 54 |
| | L | 102 | 117 | 131 | 155 | 176 | 195 | 212 | 242 | 269 | 293 | 316 | 337 |
| 4 | R | 17 | 20 | 22 | 26 | 30 | 33 | 36 | 41 | 46 | 50 | 54 | 57 |
| | L | 109 | 126 | 140 | 166 | 188 | 208 | 226 | 259 | 288 | 314 | 338 | 361 |

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Tabla 8. Consumo de soldadura (1/8")

| Diámetro de la unión (mm) | Por unión (cm) | Por 100 uniones | | |
|------------------------------|-------------------|-----------------|----------|---------|
| | | (m) | 50/50 kg | 95/5 kg |
| 9.5 | 1.3 | 1.30 | 0.108 | 0.091 |
| 12.7 | 1.6 | 1.60 | 0.133 | 0.112 |
| 19.0 | 2.2 | 2.20 | 0.183 | 0.154 |
| 25.4 | 2.9 | 2.90 | 0.241 | 0.204 |
| 31.7 | 3.5 | 3.50 | 0.291 | 0.246 |
| 38.1 | 4.1 | 4.10 | 0.341 | 0.288 |
| 50.8 | 5.4 | 5.40 | 0.450 | 0.379 |
| 63.5 | 6.7 | 6.70 | 0.558 | 0.471 |
| 76.2 | 8.0 | 8.00 | 0.666 | 0.562 |
| 101.6 | 10.5 | 10.50 | 0.875 | 0.738 |

Tabla 9. Consumo de metal de aporte o relleno

| Diámetro nominal | Consumo de metal de aporte o relleno | | | | Peso medio por 100 uniones (gramos) |
|------------------|--------------------------------------|------------------|---------------|--------------|-------------------------------------|
| | Alambre 1 1/16" | Varila 1/8" x 50 | Alambre 3/32" | Alambre 1/8" | |
| 1/4 | 1/4 | 1/4 | 1/4 | 1/8 | 18.14 |
| 3/8 | 5/8 | 3/8 | 3/8 | 1/4 | 27.21 |
| 1/2 | 1 1/8 | 5/8 | 1/2 | 3/8 | 45.35 |
| 5/8 | 1 5/8 | 7/8 | 5/8 | 1/2 | 68.03 |
| 3/4 | 2 1/4 | 1 1/8 | 1 | 5/8 | 95.25 |
| 1 | 3 1/2 | 1 3/4 | 1 5/8 | 7/8 | 145.14 |
| 1 1/4 | 4 1/2 | 2 1/4 | 2 | 1 1/4 | 190.50 |
| 1 1/2 | - | 3 | 2 5/8 | 1 1/2 | 254.01 |
| 2 | - | 4 3/4 | 4 3/8 | 2 1/2 | 408.23 |
| 2 1/2 | - | 6 1/2 | 5 7/8 | 3 3/8 | 553.38 |
| 3 | - | 8 5/8 | 7 7/8 | 4 1/2 | 743.89 |
| 3 1/2 | - | 11 1/2 | 10 1/2 | 5 7/8 | 988.83 |
| 4 | - | 14 7/8 | 13 1/2 | 7 5/8 | 1274.59 |

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Tabla 10. Metales de aporte para soldadura

| Clasificación ¹ | Porcentaje del principal elemento | | | | | | Temperatura°C | |
|----------------------------|-----------------------------------|-------------|-----------|-------------|-------------|------------|----------------|--------------|
| | Plata | Fósforo (P) | Zinc (Zn) | Cadmio (Cd) | Estaño (Sn) | Cobre (Cu) | Solidificación | Licuefacción |
| BCup-2 | – | 7.00-7.5 | – | – | – | Sobrante | 710 | 795 |
| BCup-3 | 4.8-5.2 | 5.8-6.2 | – | – | – | Sobrante | 645 | 815 |
| BCup-4 | 5.8-6.2 | 7.0-7.5 | – | – | – | Sobrante | 645 | 720 |
| BCup-5 | 14.5-15.5 | 4.8-5.2 | – | – | – | Sobrante | 645 | 800 |
| BAG-12 | 44-46 | – | 14-18 | 23-252 | – | 14-16 | 610 | 620 |
| BAG-22 | 33-36 | – | 19-23 | 17-192 | – | 25-27 | 610 | 700 |
| BAG-5 | 44-46 | – | 23-27 | – | – | 29-31 | 610 | 745 |
| BAG-7 | 55-57 | – | 15-19 | – | 4.5-5.5 | 21-23 | 620 | 650 |

Tabla 11. Radio mínimo de curvado

| Diámetro nominal (pulgadas) | Tipo de tubo | Temple | Radio mínimo de curvatura (pulgadas) |
|-----------------------------|--------------|----------|--------------------------------------|
| 1/4 | K - L | Flexible | 3/4 |
| 3/8 | K - L | Flexible | 1 1/2 |
| 3/8 | K - L | Rígido | 1 3/4 |
| 1/2 | K - L | Flexible | 2 1/4 |
| 1/2 | K - L | Rígido | 2 1/2 |
| 3/4 | K - L | Flexible | 3 |
| 3/4 | K - L | Rígido | 3 |
| 1 | K - L | Flexible | 4 |
| 1 1/4 | K - L | Flexible | 9 |



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