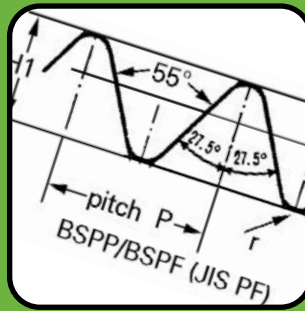
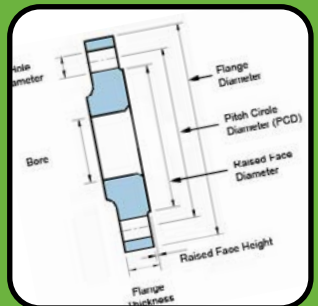
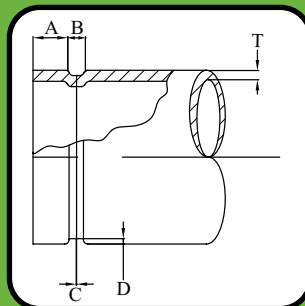
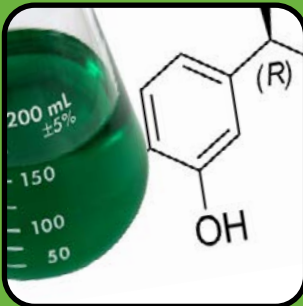


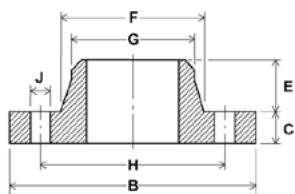


**09**



**TECHNICAL DATA**

## 10.01 | Flange Specification (AS 2129)



WELDING NECK

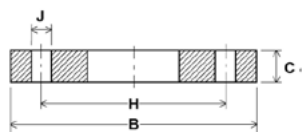
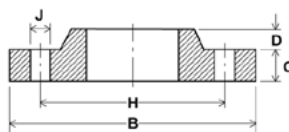
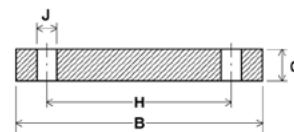


PLATE SLIP-ON WELDING



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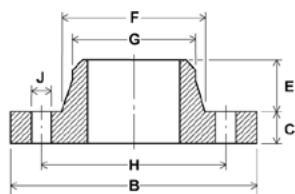
### TABLE D

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                 | Length Through Hub |                        | Diameter at Large End of Neck | Diameter at Small End of Neck | Drilling Data        |                        |                 |
|-------------------|--------|--------------------------|-------------------------|---------------------|-----------------|--------------------|------------------------|-------------------------------|-------------------------------|----------------------|------------------------|-----------------|
|                   |        |                          |                         | Copper Alloy        | Plate or Forged | Length of Boss     | Length of Welding Neck |                               |                               | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                   | C               | D                  | E                      | F                             | G                             | H                    | J                      | K               |
| 15                | 1/2"   | 21.3                     | 95                      | 6                   | 5               | 10                 | 22                     | 27                            | 22                            | 67                   | 14                     | 4               |
| 20                | 3/4"   | 26.7                     | 100                     | 6                   | 5               | 11                 | 22                     | 33                            | 27                            | 73                   | 14                     | 4               |
| 25                | 1"     | 33.4                     | 115                     | 8                   | 5               | 11                 | 22                     | 43                            | 34                            | 83                   | 14                     | 4               |
| 32                | 1 1/4" | 42.2                     | 120                     | 8                   | 6               | 11                 | 26                     | 49                            | 43                            | 87                   | 14                     | 4               |
| 40                | 1 1/2" | 48.3                     | 135                     | 10                  | 6               | 13                 | 29                     | 59                            | 49                            | 98                   | 14                     | 4               |
| 50                | 2"     | 60.3                     | 150                     | 10                  | 8               | 13                 | 29                     | 70                            | 61                            | 114                  | 19                     | 4               |
| 65                | 2 1/2" | 73                       | 165                     | 11                  | 8               | 16                 | 32                     | 83                            | 76                            | 127                  | 19                     | 4               |
| 80                | 3"     | 88.9                     | 185                     | 13                  | 10              | 16                 | 35                     | 102                           | 89                            | 146                  | 19                     | 4               |
| 100               | 4"     | 114.3                    | 215                     | 16                  | 10              | 19                 | 41                     | 130                           | 115                           | 178                  | 19                     | 4               |
| 125               | 5"     | 141.3                    | 255                     | 17                  | 13              | 19                 | 44                     | 152                           | 142                           | 210                  | 19                     | 8               |
| 150               | 6"     | 168.3                    | 280                     | 17                  | 13              | 19                 | 48                     | 187                           | 169                           | 235                  | 19                     | 8               |
| 200               | 8"     | 219.1                    | 335                     | 19                  | 13              | 22                 | 51                     | 241                           | 220                           | 292                  | 19                     | 8               |
| 250               | 10"    | 273.8                    | 405                     | 19                  | 16              | 27                 | 64                     | 292                           | 274                           | 356                  | 22                     | 8               |
| 300               | 12"    | 323.8                    | 455                     | 22                  | 19              | 29                 | 70                     | 343                           | 324                           | 406                  | 22                     | 12              |
| 350               | 14"    | 355.6                    | 525                     | 25                  | 22              | -                  | 73                     | 387                           | 356                           | 470                  | 26                     | 12              |
| 400               | 16"    | 406.4                    | 580                     | 25                  | 22              | -                  | -                      | -                             | -                             | 521                  | 26                     | 12              |
| 450               | 18"    | 457                      | 640                     | 29                  | 25              | -                  | -                      | -                             | -                             | 584                  | 26                     | 12              |
| 500               | 20"    | 508                      | 705                     | 32                  | 29              | -                  | -                      | -                             | -                             | 641                  | 26                     | 16              |
| 600               | 24"    | 610                      | 825                     | 35                  | 32              | -                  | -                      | -                             | -                             | 756                  | 30                     | 16              |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Thickness dimension include raised face
- Available with or without raised face
- Pipe diameter to ANSI standard
- Bore to suit customers pipe

## 10.02 | Flange Specification (AS 2129)



WELDING NECK

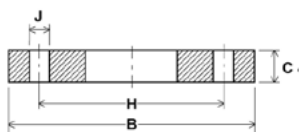
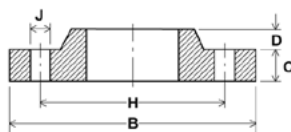
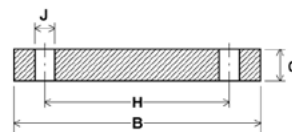


PLATE SLIP-ON WELDING



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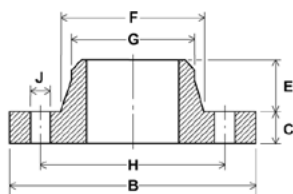
### TABLE E

