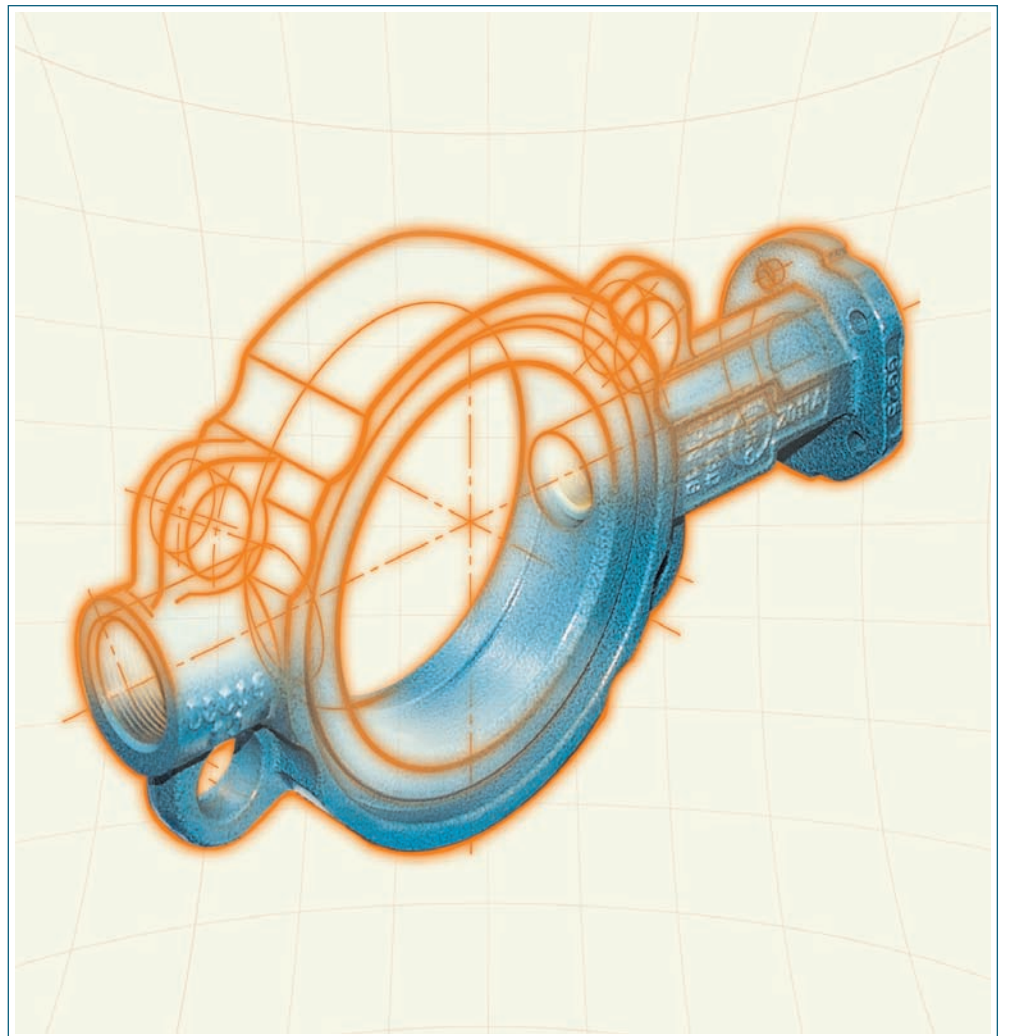


TECHNICAL GUIDE



TECHNICAL GUIDE

CONTENTS

- 1 Conversion tables
- 2 Standards
 - 2.1 Face-to-face to EN 558, ISO 5752
 - 2.2 Flange designs to DIN 2526
 - 2.3 Flange accommodation DIN 2501
 - 2.4 Connections of pneumatic quarter turn actuators to EN ISO 5211
- 3 Screw lengths for DIN flanges
- 4. Formulas and tables
 - 4.1 K_v -values
 - 4.2 Saturated steam table
 - 4.3 Density of gases and liquids
 - 4.4 Steel key
- 5 General
 - 5.1 Acceptance specifications
 - 5.2 General resistance of elastomers
 - 5.3 Translation of technical terms
 - 5.4 Symbols for valves
 - 5.5 Abbreviations for names of standards
 - 5.6 Explosion protection
Safety parameters

TECHNICAL GUIDE

1. CONVERSION TABLES

Length l

| | mm | cm | m | in | ft | yd |
|----|------|-------|--------|---------|-------|--------|
| mm | 1 | 0.1 | 0.001 | 0.0394 | 0.003 | 0.0011 |
| cm | 10 | 1 | 0.01 | 0.3937 | 0.033 | 0.0109 |
| m | 1000 | 100 | 1 | 39.3701 | 3.281 | 1.0936 |
| in | 25.4 | 2.54 | 0.0254 | 1 | 0.083 | 0.0278 |
| ft | 305 | 30.48 | 0.3048 | 12 | 1 | 0.3333 |
| yd | 914 | 91.44 | 0.9144 | 36 | 3 | 1 |

1 km = 1 thousand metres = 0.62137 miles

1 mile = 1,609.34 metres = 1.60934 kilometres

Area A

| | mm ² | cm ² | m ² | in ² | ft ² | yd ² |
|-----------------|-----------------|-----------------|--------------------------|-------------------------|--------------------------|--------------------------|
| mm ² | 1 | 0.01 | 10 ⁻⁶ | 1.55 × 10 ⁻³ | 1.076 × 10 ⁻⁵ | 1.196 × 10 ⁻⁶ |
| cm ² | 100 | 1 | 10 ⁻⁴ | 0.155 | 1.076 × 10 ⁻³ | 1.196 × 10 ⁻⁴ |
| m ² | 10 ⁶ | 10 000 | 1 | 1550 | 10.764 | 1.196 |
| in ² | 645.16 | 6.4516 | 6.452 × 10 ⁻⁴ | 1 | 6.944 × 10 ⁻³ | 7.716 × 10 ⁻⁴ |
| ft ² | 92 903 | 929.03 | 0.093 | 144 | 1 | 0.1111 |
| yd ² | 836 127 | 8361.27 | 0.836 | 1296 | 9 | 1 |

Volume V

| | mm ³ | cm ³ | m ³ | in ³ | ft ³ | yd ³ |
|-----------------|-------------------------|-------------------------|--------------------------|------------------------|--------------------------|--------------------------|
| mm ³ | 1 | 0.001 | 10 ⁻⁹ | 6.1 × 10 ⁻⁵ | 3.531 × 10 ⁻⁸ | 1.308 × 10 ⁻⁹ |
| cm ³ | 1000 | 1 | 10 ⁻⁶ | 0.061 | 3.531 × 10 ⁻⁵ | 1.308 × 10 ⁻⁸ |
| m ³ | 10 ⁹ | 10 ⁶ | 1 | 61 024 | 35.31 | 1.308 |
| in ³ | 16 387 | 16.39 | 1.639 × 10 ⁻⁵ | 1 | 5.787 × 10 ⁻⁴ | 2.143 × 10 ⁻⁵ |
| ft ³ | 2.832 × 10 ⁷ | 2.832 × 10 ⁴ | 0.0283 | 1728 | 1 | 0.0370 |
| yd ³ | 7.646 × 10 ⁸ | 7.646 × 10 ⁵ | 0.7646 | 46 656 | 27 | 1 |

Velocity v

| | m/s | ft/s | m/min | ft/min | km/h | mile/h |
|--------|-------|-------|--------|--------|--------|--------|
| m/s | 1 | 3.281 | 60 | 196.85 | 3.6 | 2.2369 |
| ft/s | 0.305 | 1 | 18.288 | 60 | 196.85 | 0.6818 |
| m/min | 0.017 | 0.055 | 1 | 3.281 | 0.06 | 0.0373 |
| ft/min | 0.005 | 0.017 | 0.305 | 1 | 0.0183 | 0.0114 |
| km/h | 0.278 | 0.911 | 16.667 | 54.68 | 1 | 0.6214 |
| mile/h | 0.447 | 1.467 | 26.822 | 88 | 1.6093 | 1 |

Force F, G

| | N | kN | kgf | lbf |
|-----|-------|--------|--------|--------|
| N | 1 | 0.001 | 0.102 | 0.225 |
| kN | 1000 | 1 | 101.97 | 224.81 |
| kgf | 9.807 | 0.0098 | 1 | 2.205 |
| lbf | 4.448 | 0.0044 | 0.454 | 1 |

TECHNICAL GUIDE

1. CONVERSION TABLES

Mass m

| | kg | lb | cwt | t | sh ton |
|--------|--------|--------|--------|-----------------------|----------------------|
| kg | 1 | 2.205 | 0.0197 | 0.001 | 0.0011 |
| lb | 0.454 | 1 | 0.0089 | 4.54×10^{-4} | 5.0×10^{-4} |
| cwt | 50.802 | 112 | 1 | 0.0508 | 0.056 |
| t | 1000 | 2204.6 | 19.684 | 1 | 1.1023 |
| sh ton | 907.2 | 2000 | 17.857 | 0.9072 | 1 |

Mass flow m/Q

| | kg/s | lb/s | kg/h | lb/h | t/h |
|------|-----------------------|-----------------------|--------|---------|-----------------------|
| kg/s | 1 | 2.205 | 3600 | 7936.64 | 3.6 |
| lb/s | 0.454 | 1 | 0.0089 | 3600 | 1.633 |
| kg/h | 2.78×10^{-4} | 6.12×10^{-4} | 1 | 2.205 | 0.001 |
| lb/h | 1.26×10^{-4} | 2.78×10^{-4} | 0.454 | 1 | 4.54×10^{-4} |
| t/h | 0.278 | 0.612 | 1000 | 2204.6 | 1 |

Volumetric flow V

| | l/s | l/min | m ³ /h | ft ³ /h | ft ³ /min | US barrel/d |
|----------------------|-------|--------|-------------------|--------------------|----------------------|-------------|
| l/s | 1 | 60 | 3.6 | 127.133 | 2.1189 | 543.439 |
| l/min | 0.017 | 1 | 0.06 | 2.1189 | 0.0353 | 9.057 |
| m ³ /h | 0.278 | 16.667 | 1 | 35.3147 | 0.5886 | 150.955 |
| ft ³ /h | 0.008 | 0.472 | 0.0283 | 1 | 0.0167 | 4.275 |
| ft ³ /min | 0.472 | 28.317 | 1.6990 | 60 | 1 | 256.475 |
| US barrel/d | 0.002 | 0.11 | 0.0066 | 0.2339 | 0.0039 | 1 |

Energy W, E

| | J | kJ | MJ | ft lbf | kW h |
|--------|-------------------|-----------------------|-----------------------|--------------------|-----------------------|
| J | 1 | 0.001 | 10^{-6} | 0.7376 | 2.78×10^{-7} |
| kJ | 1000 | 1 | 0.001 | 737.56 | 2.78×10^{-4} |
| MJ | 10^6 | 1000 | 1 | 737 562 | 0.2778 |
| ft lbf | 1.356 | 1.36×10^{-3} | 1.36×10^{-6} | 1 | 3.77×10^{-7} |
| kW h | 3.6×10^6 | 3600 | 3.6 | 2.65×10^6 | 1 |

1 Joule = 1 Newton metre

Power P

| | W | kgf m/s | PS | ft lbf/s | hp |
|----------|-------|---------|---------|----------|---------|
| W | 1 | 0.102 | 0.00136 | 0.7376 | 0.00134 |
| kgf m/s | 9.806 | 1 | 0.0133 | 7.233 | 0.0131 |
| PS | 735.5 | 75 | 1 | 542.476 | 0.9863 |
| ft lbf/s | 1.356 | 0.138 | 0.00184 | 1 | 0.00182 |
| hp | 745.7 | 76.04 | 1.0139 | 550 | 1 |

1 Watt = 1 Joule per sec. = 1 Nm per sec.

TECHNICAL GUIDE

1. CONVERSION TABLES

Pressure p

| | N/m ² =Pa | mbar | bar | kgf/cm ² | lbf/in ² | ft H ₂ O | m H ₂ O | mm Hg | in Hg |
|----------------------|----------------------|-------|------------------|-------------------------|-------------------------|------------------------|-------------------------|--------|-------------------------|
| N/m ² =Pa | 1 | 0.01 | 10 ⁻⁵ | 1.02 x 10 ⁻⁵ | 1.45 x 10 ⁻⁴ | 3.3 x 10 ⁻⁴ | 1.02 x 10 ⁻⁴ | 0.0075 | 2.95 x 10 ⁻⁴ |
| mbar | 100 | 1 | 0.001 | 0.00102 | 0.0145 | 0.033 | 0.0102 | 0.75 | 0.029 |
| bar | 10 ⁵ | 1000 | 1 | 1.02 | 14.5 | 33.455 | 10.2 | 750.1 | 29.53 |
| kgf/cm ² | 98066 | 980.7 | 0.981 | 1 | 14.22 | 32.808 | 10.0 | 735.6 | 28.96 |
| lbf/in ² | 6895 | 68.95 | 0.069 | 0.0703 | 1 | 2.307 | 0.703 | 51.71 | 2.036 |
| ft H ₂ O | 2989 | 29.89 | 0.03 | 0.0305 | 0.433 | 1 | 0.305 | 22.42 | 0.883 |
| m H ₂ O | 9807 | 98.07 | 0.098 | 0.1 | 1.42 | 3.28 | 1 | 73.55 | 2.896 |
| mm Hg | 133.3 | 1.333 | 0.0013 | 0.0014 | 0.019 | 0.045 | 0.014 | 1 | 0.039 |
| in Hg | 3386 | 33.86 | 0.0338 | 0.0345 | 0.491 | 1.133 | 0.345 | 25.4 | 1 |

Temperature t

| °C | °F | °C | °F |
|-----|-----|-----|-----|
| -40 | -40 | 115 | 239 |
| -35 | -31 | 120 | 248 |
| -30 | -22 | 125 | 257 |
| -25 | -13 | 130 | 266 |
| -20 | -4 | 135 | 275 |
| -15 | +5 | 140 | 284 |
| -10 | +14 | 145 | 293 |
| -5 | +23 | 150 | 302 |
| 0 | 32 | 155 | 311 |
| 5 | 41 | 160 | 320 |
| 10 | 50 | 165 | 329 |
| 15 | 59 | 170 | 338 |
| 20 | 68 | 175 | 347 |
| 25 | 77 | 180 | 356 |
| 30 | 86 | 185 | 365 |
| 35 | 95 | 190 | 374 |
| 40 | 104 | 195 | 383 |
| 45 | 113 | 200 | 392 |
| 50 | 122 | 205 | 401 |
| 55 | 131 | 210 | 410 |
| 60 | 140 | 215 | 419 |
| 65 | 149 | 220 | 428 |
| 70 | 158 | 225 | 437 |
| 75 | 167 | 230 | 446 |
| 80 | 176 | 235 | 455 |
| 85 | 185 | 240 | 464 |
| 90 | 194 | 245 | 473 |
| 95 | 203 | 250 | 482 |
| 100 | 212 | 255 | 491 |
| 105 | 221 | 260 | 500 |
| 110 | 230 | | |

