

Chain:

Dimensions of Standard chain:

| ANSI Chain Number | Pitch, in (mm) | Width, in (mm) | Minimum Tensile Strength, lbf (N) | Average Weight, lbf/ft (N/m) | Roller Diameter, in (mm) | Multiple-Strand Spacing, in (mm) |
|-------------------|------------------|------------------|-----------------------------------|------------------------------|--------------------------|----------------------------------|
| 25 | 0.250 (6.35) | 0.125 (3.18) | 780 (3 470) | 0.09 (1.31) | 0.130 (3.30) | 0.252 (6.40) |
| 35 | 0.375 (9.52) | 0.188 (4.76) | 1 760 (7 830) | 0.21 (3.06) | 0.200 (5.08) | 0.399 (10.13) |
| 41 | 0.500 (12.70) | 0.25 (6.35) | 1 500 (6 670) | 0.25 (3.65) | 0.306 (7.77) | — — |
| 40 | 0.500 (12.70) | 0.312 (7.94) | 3 130 (13 920) | 0.42 (6.13) | 0.312 (7.92) | 0.566 (14.38) |
| 50 | 0.625 (15.88) | 0.375 (9.52) | 4 880 (21 700) | 0.69 (10.1) | 0.400 (10.16) | 0.713 (18.11) |
| 60 | 0.750 (19.05) | 0.500 (12.7) | 7 030 (31 300) | 1.00 (14.6) | 0.469 (11.91) | 0.897 (22.78) |
| 80 | 1.000 (25.40) | 0.625 (15.88) | 12 500 (55 600) | 1.71 (25.0) | 0.625 (15.87) | 1.153 (29.29) |
| 100 | 1.250 (31.75) | 0.750 (19.05) | 19 500 (86 700) | 2.58 (37.7) | 0.750 (19.05) | 1.409 (35.76) |
| 120 | 1.500 (38.10) | 1.000 (25.40) | 28 000 (124 500) | 3.87 (56.5) | 0.875 (22.22) | 1.789 (45.44) |
| 140 | 1.750 (44.45) | 1.000 (25.40) | 38 000 (169 000) | 4.95 (72.2) | 1.000 (25.40) | 1.924 (48.87) |
| 160 | 2.000 (50.80) | 1.250 (31.75) | 50 000 (222 000) | 6.61 (96.5) | 1.125 (28.57) | 2.305 (58.55) |
| 180 | 2.250 (57.15) | 1.406 (35.71) | 63 000 (280 000) | 9.06 (132.2) | 1.406 (35.71) | 2.592 (65.84) |
| 200 | 2.500 (63.50) | 1.500 (38.10) | 78 000 (347 000) | 10.96 (159.9) | 1.562 (39.67) | 2.817 (71.55) |
| 240 | 3.00 (76.70) | 1.875 (47.63) | 112 000 (498 000) | 16.4 (239) | 1.875 (47.62) | 3.458 (87.83) |

Rated power(HR):

| Sprocket Speed, rev/min | ANSI Chain Number | | | | | |
|-------------------------|-------------------|-------|-------|-------|-------|------|
| | 25 | 35 | 40 | 41 | 50 | 60 |
| 50 | 0.05 | 0.16 | 0.37 | 0.20 | 0.72 | 1.24 |
| 100 | 0.09 | 0.29 | 0.69 | 0.38 | 1.34 | 2.31 |
| 150 | 0.13* | 0.41* | 0.99* | 0.55* | 1.92* | 3.32 |
| 200 | 0.16* | 0.54* | 1.29 | 0.71 | 2.50 | 4.30 |
| 300 | 0.23 | 0.78 | 1.85 | 1.02 | 3.61 | 6.20 |
| 400 | 0.30* | 1.01* | 2.40 | 1.32 | 4.67 | 8.03 |
| 500 | 0.37 | 1.24 | 2.93 | 1.61 | 5.71 | 9.81 |
| 600 | 0.44* | 1.46* | 3.45* | 1.90* | 6.72* | 11.6 |
| 700 | 0.50 | 1.68 | 3.97 | 2.18 | 7.73 | 13.3 |
| 800 | 0.56* | 1.89* | 4.48* | 2.46* | 8.71* | 15.0 |
| 900 | 0.62 | 2.10 | 4.98 | 2.74 | 9.69 | 16.7 |
| 1000 | 0.68* | 2.31* | 5.48 | 3.01 | 10.7 | 18.3 |
| 1200 | 0.81 | 2.73 | 6.45 | 3.29 | 12.6 | 21.6 |
| 1400 | 0.93* | 3.13* | 7.41 | 2.61 | 14.4 | 18.1 |
| 1600 | 1.05* | 3.53* | 8.36 | 2.14 | 12.8 | 14.8 |
| 1800 | 1.16 | 3.93 | 8.96 | 1.79 | 10.7 | 12.4 |
| 2000 | 1.27* | 4.32* | 7.72* | 1.52* | 9.23* | 10.6 |
| 2500 | 1.56 | 5.28 | 5.51* | 1.10* | 6.58* | 7.57 |
| 3000 | 1.84 | 5.64 | 4.17 | 0.83 | 4.98 | 5.76 |