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                 | Length Through Hub |                        | Diameter at Large End of Neck | Diameter at Small End of Neck | Drilling Data        |                        |                 |
|-------------------|--------|--------------------------|-------------------------|---------------------|-----------------|--------------------|------------------------|-------------------------------|-------------------------------|----------------------|------------------------|-----------------|
|                   |        |                          |                         | Copper Alloy        | Plate or Forged | Length of Boss     | Length of Welding Neck |                               |                               | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                   | C               | D                  | E                      | F                             | G                             | H                    | J                      | K               |
| 15                | 1/2"   | 21.3                     | 95                      | 6                   | 6               | 10                 | 22                     | 27                            | 22                            | 67                   | 14                     | 4               |
| 20                | 3/4"   | 26.7                     | 100                     | 6                   | 6               | 11                 | 22                     | 33                            | 27                            | 73                   | 14                     | 4               |
| 25                | 1"     | 33.4                     | 115                     | 8                   | 7               | 11                 | 22                     | 43                            | 34                            | 83                   | 14                     | 4               |
| 32                | 1 1/4" | 42.2                     | 120                     | 8                   | 8               | 11                 | 26                     | 49                            | 43                            | 87                   | 14                     | 4               |
| 40                | 1 1/2" | 48.3                     | 135                     | 10                  | 9               | 13                 | 29                     | 59                            | 49                            | 98                   | 14                     | 4               |
| 50                | 2"     | 60.3                     | 150                     | 10                  | 10              | 13                 | 29                     | 70                            | 61                            | 114                  | 18                     | 4               |
| 65                | 2 1/2" | 73                       | 165                     | 11                  | 10              | 16                 | 32                     | 83                            | 76                            | 127                  | 18                     | 4               |
| 80                | 3"     | 88.9                     | 185                     | 13                  | 11              | 16                 | 35                     | 102                           | 89                            | 146                  | 18                     | 4               |
| 100               | 4"     | 114.3                    | 215                     | 16                  | 13              | 19                 | 41                     | 130                           | 115                           | 178                  | 18                     | 8               |
| 125               | 5"     | 141.3                    | 255                     | 17                  | 14              | 19                 | 44                     | 152                           | 142                           | 210                  | 18                     | 8               |
| 150               | 6"     | 168.3                    | 280                     | 17                  | 17              | 19                 | 48                     | 184                           | 169                           | 235                  | 22                     | 8               |
| 200               | 8"     | 219.1                    | 335                     | 19                  | 19              | 22                 | 51                     | 241                           | 220                           | 292                  | 22                     | 8               |
| 250               | 10"    | 273.8                    | 405                     | 25                  | 22              | 27                 | 64                     | 292                           | 274                           | 356                  | 22                     | 12              |
| 300               | 12"    | 323.8                    | 455                     | 28                  | 25              | 29                 | 70                     | 343                           | 324                           | 406                  | 26                     | 12              |
| 350               | 14"    | 355.6                    | 525                     | 32                  | 29              | -                  | 73                     | 387                           | 356                           | 470                  | 26                     | 12              |
| 400               | 16"    | 406.4                    | 580                     | 32                  | 32              | -                  | -                      | -                             | -                             | 521                  | 26                     | 12              |
| 450               | 18"    | 457                      | 640                     | 35                  | 35              | -                  | -                      | -                             | -                             | 584                  | 26                     | 16              |
| 500               | 20"    | 508                      | 705                     | 38                  | 38              | -                  | -                      | -                             | -                             | 641                  | 26                     | 16              |
| 600               | 24"    | 610                      | 825                     | 48                  | 48              | -                  | -                      | -                             | -                             | 756                  | 33                     | 16              |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Thickness dimension include raised face
- Available with or without raised face
- Pipe diameter to ANSI standard
- Bore to suit customers pipe

## 10.03 | Flange Specification (AS 2129)



WELDING NECK

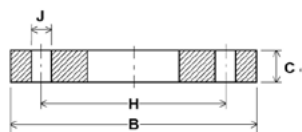
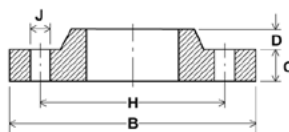
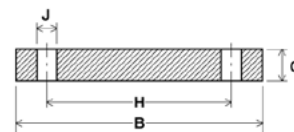


PLATE SLIP-ON WELDING



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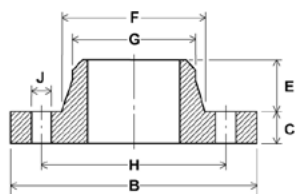
### TABLE F

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                 | Length Through Hub |                        | Diameter at Large End of Neck | Diameter at Small End of Neck | Drilling Data        |                        |                 |
|-------------------|--------|--------------------------|-------------------------|---------------------|-----------------|--------------------|------------------------|-------------------------------|-------------------------------|----------------------|------------------------|-----------------|
|                   |        |                          |                         | Copper Alloy        | Plate or Forged | Length of Boss     | Length of Welding Neck |                               |                               | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                   | C               | D                  | E                      | F                             | G                             | H                    | J                      | K               |
| 15                | 1/2"   | 21.3                     | 95                      | 8                   | 10              | 10                 | 22                     | 27                            | 22                            | 67                   | 14                     | 4               |
| 20                | 3/4"   | 26.7                     | 100                     | 8                   | 10              | 11                 | 22                     | 33                            | 27                            | 73                   | 14                     | 4               |
| 25                | 1"     | 33.4                     | 120                     | 10                  | 10              | 11                 | 29                     | 43                            | 34                            | 87                   | 18                     | 4               |
| 32                | 1 1/4" | 42.2                     | 135                     | 10                  | 13              | 11                 | 35                     | 52                            | 43                            | 98                   | 18                     | 4               |
| 40                | 1 1/2" | 48.3                     | 140                     | 11                  | 13              | 13                 | 35                     | 59                            | 49                            | 105                  | 18                     | 4               |
| 50                | 2"     | 60.3                     | 165                     | 11                  | 16              | 13                 | 35                     | 70                            | 61                            | 127                  | 18                     | 4               |
| 65                | 2 1/2" | 73                       | 185                     | 13                  | 16              | 16                 | 38                     | 86                            | 76                            | 146                  | 18                     | 8               |
| 80                | 3"     | 88.9                     | 205                     | 14                  | 16              | 16                 | 44                     | 102                           | 89                            | 165                  | 18                     | 8               |
| 100               | 4"     | 114.3                    | 230                     | 17                  | 19              | 19                 | 51                     | 130                           | 115                           | 191                  | 18                     | 8               |
| 125               | 5"     | 141.3                    | 280                     | 19                  | 22              | 19                 | 57                     | 159                           | 142                           | 235                  | 22                     | 8               |
| 150               | 6"     | 168.3                    | 305                     | 22                  | 22              | 19                 | 57                     | 184                           | 169                           | 260                  | 22                     | 12              |
| 200               | 8"     | 219.1                    | 370                     | 25                  | 25              | 22                 | 67                     | 241                           | 220                           | 324                  | 22                     | 12              |
| 250               | 10"    | 273.8                    | 430                     | 25                  | 29              | 27                 | 73                     | 298                           | 274                           | 381                  | 26                     | 12              |
| 300               | 12"    | 323.8                    | 490                     | 29                  | 32              | 29                 | 79                     | 352                           | 324                           | 438                  | 26                     | 16              |
| 350               | 14"    | 355.6                    | 550                     | 32                  | 35              | -                  | 86                     | 387                           | 356                           | 495                  | 30                     | 16              |
| 400               | 16"    | 406.4                    | 610                     | 32                  | 41              | -                  | -                      | -                             | -                             | 552                  | 30                     | 20              |
| 450               | 18"    | 457                      | 675                     | 35                  | 44              | -                  | -                      | -                             | -                             | 610                  | 33                     | 20              |
| 500               | 20"    | 508                      | 735                     | 38                  | 51              | -                  | -                      | -                             | -                             | 673                  | 33                     | 24              |
| 600               | 24"    | 610                      | 850                     | 41                  | 57              | -                  | -                      | -                             | -                             | 781                  | 36                     | 24              |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Thickness dimension include raised face
- Available with or without raised face
- Pipe diameter to ANSI standard
- Bore to suit customers pipe

## 10.04 | Flange Specification (AS 2129)



WELDING NECK

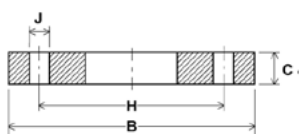
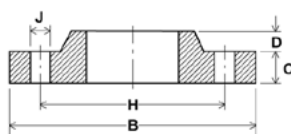
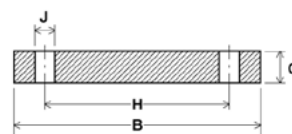