TECHNICAL GUIDE

1. TABLE FOR CONVERTING INCHES TO MILLIMETRES (1 INCH = 25.4 MILLIMETRES)

| Inch | 0 | 1/16 | 1/8 | 3/16 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 11/16 | 3/4 | 13/16 | 7/8 | 15/16 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0 | 0.0 | 1.6 | 3.2 | 4.8 | 6.4 | 7.9 | 9.5 | 11.1 | 12.7 | 14.3 | 15.9 | 17.5 | 19.1 | 20.6 | 22.2 | 23.8 |
| 1 | 25.4 | 27.0 | 28.6 | 30.2 | 31.8 | 33.3 | 34.9 | 36.5 | 38.1 | 39.7 | 41.3 | 42.9 | 44.5 | 46.0 | 47.6 | 49.2 |
| 2 | 50.8 | 52.4 | 54.0 | 55.6 | 57.2 | 58.7 | 60.3 | 61.9 | 63.5 | 65.1 | 66.7 | 68.3 | 69.9 | 71.4 | 73.0 | 74.6 |
| 3 | 76.2 | 77.8 | 79.4 | 81.0 | 82.6 | 84.1 | 85.7 | 87.3 | 88.9 | 90.5 | 92.1 | 93.7 | 95.3 | 96.8 | 98.4 | 100.0 |
| 4 | 101.6 | 103.2 | 104.8 | 106.4 | 108.0 | 109.5 | 111.1 | 112.7 | 114.3 | 115.9 | 117.5 | 119.1 | 120.7 | 122.2 | 123.8 | 125.4 |
| 5 | 127.0 | 128.6 | 130.2 | 131.8 | 133.4 | 134.9 | 136.5 | 138.1 | 139.7 | 141.3 | 142.9 | 144.5 | 146.1 | 147.6 | 149.2 | 150.8 |
| 6 | 152.4 | 154.0 | 155.6 | 157.2 | 158.8 | 160.3 | 161.9 | 163.5 | 165.1 | 166.7 | 168.3 | 169.9 | 171.5 | 173.0 | 174.6 | 176.2 |
| 7 | 177.8 | 179.4 | 181.0 | 182.6 | 184.2 | 185.7 | 187.3 | 188.9 | 190.5 | 192.1 | 193.7 | 195.3 | 196.9 | 198.4 | 200.0 | 201.6 |
| 8 | 203.2 | 204.8 | 206.4 | 208.0 | 209.6 | 211.1 | 212.7 | 214.3 | 215.9 | 217.5 | 219.1 | 220.7 | 222.3 | 223.8 | 225.4 | 227.0 |
| 9 | 228.6 | 230.2 | 231.8 | 233.4 | 235.0 | 236.5 | 238.1 | 239.7 | 241.3 | 242.9 | 244.5 | 246.1 | 247.7 | 249.2 | 250.8 | 252.4 |
| 10 | 254.0 | 255.6 | 257.2 | 258.8 | 260.4 | 261.9 | 263.5 | 265.1 | 266.7 | 268.3 | 269.9 | 271.5 | 273.1 | 274.6 | 276.2 | 277.8 |
| 11 | 279.4 | 281.0 | 282.6 | 284.2 | 285.8 | 287.3 | 288.9 | 290.5 | 292.1 | 293.7 | 295.3 | 296.9 | 298.5 | 300.0 | 301.6 | 303.2 |
| 12 | 304.8 | 306.4 | 308.0 | 309.6 | 311.2 | 312.7 | 314.3 | 315.9 | 317.5 | 319.1 | 320.7 | 322.3 | 323.9 | 325.4 | 327.0 | 328.6 |
| 13 | 330.2 | 331.8 | 333.4 | 335.0 | 336.6 | 338.1 | 339.7 | 341.3 | 342.9 | 344.5 | 346.1 | 347.7 | 349.3 | 350.8 | 352.4 | 354.0 |
| 14 | 355.6 | 357.2 | 358.8 | 360.4 | 362.0 | 363.5 | 365.1 | 366.7 | 368.3 | 369.9 | 371.5 | 373.1 | 374.7 | 376.2 | 377.8 | 379.4 |
| 15 | 381.0 | 382.6 | 384.2 | 385.8 | 387.4 | 388.9 | 390.5 | 392.1 | 393.7 | 395.3 | 396.9 | 398.5 | 400.1 | 401.6 | 403.2 | 404.8 |
| 16 | 406.4 | 408.0 | 409.6 | 411.2 | 412.8 | 414.3 | 415.9 | 417.5 | 419.1 | 420.7 | 422.3 | 423.9 | 425.5 | 427.0 | 428.6 | 430.2 |
| 17 | 431.8 | 433.4 | 435.0 | 436.6 | 438.2 | 439.7 | 441.3 | 442.9 | 444.5 | 446.1 | 447.7 | 449.3 | 450.9 | 452.4 | 454.0 | 455.6 |
| 18 | 457.2 | 458.8 | 460.4 | 462.0 | 463.6 | 465.1 | 466.7 | 468.3 | 469.9 | 471.5 | 473.1 | 474.7 | 476.3 | 477.8 | 479.4 | 481.0 |
| 19 | 482.6 | 484.2 | 485.85 | 487.4 | 489.0 | 490.5 | 492.1 | 493.7 | 495.3 | 496.9 | 498.5 | 500.1 | 501.7 | 503.2 | 504.8 | 506.4 |
| 20 | 508.0 | 509.6 | 11.2 | 512.8 | 514.4 | 515.9 | 517.5 | 519.1 | 520.7 | 522.3 | 523.9 | 525.5 | 527.1 | 528.6 | 530.2 | 531.8 |
| 21 | 533.4 | 535.0 | 536.6 | 538.2 | 539.8 | 541.3 | 542.9 | 544.5 | 546.1 | 547.7 | 549.3 | 550.9 | 552.5 | 554.0 | 555.6 | 557.2 |
| 22 | 558.8 | 560.4 | 562.0 | 563.6 | 565.2 | 566.7 | 568.3 | 569.9 | 571.5 | 573.1 | 574.7 | 576.3 | 577.9 | 579.4 | 581.0 | 582.6 |
| 23 | 584.2 | 585.8 | 587.4 | 589.0 | 590.6 | 592.1 | 593.7 | 595.3 | 596.9 | 598.5 | 600.1 | 601.7 | 603.3 | 604.8 | 606.4 | 608.0 |
| 24 | 609.6 | 611.2 | 612.8 | 614.4 | 616.0 | 617.5 | 619.1 | 620.7 | 622.3 | 623.9 | 625.5 | 627.1 | 628.7 | 630.2 | 631.8 | 633.4 |
| 25 | 635.0 | 636.6 | 638.2 | 639.8 | 641.4 | 642.9 | 644.5 | 646.1 | 647.7 | 649.3 | 650.9 | 652.5 | 654.1 | 655.6 | 657.2 | 658.8 |
| 26 | 660.4 | 662.0 | 663.6 | 665.2 | 666.8 | 668.3 | 669.9 | 671.5 | 673.1 | 674.7 | 676.3 | 677.9 | 679.5 | 681.0 | 682.6 | 684.2 |
| 27 | 685.8 | 687.4 | 689.0 | 690.6 | 692.2 | 693.7 | 695.3 | 696.9 | 698.5 | 700.1 | 701.7 | 703.3 | 704.9 | 706.4 | 708.0 | 709.6 |
| 28 | 711.2 | 712.8 | 714.4 | 716.0 | 717.6 | 719.1 | 720.7 | 722.3 | 723.9 | 725.5 | 727.1 | 728.7 | 730.3 | 731.8 | 733.4 | 735.0 |
| 29 | 736.6 | 738.2 | 739.8 | 714.4 | 743.0 | 744.5 | 746.1 | 747.7 | 749.3 | 750.9 | 752.5 | 754.1 | 755.7 | 757.2 | 758.8 | 760.4 |
| 30 | 762.0 | 763.6 | 765.2 | 766.8 | 768.4 | 769.9 | 771.5 | 773.1 | 774.7 | 776.3 | 777.9 | 779.5 | 781.1 | 782.6 | 784.2 | 785.8 |
| 31 | 787.4 | 789.0 | 790.6 | 792.2 | 783.8 | 795.3 | 796.9 | 798.5 | 800.1 | 801.7 | 803.3 | 804.9 | 806.5 | 808.0 | 809.6 | 811.2 |
| 32 | 812.8 | 814.4 | 816.0 | 817.6 | 819.2 | 820.7 | 822.3 | 823.9 | 825.5 | 827.1 | 828.7 | 830.3 | 831.9 | 833.4 | 835.0 | 836.6 |
| 33 | 838.2 | 839.8 | 841.4 | 843.0 | 844.6 | 846.1 | 847.7 | 849.3 | 850.9 | 852.5 | 854.1 | 855.7 | 857.3 | 858.8 | 860.4 | 862.0 |
| 34 | 863.6 | 865.2 | 866.8 | 868.4 | 870.0 | 871.5 | 873.1 | 874.7 | 876.3 | 877.9 | 879.5 | 881.1 | 882.7 | 884.2 | 885.8 | 887.4 |
| 35 | 889.0 | 890.6 | 892.2 | 893.8 | 895.4 | 896.9 | 898.5 | 900.1 | 901.7 | 903.3 | 904.9 | 906.5 | 908.1 | 909.6 | 911.2 | 912.8 |
| 36 | 914.4 | 916.0 | 917.6 | 919.2 | 920.8 | 922.3 | 923.9 | 925.5 | 927.1 | 928.7 | 930.3 | 931.9 | 933.5 | 935.0 | 936.6 | 938.2 |
| 37 | 939.8 | 941.4 | 943.0 | 944.6 | 946.2 | 947.7 | 949.3 | 950.9 | 952.5 | 954.1 | 955.7 | 957.3 | 958.9 | 960.4 | 962.0 | 963.6 |
| 38 | 965.2 | 966.8 | 968.4 | 970.0 | 971.6 | 973.1 | 974.7 | 976.3 | 977.9 | 979.5 | 981.1 | 982.7 | 984.3 | 985.8 | 987.4 | 989.0 |
| 39 | 990.6 | 992.2 | 993.8 | 995.4 | 997.0 | 998.5 | 1000.1 | 1001.7 | 1003.3 | 1004.9 | 1006.5 | 1008.1 | 1009.7 | 1011.2 | 1012.8 | 1014.4 |
| 40 | 1016.0 | 1017.6 | 1019.2 | 1020.8 | 1022.4 | 1023.9 | 1025.5 | 1027.1 | 1028.7 | 1030.3 | 1031.9 | 1033.5 | 1035.1 | 1036.6 | 1038.2 | 1039.8 |
| 41 | 1041.4 | 1043.0 | 1044.6 | 1046.2 | 1047.8 | 1049.3 | 1050.9 | 1052.5 | 1054.1 | 1055.7 | 1057.3 | 1058.9 | 1060.5 | 1062.0 | 1063.6 | 1065.2 |
| 42 | 1066.8 | 1068.4 | 1070.0 | 1071.6 | 1073.2 | 1074.7 | 1076.3 | 1077.9 | 1079.5 | 1081.1 | 1082.7 | 1084.3 | 1085.9 | 1087.4 | 1089.0 | 1090.6 |
| 43 | 1092.2 | 1093.8 | 1095.4 | 1097.0 | 1098.6 | 1100.1 | 1101.7 | 1103.3 | 1104.9 | 1106.5 | 1108.1 | 1109.7 | 1111.3 | 1112.8 | 1114.4 | 1116.0 |
| 44 | 1117.6 | 1119.2 | 1120.8 | 1122.4 | 1124.0 | 1125.5 | 1127.1 | 1128.7 | 1130.3 | 1131.9 | 1133.5 | 1135.1 | 1136.7 | 1138.2 | 1139.8 | 1141.4 |
| 45 | 1143.0 | 1144.6 | 1146.2 | 1147.8 | 1149.4 | 1150.9 | 1152.5 | 1154.1 | 1155.7 | 1157.3 | 1158.9 | 1160.5 | 1162.1 | 1163.6 | 1165.2 | 1166.8 |
| 46 | 1168.4 | 1170.0 | 1171.6 | 1173.2 | 1174.8 | 1176.3 | 1177.9 | 1179.5 | 1181.1 | 1182.7 | 1184.3 | 1185.9 | 1187.5 | 1189.0 | 1190.6 | 1192.2 |
| 47 | 1193.8 | 1195.2 | 1197.0 | 1198.6 | 1200.2 | 1201.7 | 1203.3 | 1204.9 | 1206.5 | 1208.1 | 1209.7 | 1211.3 | 1212.9 | 1214.4 | 1216.0 | 1217.6 |
| 48 | 1219.2 | 1220.8 | 1222.4 | 1224.0 | 1225.6 | 1227.1 | 1228.7 | 1230.3 | 1231.9 | 1233.5 | 1235.1 | 1236.7 | 1238.3 | 1239.8 | 1241.4 | 1243.0 |
| 49 | 1244.6 | 1246.2 | 1247.8 | 1249.4 | 1251.0 | 1252.5 | 1254.1 | 1255.7 | 1257.3 | 1258.9 | 1260.5 | 1262.1 | 1263.7 | 1265.2 | 1266.8 | 1268.4 |

TECHNICAL GUIDE

2.1 FACE-TO-FACE TO EN 558

Shut-off valves - Wafer type

| DN | Face-to-face FTF | | | | |
|---------------------|------------------|------------------|------------------|-------|-------|
| | PN 2.5 - PN 6 | PN 10 | PN 16 | PN 25 | PN 40 |
| 40 | 38 | 33 | - | 33 | 33 |
| 50 | 40 | 43 | - | 43 | 43 |
| 65 | 42 | 46 | - | 46 | 46 |
| 80 | 44 | 46 | 49 | 64 | 64 |
| 100 | 46 | 52 | 56 | 64 | 64 |
| 125 | 48 | 56 | 64 | 70 | 70 |
| 150 | 50 | 56 | 70 | 76 | 76 |
| 200 | 60 | 60 | 71 | 89 | 89 |
| 250 | 65 | 68 | 76 | 114 | 114 |
| 300 | 75 | 78 | 83 | 114 | 114 |
| 350 | 80 | 92 ¹⁾ | 92 | 127 | 127 |
| 400 | 95 | 102 | 102 | 140 | 140 |
| 450 | 107 | 114 | 114 | 152 | 152 |
| 500 | 120 | 127 | 127 | 152 | 152 |
| 600 | 144 | 154 | 154 | 178 | 178 |
| 700 | 160 | 165 | - | 229 | - |
| 800 | 180 | 190 | - | 241 | - |
| 900 | 195 | 203 | - | 241 | - |
| 1000 | 210 | 216 | - | 300 | - |
| 1200 | - | 254 | - | 350 | - |
| 1400 | - | 279 | - | 390 | - |
| 1600 | - | 318 | - | 440 | - |
| 1800 | - | 356 | - | 490 | - |
| 2000 | - | 406 | - | 540 | - |
| Basic series | 53 ¹⁾ | 20 | 25 ²⁾ | 16 | 16 |

Shut-off valves - Flanged type

| DN | Face-to-face FTF | | |
|---------------------|------------------|---------------|---------------|
| | PN 2.5 - PN 6 | PN 10 - PN 16 | PN 25 - PN 40 |
| 40 | 106 | 140 | 140 |
| 50 | 108 | 150 | 150 |
| 65 | 112 | 170 | 170 |
| 80 | 114 | 180 | 180 |
| 100 | 127 | 190 | 190 |
| 125 | 140 | 200 | 200 |
| 150 | 140 | 210 | 210 |
| 200 | 152 | 230 | 230 |
| 250 | 165 | 250 | 250 |
| 300 | 178 | 270 | 270 |
| 350 | 190 | 290 | 290 |
| 400 | 216 | 310 | 310 |
| 450 | 222 | 330 | 330 |
| 500 | 229 | 350 | 350 |
| 600 | 267 | 390 | 390 |
| 700 | 292 | 430 | 430 |
| 800 | 318 | 470 | 470 |
| 900 | 330 | 510 | 510 |
| 1000 | 410 | 550 | 550 |
| 1200 | 470 | 630 | 630 |
| 1400 | 530 | 710 | 710 |
| 1600 | 600 | 790 | 790 |
| 1800 | 670 | 870 | 870 |
| 2000 | 760 | 950 | 950 |
| Basic series | 13 | 14 | 14 |

¹⁾ Only for PN 2.5, PN 6 and PN 10.

²⁾ Or 78 mm, until basic series 2.5 is phased out (see ³⁾).

³⁾ Basic series 25 will be phased out five years after this standard is published for the first time.