| Sprocket Speed, rev/min | | ANSI Chain Number | | | | | | | |
|-------------------------|--------|-------------------|------|------|------|------|------|------|------|
| | | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 240 |
| 50 | Type A | 2.88 | 5.52 | 9.33 | 14.4 | 20.9 | 28.9 | 38.4 | 61.8 |
| 100 | | 5.38 | 10.3 | 17.4 | 26.9 | 39.1 | 54.0 | 71.6 | 115 |
| 150 | | 7.75 | 14.8 | 25.1 | 38.8 | 56.3 | 77.7 | 103 | 166 |
| 200 | | 10.0 | 19.2 | 32.5 | 50.3 | 72.9 | 101 | 134 | 215 |
| 300 | | 14.5 | 27.7 | 46.8 | 72.4 | 105 | 145 | 193 | 310 |
| 400 | | 18.7 | 35.9 | 60.6 | 93.8 | 136 | 188 | 249 | 359 |
| 500 | Type B | 22.9 | 43.9 | 74.1 | 115 | 166 | 204 | 222 | 0 |
| 600 | | 27.0 | 51.7 | 87.3 | 127 | 141 | 155 | 169 | |
| 700 | | 31.0 | 59.4 | 89.0 | 101 | 112 | 123 | 0 | |
| 800 | | 35.0 | 63.0 | 72.8 | 82.4 | 91.7 | 101 | | |
| 900 | | 39.9 | 52.8 | 61.0 | 69.1 | 76.8 | 84.4 | | |
| 1000 | | 37.7 | 45.0 | 52.1 | 59.0 | 65.6 | 72.1 | | |
| 1200 | | 28.7 | 34.3 | 39.6 | 44.9 | 49.9 | 0 | | |
| 1400 | | 22.7 | 27.2 | 31.5 | 35.6 | 0 | | | |
| 1600 | | 18.6 | 22.3 | 25.8 | 0 | | | | |
| 1800 | | 15.6 | 18.7 | 21.6 | | | | | |
| 2000 | | 13.3 | 15.9 | 0 | | | | | |
| 2500 | | 9.56 | 0.40 | | | | | | |
| 3000 | | 7.25 | 0 | | | | | | |

Tooth correction factor (K1):

| Number of Teeth on Driving Sprocket | K_1 Pre-extreme Horsepower | K_1 Post-extreme Horsepower |
|-------------------------------------|------------------------------|-------------------------------|
| 11 | 0.62 | 0.52 |
| 12 | 0.69 | 0.59 |
| 13 | 0.75 | 0.67 |
| 14 | 0.81 | 0.75 |
| 15 | 0.87 | 0.83 |
| 16 | 0.94 | 0.91 |
| 17 | 1.00 | 1.00 |
| 18 | 1.06 | 1.09 |
| 19 | 1.13 | 1.18 |
| 20 | 1.19 | 1.28 |
| N | $(N_1/17)^{1.08}$ | $(N_1/17)^{1.5}$ |

Multiple-strand factors (K2):

| Number of Strands | K_2 |
|-------------------|-------|
| 1 | 1.0 |
| 2 | 1.7 |
| 3 | 2.5 |
| 4 | 3.3 |
| 5 | 3.9 |
| 6 | 4.6 |
| 8 | 6.0 |

Service factor (Ks):

| Driven Machinery | Source of Power | |
|------------------|------------------------------|---------------------------|
| | Normal Torque Characteristic | High or Nonuniform Torque |
| Uniform | 1.0 to 1.2 | 1.1 to 1.3 |
| Light shock | 1.1 to 1.3 | 1.2 to 1.4 |
| Medium shock | 1.2 to 1.4 | 1.4 to 1.6 |
| Heavy shock | 1.3 to 1.5 | 1.5 to 1.8 |

Wire-rope:

Wire-Rope Data:

Table 17-24

Wire-Rope Data *Source: Compiled from American Steel and Wire Company Handbook.*

| Rope | Weight per Foot, lbf | Minimum Sheave Diameter, in | Standard Sizes d , in | Material | Size of Outer Wires | Modulus of Elasticity,* Mpsi | Strength,† kpsi |
|--------------------------|----------------------|-----------------------------|---------------------------------|---------------------------|---------------------|------------------------------|-----------------|
| 6 × 7 haulage | $1.50d^2$ | $42d$ | $\frac{1}{4}$ – $1\frac{1}{2}$ | Monitor steel | $d/9$ | 14 | 100 |
| | | | | Plow steel | $d/9$ | 14 | 88 |
| | | | | Mild plow steel | $d/9$ | 14 | 76 |
| 6 × 19 standard hoisting | $1.60d^2$ | $26d$ – $34d$ | $\frac{1}{4}$ – $2\frac{3}{4}$ | Monitor steel | $d/13$ – $d/16$ | 12 | 106 |
| | | | | Plow steel | $d/13$ – $d/16$ | 12 | 93 |
| | | | | Mild plow steel | $d/13$ – $d/16$ | 12 | 80 |
| 6 × 37 special flexible | $1.55d^2$ | $18d$ | $\frac{1}{4}$ – $3\frac{1}{2}$ | Monitor steel | $d/22$ | 11 | 100 |
| | | | | Plow steel | $d/22$ | 11 | 88 |
| 8 × 19 extra flexible | $1.45d^2$ | $21d$ – $26d$ | $\frac{1}{4}$ – $1\frac{1}{2}$ | Monitor steel | $d/15$ – $d/19$ | 10 | 92 |
| | | | | Plow steel | $d/15$ – $d/19$ | 10 | 80 |
| 7 × 7 aircraft | $1.70d^2$ | — | $\frac{1}{16}$ – $\frac{3}{8}$ | Corrosion-resistant steel | — | — | 124 |
| | | | | Carbon steel | — | — | 124 |
| 7 × 9 aircraft | $1.75d^2$ | — | $\frac{1}{8}$ – $1\frac{3}{8}$ | Corrosion-resistant steel | — | — | 135 |
| | | | | Carbon steel | — | — | 143 |
| 19-wire aircraft | $2.15d^2$ | — | $\frac{1}{32}$ – $\frac{5}{16}$ | Corrosion-resistant steel | — | — | 165 |
| | | | | Carbon steel | — | — | 165 |