PLATE SLIP-ON WELDING



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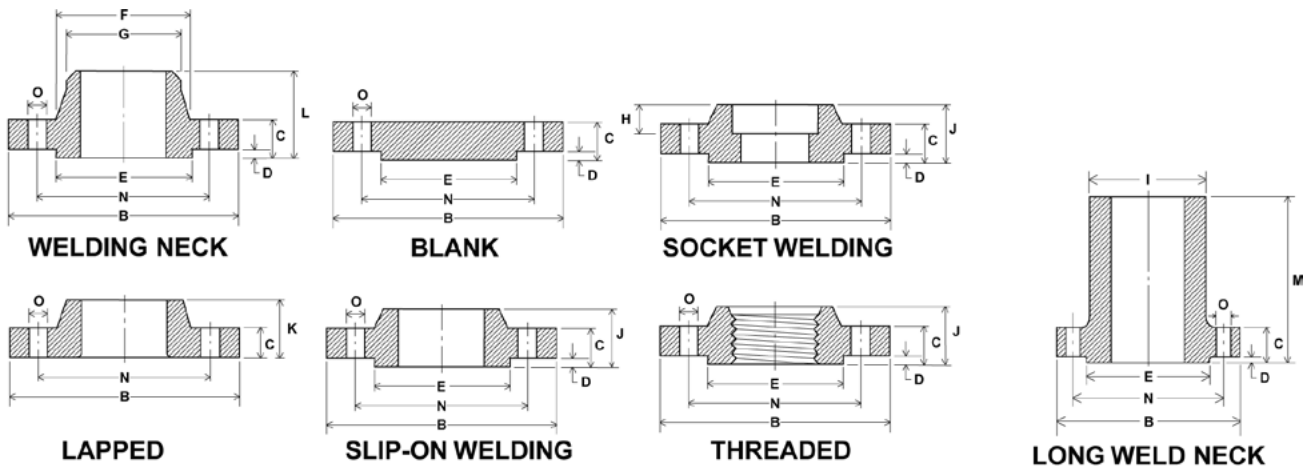
### TABLE H

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                 | Length Through Hub |                        | Diameter at Large End of Neck | Diameter at Small End of Neck | Drilling Data        |                        |                 |
|-------------------|--------|--------------------------|-------------------------|---------------------|-----------------|--------------------|------------------------|-------------------------------|-------------------------------|----------------------|------------------------|-----------------|
|                   |        |                          |                         | Copper Alloy        | Plate or Forged | Length of Boss     | Length of Welding Neck |                               |                               | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                   | C               | D                  | E                      | F                             | G                             | H                    | J                      | K               |
| 15                | 1/2"   | 21.3                     | 115                     | 10                  | 13              | 10                 | 29                     | 30                            | 22                            | 83                   | 18                     | 4               |
| 20                | 3/4"   | 26.7                     | 115                     | 10                  | 13              | 11                 | 29                     | 35                            | 27                            | 83                   | 18                     | 4               |
| 25                | 1"     | 33.4                     | 120                     | 11                  | 14              | 11                 | 29                     | 43                            | 34                            | 87                   | 18                     | 4               |
| 32                | 1 1/4" | 42.2                     | 135                     | 11                  | 17              | 11                 | 35                     | 52                            | 43                            | 98                   | 18                     | 4               |
| 40                | 1 1/2" | 48.3                     | 140                     | 13                  | 17              | 13                 | 35                     | 59                            | 49                            | 105                  | 18                     | 4               |
| 50                | 2"     | 60.3                     | 165                     | 13                  | 19              | 13                 | 35                     | 70                            | 61                            | 127                  | 18                     | 4               |
| 65                | 2 1/2" | 73                       | 185                     | 14                  | 19              | 16                 | 38                     | 86                            | 76                            | 146                  | 18                     | 8               |
| 80                | 3"     | 88.9                     | 205                     | 16                  | 22              | 16                 | 44                     | 102                           | 89                            | 165                  | 18                     | 8               |
| 100               | 4"     | 114.3                    | 230                     | 19                  | 25              | 19                 | 51                     | 130                           | 115                           | 191                  | 18                     | 8               |
| 125               | 5"     | 141.3                    | 280                     | 22                  | 29              | 19                 | 57                     | 159                           | 142                           | 235                  | 22                     | 8               |
| 150               | 6"     | 168.3                    | 305                     | 25                  | 29              | 19                 | 57                     | 184                           | 169                           | 260                  | 22                     | 12              |
| 200               | 8"     | 219.1                    | 370                     | 32                  | 32              | 22                 | 67                     | 241                           | 220                           | 324                  | 22                     | 12              |
| 250               | 10"    | 273.8                    | 430                     | 35                  | 35              | 27                 | 73                     | 298                           | 274                           | 381                  | 26                     | 12              |
| 300               | 12"    | 323.8                    | 490                     | 38                  | 41              | 29                 | 79                     | 352                           | 324                           | 438                  | 26                     | 16              |
| 350               | 14"    | 355.6                    | 550                     | 41                  | 48              | -                  | 86                     | 387                           | 356                           | 495                  | 30                     | 16              |
| 400               | 16"    | 406.4                    | 610                     | 44                  | 54              | -                  | -                      | -                             | -                             | 552                  | 30                     | 20              |
| 450               | 18"    | 457                      | 675                     | 48                  | 60              | -                  | -                      | -                             | -                             | 610                  | 33                     | 20              |
| 500               | 20"    | 508                      | 735                     | 51                  | 67              | -                  | -                      | -                             | -                             | 673                  | 33                     | 24              |
| 600               | 24"    | 610                      | 850                     | 57                  | 76              | -                  | -                      | -                             | -                             | 781                  | 36                     | 24              |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Thickness dimension include raised face
- Available with or without raised face
- Pipe diameter to ANSI standard
- Bore to suit customers pipe