Gate valves

| DN | Face-to-face FTF | | | | | | | | | | | | | | | | | | |
|---------------------|----------------------|------------------|------------------|-----|-----------------|------|-----|------|------------------|------------------|-----------------|-----|------|-----|------|----------------|------|------------------|---|
| | PN 6 - PN 10 - PN 16 | | | | | | | | PN 25 - PN 40 | | | | | | | PN 63 - PN 100 | | | |
| 10 | - | 80 | - | 102 | 108 | - | 108 | - | - | 80 | 108 | - | - | - | - | - | - | - | - |
| 15 | - | 80 | - | 108 | 108 | - | 108 | 150 | - | 80 | 108 | 140 | 140 | - | - | 140 | - | 165 | - |
| 20 | 75 | 90 | - | 117 | 117 | - | 117 | 160 | 75 | 90 | 117 | 152 | 152 | - | - | 152 | - | 250 | - |
| 25 | 80 | 100 | 125 | 127 | 127 | 120 | 127 | 160 | 80 | 100 | 127 | 165 | 165 | 120 | - | 210 | - | 255 | - |
| 32 | 90 | 110 | 130 | 140 | 146 | 140 | 127 | 180 | 90 | 110 | 146 | 178 | 178 | 140 | - | 230 | - | 256 | - |
| 40 | 100 | 120 | 140 | 165 | 159 | 240 | 136 | 190 | 100 | 120 | 159 | 190 | 190 | 240 | 240 | 240 | 240 | 280 | - |
| 50 | 110 | 135 | 150 | 178 | 190 | 250 | 142 | 200 | 110 | 135 | 190 | 216 | 216 | 250 | 250 | 250 | 250 | 300 | - |
| 65 | 130 | 165 | 170 | 190 | 216 | 270 | 154 | 215 | 130 | 165 | 216 | 241 | 241 | 270 | 290 | 270 | 290 | 340 | - |
| 80 | 150 | 185 | 180 | 203 | 254 | 280 | 160 | 230 | 150 | 185 | 254 | 283 | 283 | 280 | 310 | 280 | 310 | 360 | - |
| 100 | 160 | 229 | 190 | 229 | 305 | 300 | 172 | 250 | 160 | 229 | 305 | 305 | 305 | 300 | 350 | 300 | 350 | 400 | - |
| 125 | 200 | - | 200 | 254 | - | 325 | 186 | 275 | 200 | - | - | 381 | 381 | 325 | 400 | 350 | 400 | 450 | - |
| 150 | 210 | - | 210 | 267 | - | 350 | 200 | 300 | 210 | - | - | 403 | 403 | 350 | 450 | 375 | 450 | 500 | - |
| 200 | - | - | 230 | 292 | - | 400 | 228 | 350 | - | - | - | 419 | 419 | 400 | 550 | 425 | 550 | 600 | - |
| 250 | - | - | 250 | 330 | - | 450 | 255 | 400 | - | - | - | 457 | 457 | 450 | 650 | 450 | 650 | 700 | - |
| 300 | - | - | 270 | 356 | - | 500 | 285 | 425 | - | - | - | 502 | 502 | 500 | 750 | 500 | 750 | 800 | - |
| 350 | - | - | 290 | 381 | - | 550 | 315 | 475 | - | - | - | 572 | 762 | 550 | 850 | 550 | 850 | - | - |
| 400 | - | - | 310 | 406 | - | 600 | 340 | 525 | - | - | - | 610 | 838 | 600 | 950 | 600 | 950 | - | - |
| 450 | - | - | 330 | 432 | - | 650 | 360 | 575 | - | - | - | 660 | 914 | 650 | 1050 | - | 1050 | - | - |
| 500 | - | - | 350 | 457 | - | 700 | 380 | 625 | - | - | - | 711 | 991 | 700 | 1150 | - | 1150 | - | - |
| 600 | - | - | 390 | 508 | - | 800 | 425 | 725 | - | - | - | 787 | 1143 | 800 | 1350 | - | 1350 | - | - |
| 700 | - | - | 430 | 610 | - | 900 | 470 | 825 | - | - | - | - | - | - | - | - | - | - | - |
| 800 | - | - | 470 | 660 | - | 1000 | 510 | 925 | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | 510 | 711 | - | 1100 | 555 | 1025 | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | 550 | 813 | - | 1200 | 600 | 1125 | - | - | - | - | - | - | - | - | - | - | - |
| Basic series | 47 ³⁾ | 18 ³⁾ | 14 ¹⁾ | 3 | 7 ³⁾ | 15 | 29 | 30 | 47 ³⁾ | 18 ³⁾ | 7 ³⁾ | 19 | 4 | 15 | 26 | 45 | 26 | 46 ³⁾ | - |

¹⁾ This series is also used for gate valves made of cast iron with laminated graphite (for details see relevant product standards).

²⁾ This series is only designed for PN 63.

³⁾ This series is only designed for valves made of copper alloys; it must not be used for valves made of cast iron or steel.

TECHNICAL GUIDE

2.1 FACE-TO-FACE TO ISO 5752

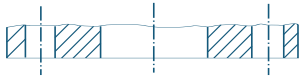
| ID | ISO 5752 | | | | | | | | | |
|------|---|------|---|-----|--|-----|-----|---|------|------|
| | Table 3 short (ANSI B16 B16.10) long (DIN 3202 F4) | | Table 4 short series (BS 3952) long series (DIN 3202 F4) | | Table 5 short (API 609 BS 3953) medium (MSS SP 67) long (API 609 BS 3952) | | | Table 6 short (ANSI B16 B 16.10) medium (ANSI B16.10 BS 1570) long (DIN 3202 F1) | | |
| | Gate valves | | Double flanged butterfly valves | | Wafer type butterfly valves | | | Ball valves | | |
| DN | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 20 | 117 | - | - | - | - | - | - | 117 | 117 | 150 |
| 25 | 127 | - | - | - | - | - | - | 127 | 127 | 160 |
| 32 | 140 | - | - | - | - | - | - | 140 | 140 | 180 |
| 40 | 165 | 240 | 106 | 140 | 33 | - | 33 | 165 | 165 | 200 |
| 50 | 178 | 250 | 108 | 150 | 43 | - | 43 | 178 | 203 | 230 |
| 65 | 190 | 270 | 112 | 170 | 46 | - | 46 | 190 | 222 | 290 |
| 80 | 203 | 280 | 114 | 180 | 46 | 49 | 64 | 203 | 241 | 310 |
| 100 | 229 | 300 | 127 | 190 | 52 | 56 | 64 | 229 | 305 | 350 |
| 125 | 254 | 325 | 140 | 200 | 56 | 64 | 70 | 254 | 356 | 400 |
| 150 | 267 | 350 | 140 | 210 | 56 | 70 | 76 | 267 | 394 | 480 |
| 200 | 292 | 400 | 152 | 230 | 60 | 71 | 89 | 292 | 457 | 600 |
| 250 | 330 | 450 | 165 | 250 | 68 | 76 | 114 | 330 | 533 | 730 |
| 300 | 356 | 500 | 178 | 270 | 78 | 83 | 114 | 356 | 610 | 850 |
| 350 | 381 | 550 | 190 | 290 | 78 | 92 | 127 | 381 | 686 | 980 |
| 400 | 406 | 600 | 216 | 310 | 102 | 102 | 140 | 406 | 762 | 1100 |
| 450 | 432 | 650 | 222 | 330 | 114 | 114 | 152 | 432 | 864 | 1200 |
| 500 | 457 | 700 | 229 | 350 | 127 | 127 | 152 | 457 | 914 | 1250 |
| 600 | 508 | 800 | 267 | 390 | 154 | 154 | 178 | 508 | 1067 | 1450 |
| 700 | 610 | 900 | 292 | 430 | 165 | - | 229 | - | - | - |
| 800 | 660 | 1000 | 318 | 470 | 190 | - | 241 | - | - | - |
| 900 | 711 | 1100 | 330 | 510 | 203 | - | 241 | - | - | - |
| 1000 | 811 | 1200 | 410 | 550 | 216 | - | 300 | - | - | - |

TECHNICAL GUIDE

2.2 FLANGE DESIGNS TO DIN 2526

The possible types of sealing depend on the dimensional standards of the flanges.

Flanges without sealing strip



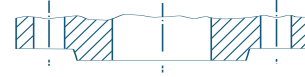
Type A

Sealing surface without requirement

Type B

Sealing surface $R_z = 160$, turned (not finer than $40 \mu\text{m}$)

Flanges with sealing strip



Type C

Sealing surface $R_z = 160$ (not finer than $40 \mu\text{m}$), turned

Type D

Sealing surface $R_z = 40$, turned

Form E

Sealing surface $R_z = 16$, turned

Flanges with positive locking seal

Type F

Spring to DIN 2512



Type N

Groove to DIN 2512



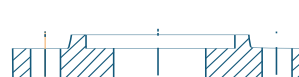
Type V 13

Projection to DIN 2513



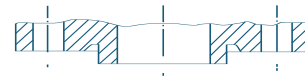
Type R 13

Recess to DIN 2513



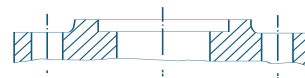
Type V 14

Projection to DIN 2514



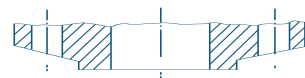
Type R 14

Recess to DIN 2514



Type M

Bevel for diaphragm only weld seal to DIN 2695



Type L

Groove for lenticular seal to DIN 2696



TECHNICAL GUIDE

2.3 FLANGE ACCOMODATION (TO DIN 2501 SHEET 1 IN EXTRACTS FOR PN 1 TO PN 100)

| Pressure rating | PN 1 and 2,5 | | | | PN 6 | | | | PN 10 | | | | PN 16 | | | | |
|-----------------|--------------------|-----------------|-----------------------|------------|----------|-----------------|-----------------------|------------|----------|-----------------|-----------------------|------------|----------|-----------------|-----------------------|------------|----------|
| | Nominal diameter*) | Flange diameter | Pitch circle diameter | Bolt holes | | Flange diameter | Pitch circle diameter | Bolt holes | | Flange diameter | Pitch circle diameter | Bolt holes | | Flange diameter | Pitch circle diameter | Bolt holes | |
| | | | | Number | Diameter | | | Number | Diameter | | | Number | Diameter | | | Number | Diameter |
| DN | | | | | | | | | | | | | | | | | |
| 10 | 75 | 50 | 4 | 11 | 75 | 50 | 4 | 11 | 90 | 60 | 4 | 14 | 90 | 60 | 4 | 14 | |
| 15 | 80 | 55 | 4 | 11 | 80 | 55 | 4 | 11 | 95 | 65 | 4 | 14 | 95 | 65 | 4 | 14 | |
| 20 | 90 | 65 | 4 | 11 | 90 | 65 | 4 | 11 | 105 | 75 | 4 | 14 | 105 | 75 | 4 | 14 | |
| 25 | 100 | 75 | 4 | 11 | 100 | 75 | 4 | 11 | 115 | 85 | 4 | 14 | 115 | 85 | 4 | 14 | |
| 32 | 120 | 90 | 4 | 14 | 120 | 90 | 4 | 14 | 140 | 100 | 4 | 18 | 140 | 100 | 4 | 18 | |
| 40 | 130 | 100 | 4 | 14 | 130 | 100 | 4 | 14 | 150 | 110 | 4 | 18 | 150 | 110 | 4 | 18 | |
| 50 | 140 | 110 | 4 | 14 | 140 | 110 | 4 | 14 | 165 | 125 | 4 | 18 | 165 | 125 | 4 | 18 | |
| 65 | 160 | 130 | 4 | 14 | 160 | 130 | 4 | 14 | 185 | 145 | 4 | 18 | 185 | 145 | 4 | 18 | |
| 80 | 190 | 150 | 4 | 18 | 190 | 150 | 4 | 18 | 200 | 160 | 8 | 18 | 200 | 160 | 8 | 18 | |
| 100 | 210 | 170 | 4 | 18 | 210 | 170 | 4 | 18 | 220 | 180 | 8 | 18 | 220 | 180 | 8 | 18 | |
| 125 | 240 | 200 | 8 | 18 | 240 | 200 | 8 | 18 | 250 | 210 | 8 | 18 | 250 | 210 | 8 | 18 | |
| 150 | 265 | 225 | 8 | 18 | 265 | 225 | 8 | 18 | 285 | 240 | 8 | 22 | 285 | 240 | 8 | 22 | |
| (175) | - | - | - | - | - | - | - | - | 315 | 270 | 8 | 22 | 315 | 270 | 8 | 22 | |
| 200 | 320 | 280 | 8 | 18 | 320 | 280 | 8 | 18 | 340 | 295 | 8 | 22 | 340 | 295 | 12 | 22 | |
| 250 | 375 | 335 | 12 | 18 | 375 | 335 | 12 | 18 | 395 | 350 | 12 | 22 | 405 | 355 | 12 | 26 | |
| 300 | 440 | 395 | 12 | 22 | 440 | 395 | 12 | 22 | 445 | 400 | 12 | 22 | 460 | 410 | 12 | 26 | |
| 350 | 490 | 445 | 12 | 22 | 490 | 445 | 12 | 22 | 505 | 460 | 16 | 22 | 520 | 470 | 12 | 26 | |
| 400 | 540 | 495 | 16 | 22 | 540 | 495 | 16 | 22 | 565 | 515 | 16 | 26 | 580 | 525 | 20 | 30 | |
| 450 | 595 | 550 | 16 | 22 | 595 | 550 | 16 | 22 | 615 | 565 | 20 | 26 | 640 | 585 | 20 | 30 | |
| 500 | 645 | 600 | 20 | 22 | 645 | 600 | 20 | 22 | 670 | 620 | 20 | 26 | 715 | 650 | 20 | 33 | |
| 600 | 755 | 705 | 20 | 26 | 755 | 705 | 20 | 26 | 780 | 725 | 20 | 30 | 840 | 770 | 20 | 36 | |
| 700 | 860 | 810 | 24 | 26 | 860 | 810 | 24 | 26 | 895 | 840 | 24 | 30 | 910 | 840 | 24 | 36 | |
| 800 | 975 | 920 | 24 | 30 | 975 | 920 | 24 | 30 | 1015 | 950 | 24 | 33 | 1025 | 950 | 24 | 39 | |
| 900 | 1075 | 1020 | 24 | 30 | 1075 | 1020 | 24 | 30 | 1115 | 1050 | 28 | 33 | 1125 | 1050 | 28 | 39 | |
| 1000 | 1175 | 1120 | 28 | 30 | 1175 | 1120 | 28 | 30 | 1230 | 1160 | 28 | 36 | 1255 | 1170 | 28 | 42 | |
| 1200 | 1375 | 1320 | 32 | 30 | 1405 | 1340 | 32 | 33 | 1455 | 1380 | 32 | 39 | 1485 | 1390 | 32 | 48 | |
| 1400 | 1575 | 1520 | 36 | 30 | 1630 | 1560 | 36 | 36 | 1675 | 1590 | 36 | 42 | 1685 | 1590 | 36 | 48 | |
| 1600 | 1790 | 1730 | 40 | 30 | 1830 | 1760 | 40 | 36 | 1915 | 1820 | 40 | 48 | 1930 | 1820 | 40 | 56 | |
| 1800 | 1990 | 1930 | 44 | 30 | 2045 | 1970 | 44 | 39 | 2115 | 2020 | 44 | 48 | 2130 | 2020 | 44 | 56 | |
| 2000 | 2190 | 2130 | 48 | 30 | 2265 | 2180 | 48 | 42 | 2325 | 2230 | 48 | 48 | 2345 | 2230 | 48 | 62 | |