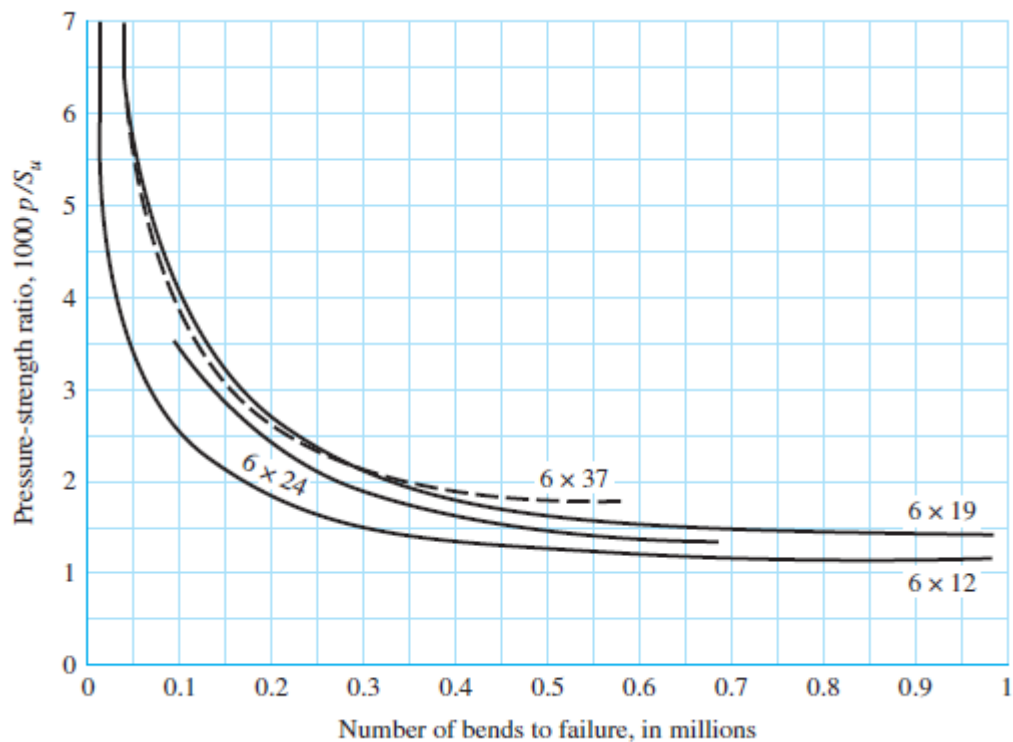
Area of metal (Am):

| Wire Rope | Weight per Foot w , lbf/ft | Weight per Foot Including Core w , lbf/ft | Minimum Sheave Diameter D , in | Better Sheave Diameter D , in | Diameter of Wires d_w , in | Area of Metal A_m , in ² | Rope Young's Modulus E_r , psi |
|-----------|------------------------------|---|----------------------------------|---------------------------------|------------------------------|---------------------------------------|----------------------------------|
| 6 × 7 | $1.50d^2$ | | $42d$ | $72d$ | $0.111d$ | $0.38d^2$ | 13×10^6 |
| 6 × 19 | $1.60d^2$ | $1.76d^2$ | $30d$ | $45d$ | $0.067d$ | $0.40d^2$ | 12×10^6 |
| 6 × 37 | $1.55d^2$ | $1.71d^2$ | $18d$ | $27d$ | $0.048d$ | $0.40d^2$ | 12×10^6 |

Bearing Pressures:

| Rope | Sheave Material | | | | |
|--------------|-------------------|------------------------|-------------------------|---------------------------------|------------------------------|
| | Wood ^a | Cast Iron ^b | Cast Steel ^c | Chilled Cast Irons ^d | Manganese Steel ^e |
| Regular lay: | | | | | |
| 6 × 7 | 150 | 300 | 550 | 650 | 1470 |
| 6 × 19 | 250 | 480 | 900 | 1100 | 2400 |
| 6 × 37 | 300 | 585 | 1075 | 1325 | 3000 |
| 8 × 19 | 350 | 680 | 1260 | 1550 | 3500 |
| Lang lay: | | | | | |
| 6 × 7 | 165 | 350 | 600 | 715 | 1650 |
| 6 × 19 | 275 | 550 | 1000 | 1210 | 2750 |
| 6 × 37 | 330 | 660 | 1180 | 1450 | 3300 |

(P/Sut) for fatigue:

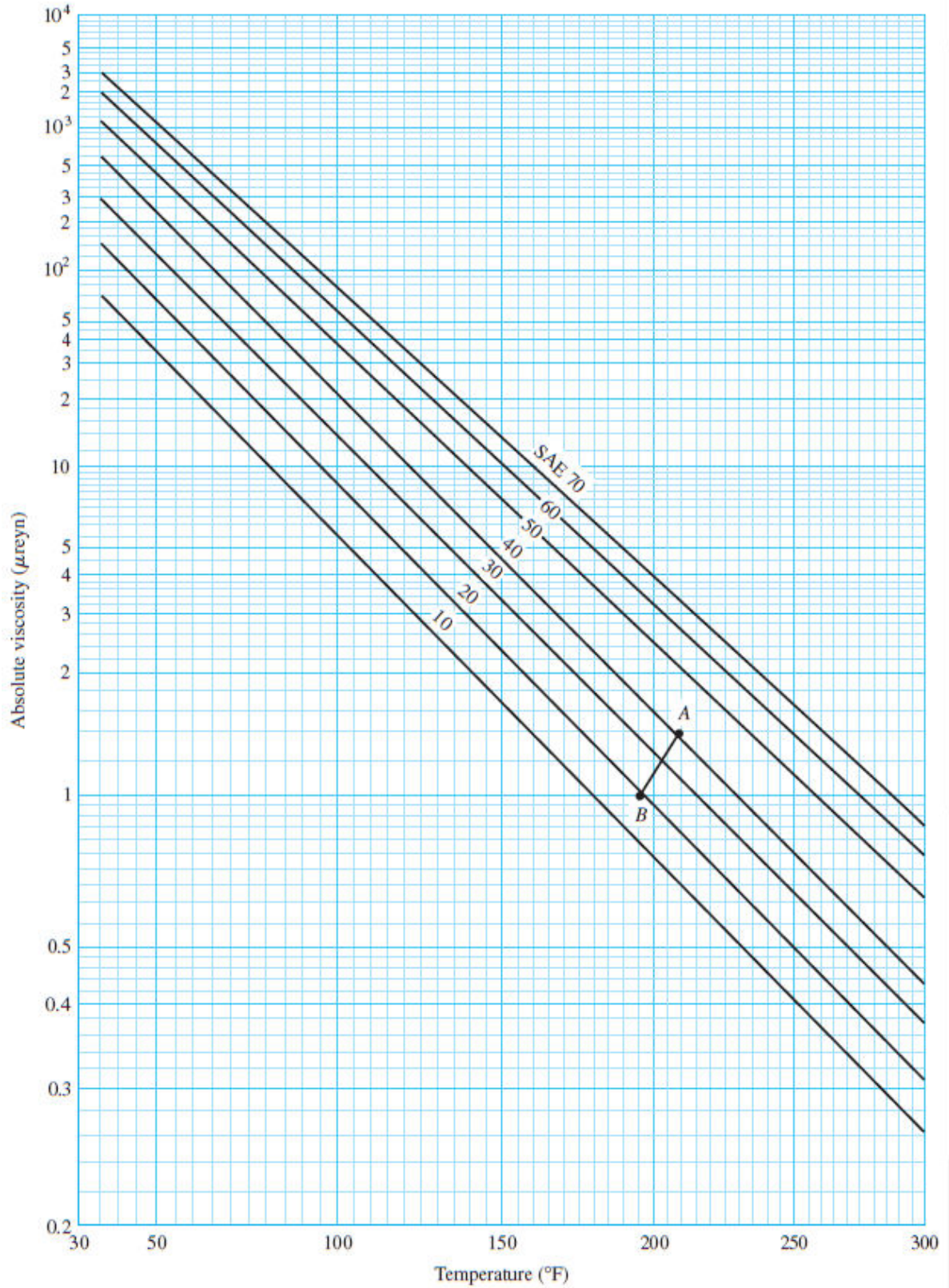


Sut for wire:

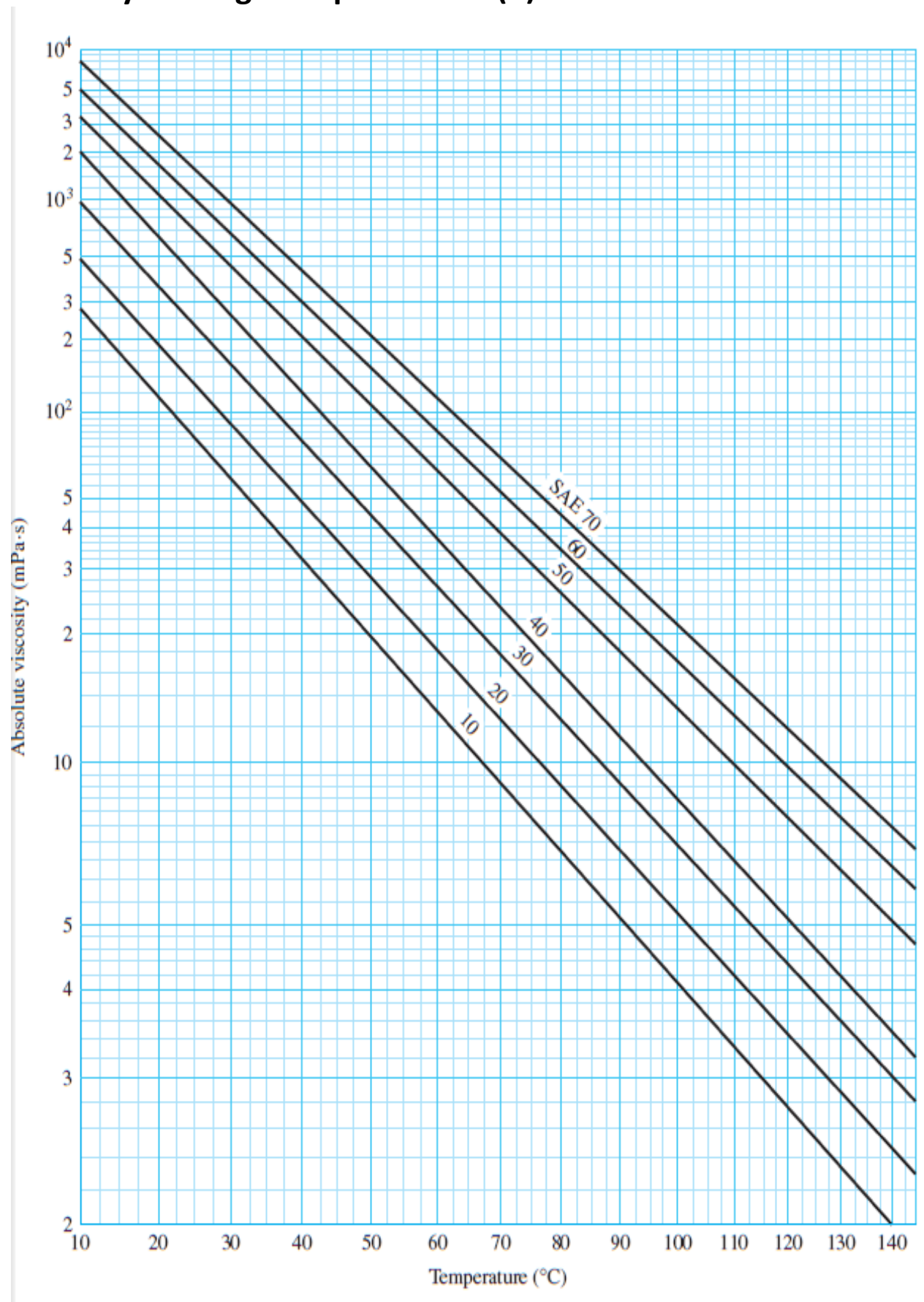
| | |
|-------------------------------|------------------------|
| Improved plow steel (monitor) | $240 < S_u < 280$ kpsi |
| Plow steel | $210 < S_u < 240$ kpsi |
| Mild plow steel | $180 < S_u < 210$ kpsi |

Lubrication:

Viscosity VS Avg. Temperature in(F):



Viscosity VS Avg. Temperature in(C):