## 10.05 | Flange Specification (ASME B16.5)



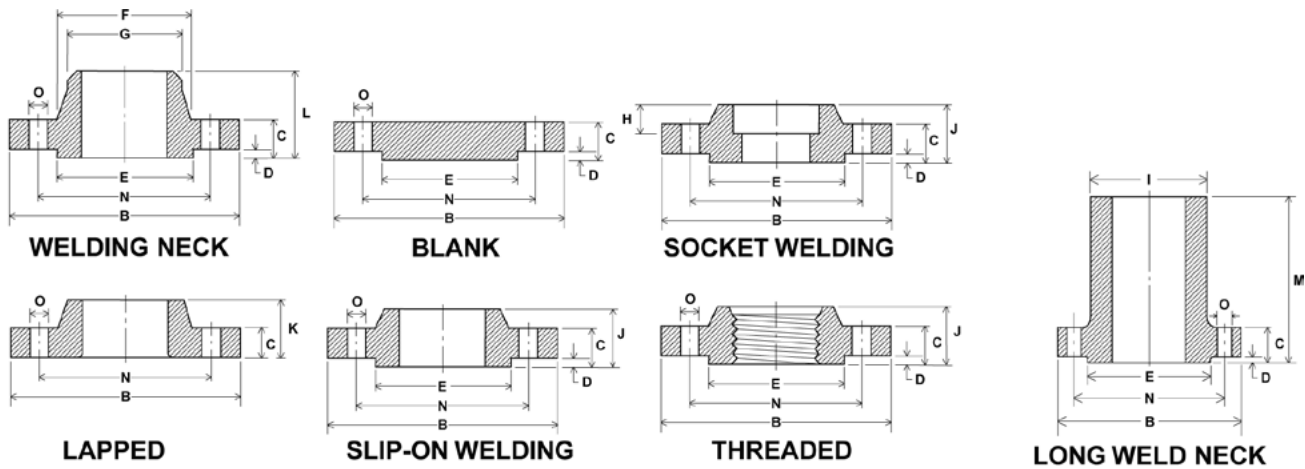
## CLASS 150

| Nominal Pipe Size |        | Length Through Hub       |                         |                         |                       |                      |              |                                   |                   |                         |                               |        |              |                   | Drilling Data        |                        |                 |
|-------------------|--------|--------------------------|-------------------------|-------------------------|-----------------------|----------------------|--------------|-----------------------------------|-------------------|-------------------------|-------------------------------|--------|--------------|-------------------|----------------------|------------------------|-----------------|
|                   |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange Min | Raised Face Thickness | Raised Face Diameter | Hub Diameter | Hub Dia. Start of Chamfer W. Neck | Socket Weld Depth | Hub Dia. Long Weld Neck | Thread Slip on Socket Welding | Lapped | Welding Neck | Long Welding Neck | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                       | D                     | E                    | F            | G                                 | H                 | I                       | J                             | K      | L            | M                 | N                    | O                      | P               |
| 15                | 1/2"   | 21.3                     | 90                      | 11.5                    | 1.6                   | 34.9                 | 30           | 21.5                              | 9.5               | 30.2                    | 16                            | 16     | 48           | 228.6             | 60.5                 | 16                     | 4               |
| 20                | 3/4"   | 26.7                     | 98                      | 13.0                    | 1.6                   | 42.9                 | 38           | 26.5                              | 11.1              | 38.1                    | 16                            | 16     | 52           | 228.6             | 70.0                 | 16                     | 4               |
| 25                | 1"     | 33.4                     | 108                     | 14.5                    | 1.6                   | 50.8                 | 49           | 33.5                              | 12.7              | 50.8                    | 17                            | 17     | 56           | 228.6             | 79.5                 | 16                     | 4               |
| 32                | 1 1/4" | 42.2                     | 117                     | 16.0                    | 1.6                   | 63.5                 | 59           | 42.0                              | 14.2              | 60.3                    | 21                            | 21     | 57           | 228.6             | 89.0                 | 16                     | 4               |
| 40                | 1 1/2" | 48.3                     | 127                     | 17.5                    | 1.6                   | 73.0                 | 65           | 48.5                              | 15.7              | 66.7                    | 22                            | 22     | 62           | 228.6             | 98.5                 | 16                     | 4               |
| 50                | 2"     | 60.3                     | 152                     | 19.5                    | 1.6                   | 92.1                 | 78           | 60.5                              | 17.5              | 82.5                    | 25                            | 25     | 64           | 228.6             | 120.5                | 20                     | 4               |
| 65                | 2 1/2" | 73                       | 178                     | 22.5                    | 1.6                   | 104.8                | 90           | 73.0                              | 19.1              | 95.2                    | 29                            | 29     | 70           | 228.6             | 139.5                | 20                     | 4               |
| 80                | 3"     | 88.9                     | 191                     | 24.0                    | 1.6                   | 127.0                | 108          | 89.0                              | 20.6              | 107.9                   | 30                            | 30     | 70           | 304.8             | 152.5                | 20                     | 4               |
| 100               | 4"     | 114.3                    | 229                     | 24.0                    | 1.6                   | 157.0                | 135          | 114.5                             | -                 | 139.7                   | 32                            | 33     | 76           | 304.8             | 190.5                | 20                     | 8               |
| 125               | 5"     | 141.3                    | 254                     | 24.0                    | 1.6                   | 185.7                | 164          | 141.5                             | -                 | 165.1                   | 36                            | 36     | 89           | 304.8             | 216.0                | 23                     | 8               |
| 150               | 6"     | 168.3                    | 279                     | 25.5                    | 1.6                   | 215.9                | 192          | 168.5                             | -                 | 196.8                   | 40                            | 40     | 89           | 304.8             | 241.5                | 23                     | 8               |
| 200               | 8"     | 219.1                    | 343                     | 29.0                    | 1.6                   | 269.9                | 246          | 219.0                             | -                 | 247.6                   | 44                            | 44     | 102          | 304.8             | 298.5                | 23                     | 8               |
| 250               | 10"    | 273.8                    | 406                     | 30.5                    | 1.6                   | 323.8                | 305          | 273.0                             | -                 | 304.8                   | 49                            | 49     | 102          | 304.8             | 362.0                | 26                     | 12              |
| 300               | 12"    | 323.8                    | 483                     | 32.0                    | 1.6                   | 381.0                | 365          | 324.0                             | -                 | 365.1                   | 56                            | 56     | 114          | 304.8             | 432.0                | 26                     | 12              |
| 350               | 14"    | 355.6                    | 535                     | 35.0                    | 1.6                   | 412.8                | 400          | 355.5                             | -                 | 406.4                   | 57                            | 79     | 127          | 304.8             | 476.5                | 29                     | 12              |
| 400               | 16"    | 406.4                    | 600                     | 37.0                    | 1.6                   | 469.9                | 457          | 406.5                             | -                 | 457.2                   | 64                            | 87     | 127          | 304.8             | 540.0                | 29                     | 16              |
| 450               | 18"    | 457                      | 635                     | 40.0                    | 1.6                   | 533.4                | 505          | 457.0                             | -                 | 508.0                   | 68                            | 97     | 140          | 304.8             | 578.0                | 32                     | 16              |
| 500               | 20"    | 508                      | 700                     | 43.0                    | 1.6                   | 584.2                | 559          | 508.0                             | -                 | 558.8                   | 73                            | 103    | 145          | 304.8             | 635.0                | 32                     | 20              |
| 600               | 24"    | 610                      | 815                     | 48.0                    | 1.6                   | 692.2                | 664          | 609.5                             | -                 | 666.7                   | 83                            | 111    | 152          | 304.8             | 749.5                | 35                     | 20              |

### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Slip on bore is 0.76mm larger than pipe up to 250mm OD then 1.5mm
- Bore of long weld neck is to be nominal pipe size