*) DN 175 for shipbuilding only

TECHNICAL GUIDE

2.3 FLANGE ACCOMODATION (TO DIN 2501 SHEET 1 IN EXTRACTS FOR PN 1 TO PN 100)

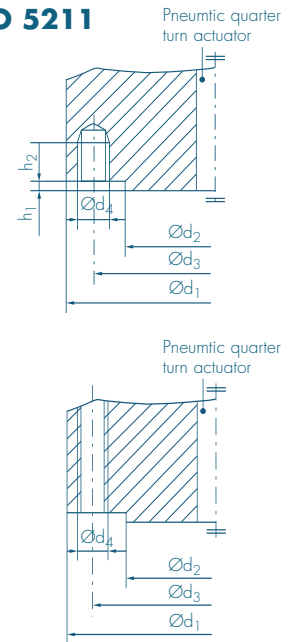
| Pressure rating Nominal diameter*) DN | PN 25 | | | | PN 40 | | | | PN 64 | | | | PN 100 | | | |
|---|-----------------|-----------------------|------------|----------|-----------------|-----------------------|------------|----------|-----------------|-----------------------|------------|----------|-----------------|-----------------------|------------|----------|
| | Flange diameter | Pitch circle diameter | Bolt holes | | Flange diameter | Pitch circle diameter | Bolt holes | | Flange diameter | Pitch circle diameter | Bolt holes | | Flange diameter | Pitch circle diameter | Bolt holes | |
| | | | Number | Diameter | | | Number | Diameter | | | Number | Diameter | | | Number | Diameter |
| 10 | 90 | 60 | 4 | 14 | 90 | 60 | 4 | 14 | 100 | 70 | 4 | 14 | 100 | 70 | 4 | 14 |
| 15 | 95 | 65 | 4 | 14 | 95 | 65 | 4 | 14 | 105 | 75 | 4 | 14 | 105 | 75 | 4 | 14 |
| 20 | 105 | 75 | 4 | 14 | 105 | 75 | 4 | 14 | 130 | 90 | 4 | 18 | 130 | 90 | 4 | 18 |
| 25 | 115 | 85 | 4 | 14 | 115 | 85 | 4 | 14 | 140 | 100 | 4 | 18 | 140 | 100 | 4 | 18 |
| 32 | 140 | 100 | 4 | 18 | 140 | 100 | 4 | 18 | 155 | 110 | 4 | 22 | 155 | 110 | 4 | 22 |
| 40 | 150 | 110 | 4 | 18 | 150 | 110 | 4 | 18 | 170 | 125 | 4 | 22 | 170 | 125 | 4 | 22 |
| 50 | 165 | 125 | 4 | 18 | 165 | 125 | 4 | 18 | 180 | 135 | 4 | 22 | 195 | 145 | 4 | 26 |
| 65 | 185 | 145 | 8 | 18 | 185 | 145 | 8 | 18 | 205 | 160 | 8 | 22 | 220 | 170 | 8 | 26 |
| 80 | 200 | 160 | 8 | 18 | 200 | 160 | 8 | 18 | 215 | 170 | 8 | 22 | 230 | 180 | 8 | 26 |
| 100 | 235 | 190 | 8 | 22 | 235 | 190 | 8 | 22 | 250 | 200 | 8 | 26 | 265 | 210 | 8 | 30 |
| 125 | 270 | 220 | 8 | 26 | 270 | 220 | 8 | 26 | 295 | 240 | 8 | 30 | 315 | 250 | 8 | 33 |
| 150 | 300 | 250 | 8 | 26 | 300 | 250 | 8 | 26 | 345 | 280 | 8 | 33 | 355 | 290 | 12 | 33 |
| (175) | 330 | 280 | 12 | 26 | 350 | 295 | 12 | 30 | 375 | 310 | 12 | 33 | 385 | 320 | 12 | 33 |
| 200 | 360 | 310 | 12 | 26 | 375 | 320 | 12 | 30 | 415 | 345 | 12 | 36 | 430 | 360 | 12 | 36 |
| 250 | 425 | 370 | 12 | 30 | 450 | 385 | 12 | 33 | 470 | 400 | 12 | 36 | 505 | 430 | 12 | 39 |
| 300 | 485 | 430 | 16 | 30 | 515 | 450 | 16 | 33 | 530 | 460 | 16 | 36 | 585 | 500 | 16 | 42 |
| 350 | 555 | 490 | 16 | 33 | 580 | 510 | 16 | 36 | 600 | 525 | 16 | 39 | 655 | 560 | 16 | 48 |
| 400 | 620 | 550 | 16 | 36 | 660 | 585 | 16 | 39 | 670 | 585 | 16 | 42 | 715 | 620 | 16 | 48 |
| 450 | - | - | - | - | 685 | 610 | 20 | 39 | - | - | - | - | - | - | - | - |
| 500 | 730 | 660 | 20 | 36 | 755 | 670 | 20 | 42 | 800 | 705 | 20 | 48 | 870 | 760 | 20 | 56 |
| 600 | 845 | 770 | 20 | 39 | 890 | 795 | 20 | 48 | 930 | 820 | 20 | 56 | 990 | 875 | 20 | 62 |
| 700 | 960 | 875 | 24 | 42 | 995 | 900 | 24 | 48 | 1045 | 935 | 24 | 56 | 1145 | 1020 | 24 | 70 |
| 800 | 1085 | 990 | 24 | 48 | 1140 | 1030 | 24 | 56 | 1165 | 1050 | 24 | 62 | | | | |
| 900 | 1185 | 1090 | 28 | 48 | 1250 | 1140 | 28 | 56 | 1285 | 1170 | 28 | 62 | | | | |
| 1000 | 1320 | 1210 | 28 | 56 | 1360 | 1250 | 28 | 56 | 1415 | 1290 | 28 | 70 | | | | |
| 1200 | 1530 | 1420 | 32 | 56 | 1575 | 1460 | 32 | 62 | 1665 | 1530 | 32 | 78 | | | | |
| 1400 | 1755 | 1640 | 36 | 62 | 1795 | 1680 | 36 | 62 | | | | | | | | |
| 1600 | 1975 | 1860 | 40 | 62 | 2025 | 1900 | 40 | 70 | | | | | | | | |
| 1800 | 2195 | 2070 | 44 | 70 | | | | | | | | | | | | |
| 2000 | 2425 | 2300 | 48 | 70 | | | | | | | | | | | | |

*) DN 175 for shipbuilding only

TECHNICAL GUIDE

2.4 CONNECTIONS OF PNEUMATIC QUARTER TURN ACTUATORS TO EN ISO 5211

| Flange type | Maximum torque of flange Nm | Flange dimensions | | | | | | | Number of stud or through bolts |
|-------------|-----------------------------|-------------------|----------------|----------------|----------------|---------------------|---------------------|---|---------------------------------|
| | | d ₁ | d ₂ | d ₃ | d ₄ | h ₁ max. | h ₂ min. | | |
| F 03 | 32 | 46 | 25 | 36 | M 5 | 3 | 8 | 4 | |
| F 04 | 63 | 54 | 30 | 42 | M 5 | 3 | 8 | 4 | |
| F 05 | 125 | 65 | 35 | 50 | M 6 | 3 | 9 | 4 | |
| F 07 | 250 | 90 | 55 | 70 | M 8 | 3 | 12 | 4 | |
| F 10 | 500 | 125 | 70 | 102 | M 10 | 3 | 15 | 4 | |
| F 12 | 1000 | 150 | 85 | 125 | M 12 | 3 | 18 | 4 | |
| F 14 | 2000 | 175 | 100 | 140 | M 16 | 4 | 24 | 4 | |
| F 16 | 4000 | 210 | 130 | 165 | M 20 | 5 | 30 | 4 | |
| F 25 | 8000 | 300 | 200 | 254 | M 16 | 5 | 24 | 8 | |
| F 30 | 16000 | 350 | 230 | 298 | M 20 | 5 | 30 | 8 | |

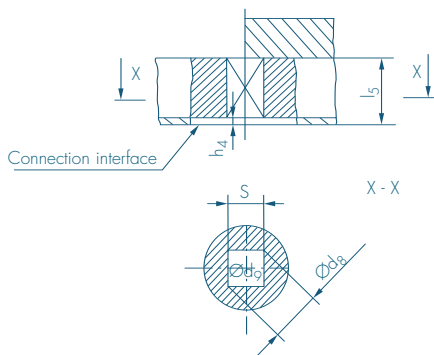


| Flange type | Maximum torque of flange Nm | h ₄ max. ¹⁾ | Actuator with parallel or diagonal square end | | | | | | | | | | |
|-------------|-----------------------------|-----------------------------------|---|------------------|------------------|------------------|------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | | SH11 | | | | | | | | | | |
| F 03 | 32 | 1.5 | 9 | - | - | - | - | - | - | - | - | - | - |
| F 04 | 63 | 1.5 | 9 | 11 ²⁾ | - | - | - | - | - | - | - | - | - |
| F 05 | 125 | 3.0 | 9 | 11 | 14 ²⁾ | - | - | - | - | - | - | - | - |
| F 07 | 250 | 3.0 | - | 11 | 14 | 17 ²⁾ | - | - | - | - | - | - | - |
| F 10 | 500 | 3.0 | - | - | 14 | 17 | 19 | 22 ²⁾ | - | - | - | - | - |
| F 12 | 1000 | 3.0 | - | - | - | 17 | 19 | 22 | 27 ²⁾ | - | - | - | - |
| F 14 | 2000 | 5.0 | - | - | - | - | - | 22 | 27 | 36 ²⁾ | - | - | - |
| F 16 | 4000 | 5.0 | - | - | - | - | - | - | 27 | 36 | 46 ²⁾ | - | - |
| F 25 | 8000 | 5.0 | - | - | - | - | - | - | - | 36 | 46 | 55 ²⁾ | - |
| F 30 | 16000 | 5.0 | - | - | - | - | - | - | - | - | 46 | 55 | 75 ²⁾ |
| | | Ø d ₈ min. | 12.1 | 14.1 | 18.1 | 22.2 | 25.2 | 28.2 | 36.2 | 48.2 | 60.2 | 72.2 | 98.2 |
| | | Ø d ₉ max. | 9.5 | 11.6 | 14.7 | 17.9 | 20 | 23.1 | 28.4 | 38 | 48.5 | 57.9 | 79.1 |
| | | l ₅ min. | 10 | 12 | 16 | 19 | 21 | 24 | 29 | 38 | 48 | 57 | 77 |

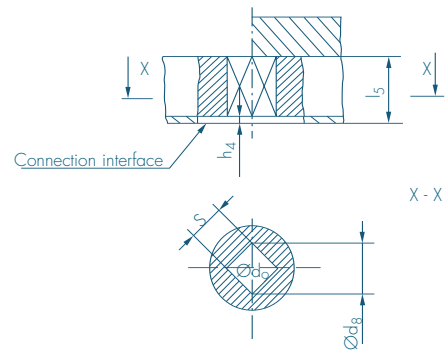
¹⁾ h₄ = 0.5 mm

²⁾ Indicates the preferred dimension

³⁾ The maximum permissible torques for the coupling relate to a maximum permissible torsional tension of 280 MPa in the actuated section.



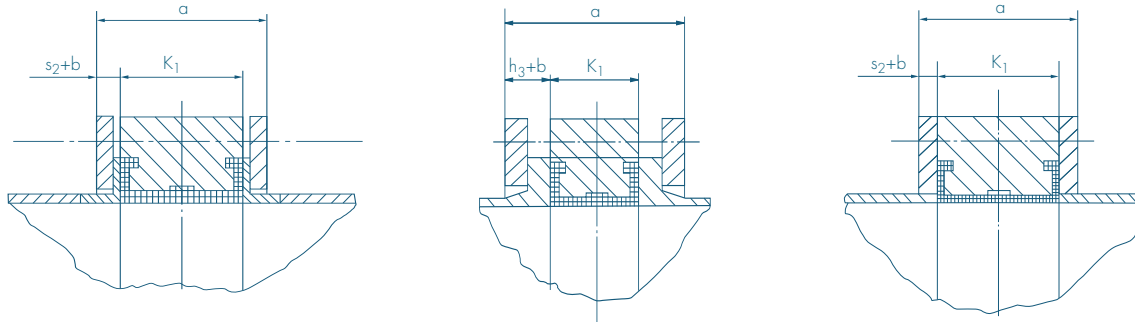
Actuator with parallel square end



Actuator with diagonal square end

TECHNICAL GUIDE

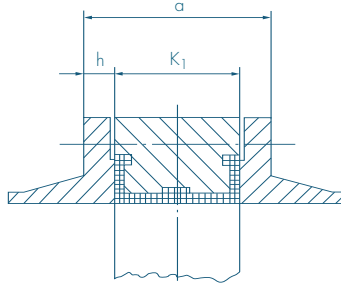
3 SCREW LENGTHS



| DN | Flared flanges | | | Loose flange | | | Brazed flanges, flush | | | | | | | | |
|------|-------------------------------|-----------|--------------|-------------------------------|------------|---------------|-------------------------------|------------|---------------|---------------|-----------|--------------|---------------|------------|---------------|
| | DIN 2641 S ₂ +b | PN 6 a | PN 6 Bolt | DIN 2642 S ₂ +b | PN 10 a | PN 10 Bolt | DIN 2673 h ₃ +b | PN 10 a | PN 10 Bolt | DIN 2573 b | PN 6 a | PN 6 Bolt | DIN 2576 b | PN 10 a | PN 10 Bolt |
| 25 | 15 | 63 | M10x80 | 19 | 71 | M12x90 | 28 | 89 | M12x110 | 14 | 61 | M10x80 | 16 | 65 | M12x80 |
| 32 | 15.5 | 64 | M12x80 | 19.5 | 72 | M16x90 | 28 | 89 | M16x110 | 16 | 65 | M12x80 | 16 | 65 | M16x90 |
| 40 | 15.5 | 64 | M12x80 | 19.5 | 72 | M16x90 | 28 | 89 | M16x110 | 16 | 65 | M12x80 | 16 | 65 | M16x90 |
| 50 | 15.5 | 74 | M12x90 | 19.5 | 82 | M16x100 | 30 | 103 | M16x130 | 16 | 75 | M12x90 | 18 | 79 | M16x100 |
| 65 | 15.5 | 77 | M12x100 | 19.5 | 85 | M16x110 | 30 | 106 | M16x130 | 16 | 78 | M12x100 | 18 | 82 | M16x100 |
| 80 | 18 | 82 | M16x100 | 22 | 90 | M16x110 | 34 | 114 | M16x130 | 18 | 82 | M16x110 | 20 | 86 | M16x110 |
| 100 | 18 | 88 | M16x120 | 22 | 96 | M16x120 | 34 | 120 | M16x140 | 18 | 88 | M16x110 | 20 | 92 | M16x120 |
| 125 | 18 | 92 | M16x120 | 22 | 100 | M16x120 | 36 | 128 | M16x150 | 20 | 96 | M16x120 | 22 | 100 | M16x120 |
| 150 | 18 | 92 | M16x120 | 22 | 100 | M20x130 | 36 | 128 | M20x160 | 20 | 96 | M16x120 | 22 | 100 | M20x130 |
| 200 | 20 | 100 | M16x120 | 24 | 108 | M20x140 | 40 | 140 | M20x170 | 22 | 104 | M16x130 | 24 | 108 | M20x140 |
| 250 | 25 | 118 | M16x140 | 27 | 122 | M20x150 | 44 | 156 | M20x180 | 24 | 116 | M16x140 | 26 | 120 | M20x150 |
| 300 | 29 | 136 | M20x160 | 31 | 140 | M20x180 | 48 | 174 | M20x200 | 24 | 126 | M20x150 | 26 | 130 | M20x160 |
| 350 | 30 | 152 | M20x180 | 34 | 160 | M20x200 | 50 | 192 | M20x220 | 26 | 144 | M20x170 | 28 | 148 | M20x180 |
| 400 | 32 | 166 | M20x200 | 38 | 178 | M20x240 | 56 | 214 | M24x280 | 28 | 158 | M20x180 | 32 | 166 | M24x200 |
| 450 | - | - | - | - | - | - | - | - | - | 30 | 174 | M20x200 | 38 | 190 | M24x220 |
| 500 | 36 | 199 | M20x250 | 44 | 215 | M24x280 | 64 | 255 | M24x320 | 30 | 187 | M20x220 | 38 | 203 | M24x270 |
| 550 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 600 | 40 | 236 | M24x300 | 51 | 256 | M27x330 | 70 | 294 | M27x370 | - | - | - | - | - | - |
| 700 | 44 | 253 | M24x320 | 57 | 279 | M27x350 | 78 | 321 | M27x400 | - | - | - | - | - | - |
| 800 | 48 | 286 | M27x360 | 63 | 316 | M30x390 | 86 | 362 | M30x430 | - | - | - | - | - | - |
| 900 | 52 | 307 | M27x380 | - | 307 | - | 94 | 391 | M30x490 | - | - | - | - | - | - |
| 1000 | 56 | 328 | M27x400 | - | 328 | - | 102 | 420 | M33x500 | - | - | - | - | - | - |