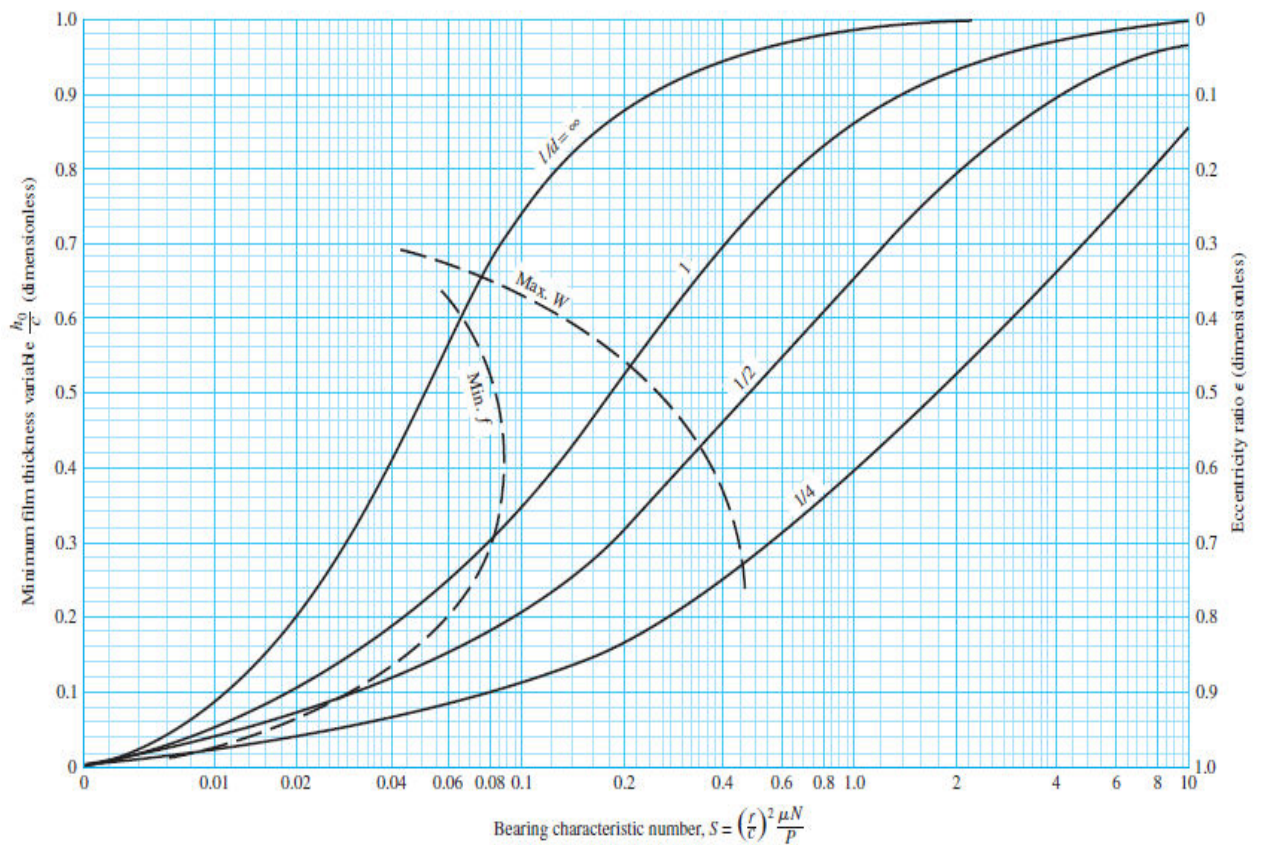


or we can find the Viscosity from the following table and it's equation:

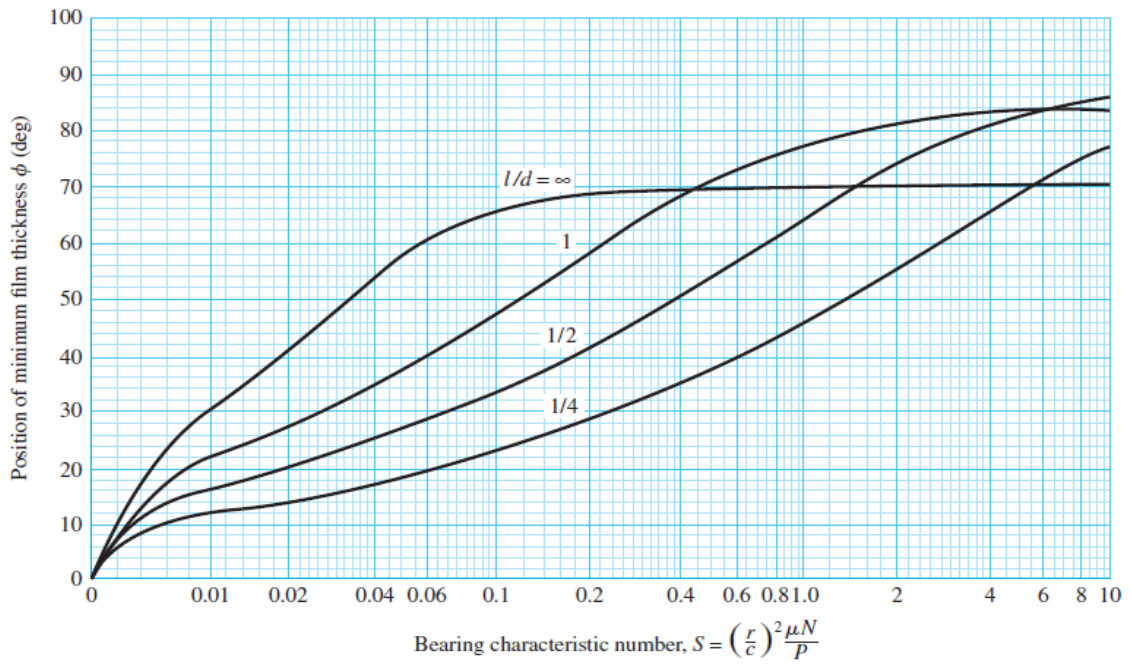
| Oil Grade, SAE | Viscosity μ_0 , reyn | Constant b , °F |
|----------------|--------------------------|-------------------|
| 10 | $0.0158(10^{-6})$ | 1157.5 |
| 20 | $0.0136(10^{-6})$ | 1271.6 |
| 30 | $0.0141(10^{-6})$ | 1360.0 |
| 40 | $0.0121(10^{-6})$ | 1474.4 |
| 50 | $0.0170(10^{-6})$ | 1509.6 |
| 60 | $0.0187(10^{-6})$ | 1564.0 |

* $\mu = \mu_0 \exp [b/(T + 95)]$, T in °F.