## 10.06 | Flange Specification (ASME B16.5)



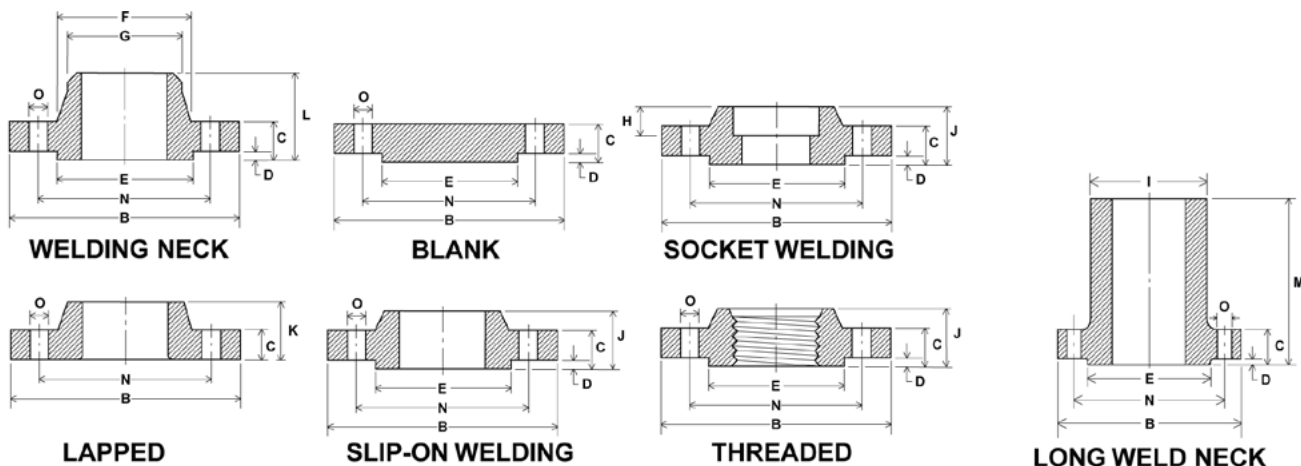
### CLASS 300

| Nominal Pipe Size |        | Length Through Hub       |                         |                         |                       |                      |              |                                   |                   |                         |                               | Drilling Data |              |                   |                      |                        |                 |
|-------------------|--------|--------------------------|-------------------------|-------------------------|-----------------------|----------------------|--------------|-----------------------------------|-------------------|-------------------------|-------------------------------|---------------|--------------|-------------------|----------------------|------------------------|-----------------|
|                   |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange Min | Raised Face Thickness | Raised Face Diameter | Hub Diameter | Hub Dia. Start of Chamfer W. Neck | Socket Weld Depth | Hub Dia. Long Weld Neck | Thread Slip on Socket Welding | Lapped        | Welding Neck | Long Welding Neck | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                       | D                     | E                    | F            | G                                 | H                 | I                       | J                             | K             | L            | M                 | N                    | O                      | P               |
| 15                | 1/2"   | 21.3                     | 95                      | 14.5                    | 1.6                   | 34.9                 | 38           | 21.5                              | 9.5               | 38.1                    | 22                            | 22            | 52           | 228.6             | 66.5                 | 16                     | 4               |
| 20                | 3/4"   | 26.7                     | 117                     | 16.5                    | 1.6                   | 42.9                 | 48           | 26.5                              | 11.1              | 47.6                    | 25                            | 25            | 57           | 228.6             | 82.5                 | 20                     | 4               |
| 25                | 1"     | 33.4                     | 124                     | 17.5                    | 1.6                   | 50.8                 | 54           | 33.5                              | 12.7              | 54.0                    | 27                            | 27            | 62           | 228.6             | 89.0                 | 20                     | 4               |
| 32                | 1 1/4" | 42.2                     | 133                     | 19.5                    | 1.6                   | 63.5                 | 64           | 42.0                              | 14.2              | 63.5                    | 27                            | 27            | 65           | 228.6             | 98.5                 | 20                     | 4               |
| 40                | 1 1/2" | 48.3                     | 156                     | 21.0                    | 1.6                   | 73.0                 | 70           | 48.5                              | 15.7              | 69.8                    | 30                            | 30            | 68           | 228.6             | 114.5                | 23                     | 4               |
| 50                | 2"     | 60.3                     | 165                     | 22.5                    | 1.6                   | 92.1                 | 84           | 60.5                              | 17.6              | 84.1                    | 33                            | 33            | 70           | 228.6             | 127.0                | 20                     | 8               |
| 65                | 2 1/2" | 73                       | 191                     | 25.5                    | 1.6                   | 104.8                | 100          | 73.0                              | 19.1              | 100.0                   | 38                            | 38            | 76           | 228.6             | 149.0                | 23                     | 8               |
| 80                | 3"     | 88.9                     | 210                     | 29.0                    | 1.6                   | 127.0                | 118          | 89.0                              | 20.6              | 117.5                   | 43                            | 43            | 79           | 228.6             | 168.5                | 23                     | 8               |
| 100               | 4"     | 114.3                    | 254                     | 32.0                    | 1.6                   | 157.2                | 146          | 114.5                             | -                 | 146.0                   | 48                            | 48            | 86           | 304.8             | 200.0                | 23                     | 8               |
| 125               | 5"     | 141.3                    | 279                     | 35.0                    | 1.6                   | 185.7                | 178          | 141.5                             | -                 | 177.8                   | 51                            | 51            | 98           | 304.8             | 235.0                | 23                     | 8               |
| 150               | 6"     | 168.3                    | 318                     | 37.0                    | 1.6                   | 215.9                | 206          | 168.5                             | -                 | 206.4                   | 52                            | 52            | 98           | 304.8             | 270.0                | 23                     | 12              |
| 200               | 8"     | 219.1                    | 381                     | 41.5                    | 1.6                   | 269.9                | 260          | 219.0                             | -                 | 260.3                   | 62                            | 56            | 111          | 304.8             | 330.0                | 26                     | 12              |
| 250               | 10"    | 273.8                    | 445                     | 48.0                    | 1.6                   | 323.8                | 321          | 273.0                             | -                 | 32.7                    | 67                            | 95            | 117          | 304.8             | 387.5                | 29                     | 16              |
| 300               | 12"    | 323.8                    | 520                     | 51.0                    | 1.6                   | 381.0                | 375          | 324.0                             | -                 | 374.6                   | 73                            | 102           | 130          | 304.8             | 451.0                | 32                     | 16              |
| 350               | 14"    | 355.6                    | 585                     | 54.0                    | 1.6                   | 412.9                | 426          | 355.5                             | -                 | 425.4                   | 76                            | 111           | 143          | 304.8             | 514.5                | 32                     | 20              |
| 400               | 16"    | 406.4                    | 650                     | 57.5                    | 1.6                   | 469.9                | 483          | 406.5                             | -                 | 482.6                   | 83                            | 121           | 146          | 304.8             | 571.5                | 35                     | 20              |
| 450               | 18"    | 457                      | 710                     | 60.5                    | 1.6                   | 533.4                | 533          | 457.0                             | -                 | 533.4                   | 89                            | 130           | 159          | 304.8             | 628.5                | 35                     | 24              |
| 500               | 20"    | 508                      | 775                     | 63.5                    | 1.6                   | 584.2                | 587          | 508.0                             | -                 | 587.3                   | 95                            | 140           | 162          | 304.8             | 686.0                | 35                     | 24              |
| 600               | 24"    | 610                      | 915                     | 70.0                    | 1.6                   | 692.2                | 702          | 609.5                             | -                 | 701.6                   | 106                           | 152           | 168          | 304.8             | 813.0                | 42                     | 24              |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Slip on bore is 0.76mm larger than pipe up to 250mm OD then 1.5mm
- Bore of long weld neck is to be nominal pipe size