TECHNICAL GUIDE

3 SCREW LENGTHS

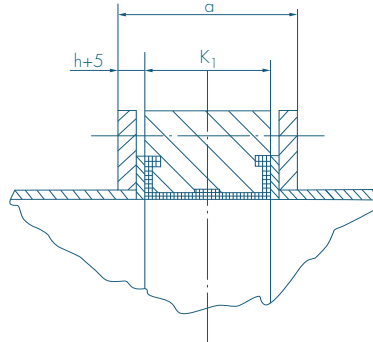


| | | Welding flanges | | | | | | | | | | | | | | | | |
|------|-----|-----------------|-----|-----------------------|--|------|-----|-----------------------|--|-------|-----|-----------------------|--|-------|-----|--------------------------|--|--|
| | | Face-to-face | | DIN 2631 | | PN 6 | | DIN 2632 | | PN 10 | | DIN 2633 | | PN 16 | | ANSI 150 | | |
| DN | K1 | h | a | Bolt | | h | a | Bolt | | h | a | Bolt | | h | a | Bolt | | |
| 25 | 33 | 14 | 61 | M10x80 | | 16 | 65 | M12x80 | | 16 | 65 | M12x80 | | 14 | 61 | 1/2"x80 | | |
| 32 | 33 | 14 | 61 | M12x80 | | 16 | 65 | M16x90 | | 16 | 65 | M16x90 | | 16 | 65 | 1/2"x80 | | |
| 40 | 33 | 14 | 61 | M12x80 | | 16 | 65 | M16x90 | | 16 | 65 | M16x90 | | 18 | 69 | 1/2"x90 | | |
| 50 | 43 | 14 | 71 | M12x90 | | 18 | 79 | M16x100 | | 18 | 79 | M16x100 | | 19 | 81 | 5/8"x100 | | |
| 65 | 46 | 14 | 74 | M12x90 | | 18 | 82 | M16x100 | | 18 | 82 | M16x100 | | 22 | 90 | 5/8"x110 | | |
| 80 | 46 | 16 | 78 | M16x100 | | 20 | 86 | M16x110 | | 20 | 86 | M16x110 | | 24 | 94 | 5/8"x120 | | |
| 100 | 52 | 16 | 84 | M16x100 | | 20 | 92 | M16x120 | | 20 | 92 | M16x120 | | 24 | 100 | 5/8"x120 | | |
| 125 | 56 | 18 | 92 | M16x120 | | 22 | 100 | M16x120 | | 22 | 100 | M16x120 | | 24 | 104 | 3/4"x130 | | |
| 150 | 56 | 18 | 92 | M16x120 | | 22 | 100 | M20x130 | | 22 | 100 | M20x130 | | 25 | 106 | 3/4"x130 | | |
| 200 | 60 | 20 | 100 | M16x120 | | 24 | 108 | M20x140 | | 24 | 108 | M20x140 | | 28 | 116 | 3/4"x140 | | |
| 250 | 68 | 22 | 112 | M16x140 | | 26 | 120 | M20x150 | | 26 | 120 | M24x150 | | 30 | 128 | 7/8"x160 | | |
| 300 | 78 | 22 | 122 | M20x150 | | 26 | 130 | M20x160 | | 28 | 134 | M24x160 | | 32 | 142 | 7/8"x170 | | |
| 350 | 92 | 22 | 136 | M20x160 | | 26 | 144 | M20x180 | | 30 | 152 | M24x180 | | 35 | 162 | 1"x190 | | |
| 400 | 102 | 22 | 146 | M20x180 | | 26 | 154 | M24x180 | | 32 | 166 | M27x200 | | 37 | 176 | 1"x210 | | |
| 450 | 114 | - | - | - | | - | - | - | | - | - | - | | 40 | 194 | 1 1/8"x260 ¹⁾ | | |
| 500 | 127 | 24 | 175 | M20x200 | | 28 | 183 | M24x240 ¹⁾ | | 34 | 195 | M30x240 | | 43 | 213 | 1 1/8"x280 ¹⁾ | | |
| 550 | 154 | - | - | - | | - | - | - | | - | - | - | | - | - | - | | |
| 600 | 154 | 24 | 202 | M24x260 ¹⁾ | | 28 | 210 | M27x280 ¹⁾ | | 36 | 228 | M33x280 | | 48 | 250 | 1 1/8"x320 ¹⁾ | | |
| 700 | 165 | 24 | 213 | M24x280 ¹⁾ | | 30 | 225 | M27x300 ¹⁾ | | 36 | 237 | M33x280 | | 52 | 269 | 1 1/4"x350 ¹⁾ | | |
| 800 | 190 | 24 | 238 | M27x310 ¹⁾ | | 32 | 254 | M30x330 ¹⁾ | | 38 | 266 | M36x360 ¹⁾ | | 57 | 304 | 1 1/2"x390 ¹⁾ | | |
| 900 | 203 | 26 | 255 | M27x330 ¹⁾ | | 34 | 271 | M30x340 ¹⁾ | | 40 | 283 | M36x370 ¹⁾ | | 60 | 323 | 1 1/2"x410 ¹⁾ | | |
| 1000 | 216 | 26 | 268 | M27x340 ¹⁾ | | 34 | 282 | M33x360 ¹⁾ | | 42 | 300 | M39x390 ¹⁾ | | 64 | 344 | 1 1/2"x430 ¹⁾ | | |

¹⁾ Threaded rod with two nuts and a washer

TECHNICAL GUIDE

3 SCREW LENGTHS



| Welding flanges for tank construction | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|-----------|-----|-----------------------|-----------|------|-----------------------|-------|-----|-----------------------|-----------|-----|-----------------------|------------------|-----|-----------------------|-----------|-----|-----------------------|-------|-----|-----------------------|-----------------------|
| DN | DIN 28031 | | | DIN 28032 | | | PN 10 | | | DIN 28034 | | | PN 10 | | | DIN 28036 | | | PN 10 | | | |
| | h | a | Bolt | h | a | Bolt | h | a | Bolt | h | a | Bolt | h ^{2/5} | a | Bolt | h | a | Bolt | h | a | Bolt | |
| 25 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 32 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 40 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 50 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 65 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 125 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 150 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 250 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 300 | 20 | 118 | M16x140 | 30 | 138 | M20x190 | 25 | 128 | M20x160 | 35 | 148 | M20x180 | 35 | 148 | M20x180 | 35 | 148 | M20x160 | 35 | 148 | M20x180 | M20x180 |
| 350 | 20 | 132 | M16x160 | 35 | 162 | M20x220 ¹⁾ | 25 | 142 | M20x170 | 40 | 172 | M20x200 | 40 | 172 | M20x200 | 40 | 172 | M20x170 | 40 | 172 | M20x200 | M20x200 |
| 400 | 20 | 142 | M16x140 | 35 | 172 | M20x230 ¹⁾ | 25 | 152 | M20x180 | 40 | 182 | M20x240 ¹⁾ | 40 | 182 | M20x240 ¹⁾ | 40 | 182 | M20x180 | 40 | 182 | M20x240 ¹⁾ | M20x240 ¹⁾ |
| 450 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 500 | 20 | 167 | M16x210 | 35 | 1697 | M20x250 ¹⁾ | 30 | 187 | M20x240 ¹⁾ | 40 | 207 | M20x260 ¹⁾ | 40 | 207 | M20x260 ¹⁾ | 40 | 207 | M20x240 ¹⁾ | 40 | 207 | M20x260 ¹⁾ | M20x260 ¹⁾ |
| 550 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 600 | 20 | 194 | M16x240 ¹⁾ | 35 | 224 | M20x280 ¹⁾ | 30 | 214 | M20x270 ¹⁾ | 45 | 244 | M20x300 ¹⁾ | 45 | 244 | M20x300 ¹⁾ | 45 | 244 | M20x270 ¹⁾ | 45 | 244 | M20x300 ¹⁾ | M20x300 ¹⁾ |
| 700 | 20 | 205 | M16x250 ¹⁾ | 50 | 265 | M24x330 ¹⁾ | 40 | 245 | M24x310 ¹⁾ | 50 | 265 | M24x320 ¹⁾ | 50 | 265 | M24x320 ¹⁾ | 50 | 265 | M24x310 ¹⁾ | 50 | 265 | M24x320 ¹⁾ | M24x320 ¹⁾ |
| 800 | 20 | 230 | M16x270 ¹⁾ | 55 | 300 | M24x360 ¹⁾ | 45 | 280 | M24x340 ¹⁾ | 55 | 300 | M24x360 ¹⁾ | 55 | 300 | M24x360 ¹⁾ | 55 | 300 | M24x340 ¹⁾ | 55 | 300 | M24x360 ¹⁾ | M24x360 ¹⁾ |
| 900 | 20 | 243 | M16x290 ¹⁾ | 60 | 323 | M24x390 ¹⁾ | 45 | 293 | M24x360 ¹⁾ | 65 | 333 | M24x400 ¹⁾ | 65 | 333 | M24x400 ¹⁾ | 65 | 333 | M24x360 ¹⁾ | 65 | 333 | M24x400 ¹⁾ | M24x400 ¹⁾ |
| 1000 | 20 | 256 | M16x300 ¹⁾ | 60 | 336 | M24x400 ¹⁾ | 45 | 306 | M24x370 ¹⁾ | 65 | 346 | M24x410 ¹⁾ | 65 | 346 | M24x410 ¹⁾ | 65 | 346 | M24x370 ¹⁾ | 65 | 346 | M24x410 ¹⁾ | M24x410 ¹⁾ |

TECHNICAL GUIDE

4.1 K_v-VALUE CALCULATION

a) Formula for liquid media

| | |
|-----------------|---|
| p ₁ | Absolute pressure at valve input |
| p ₂ | Absolute pressure at valve output |
| p _v | Liquid boiling pressure |
| K _v | Flow characteristic |
| Q | Flow (m ³ /h) |
| Δp ₀ | 1 bar = 10 ⁵ N/m ² |
| Δp | Differential pressure (p ₁ -p ₂) |
| ρ ₀ | 10 ³ kg/m ³ |
| ρ | Density of medium |
| X _F | Pressure ratio |
| Z _y | (Cavitation value) Z-value at capacity y |
| V | Velocity m/s |
| ξ | Zeta-value |
| L _A | Sound pressure level at 1 m distance |
| L _L | Max. flow Q _{max} (m ³ /h) |

$$K_v = Q \cdot \sqrt{\frac{\Delta p_0 \cdot \rho_0}{\Delta p \cdot \rho}}$$

$$Q = K_v \cdot \sqrt{\frac{\Delta p \cdot \rho}{\Delta p_0 \cdot \rho_0}}$$

$$\Delta p = \left(\frac{Q}{K_v}\right)^2 \cdot \Delta p_0 \cdot \frac{\rho_0}{\rho}$$

Where the medium is water the simplified formula is often used:

$$K_v = \frac{Q}{\sqrt{\Delta p}}$$

$$Q = K_v \cdot \sqrt{\Delta p}$$

$$V = \sqrt{\frac{200 \cdot \Delta p}{\xi}}$$

Cavitation-free operation means that X_F must be ≤ Z_y (pressure ratio)

$$X_F = \frac{\Delta p}{p_1 - p_v}$$

Sound pressure level for cavitation-free operation

$$L_A = 10 \cdot \lg K_v + 18 \lg (p_1 - p_v) - 5 \lg \rho + 18 \lg (X_F / Z_y) + 40 + \Delta L_F$$

The value ΔL_F is always stated by the value manufacturer.

b) Formula for steam

Compressible media

If Δp < 0.5 p₁

Δp₂ > 0.5 p₁

= sub-critical pressure drop

$$K_v = \frac{G}{31.6} \sqrt{\frac{V_2}{\Delta p}} \left[\frac{m^3}{h} \right]$$

If Δp > 0.5 p₁

Δp₂ < 0.5 p₁

= super-critical pressure drop

$$K_v = \frac{G}{31.6} \sqrt{\frac{V}{\Delta p}} \left[\frac{m^3}{h} \right]$$

Noise-problems!

| P (bar abs.) | t °C | | | | | | | | |
|--------------------|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 |
| 1 | 1.900 | 2.200 | 2.400 | 2.600 | 2.900 | 3.100 | 3.300 | 3.600 | 3.800 |
| 2 | 0.960 | 1.100 | 1.200 | 1.300 | 1.400 | 1.500 | 1.600 | 1.800 | 1.900 |
| 4 | 0.470 | 0.500 | 0.600 | 0.650 | 0.700 | 0.777 | 0.800 | 0.890 | 0.950 |
| 10 | | 0.200 | 0.230 | 0.260 | 0.280 | 0.310 | 0.330 | 0.350 | 0.380 |
| 16 | | | 0.140 | 0.160 | 0.175 | 0.119 | 0.205 | 0.220 | 0.235 |
| 25 | | | 0.087 | 0.099 | 0.110 | 0.120 | 0.130 | 0.140 | 0.150 |
| 40 | | | | 0.059 | 0.066 | 0.073 | 0.080 | 0.086 | 0.093 |
| 64 | Steam | | | 0.033 | 0.039 | 0.044 | 0.049 | 0.053 | 0.057 |
| 100 | V (m ³ /kg) | | | | 0.022 | 0.026 | 0.030 | 0.033 | 0.035 |

| Medium | Temperature (°C) | Speed of sound M (m/s) |
|--------------|---------------------|---------------------------|
| Steam | 150 | 504 |
| | 200 | 532 |
| Super-heated | 250 | 560 |
| | 275 | 573 |
| | 300 | 586 |
| | 400 | 635 |
| | 500 | 680 |

TECHNICAL GUIDE

4.2 SATURATED STEAM TABLE

| °C | Pressure p in bar of the saturated steam from 0 °C to 199 °C | | | | | | | | | |
|-----|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | 0.0061 | 0.0066 | 0.0071 | 0.0076 | 0.0081 | 0.0087 | 0.0093 | 0.0100 | 0.0107 | 0.0115 |
| 10 | 0.0123 | 0.0131 | 0.0140 | 0.0150 | 0.0160 | 0.0170 | 0.0182 | 0.0194 | 0.0210 | 0.0220 |
| 20 | 0.0234 | 0.0249 | 0.0264 | 0.0281 | 0.0300 | 0.0317 | 0.0336 | 0.0356 | 0.0378 | 0.0400 |
| 30 | 0.0424 | 0.0449 | 0.0475 | 0.0503 | 0.0532 | 0.0562 | 0.0594 | 0.0627 | 0.0662 | 0.0699 |
| 40 | 0.0737 | 0.0778 | 0.0820 | 0.0864 | 0.0910 | 0.0958 | 0.1009 | 0.1061 | 0.1116 | 0.1174 |
| 50 | 0.1234 | 0.1296 | 0.1361 | 0.1429 | 0.1500 | 0.1574 | 0.1651 | 0.1731 | 0.1815 | 0.1901 |
| 60 | 0.1992 | 0.2086 | 0.2184 | 0.2285 | 0.2391 | 0.2501 | 0.2615 | 0.2733 | 0.2856 | 0.2984 |
| 70 | 0.3117 | 0.3254 | 0.3396 | 0.3543 | 0.3696 | 0.3855 | 0.4019 | 0.4189 | 0.4365 | 0.4547 |
| 80 | 0.4736 | 0.4931 | 0.5133 | 0.5342 | 0.5558 | 0.5781 | 0.6011 | 0.6249 | 0.6495 | 0.6749 |
| 90 | 0.7011 | 0.7281 | 0.7560 | 0.7848 | 0.8145 | 0.8451 | 0.8767 | 0.9093 | 0.9429 | 0.9775 |
| 100 | 1.01325 | 1.0499 | 1.0876 | 1.1256 | 1.1666 | 1.2079 | 1.2504 | 1.2941 | 1.3390 | 1.3852 |
| 110 | 1.4326 | 1.4814 | 1.5316 | 1.5831 | 1.6361 | 1.6905 | 1.7464 | 1.8038 | 1.8628 | 1.9233 |
| 120 | 1.9854 | 2.0491 | 2.1144 | 2.1814 | 2.2502 | 2.3208 | 2.3932 | 2.4674 | 2.5434 | 2.6213 |
| 130 | 2.7011 | 1.7829 | 2.8668 | 2.9528 | 3.041 | 3.130 | 3.222 | 3.317 | 3.414 | 3.513 |
| 140 | 3.614 | 3.717 | 3.823 | 3.931 | 4.042 | 4.155 | 4.271 | 4.389 | 4.510 | 4.634 |
| 150 | 4.760 | 4.889 | 5.020 | 5.155 | 5.293 | 5.433 | 5.576 | 5.723 | 5.872 | 6.024 |
| 160 | 6.180 | 6.339 | 6.502 | 6.667 | 6.836 | 7.008 | 7.183 | 7.362 | 7.545 | 7.731 |
| 170 | 7.929 | 7.114 | 8.311 | 8.511 | 8.716 | 8.925 | 9.137 | 9.354 | 9.574 | 9.799 |
| 180 | 10.027 | 10.497 | 10.497 | 10.738 | 10.984 | 11.234 | 11.488 | 11.747 | 12.011 | 12.280 |
| 190 | 12.553 | 12.830 | 13.112 | 13.400 | 13.692 | 13.989 | 14.291 | 14.598 | 14.910 | 15.228 |