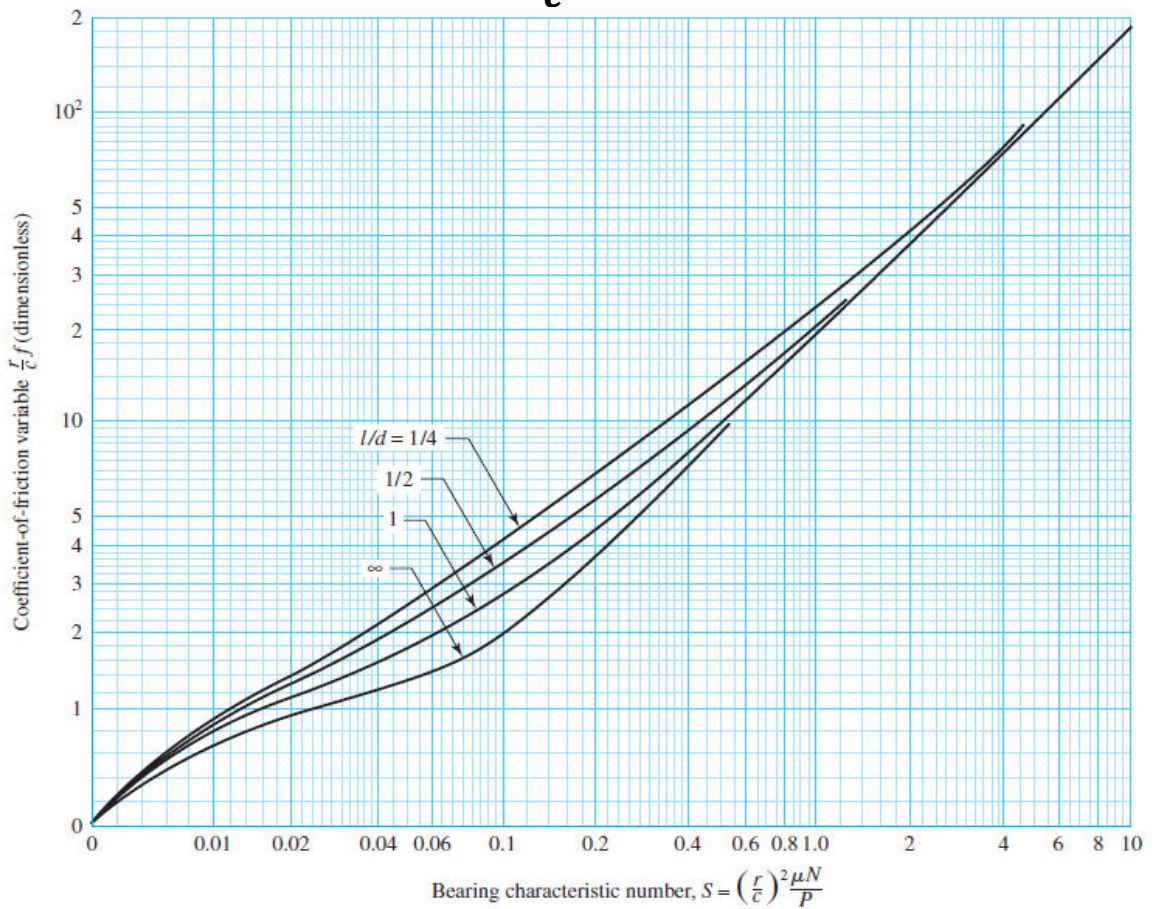
sommerfeld number(S) VS $\frac{h_0}{c}$



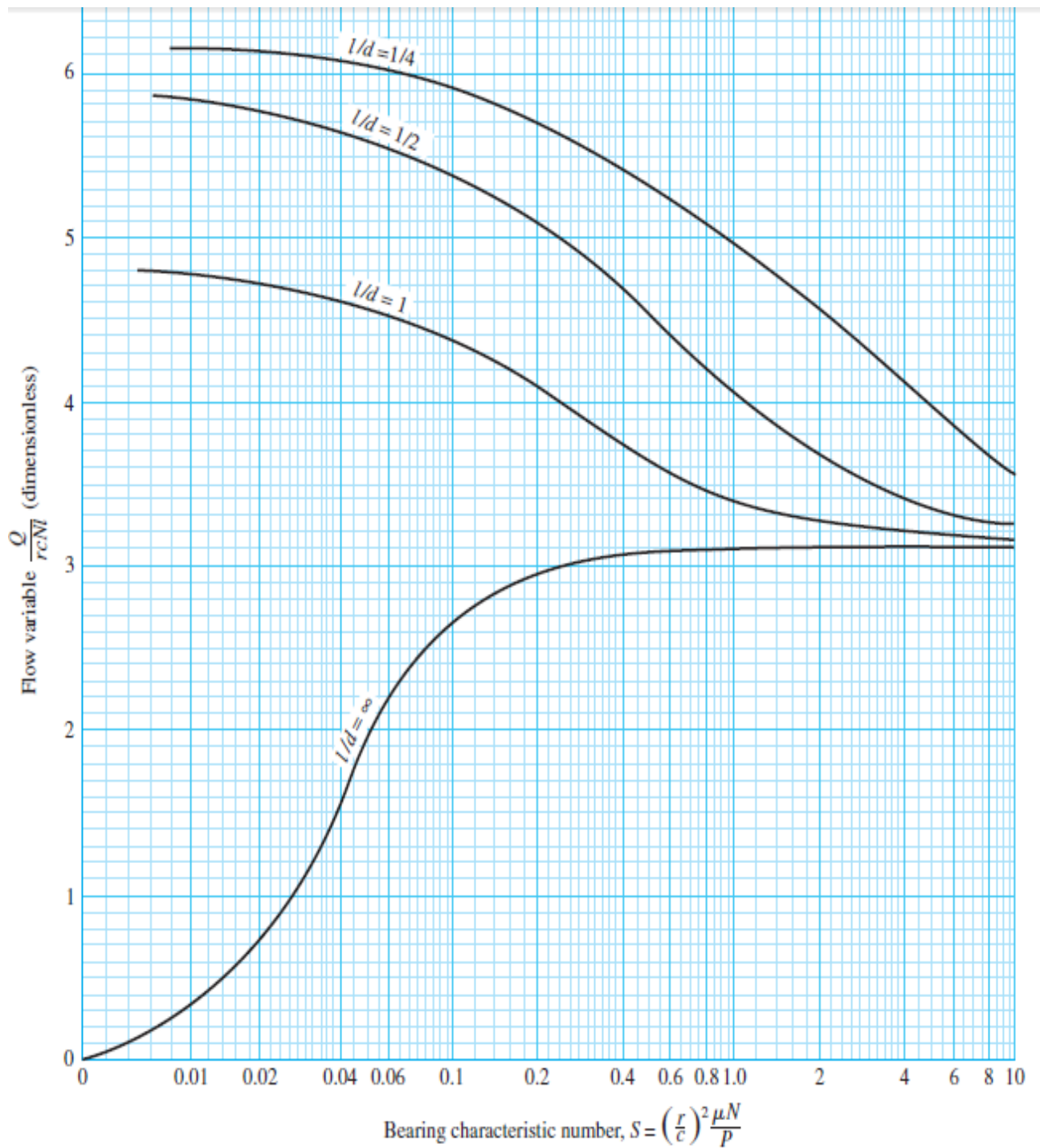
sommerfeld number(S) VS ϕ :