## 10.07 | Flange Specification (ASME B16.5)



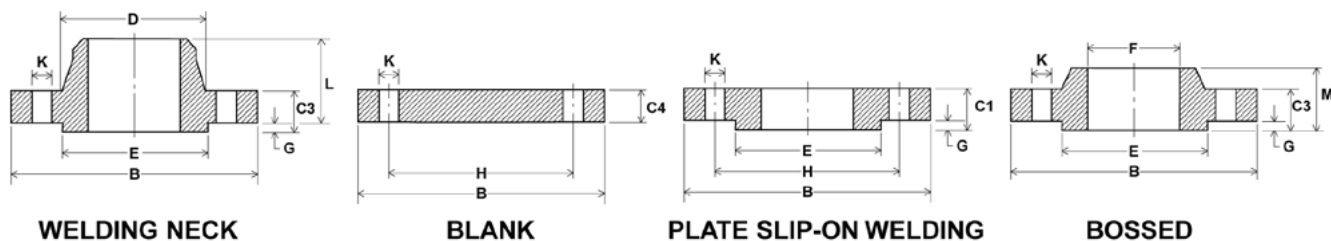
## CLASS 600

|                   |        |                          |                         |                         |                       |                      |              |                                   |                   |                         | Length Through Hub            |        |              |                   | Drilling Data        |                        |                 |
|-------------------|--------|--------------------------|-------------------------|-------------------------|-----------------------|----------------------|--------------|-----------------------------------|-------------------|-------------------------|-------------------------------|--------|--------------|-------------------|----------------------|------------------------|-----------------|
| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange Min | Raised Face Thickness | Raised Face Diameter | Hub Diameter | Hub Dia. Start of Chamfer W. Neck | Socket Weld Depth | Hub Dia. Long Weld Neck | Thread Slip on Socket Welding | Lapped | Welding Neck | Long Welding Neck | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts |
| mm                | inch   | A                        | B                       | C                       | D                     | E                    | F            | G                                 | H                 | I                       | J                             | K      | L            | M                 | N                    | O                      | P               |
| 15                | 1/2"   | 21.3                     | 95                      | 14.5                    | 6.4                   | 34.9                 | 38           | 21.5                              | 9.5               | 38.1                    | 22                            | 22     | 52           | -                 | 66.5                 | 16                     | 4               |
| 20                | 3/4"   | 26.7                     | 117                     | 16.0                    | 6.4                   | 42.9                 | 48           | 26.5                              | 11.1              | 47.6                    | 25                            | 25     | 57           | -                 | 82.5                 | 20                     | 4               |
| 25                | 1"     | 33.4                     | 124                     | 17.5                    | 6.4                   | 50.8                 | 54           | 33.5                              | 12.7              | 54.0                    | 27                            | 27     | 62           | 228.6             | 89.0                 | 20                     | 4               |
| 32                | 1 1/4" | 42.2                     | 133                     | 21.0                    | 6.4                   | 63.5                 | 64           | 42.0                              | 14.2              | 63.5                    | 29                            | 29     | 67           | 228.6             | 98.5                 | 20                     | 4               |
| 40                | 1 1/2" | 48.3                     | 156                     | 22.5                    | 6.4                   | 73.0                 | 70           | 48.5                              | 15.7              | 69.8                    | 32                            | 32     | 70           | 228.6             | 114.5                | 23                     | 4               |
| 50                | 2"     | 60.3                     | 165                     | 25.5                    | 6.4                   | 92.1                 | 84           | 60.5                              | 17.5              | 84.1                    | 37                            | 37     | 73           | 228.6             | 127.0                | 20                     | 8               |
| 65                | 2 1/2" | 73                       | 191                     | 19.0                    | 6.4                   | 104.8                | 100          | 73.0                              | 19.1              | 100.0                   | 41                            | 41     | 79           | 228.6             | 149.0                | 23                     | 8               |
| 80                | 3"     | 88.9                     | 210                     | 32.0                    | 6.4                   | 127.0                | 117          | 89.0                              | 20.6              | 117.5                   | 46                            | 46     | 83           | 228.6             | 168.0                | 23                     | 8               |
| 100               | 4"     | 114.3                    | 273                     | 38.5                    | 6.4                   | 157.2                | 152          | 114.5                             | -                 | 152.4                   | 54                            | 54     | 102          | 304.8             | 216.0                | 26                     | 8               |
| 125               | 5"     | 141.3                    | 330                     | 44.5                    | 6.4                   | 185.7                | 189          | 141.5                             | -                 | 190.5                   | 60                            | 60     | 114          | 304.8             | 267.0                | 29                     | 8               |
| 150               | 6"     | 168.3                    | 356                     | 48.0                    | 6.4                   | 215.9                | 222          | 168.5                             | -                 | 222.2                   | 67                            | 67     | 117          | 304.8             | 292.0                | 29                     | 12              |
| 200               | 8"     | 219.1                    | 419                     | 55.5                    | 6.4                   | 269.9                | 273          | 219.0                             | -                 | 273.0                   | 76                            | 76     | 133          | 304.8             | 349.0                | 32                     | 12              |
| 250               | 10"    | 273.8                    | 510                     | 63.5                    | 6.4                   | 323.8                | 343          | 273.0                             | -                 | 342.9                   | 86                            | 111    | 152          | 304.8             | 432.0                | 35                     | 16              |
| 300               | 12"    | 323.8                    | 560                     | 67.0                    | 6.4                   | 381.0                | 400          | 324.0                             | -                 | 400.0                   | 92                            | 117    | 156          | 304.8             | 489.0                | 35                     | 20              |
| 350               | 14"    | 355.6                    | 605                     | 70.0                    | 6.4                   | 412.8                | 432          | 355.5                             | -                 | 431.8                   | 94                            | 127    | 165          | 304.8             | 527.0                | 39                     | 20              |
| 400               | 16"    | 406.4                    | 685                     | 76.5                    | 6.4                   | 469.9                | 495          | 406.5                             | -                 | 495.3                   | 106                           | 140    | 178          | 304.8             | 603.0                | 42                     | 20              |
| 450               | 18"    | 457                      | 745                     | 83.0                    | 6.4                   | 533.4                | 546          | 457.0                             | -                 | 546.1                   | 117                           | 152    | 184          | 304.8             | 654.0                | 45                     | 20              |
| 500               | 20"    | 508                      | 815                     | 89.0                    | 6.4                   | 584.2                | 610          | 508.0                             | -                 | 609.6                   | 127                           | 165    | 190          | 304.8             | 724.0                | 45                     | 24              |
| 600               | 24"    | 610                      | 940                     | 102.0                   | 6.4                   | 692.2                | 718          | 609.5                             | -                 | 717.5                   | 140                           | 184    | 203          | 304.8             | 838.0                | 51                     | 24              |

### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Slip on bore is 0.76mm larger than pipe up to 250mm OD then 1.5mm
- Bore of long weld neck is to be nominal pipe size