TECHNICAL GUIDE

4.3 DENSITY OF GASES AND LIQUIDS

Density of liquids

| Description | kg-dm ³ |
|-------------------------|--------------------|
| Water | 1.0 |
| Sea water | 1.025 |
| Kerosene | 0.80 |
| Sulphuric acid, 100 % | 1.83 |
| Hydrochloric acid, 45 % | 1.48 |
| Caustic soda, 25 % | 1.27 |
| Carbon tetrachloride | 1.60 |
| Petrol | 0.65 – 0.80 |
| Benzole | 0.88 |
| Turpentine | 1.1 – 1.2 |
| Air | 1.29 |

Density of molecular weight of gases

| Description | Chem. formula | Density | Mol. weight |
|-------------------|-------------------------------|---------|-------------|
| Air | – | 1.000 | 28.97 |
| Ammonia | NH ₃ | 0.5963 | 17.03 |
| Carbon dioxide | CO ₂ | 1.5290 | 44.00 |
| Carbon monoxide | Co | 0.9670 | 28.00 |
| Chlorine | Cl ₂ | 2.486 | 70.91 |
| Ethylene | C ₂ H ₄ | 0.9749 | 28.03 |
| Helium | He | 0.1380 | 4.00 |
| Hydrogen | H ₂ | 0.0695 | 2.016 |
| Hydrogen sulphide | H ₂ S | 1.1900 | 34.08 |
| Methane | CH ₄ | 0.5544 | 16.03 |
| Chloromethane | CH ₃ Cl | 1.7848 | 50.48 |
| Nitrogen | N ₂ | 0.9672 | 28.02 |
| Nitrogen oxide | N ₂ O | 1.530 | 44.02 |
| Oxygen | O ₂ | 1.105 | 32.00 |
| Sulphur dioxide | SO ₂ | 2.264 | 65.06 |
| Natural gas | | 0.60 | |

TECHNICAL GUIDE

4.4 STEEL KEY

| Steel | ASTM | UNS No. | C | N | Cr | Ni | Mo | Other | EN | DN | SS | BS | Welded |
|---------|---------|---------|------|------|------|------|------|--------|--------|--------|------|---------|--------------|
| 201 | 201 | S 20100 | 0.05 | 0.15 | 17.0 | 5.0 | - | Mn | 1.4372 | - | - | 284 S16 | - |
| 301 | 301 | S 30100 | 0.10 | 0.04 | 17.0 | 7.0 | - | - | 1.4310 | 1.4310 | 2331 | 301 S21 | - |
| 303 | 303 | S 30300 | 0.06 | 0.06 | 17.5 | 8.1 | - | S | 1.4305 | 1.4305 | 2346 | 303 S31 | - |
| 304 | 304 | S 30400 | 0.04 | 0.06 | 18.5 | 8.7 | - | - | 1.4301 | 1.4301 | 2333 | 304 S31 | 308 L |
| 304 L | 304 L | S 30403 | 0.02 | 0.06 | 18.3 | 10.2 | - | - | 1.4306 | 1.4306 | 2352 | 304 S11 | 308 L |
| 304 LN | 304 LN | S 30453 | 0.02 | 0.15 | 18.5 | 9.5 | - | - | 1.4311 | 1.4311 | 2371 | 304 S61 | 308 L 2304 |
| 304 N | 304 N | S 30451 | 0.04 | 0.15 | 18.5 | 8.5 | - | - | 1.6907 | 1.6907 | - | 304 S71 | 308 L 2304 |
| 321 | 321 | S 32100 | 0.04 | 0.01 | 17.3 | 9.2 | - | Ti | 1.4541 | 1.4541 | 2337 | 321 S31 | 308 L |
| 347 | S 34700 | S 34700 | 0.04 | 0.04 | 17.5 | 9.5 | - | Cb | 1.4550 | - | 2338 | 347 S31 | 347 |
| 316 | 316 | S 31600 | 0.04 | 0.04 | 16.8 | 10.7 | 2.0 | - | 1.4401 | 1.4401 | 2347 | 316 S31 | 316 L |
| 316 | 316 | S 31600 | 0.04 | 0.06 | 17.0 | 11.0 | 2.7 | - | 1.4436 | 1.4436 | 2343 | 316 S33 | 316 L |
| 316 L | 316 L | S 31603 | 0.02 | 0.06 | 17.3 | 11.0 | 2.0 | - | 1.4404 | 1.4404 | 2348 | 316 S11 | 316 L |
| 316 L | 316 L | S 31603 | 0.02 | 0.06 | 17.0 | 11.7 | 2.7 | - | 1.4432 | 1.4432 | 2353 | 316 S13 | 316 L |
| 316 LN | 316 LN | S 31653 | 0.02 | 0.14 | 17.5 | 11.0 | 2.0 | - | 1.4406 | 1.4406 | - | 316 S61 | 316 L |
| 317 L | 317 L | S 31703 | 0.02 | 0.06 | 18.3 | 12.2 | 3.0 | - | 1.4438 | 1.4438 | 2367 | 317 S12 | 317 L |
| 317 LMN | S 31726 | S 31726 | 0.02 | 0.14 | 17.3 | 14.0 | 4.2 | - | 1.4439 | 1.4439 | - | - | P12 |
| 904 L | 904 L | N 08904 | 0.01 | 0.06 | 20.0 | 25.0 | 4.5 | Cu | 1.4539 | 1.4539 | 2562 | 904S13 | P12 |
| 254 SMO | S 31254 | S 31254 | 0.01 | 0.20 | 20.0 | 18.0 | 6.1 | Cu | 1.4547 | - | 2378 | - | P12, P16 |
| AL 6 XN | B 688 | N 08367 | 0.02 | 0.20 | 20.5 | 24.0 | 6.2 | - | - | 50049 | - | - | - |
| 20 Cb-3 | B 463 | N 08020 | - | - | - | - | - | - | - | 50049 | - | - | - |
| 2205 | S 31803 | S 31803 | 0.02 | 0.17 | 22.0 | 5.5 | 3.0 | - | 1.4462 | 1.4462 | 2377 | 318 S13 | 2205 |
| 409 | 409 | S 40900 | 0.02 | - | 11.0 | - | - | Ti | 1.4512 | 1.4512 | - | 409 S19 | 308 L, 309 L |
| 410 | 410 | S 41000 | 0.12 | - | 12.0 | - | - | - | 1.4006 | 1.4006 | 2302 | 410 S21 | 410 |
| 410 S | 410 S | S 41008 | 0.06 | - | 12.0 | - | - | - | 1.4000 | 1.4000 | 2301 | 403 S17 | 410 |
| 430 | 430 | S 43000 | 0.04 | - | 16.5 | - | - | - | 1.4016 | 1.4016 | 2320 | 430 S17 | 308 L, 309 L |
| 304 H | 304 H | S 30409 | 0.05 | 0.06 | 18.3 | 8.7 | - | - | 1.4948 | 1.4948 | 2333 | 304 S51 | 308 |
| 321 H | 321 H | S 32109 | 0.05 | 0.01 | 17.3 | 9.2 | - | Ti | 1.4878 | 1.4878 | 2337 | 321 S51 | 347 |
| 309 S | 309 S | S 30908 | 0.06 | 0.08 | 22.5 | 12.5 | - | - | 1.4833 | 1.4833 | - | 309 S16 | 309 |
| 310 S | 310 S | S 31008 | 0.05 | 0.06 | 25.0 | 20.0 | - | - | 1.4845 | 1.4845 | 2361 | 310 S16 | 310 |
| C-22 | B 575 | N 06022 | 0.01 | - | 22.0 | 56.0 | 13.0 | V 0.35 | - | 17750 | - | - | - |
| C-276 | B 575 | N 10276 | 0.01 | - | 16.0 | 57.0 | 16.0 | V 0.35 | - | 17750 | - | - | - |
| Monel | Monel | | | | | | | | | | | | |
| 400 | B 127 | N 04400 | 0.03 | - | - | 63.0 | - | - | - | 17743 | - | 3072 | - |
| Inconel | Inconel | | | | | | | | | | | | |
| 200 | B 162 | N 02200 | 0.15 | - | - | 99.0 | - | - | - | 17741 | - | 3072 | - |
| 600 | B 168 | N 06600 | 0.15 | - | 17.0 | 72.0 | - | - | - | 17742 | - | 3072 | - |
| 625 | B 443 | N 06625 | 0.10 | - | 23.0 | 58.0 | 10.0 | - | - | 17744 | - | 3072 | - |
| 800 HT | B 409 | N 08811 | 0.10 | - | 23.0 | 35.0 | - | - | - | 17460 | - | 3072 | - |
| 825 | B 424 | N 08825 | 0.05 | - | 23.5 | 46.0 | 3.5 | - | - | 17744 | - | 3072 | - |

TECHNICAL GUIDE

5.1 ACCEPTANCE SPECIFICATIONS

| No. | Specifications | Requirements, proofs |
|-----|--|--|
| 1 | Acceptance AD Code of Practice | Permitted materials: AD codes of practice in series W Material acceptance: AD codes of practice |
| 2 | Acceptance DIN 2470 Part 1 | Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B |
| 3 | Acceptance DIN 2470 Part 2 | Permitted materials: group WG 4 DIN 3230 Part 5 Test group: PG 2 DIN 3230 Part 5 Final acceptance: Inside diameters > DN 200: acceptance test certificate 3.1 C Inside diameters ≤ DN 200: acceptance test certificate 3.1 B Component-tested stop valves: 3.1 B |
| 4 | Factory sheet acceptance DIN 3545 | System-independent and system-based requirements and tests for steam traps according to certain test methods defined in DIN 3230 Part 3. Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B |
| 5 | Technical rules for steam boilers (TRD) | a) Material acceptance: officially recognised independent inspectors (TÜV) Proof: acceptance test certificate DIN 50049-3.1 A b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: officially recognised independent inspectors (TÜV) Proof: acceptance test certificate DIN 50049-3.1 A d) Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B |
| 6 | Technical rules for combustible liquids (TRbF 301) | Permitted materials: observe DIN 3230 Part 6 Final acceptance: Inside diameters > DN 200: acceptance test certificate 3.1 C Inside diameters ≤ DN 200: acceptance test certificate 3.1 B Component-tested valves (VdTÜV code of practice 1065): acceptance test certificate 3.1 B |

TECHNICAL GUIDE

5.1 ACCEPTANCE SPECIFICATIONS

| No. | Specifications | Requirements, proofs |
|-----|------------------------------|--|
| 7 | Lloyd's Register of Shipping | <ul style="list-style-type: none"> a) Material acceptance: Lloyd's Register of Shipping Proof: acceptance test certificate from Lloyd's Register of Shipping b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Lloyd's Register of Shipping Proof: acceptance test certificate from Lloyd's Register of Shipping |
| 8 | American Bureau of Shipping | <ul style="list-style-type: none"> a) Material acceptance: American Bureau of Shipping Proof: acceptance test certificate from the American Bureau of Shipping b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: American Bureau of Shipping Proof: acceptance test certificate from the American Bureau of Shipping |
| 9 | Det Norske Veritas | <ul style="list-style-type: none"> a) Material acceptance: Det Norske Veritas Proof: acceptance test certificate from Det Norske Veritas b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Det Norske Veritas Proof: acceptance test certificate from Det Norske Veritas |
| 10 | Germanic Lloyd | <ul style="list-style-type: none"> a) Material acceptance: Germanic Lloyd Proof: acceptance test certificate from Germanic Lloyd b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Germanic Lloyd Proof: acceptance test certificate from Germanic Lloyd |
| 11 | Bureau Veritas | <ul style="list-style-type: none"> a) Material acceptance: Bureau Veritas Proof: acceptance test certificate from Bureau Veritas b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Bureau Veritas Proof: acceptance test certificate from Bureau Veritas |

TECHNICAL GUIDE

5.1 ACCEPTANCE SPECIFICATIONS

| No. | Specifications | Requirements, proofs |
|-----|---|---|
| 12 | USSR Register of Shipping | Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B Final acceptance: USSR Register of Shipping Proof: acceptance test certificate from USSR Register of Shipping |
| 13 | Registro Italiano Navale | Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B Final acceptance: RINA Proof: acceptance test certificate from RINA |
| 14 | Register Boiler Regulations | Material acceptance: independent inspectors commissioned by the manufacturer Proof: acceptance test certificate from the independent inspectors commissioned Final acceptance: independent inspectors commissioned by the manufacturer Proof: acceptance test certificate from the independent inspectors commissioned |
| 15 | Final acceptance as per customer's instructions | Material acceptance: independent inspectors commissioned by the manufacturer Proof: according to customer's instructions Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1-B |

TECHNICAL GUIDE

5.1 ACCEPTANCE TESTS ON ALL VALVES

| Certificate to DIN 50049 | Test responsibility and signature | Delivery conditions | Basis of certificate |
|--|--|---|---|
| - 2.1 Manufacturer's certificate of compliance with order - 2.2 Manufacturer's certificate - 2.3 Manufacturer's test certificate | Manufacturing or processing plant | According to customer's instructions | Current operational inspections and knowledge of production Results from inspections of delivery or of the stated inspection units |
| - 3.1 A Acceptance test certificate A - 3.1 B Acceptance test certificate B - 3.1 C Acceptance test certificate C | Independent inspector named in the official specification From the production of independent inspectors Manufacturer's inspector Independent inspector commissioned by the customer | According to official specifications or the associated Technical Rules According to the customer's instructions, possibly also according to official specifications and the associated technical rules According to customer's instructions | Results of inspections of delivery or the stated inspection units |
| - 3.2 A Acceptance test report A - 3.2 C Acceptance test report C | As for acceptance test certificate A As for acceptance test certificate C Additional signature from the manufacturer's inspector | As for acceptance test certificate A As for acceptance test certificate C | As for acceptance test certificate A As for acceptance test certificate C |

TECHNICAL GUIDE

5.2 GENERAL RESISTANCE

| Material | Abbreviation | Properties | Thermal range of application |
|--------------------------------|--------------|--|------------------------------|
| Acrylonitrile-butadiene rubber | NBR | NBR has good mechanical properties, good low-temperature behaviour and a higher abrasion resistance than most other elastomers. It is highly resistant to mineral oils, HFA, HFB and HFC liquids. The ozone and weather resistance is limited. | -20°C to +90°C |
| Ethylene-propylene rubber | EPDM | EPDM is ideal for use in phosphate-ester-based hydraulic fluids, for glycol-based brake fluids, hot water and hot steam. It has good ozone and weather resistance but it is not resistant to mineral oil products. | -10°C to +120°C |
| Chlorosulphonated polyethylene | CSM | Good chlorine and weather resistance. Bad for oils and grease. | -10°C to +100°C |
| Fluorocarbon rubber | FPM | This material is excellent for high temperatures and has good chemical resistance. With applications in water and steam the upper temperature limit is approx. +60 °C. On account of its low permeability to gas FPM is suitable for high vacuums. However, it has good resistance to mineral oils, HFA, HFB and HFD fluids and is resistant to ozone and weather. | -25°C to +200°C |
| Silicone rubber | VSI | VSI behaves well at high and low temperatures, has good weather resistance and good physiological properties. It is the material of choice for hot air. Its mechanical properties are moderate and it is not resistant to mineral oils. VSI should not be used as a material for dynamic seals. | -50°C to +210°C |
| Polyurethane elastomer | AU | Polyurethane elastomers are split up into polyester urethanes (AU), which generally have the better mechanical properties, and polyether urethanes (EU), which have the better hydrolysis properties. Both have excellent resistance to wear, high crack resistance and elasticity, as well as low permeability to gas. AU has good resistance to mineral oils. | -20°C to +90°C |
| Polytetrafluoroethylene | PTFE | PTFE has virtually universal chemical resistance and very high thermal resistance. Its slip and electrical properties are very good, whilst resistance to weather and UV is excellent. The mechanical properties of PTFE are improved by adding various fillers. In areas with high exposure to radiation this plastic decomposes. | -50°C to +200°C |