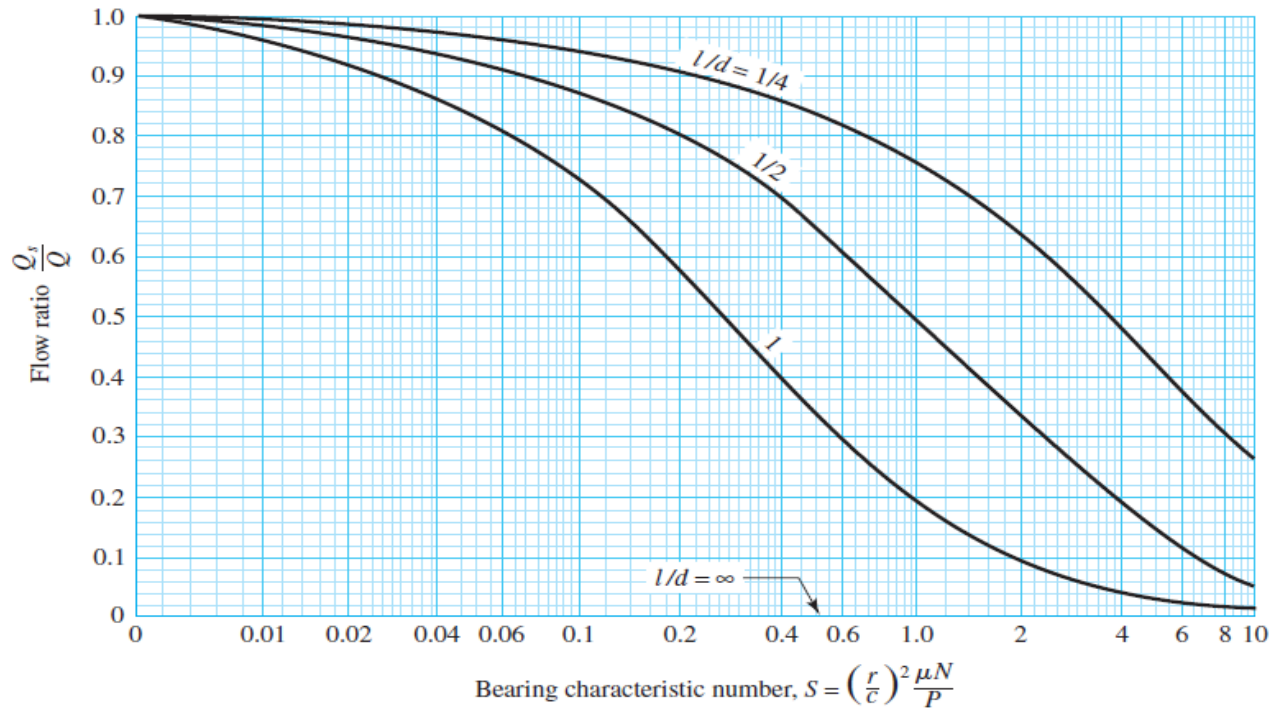
sommerfeld number(S) VS $\frac{fr}{c}$



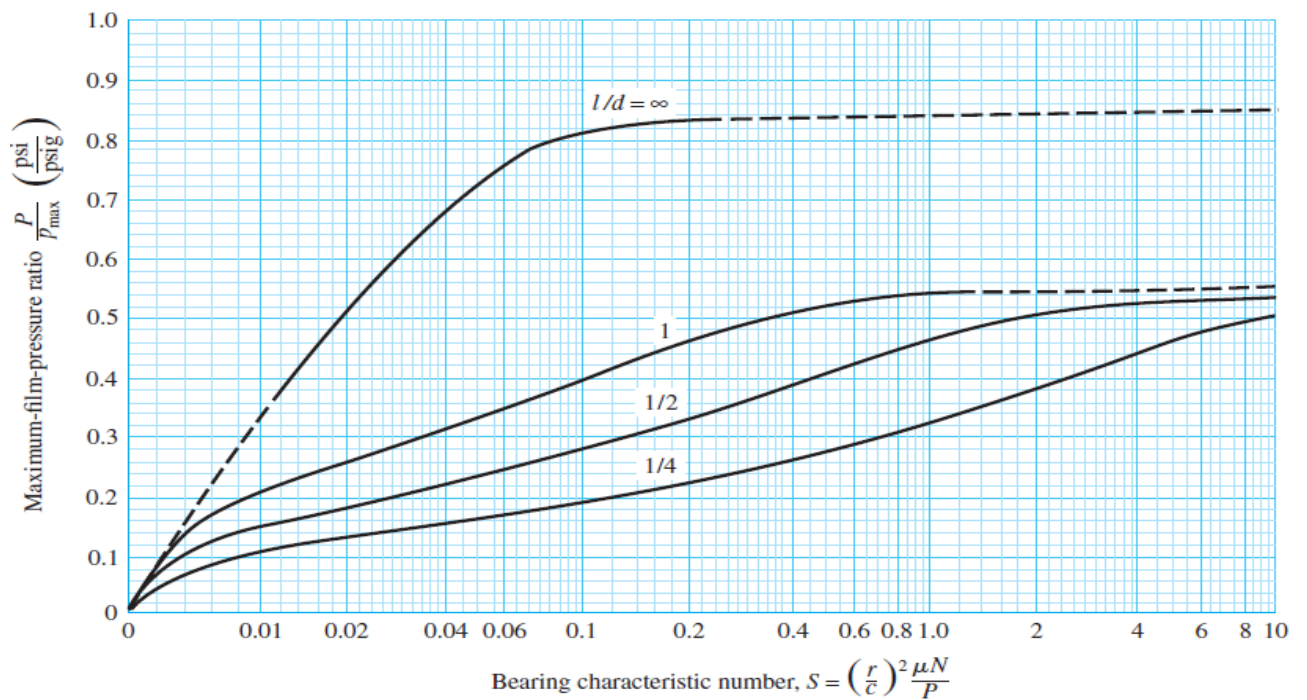
sommerfeld number(S) VS $\frac{Q}{rcnl}$