## 10.08 | Flange Specification (EN 1092-1)



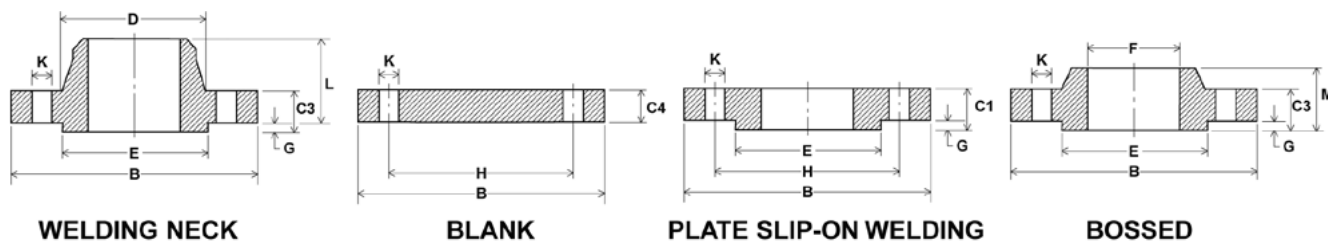
### PN 6

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                    |       | Hub Diameter Weld Neck | Raised Face Diameter | Slip On Bore | Raised Face Thickness | Drilling Data        |                        |                 | Length Through Hub          |                          |
|-------------------|--------|--------------------------|-------------------------|---------------------|--------------------|-------|------------------------|----------------------|--------------|-----------------------|----------------------|------------------------|-----------------|-----------------------------|--------------------------|
|                   |        |                          |                         | Plate               | Bossed & Weld Neck | Blind |                        |                      |              |                       | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts | Overall Thickness Weld Neck | Overall Thickness Bossed |
| mm                | inch   | A                        | B                       | C1                  | C2                 | C3    | D                      | E                    | F            | G                     | H                    | J                      | K               | L                           | M                        |
| 15                | 1/2"   | 21.3                     | 80                      | 12                  | 12                 | 12    | 30                     | 40                   | 22.3         | 2                     | 55                   | 11                     | 4               | 30                          | 12                       |
| 20                | 3/4"   | 26.7                     | 90                      | 14                  | 14                 | 14    | 38                     | 50                   | 27.6         | 2                     | 65                   | 11                     | 4               | 32                          | 24                       |
| 25                | 1"     | 33.4                     | 100                     | 14                  | 14                 | 14    | 42                     | 60                   | 34.5         | 2                     | 75                   | 11                     | 4               | 35                          | 24                       |
| 32                | 1 1/4" | 42.2                     | 120                     | 16                  | 14                 | 14    | 55                     | 70                   | 43.1         | 2                     | 90                   | 14                     | 4               | 35                          | 26                       |
| 40                | 1 1/2" | 48.3                     | 130                     | 16                  | 14                 | 14    | 62                     | 80                   | 49.5         | 3                     | 100                  | 14                     | 4               | 38                          | 26                       |
| 50                | 2"     | 60.3                     | 140                     | 16                  | 14                 | 14    | 74                     | 90                   | 61.9         | 3                     | 110                  | 14                     | 4               | 38                          | 28                       |
| 65                | 2 1/2" | 73                       | 160                     | 16                  | 14                 | 14    | 88                     | 110                  | 74.6         | 3                     | 130                  | 14                     | 4               | 38                          | 32                       |
| 80                | 3"     | 88.9                     | 190                     | 18                  | 16                 | 16    | 102                    | 128                  | 90.6         | 3                     | 150                  | 18                     | 4               | 42                          | 34                       |
| 100               | 4"     | 114.3                    | 210                     | 18                  | 16                 | 16    | 130                    | 148                  | 116.0        | 3                     | 170                  | 18                     | 4               | 45                          | 40                       |
| 125               | 5"     | 141.3                    | 24                      | 20                  | 18                 | 18    | 155                    | 178                  | 143.7        | 3                     | 200                  | 18                     | 8               | 48                          | 44                       |
| 150               | 6"     | 168.3                    | 265                     | 20                  | 18                 | 18    | 187                    | 202                  | 170.6        | 3                     | 225                  | 18                     | 8               | 48                          | 44                       |
| 200               | 8"     | 219.1                    | 320                     | 22                  | 20                 | 20    | 236                    | 258                  | 221.1        | 3                     | 280                  | 18                     | 8               | 55                          | 44                       |
| 250               | 10"    | 273.8                    | 375                     | 24                  | 22                 | 22    | 290                    | 312                  | 276.3        | 3                     | 335                  | 18                     | 12              | 60                          | 44                       |
| 300               | 12"    | 323.8                    | 440                     | 24                  | 22                 | 22    | 342                    | 365                  | 327.1        | 4                     | 395                  | 22                     | 12              | 62                          | 44                       |
| 350               | 14"    | 355.6                    | 490                     | 26                  | 22                 | 22    | 385                    | 415                  | 358.6        | 4                     | 445                  | 22                     | 12              | 62                          | -                        |
| 400               | 16"    | 406.4                    | 540                     | 28                  | 22                 | 22    | 438                    | 465                  | 409.4        | 4                     | 495                  | 22                     | 16              | 65                          | -                        |
| 450               | 18"    | 457                      | 595                     | 30                  | 22                 | 22    | 492                    | 520                  | 460.4        | 4                     | 550                  | 22                     | 16              | 65                          | -                        |
| 500               | 20"    | 508                      | 645                     | 30                  | 24                 | 24    | 538                    | 570                  | 460.0        | 4                     | 600                  | 22                     | 20              | 68                          | -                        |
| 600               | 24"    | 610                      | 755                     | 32                  | 30                 | 30    | 640                    | 670                  | 511.0        | 5                     | 705                  | 26                     | 20              | 70                          | -                        |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Available with or without raised face
- Weld neck bore is equal to pipe

## 10.09 | Flange Specification (EN 1092-1)



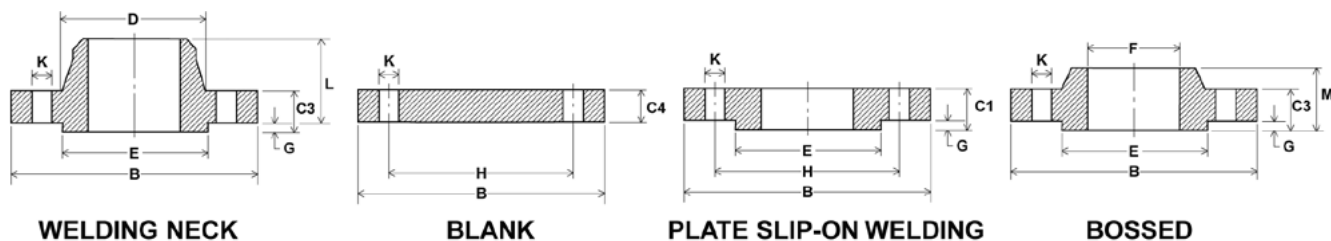
### PN 10

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                    |       | Hub Diameter Weld Neck | Raised Face Diameter | Slip On Bore | Raised Face Thickness | Drilling Data        |                        |                 | Length Through Hub          |                          |
|-------------------|--------|--------------------------|-------------------------|---------------------|--------------------|-------|------------------------|----------------------|--------------|-----------------------|----------------------|------------------------|-----------------|-----------------------------|--------------------------|
|                   |        |                          |                         | Plate               | Bossed & Weld Neck | Blind |                        |                      |              |                       | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts | Overall Thickness Weld Neck | Overall Thickness Bossed |
| mm                | inch   | A                        | B                       | C1                  | C2                 | C3    | D                      | E                    | F            | G                     | H                    | J                      | K               | L                           | M                        |
| 15                | 1/2"   | 21.3                     | 95                      | 14                  | 16                 | 16    | 32                     | 45                   | 22.3         | 2                     | 65                   | 14                     | 4               | 22                          | 22                       |
| 20                | 3/4"   | 26.7                     | 105                     | 16                  | 18                 | 18    | 39                     | 58                   | 27.6         | 2                     | 75                   | 14                     | 4               | 26                          | 26                       |
| 25                | 1"     | 33.4                     | 115                     | 16                  | 18                 | 18    | 46                     | 68                   | 34.5         | 2                     | 85                   | 14                     | 4               | 28                          | 28                       |
| 32                | 1 1/4" | 42.2                     | 140                     | 18                  | 18                 | 18    | 56                     | 78                   | 43.1         | 2                     | 100                  | 18                     | 4               | 30                          | 30                       |
| 40                | 1 1/2" | 48.3                     | 150                     | 18                  | 18                 | 18    | 64                     | 88                   | 49.5         | 3                     | 110                  | 18                     | 4               | 32                          | 32                       |
| 50                | 2"     | 60.3                     | 165                     | 19                  | 18                 | 18    | 74                     | 102                  | 61.9         | 3                     | 125                  | 18                     | 4               | 28                          | 28                       |
| 65                | 2 1/2" | 73                       | 185                     | 20                  | 18                 | 18    | 92                     | 122                  | 74.6         | 3                     | 145                  | 18                     | 4               | 32                          | 32                       |
| 80                | 3"     | 88.9                     | 200                     | 20                  | 20                 | 20    | 110                    | 138                  | 90.6         | 3                     | 160                  | 18                     | 8               | 34                          | 34                       |
| 100               | 4"     | 114.3                    | 220                     | 22                  | 20                 | 20    | 130                    | 158                  | 116.0        | 3                     | 180                  | 18                     | 8               | 40                          | 40                       |
| 125               | 5"     | 141.3                    | 250                     | 22                  | 22                 | 22    | 158                    | 188                  | 143.7        | 3                     | 210                  | 18                     | 8               | 44                          | 44                       |
| 150               | 6"     | 168.3                    | 285                     | 24                  | 22                 | 22    | 184                    | 212                  | 170.6        | 3                     | 240                  | 22                     | 8               | 44                          | 44                       |
| 200               | 8"     | 219.1                    | 340                     | 24                  | 24                 | 24    | 234                    | 268                  | 221.1        | 3                     | 295                  | 22                     | 8               | 44                          | 44                       |
| 250               | 10"    | 273.8                    | 395                     | 26                  | 26                 | 26    | 288                    | 320                  | 276.3        | 3                     | 350                  | 22                     | 12              | 46                          | 46                       |
| 300               | 12"    | 323.8                    | 445                     | 26                  | 26                 | 26    | 342                    | 370                  | 327.1        | 4                     | 400                  | 22                     | 12              | 46                          | 46                       |
| 350               | 14"    | 355.6                    | 505                     | 30                  | 26                 | 26    | 390                    | 430                  | 358.6        | 4                     | 460                  | 22                     | 16              | 53                          | 53                       |
| 400               | 16"    | 406.4                    | 565                     | 32                  | 26                 | 26    | 440                    | 482                  | 409.4        | 4                     | 515                  | 26                     | 16              | 57                          | 57                       |
| 450               | 18"    | 457                      | 615                     | 36                  | 28                 | 28    | 488                    | 532                  | 460.4        | 4                     | 565                  | 26                     | 20              | 63                          | 63                       |
| 500               | 20"    | 508                      | 670                     | 38                  | 28                 | 28    | 540                    | 585                  | 460.0        | 4                     | 620                  | 26                     | 20              | 67                          | 67                       |
| 600               | 24"    | 610                      | 780                     | 42                  | 30                 | 34    | 640                    | 685                  | 511.0        | 5                     | 725                  | 30                     | 20              | 75                          | 75                       |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Available with or without raised face
- Weld neck bore is equal to pipe