TECHNICAL GUIDE

5.3 TRANSLATION TABLE OF TECHNICAL TERMS

| English | German | French | Italian | Spanish |
|---|---|--------------------------------------|--|--|
| Air Relief Valves | Entlüfter | Soupapes de décharge pour air | Valvole sfiate aria | Válvulas de alivio de aire |
| Automatic Control Valves | automatische Regelarmaturen | Soupapes de décharge automatiques | Valvole di controllo automatica | Válvulas automáticas de control |
| Ball (float) Valves | Schwimmerventile | Robinets à flotteur | Valvole a galleggiante | Válvulas de flotador |
| Ball Valves | Kugelhähne | Robinets à boisseau sphérique | Valvole a sfera | Válvulas de bola |
| Butterfly Valves | Drosselklappen | Vannes à papillon | Valvole a farfalla | Válvulas de mariposa |
| Ceramic Valves | Armaturen aus Keramik | Robinetterie en Céramique | Valvole ceramiche | Válvulas cerámicas |
| Check Valves | Rückschlagventile | Clapets de non retour | Valvole di ritegno | Válvulas de retención |
| Cocks | Hähne | Robinets | Rubinetti | Grifos |
| Diaphragm Valves | Membranventile | Robinets à diaphragme | Valvole diaframma | Válvulas de diafragma |
| Fusible Link Valves | Schmelzsicherungen | Robinets à pastille fusible | Valvole a fusibile | Válvulas de eclisa fundible |
| Flow Regulating Valves | Reguliventile | Soupapes régulatrices de débit | Valvole regolatrici del flusso | Válvulas reguladoras de caudal |
| Gate Valves | Schieber | Vannes à passages direct | Valvole a saracinesca | Válvulas de compuerta |
| Globe Valves | Durchgangsventile | Robinets à soupapes | Valvole a tappo | Válvulas de asiento |
| Lever & Weight Safety Valves | Sicherheitsventile mit Gewicht- oder Federbelastung | Soupapes de sûreté à contrepoids | Valvole di sicurezza a contrappeso | Válvulas de seguridad de contrapeso |
| Lubricated Plug | schmierbare Hähne | Robinets à boisseau lubrifiés | Rubinetti a maschio lubrificato | Válvulas de macho lubricado |
| Non-Lubricated Plug Valves | nicht schmierbare Hähne | Robinets à boisseau non-lubrifiés | Rubinetti a maschio non-lubrificato | Válvulas de macho no lubricado |
| Parallel Slide Valves | Parallel-Absperrschieber | Vannes à sièges parallèles | Valvole a sedi parallele | Válvulas de doble compuerta de caras paralelas |
| Pilot Operated Safety Valves | Sicherheitsventile mit Hilfssteuerung | Soupapes de sûreté à clapet pilote | Valvole di sicurezza servo-comandate | Válvulas de seguridad accionadas por piloto |
| Pinch Valves | Quetscharmaturen | Robinets à membrane | Valvole a manicotto deformabile | Válvulas de pinza |
| Plastic Valves | Armaturen aus Kunststoff | Robinetterie en plastique | Rubinetti a maschio lubrificato a valvole di plastica | Válvulas de plástico |
| Plug Valves | Hähne | Robinets à boisseau | Rubinetti a maschio | Válvulas de macho |
| Pressure Control Valves | Druckregler | Soupapes régulatrices de pression | Rubinetti a maschio lubrificato a valvole regolatrici di pressione | Válvulas reguladoras de presión |
| Pressure Reducing Valves | Druckminderer | Détendeurs de pression | Valvole reductrici di pressione | Válvulas reductoras de presión |
| Radiator Valves | Heizkörperarmaturen | Robinetterie pour radiateur | Valvole del termosifone | Válvulas para radiadores |
| Relief Valves | Überstromventile | Soupapes de décharge | Valvole di sfioro | Válvulas de alivio |
| Safety Valves | Sicherheitsventile | Soupapes de sûreté | Valvole di sicurezza | Válvulas de seguridad |
| Spring Loaded | federbelastet | Soupapes de sûreté a ressort | Valvole di sicurezza a molla | Válvulas de seguridad con resortes |
| Stop Valves | Absperrventile | Robinets d'arrêt | Valvole d'intercettazione | Válvulas de interrupción |
| Temperature Regulating Valves | Temperaturregler | Soupapes régulatrices de température | Valvole regolatrici di temperatura | Válvulas reguladoras de temperatura |
| Thermostatic Mixing Valves | thermostatische Mischhähne | Mitigeurs thermostatiques | Valvole miscelatrici termostatiche | Válvulas mezcladoras termostáticas |

TECHNICAL GUIDE

5.4 SYMBOLS FOR VALVES

| Type | | Description, remarks | Type | | Description, remarks |
|--|-----------|--|-----------------------------------|----------|--|
| Group | Sub-group | | Group | Sub-goup | |
| | | Valve, general | Direction, branch or union | | |
| | | Stop valve | | | Globe valve |
| | | Slide valve | | | Angle valve |
| | | Stop cock | | | Three-way valve |
| | | Butterfly valve | | | Four-way valve |
| | | Control valve | Actuators | | |
| | | Valve with continuous control | | | Manual actuator |
| | | Valve with safety function | | | Motorised actuator |
| Stop valves | | | | | Electromagnetic actuator |
| | | Stop ball valve | | | Fluid actuator (hydraulic or pneumatic) |
| | | Stop cone valve, plug valve | | | Diaphragm actuator |
| | | Stop valve, closed | | | Piston actuator |
| | | Stop valve, open | | | Control against fixed weight |
| Valves with control/regulation function | | | | | Control against fixed spring force |
| | | Pressure reducing valve (after-pressure controller) | | | Float actuator |
| | | Relief valve (pilot pressure controller) | | | Expansion actuator valve |
| Valves with safety function | | | Connections | | |
| | | Safety valve | | | Flanged |
| | | Safety valve, spring loaded, globe type | | | Welded |
| | | Safety valve, weight-loaded, angle type | | | Bolted |
| | | Back flow preventer | | | Inserted |
| | | Check valve | | | |
| | | Swing type check valve | | | |
| | | Venting and air relief valve | | | |
| | | Fire damper | | | |
| | | Bursting disc, curved | | | |

TECHNICAL GUIDE

5.5 ABBREVIATIONS FOR NAMES OF STANDARDS

| | | | |
|-----------|---|----------|--|
| AA | Aluminium Association | IRE | Institute of Radio Engineers |
| AAR | Association of American Railroads | IRS | Indian Railway Specification |
| AASHO | American Association of State Highway Officials | ISA | International Federation of the National Standardizing Associations |
| ABCQ | Associação Brasileira de Contrôlo de Qualidade | ISI | Indian Standards Institution |
| ABNT | Associação Brasileira de Normas Técnicas | ISO | International Standard Organisation |
| ABS | American Bureau of Shipping | IVBH | Internationale Vereinigung für Brücken und Hochbau |
| ACI | Alloy Casting Institute | IWG | Imperial Wire Gauge |
| AD | Arbeitsgemeinschaft Druckbehälter | JAN | Joint Army-Navy Specification |
| AEC | Atomic Energy Commission | JIS | Japanese Industrial Standards |
| AECMA | Association Européenne des Constructeurs de Matériel Aérospatial, Paris | JSA | Japanese Standard Association |
| AENOR | Asociación Española de Normalización y Certificación | JUS | Jugoslawische Norm |
| AFNOR | Association Française de Normalisation | KBS | Kenya Bureau of Standards |
| AFW | Akademie für Führungskräfte der Wirtschaft e.V. | LR | Lloyd's Register of Shipping |
| AIEE | American Institute of Electrical Engineers | LSG | Legal Standard Gauge (= IWG) |
| AISE | Association of Iron and Steel Engineers | LW | Werkstoff-Handbuch der Deutschen Luftfahrt |
| AISI | American Iron and Steel Institute | LWG | Legal Wire Gauge (= IWG) |
| AMS | Aerospace Materials Specification | M | Siemens-Martin-Stahl, Siemens-Martin-Verfahren |
| ANP | Ausschuss Normenpraxis im DIN | Mat-A. | Materialamt der Bundeswehr |
| ANSI | American National Standards Institute | MIC | Ministério da Industria e do Comercio (Brasilien) |
| API | American Petroleum Institute | MIL | Military Specification, Washington |
| ARSO | African Regional Standards Organization | MSZ | Ungarische Norm |
| A.S. | Australian Standard Specification | N | Newton |
| ASA | American Standard Association | NASA | National Aeronautics and Space Administration |
| ASME | American Society of Mechanical Engineers | NACE | National Association of Corrosion Engineers |
| ASMO | Arab Organization for Standardization and Metrology | NB | Nominal Bore (= Nennweite) |
| ASRE | American Society of Refrigerating Engineers | NBN | Normes Belges normalisées |
| ASSAB | Associated Swedish Steel AB | NBS | National Bureau of Standards |
| ASTM | American Society for Testing and Materials | ND | Nenndruck |
| AWF | Ausschuss für Wirtschaftliche Fertigung e.V. | NEMA | National Electrical Manufacturer Association |
| AWS | American Welding Society | NEN | Norm des Nederlands Normalisatie-Instituut |
| AWV | Ausschuss für wirtschaftliche Verwaltung e.V. | NF | Norme Française |
| BC | British Cooperation Register | NNI | Nederlands Normalisatie-Instituut |
| BCIRA | British Cast Iron Research Association | NOF | Schweizerische Normenpraxis |
| BDS | Bulgarische Norm | NSF | Norges Standardiseringsforbund |
| BIBB | Bundesinstitut für Berufsbildung | NSO | Nigerianische Normenorganisation |
| BS (I) | British Standards (Institution) | NW | Nennweite |
| BV | Bureau Veritas, Paris | ÖNORM | Norm des österreichischen Normungsinstituts |
| BWB | Bundesamt für Wehrtechnik und Beschaffung | PASC | Pacific Area Standards Congress |
| BWG | Birmingham Wire Gauge | PN | Polnische Norm |
| CARICOMCO | Caribbean Common Market Standards Council | QO-S | Federal Specification, Washington |
| CAS | Normenorganisation der Volksrepublik China | RAL | Ausschuss für Lieferbedingungen und Gütesicherung beim DNA |
| CCITB | China Commodity Inspection and Testing Bureau | REFA | Verband für Arbeitsstudien e.V. |
| CDA | Copper Development Association | RKW | Rationalisierungskuratorium der Deutschen Wirtschaft |
| CEN | Europäisches Komitee für Normung (Comité Européen de Normalisation) | RTMA | Radio-Electronics-Television Manufacturers Association |
| CENIM | Centro Nacional de Investigaciones Metalúrgicas | SAA | Standards Association of Australia |
| CERN | Conseil Européen pour la Recherche Nucléaire | SAE | Society of Automotive Engineers |
| CI | Cast Iron | SEW | Stahl-Eisen-Werkstoffblatt |
| CMEA | Council for Mutual Economic Assistance | SFS | Suomen Standardisoimisliitto r.y. |
| COLIME | Comité de Liaison des Industries Métalliques Européennes | SI | Internationales Einheitssystem |
| COPANT | Pan American Standards Commission | SINMETRO | Sistema Nacional de Metrologia Normalização e Qualidade Industrial (Brasilien) |
| CS | Commercial Standard | SIS | Svensk Industrie Standard |
| CSA | Canadian Standards Association | SME | Society of Manufacturing Engineers |
| CSN | Tschechoslowakische Norm | SNCF | Société Nationale des Chemins de Fer (France) |
| DEK | Deutsche Echtheitskommission | STAS | Rumänische Norm |
| DGOR | Deutsche Gesellschaft für Operations Research | SWG | Imperial Standard Wire Gauge (= IWG) |
| DGQ | Deutsche Gesellschaft für Qualität | TBS | Tanzania Bureau of Standards |
| DIN | Deutsches Institut für Normung e.V. | TGL | DDR-Norm * |
| DNA | Deutscher Normenausschuss | TI | Tube Investment |
| DNV | Det Norske Veritas | TL | Technische Lieferbedingungen |
| DS | Dansk Standardiseringsraad | TLDB | Technische Lieferbedingungen der Deutschen Bundesbahn |
| DVM | Deutscher Verband für Materialprüfung | TMCA | Titanium Metals Corporation of America |
| DVS | Deutscher Verband für Schweißtechnik e.V. | TÜV | Technischer Überwachungsverein |
| EGKS | Europäische Gemeinschaft für Kohle und Stahl | UEAtc | Europäische Union für technische Zulassungen |
| EIA | Electronic Industries Association | UIC | Union Internationale des Chemins de Fer (Internationaler Eisenbahnverband) |
| EN | Europäische Norm | UNE | Spanische Norm |
| EU | EURONORM | UNI | Unificazione Italiana (Ente Nazionale Italiano di Unificazione) |
| EOS | Ägyptische Normenorganisation | UNS | Unified Numbering System |
| ESI | Äthiopisches Normeninstitut | UNSIDER | Sezione DI UNIFICAZIONE SIDERURGICA (Italien) |
| ESU | Elektroschlacke-Umschmelzverfahren | VDA | Verband der Automobilindustrie |
| GAEB | Gemeinsamer Ausschuss „Elektronik Im Bauwesen“ | VDE | Verband Deutscher Elektrotechniker |
| GIC | Gray Iron Casting | VDEh | Verein Deutscher Eisenhüttenleute |
| GL | Germanischer Lloyd | VDI | Verein Deutscher Ingenieure |
| GOST | Sowjetische Norm (Gosudarstvenny Standart) | VDMA | Verein Deutscher Maschinenbau-Anstalten |
| GTZ | Deutsche Gesellschaft für Technische Zusammenarbeit | VdTÜV | Vereinigung der Technischen Überwachungsvereine |
| IBN | Institut Beilge de Normalisation | Wbl | Werkstoffblatt |
| ICI | Imperial Chemical Industries | WW | Werkstoff-Handbuch der Wehrtechnik |
| IEC | Internationale Elektrotechnische Kommission | ZDA | Zinc Development Association, London |
| INMETRO | Instituto de Metrologia Normalização e Qualidade Industrial (Brasilien) | ZMD | Zentralstelle für maschinelle Dokumentation |
| INPM | Instituto de Pesos e Medidas (Brasilien) | | * only for reference purposes |

TECHNICAL GUIDE

5.6 EXPLOSION PROTECTION

| Description | EEx...I for mining EEx...II for all other sectors | | |
|--------------------------------|--|---------------------------------------|--|
| | Symbol | EN... | Installer regulations for Germany |
| General provisions | | 50014 | DIN 57165 or. VDE 0165 and DIN/EN 50039 |
| Oil enclosure | o | 50015 | |
| Excess pressure enclosure | p | 50016 | |
| Sand enclosure | q | 50017 | |
| Pressure-resistant enclosure | d | 50018 | |
| Increased safety | e | 50019 | |
| Intrinsic safety | ia, ib | 50020 | |
| Encapsulation | m | 50028 | |
| Intrinsically safe systems | i | 50039 | |
| Explosion categories | IIA, IIB, IIC after minimum ignition in the case of „i“ or maximum permitted gap in the case of „d“ | | |
| Temperature class of equipment | T1 - 450 °C T3 - 200 °C T5 - 100 °C | T2 - 300°C T4 - 135°C T6 - 85°C | |

Explanation of the table on the following page:

- 1) Extract from the table „Safety parameters of combustible gases and vapours“ in accordance with VDE 0165, September 1983.
- 2) The numbering (column 1) under which the substances are listed coincides with the consecutive numbers in the aforementioned table.
- 3) The terms flash point (column 3), ignition temperature (column 4), temperature compensation (column 5) and explosion category (column 6) are explained in section 2.
- 4) For the substances the explosion categories has not yet been determined.
- 5) The ignition temperature of these hydrocarbon compounds depends on composition; in special cases it may be above 300 °C. Compare the relevant footnotes in the aforementioned table.
- 6) The flash point chiefly depends on when the respective hydrocarbon compound begins to boil. Compare to the relevant preliminary remarks and footnotes in annex II and III of the aforementioned table, including supplement 5. The limit values of the flashpoints of diesel fuels and EL,L,M and S fuel oil are in accordance with DIN 51601 and DIN 51603, part 1 and 2 of the terms of delivery.
- 7) Also explosion group IIB + CS2.
- 8) Also explosion group IIB + H2.