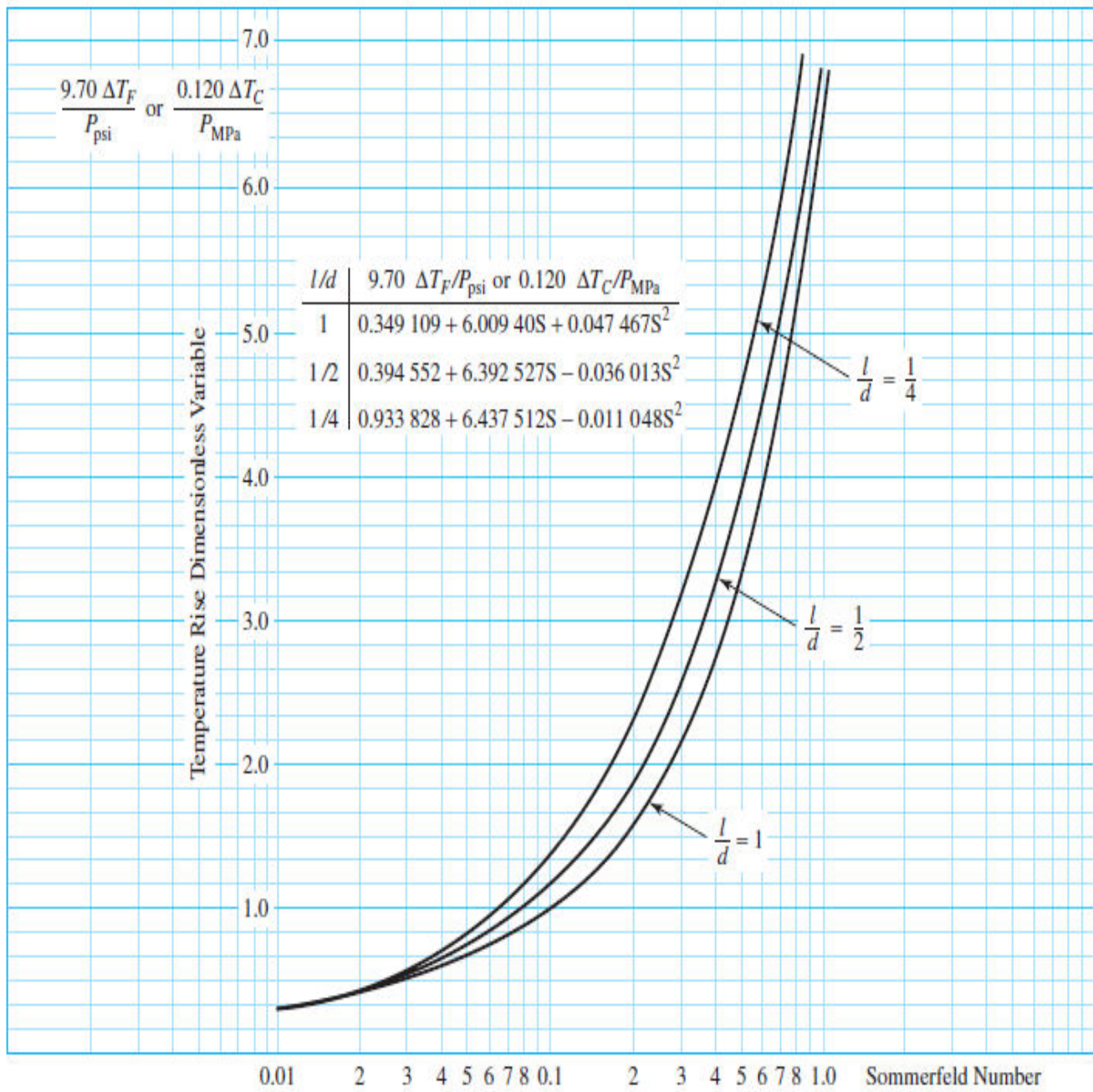
sommerfeld number(S) VS $\frac{Q_s}{Q}$



sommerfeld number(S) VS $\frac{P}{P_{max}}$



sommerfeld number(S) VS Temperature rise ΔT :



Lubrication constant (α) :

| Lubrication System | Conditions | Range of α |
|--------------------|------------|-------------------------------|
| Oil ring | Moving air | 1–2 |
| | Still air | $\frac{1}{2}$ –1 |
| Oil bath | Moving air | $\frac{1}{2}$ –1 |
| | Still air | $\frac{1}{5}$ – $\frac{2}{5}$ |

recommended values for P (unit load)

| Application | Unit Load | |
|---------------------|-----------|---------|
| | psi | MPa |
| Diesel engines: | | |
| Main bearings | 900–1700 | 6–12 |
| Crankpin | 1150–2300 | 8–15 |
| Wristpin | 2000–2300 | 14–15 |
| Electric motors | 120–250 | 0.8–1.5 |
| Steam turbines | 120–250 | 0.8–1.5 |
| Gear reducers | 120–250 | 0.8–1.5 |
| Automotive engines: | | |
| Main bearings | 600–750 | 4–5 |
| Crankpin | 1700–2300 | 10–15 |
| Air compressors: | | |
| Main bearings | 140–280 | 1–2 |
| Crankpin | 280–500 | 2–4 |
| Centrifugal pumps | 100–180 | 0.6–1.2 |