TECHNICAL GUIDE

5.6 EXPLOSION PROTECTION Safety parameters of combustible gases and vapours

| 1 No. ²⁾ | 2 Name of substance | 3 Flash point ³⁾ °C | 4 Ignition temp. ³⁾ °C | 5 Temperature class | 6 Explosion group ³⁾ |
|------------------------|--|--|--|------------------------|------------------------------------|
| 2 | Acetaldehyde | < -20 | 140 | T4 | IIA |
| 6 | Acetone | < -20 | 540 | T1 | IIA |
| 14 | Acetylene | (gas) | 305 | T2 | IIC ⁹⁾ |
| 20 | Ethane | (gas) | 515 | T1 | IIA |
| 24 | Ethyl acetate | -4 | 460 | T1 | IIA |
| 27 | Ethyl ether | < -20 | 180 Peroxide formation | T4 | IIB |
| 28 | Ethyl alcohol | 12 | 425 | T2 | IIB/IIA |
| 52 | Ethyl chloride | (gas) | 510 | T1 | IIA |
| 58 | Ethylene | (gas) | 425 | T2 | IIB |
| 64 | Ethylene oxide | (gas) | 440 Spontan. decomposit. | T2 | IIB |
| 67 | Ethyl glycol | 40 | 235 | T3 | - ⁴⁾ |
| 103 | Ammonia | (gas) | 630 | T1 | IIA |
| 106 | i-Amyl acetate | 25 | 380 | T2 | IIA |
| | Benzenes, petrol | < 21 ⁶⁾ | 220 to 300 ⁵⁾ | T3 | IIA |
| | Boiling point <135 °C | | | | |
| II/III | Special benzenes | > 21 ⁶⁾ | 220 to 300 ⁵⁾ | T3 | IIA |
| | Boiling point >135 °C | | | | |
| 135 | Benzole (pure) | -11 | 555 | T1 | IIA |
| 152 | n-Butane | (gas) | 365 | T2 | IIA |
| 165 | n-Butyl alcohol | 35 | 340 | T2 | IIA |
| 243 | Cyclohexanone | 43 | 430 | T2 | IIA |
| 324 | 1,2- Dichlorethane | 13 | 440 | T2 | IIA |
| II/17 | Diesel fuels DIN 51 601/04.78 | > 55 ⁶⁾ | 220 to 300 ⁵⁾ | T3 | IIA |
| II/16 | Jets fuels | < -20 to 60 ⁶⁾ | 220 to 300 ⁵⁾ | T3 | IIA |
| 421 | Acetic acid | 40 | 485 | T1 | IIA |
| 422 | Acetic acid anhydride | 49 | 330 | T2 | IIA |
| II/21 | EL fuel oil DIN 51 603 Part 1/12.81 | > 55 ⁶⁾ | 220 to 300 ⁵⁾ | T3 | IIA |
| II/22 | L fuel oil DIN 51 603 Part 2/10.76 | > 55 ⁶⁾ | 220 to 300 ⁵⁾ | T3 | IIA |
| II/23 und 24 | M and S fuel oils DIN 51 603 Part 2/10.76 | > 65 ⁶⁾ > 65 ⁶⁾ | 220 to 300 ⁵⁾ 220 to 300 ⁵⁾ | T3 T3 | IIA IIA |
| 448 | n-Hexane | < -20 | 240 | T3 | IIA |
| 469 | Carbon monoxide | (gas) | 605 | T1 | IIA |
| 485 | Methane | (gas) | 595 (650) | T1 | IIA |
| 503 | Methanol | 11 | 455 | T1 | IIA |
| 519 | Methyl chloride | (gas) | 625 | T1 | IIA |
| 564 | Naphtalene | 80 | 520 | T1 | IIA |
| 600 | Oleic acid | 189 | 360 Spontan. decomposit. | T2 | - ⁴⁾ |
| 616 | Phenol | 82 | 595 | T1 | IIA |
| 637 | Propane | (gas) | 470 | T1 | IIA |
| 650 | n-Propyl alcohol | 15 | 405 | T2 | - ⁴⁾ |
| 681 | Carbon bisulphide | < -20 | 95 ¹⁾ | T6 ¹⁾ | IIC ⁷⁾ |
| 682 | Hydrogen sulphide | (gas) | 270 | T3 | IIB |
| I/6 | Town gas (lightning gas) | (gas) | ca. 560 | T1 | IIB |
| 699 | Tetraline (tetrahydronaphtalene) | 77 | 425 | T2 | - ⁴⁾ |
| 709 | Toluene | 6 | 535 | T1 | IIA |
| 777 | Hydrogen | (gas) | 560 | T1 | IIC ⁸⁾ |

TECHNICAL GUIDE

Materials in accordance with DIN / EN / ASTM

Stainless steels

| Material no. | DIN | | EN | | ASTM |
|--------------|----------|--------------------|----------|----------------------|----------------|
| | Standard | Description | Standard | Description | |
| 1.4000 | 17440 | X6Cr13 | 10088-3 | X6Cr13 | A276 Gr. 403 |
| 1.4006 | 17440 | X10Cr13 | 10088-3 | X12Cr13 | A276 Gr. 410 |
| 1.4021 | 17440 | X20Cr13 | 10088-3 | X20Cr13 | A276 Gr. 420 |
| 1.4057 | 17440 | X20CrNi17 2 | 10088-3 | X17CrNi16-2 | A276 Gr. 431 |
| 1.4104 | 17440 | X12CrMoS17 | 10088-3 | X14CrMoS17 | AISI Gr. 430 F |
| 1.4301 | 17440 | X5CrNi18 10 | 10088-3 | X5CrNi18-10 | A276 Gr. 304 |
| 1.4305 | 17440 | X5CrNi18 9 | 10088-3 | X8CrNi18-9 | AISI Gr. 303 |
| 1.4310 | SEW400 | X12CrNi17 7 | 10088-3 | X10CrNi18-8 | A313 Gr. 302 |
| 1.4401 | 17440 | X5CrNiMo17 12 2 | 10088-3 | X5CrNiMo17-12-2 | A276 Gr. 316 |
| 1.4404 | 17440 | X2CrNiMo17 13 2 | 10088-3 | X2CrNiMo17-12-2 | A276 Gr. 316L |
| 1.4406 | 17440 | X2CrNiMoN17 12 2 | 10088-3 | X2CrNiMoN17-11-2 | A276 Gr. 316LN |
| 1.4418 | SEW400 | X4CrNiMo16 5 | 10088-3 | X4CrNiMo16-5-1 | - |
| 1.4436 | 17440 | X5CrNiMo17 13 3 | 10088-3 | X3CrNiMo17-13-3 | A276 Gr. 316 |
| 1.4439 | 17440 | X2CrNiMoN17 13 5 | 10088-3 | X2CrNiMoN17-13-5 | A312 |
| 1.4462 | 17440 | X2CrNiMoN22 5 3 | 10088-3 | X2CrNiMoN22-5-3 | A182 Gr. F51 |
| 1.4529* | SEW400 | X1CrNiMoCuN25 20 6 | 10088-3 | X1CrNiCrMoCuN25-20-7 | UNS N08926 |
| 1.4539 | 17440 | X1CrNiMoCuN25 20 5 | 10088-3 | X1CrNiCrMoCu25-20-5 | UNS N08904 |
| 1.4541 | 17440 | X6CrNiTi18 10 | 10088-3 | X6CrNiTi18-10 | A240 Gr. 321 |
| 1.4571 | 17440 | X6CrNiMoTi17 12 2 | 10088-3 | X6CrNiMoTi17-12-2 | A240 Gr. 316Ti |

* Avesta 254 SMO

Steel, unalloyed and low-alloy

| Material no. | DIN | | EN | | ASTM |
|--------------|----------|-------------|----------|--------------|-----------------|
| | Standard | Description | Standard | Description | |
| 1.0035 | 17100 | St 33 | 10025 | S185 | A 283 Gr. A |
| 1.0037 | 17100 | St 37-2 | 10025 | S235 JR | A 283 Gr. C |
| 1.0038 | 17100 | RSt 37-2 | 10025 | S235 JR G2 | A 283 Gr. B+C |
| 1.0050 | 17100 | St 50-2 | 10025 | E295 | A 570 Gr. 50 |
| 1.0116 | 17100 | St 37-3N | 10025 | S235 JR G3 | A 570 Gr. 36 |
| 1.0570 | 17100 | St52-3 | 10025 | S355 J2 G3 | A 572 Gr. 50 |
| 1.0402 | 17200 | C22 | 10083 | C22 | A 576 Gr. 1020 |
| 1.0425 | 17155 | H11 | 10028 | P265 GH | A 285 Gr. B |
| 1.0460 | 17243 | C22.8 | 10273 | C22 G2 | A 10 5 |
| 1.0501 | 17240 | C35 | 10083 | C35 | A576 Gr. 1035 |
| 1.0718 | 1651 | 9 SMnPb28 | 10087 | 11 SMn Pb 30 | SAE 12L14 |
| 1.0509 | 17240 | C45 | 10083 | C45 | A 576 Gr. 1045 |
| 1.7225 | 17200 | 42CrMo4 | 10083 | 42CrMo4 | A 322 Gr. 4170 |
| 1.7131 | 17210 | 16MnCr5 | 10084 | 16MnCr5 | A 304 Gr. 4118H |
| 1.7218 | 17200 | 25CrMo4 | 10083 | 25CrMo4 | A 322 Gr 4130 |
| 1.7335 | 17155 | 13CrMo44 | 10028 | 13CrMo4-5 | A182 Gr. F12 |
| 1.8159 | 17200 | 50CrV4 | 10083 | 51CrV4 | A322 Gr 6150 |

TECHNICAL GUIDE

Materials in accordance with DIN / EN / ASTM

Cast materials

| Material no. | DIN | | EN | | ASTM |
|--------------|----------|-------------------|----------|-------------------|-------------------|
| | Standard | Description | Standard | Description | |
| 0.6025 | 1691 | GG-25 | 1561 | GJL-250 | A48 Gr. 40B |
| 0.7040 | 1693 | GGG-40 | 1563 | GJS-400-15 | A536 Gr. 60-40-18 |
| 0.7043 | 1693 | GGG-40.3 | 1563 | GJS-400-18LT | - |
| 1.0619 | 17245 | GS-C25 | 10213-1 | GP 240 GH | A216 Gr. WCB |
| 1.4308 | 17445 | G-X6CrNi18 9 | 10213-4 | G X5CrNi19-10 | A351 Gr. CF8 |
| 1.4408 | 17445 | G-X6CrNiMo18 10 | 10213-4 | G X5CrNiMo19-11-2 | A351 Gr. CF8M |
| 1.4469 | 17445 | G-X2CrNiMoN25 7 4 | 10213-4 | G X2CrNiMoN26-7-4 | Alloy SX |
| 1.4008 | 17445 | G-X12Cr14 | 10283 | GX8CrNi13 | A217 Gr. CA15 |
| 2.0975 | 1714 | G-CuAl10Ni | 1982 | CuAl10Fe5Ni5-C | C95 800 |
| 2.4617 | - | Hastelloy B-2 | - | - | UNS N10665 |
| 3.2163 | 1725 T2 | G-AlSi9Cu3 | - | - | AA B380.1 |

Fasteners

| Material no. | DIN | | EN | | ASTM | |
|----------------------|----------|-----------------|----------|-----------------|------|------|
| | Standard | Description | Standard | Description | A193 | A194 |
| 1.0501 | 17240 | C35 | 10083 | C35 | 2H | 4 |
| 1.7225 ³⁾ | 17200 | 42CrMo4 | 10083 | 42CrMo4 | B7 | - |
| 1.7258 | 17240 | 24CrMo4 | - | 24CrMo4 | - | 4 |
| 1.7711 | 17240 | 40CrMoV47 | 10269 | 40CrMoV4-7 | B16 | - |
| 1.4301 ¹⁾ | 17440 | X5CrNi18 10 | 10088-3 | X5CrNi18-10 | B8 | 8 |
| 1.4541 ¹⁾ | 17440 | X6CrNiTi18 10 | 10088-3 | X6CrNiTi18-10 | B8T | 8T |
| 1.4401 ²⁾ | 17440 | X5CrNiMo17 12 2 | 10088-3 | X5CrNiMo17-12-2 | B8M | 8M |
| 1.4021 | 17440 | X20Cr13 | 10088-3 | X20Cr13 | B6 | 6 |

1) A2-70 DIN 267 T18

2) A4-70 DIN 267 T18

3) Also ASTM A320 Gr. L7 for low temperature



Head office:
EBRO ARMATUREN
Gebr. Bröer GmbH
☎ +49 (0) 23 31 9 04 0
Fax +49 (0) 23 31 9 04 111



EBRO ARMATUREN
Gebr. Bröer GmbH
Niederlassung Hamburg
☎ +49 (0) 40 64 50 37 0
Fax +49 (0) 40 64 50 37 20



EBRO ARMATUREN
Gebr. Bröer GmbH
Niederlassung Leipzig
☎ +49 (0) 3 42 05 8 40 91
Fax +49 (0) 3 42 05 8 40 93



VANNES EBRO S.a.r.l.
☎ +33 (0) 1 34 28 41 41
Fax +33 (0) 1 34 28 41 40



EBRO ARMATUREN Advies B.V.
☎ +31 (0) 7 56 12 78 78
Fax +31 (0) 7 56 12 78 79



EBRO ARMATUREN Est. & Co. KG
☎ +41 (0) 4 17 48 59 59
Fax +41 (0) 4 17 48 59 99



EBRO ARMATUREN
Gesellschaft m.b.H.
☎ +43 (0) 18 65 96 04 0
Fax +43 (0) 18 65 96 04 20



EBRO VALVES Co. Ltd.
☎ +66 (0) 27 45 78 20 31
Fax +66 (0) 27 45 78 32 33



EBRO ARMATUREN Sp.zo.o.
Rep. Office Poland
☎ +48 (0) 2 26 69 00 90
Fax +48 (0) 2 26 69 03 11



EBRO ARMATUREN Kft.
☎ +36 (0) 12 01 76 07
Fax +36 (0) 12 01 76 07



EBROINDO Arkasa Ltd.
☎ +62 (0) 2 16 51 82 31
Fax +62 (0) 2 16 50 57 48



EBRO VALVOLE S.r.l.
☎ +39 (0) 3 02 16 13 92
Fax +39 (0) 3 02 16 13 93



EBRO ARMATUREN
Pacific PTY. Ltd.
☎ +61 (0) 2 95 26 15 44
Fax +61 (0) 2 95 26 28 89



EBRO VALVES Co. Ltd.
☎ +44 (0) 12 83 55 21 43
Fax +44 (0) 12 83 55 27 51



EBRO ARMATUREN S.L.
☎ +34 (0) 96 14 14 0 21
Fax +34 (0) 96 14 14 0 20



EBRO ARMATUREN Co. Ltd.
☎ +86 (0) 10 67 89 20 31
Fax +86 (0) 10 67 89 20 30



EBRO ARMATUREN
PHILIPPINES INC.
☎ +63 (0) 26 33 78 49
Fax +63 (0) 26 33 78 48



EBRO ARMATUREN SVTLS
☎ +90 (0) 21 63 64 99 03
Fax +90 (0) 21 63 64 99 16



EBRO ARMATUREN
Rep. Office Middle East
☎ +97 (0) 1 43 39 43 55
Fax +97 (0) 1 43 39 43 66



EBRO VALVES
Rep. Office Vietnam
☎ +84 (0) 88 25 85 94
Fax +84 (0) 88 25 85 94



EBRO ARMATUREN USA Inc.
☎ +1 (0) 28 18 07 97 00
Fax +1 (0) 28 18 07 99 62



EBRO ARMATUREN s.r.o.
☎ +42 (0) 5 45 21 38 95
Fax +42 (0) 5 45 21 60 26



EBRO ARMATUREN
Rep. Office Russia
☎ +7 (0) 81 25 79 96 70
Fax +7 (0) 81 25 79 96 70



E.A. INDUSTRIAL VALVES Ltd.
☎ +98 (0) 763 544 33 62
Fax +98 (0) 763 544 32 20