## 10.10 | Flange Specification (EN 1092-1)



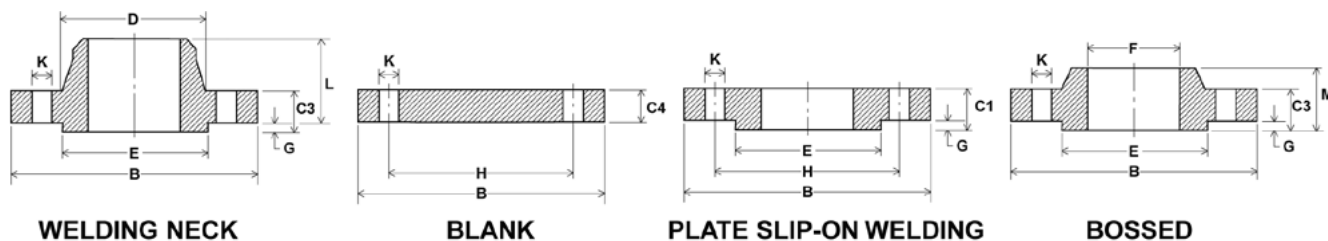
### PN 16

| Nominal Pipe Size |        | Outside Diameter of Pipe |     | 55Thickness of Flange |                    |       | Hub Diameter Weld Neck |     |       |   | Drilling Data        |                        |                 | Length Through Hub          |                          |
|-------------------|--------|--------------------------|-----|-----------------------|--------------------|-------|------------------------|-----|-------|---|----------------------|------------------------|-----------------|-----------------------------|--------------------------|
|                   |        |                          |     | Plate                 | Bossed & Weld Neck | Blind |                        |     |       |   | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts | Overall Thickness Weld Neck | Overall Thickness Bossed |
| mm                | inch   | A                        | B   | C1                    | C2                 | C3    | D                      | E   | F     | G | H                    | J                      | K               | L                           | M                        |
| 15                | 1/2"   | 21.3                     | 95  | 14                    | 16                 | 16    | 32                     | 45  | 22.3  | 2 | 65                   | 14                     | 4               | 38                          | 22                       |
| 20                | 3/4"   | 26.7                     | 105 | 16                    | 18                 | 18    | 39                     | 58  | 27.6  | 2 | 75                   | 14                     | 4               | 40                          | 26                       |
| 25                | 1"     | 33.4                     | 115 | 16                    | 18                 | 18    | 46                     | 68  | 34.5  | 2 | 85                   | 14                     | 4               | 40                          | 28                       |
| 32                | 1 1/4" | 42.2                     | 140 | 18                    | 18                 | 18    | 56                     | 78  | 43.1  | 2 | 100                  | 18                     | 4               | 42                          | 30                       |
| 40                | 1 1/2" | 48.3                     | 150 | 18                    | 18                 | 18    | 64                     | 88  | 49.5  | 3 | 110                  | 18                     | 4               | 45                          | 32                       |
| 50                | 2"     | 60.3                     | 165 | 20                    | 18                 | 18    | 74                     | 102 | 61.9  | 3 | 125                  | 18                     | 4               | 45                          | 28                       |
| 65                | 2 1/2" | 73                       | 185 | 20                    | 18                 | 18    | 92                     | 122 | 74.6  | 3 | 145                  | 18                     | 4 / 8           | 45                          | 32                       |
| 80                | 3"     | 88.9                     | 200 | 20                    | 20                 | 20    | 110                    | 138 | 90.6  | 3 | 160                  | 18                     | 8               | 50                          | 34                       |
| 100               | 4"     | 114.3                    | 220 | 22                    | 20                 | 20    | 130                    | 158 | 116.0 | 3 | 180                  | 18                     | 8               | 52                          | 40                       |
| 125               | 5"     | 141.3                    | 250 | 22                    | 22                 | 22    | 158                    | 188 | 143.7 | 3 | 210                  | 18                     | 8               | 55                          | 44                       |
| 150               | 6"     | 168.3                    | 285 | 24                    | 22                 | 22    | 184                    | 212 | 170.6 | 3 | 240                  | 22                     | 8               | 55                          | 44                       |
| 200               | 8"     | 219.1                    | 340 | 26                    | 24                 | 24    | 234                    | 268 | 221.1 | 3 | 295                  | 22                     | 12              | 62                          | 44                       |
| 250               | 10"    | 273.8                    | 405 | 29                    | 26                 | 26    | 288                    | 320 | 276.3 | 3 | 355                  | 26                     | 12              | 70                          | 46                       |
| 300               | 12"    | 323.8                    | 460 | 32                    | 28                 | 28    | 342                    | 378 | 327.1 | 4 | 410                  | 26                     | 12              | 78                          | 46                       |
| 350               | 14"    | 355.6                    | 520 | 35                    | 30                 | 30    | 390                    | 438 | 358.6 | 4 | 470                  | 26                     | 16              | 82                          | 57                       |
| 400               | 16"    | 406.4                    | 580 | 38                    | 32                 | 32    | 444                    | 490 | 409.4 | 4 | 525                  | 30                     | 16              | 85                          | 63                       |
| 450               | 18"    | 457                      | 640 | 42                    | 34                 | 40    | 490                    | 550 | 460.4 | 4 | 585                  | 30                     | 20              | 87                          | 68                       |
| 500               | 20"    | 508                      | 715 | 46                    | 36                 | 44    | 546                    | 610 | 460.0 | 4 | 650                  | 33                     | 20              | 90                          | 73                       |
| 600               | 24"    | 610                      | 840 | 55                    | 40                 | 54    | 650                    | 725 | 511.0 | 5 | 770                  | 36                     | 20              | 95                          | 83                       |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Available with or without rasied face
- Weld neck bore is equal to pipe

## 10.11 | Flange Specification (EN 1092-1)



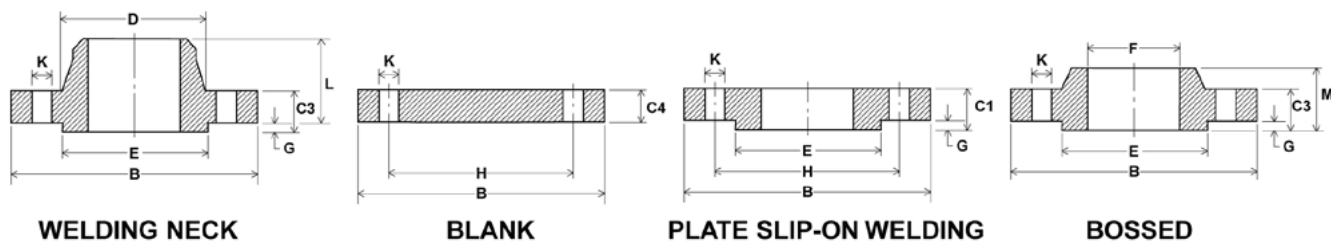
## PN 25

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                    |       | Hub Diameter Weld Neck | Raised Face Diameter | Slip On Bore | Raised Face Thickness | Drilling Data        |                        |                 | Length Through Hub          |                          |
|-------------------|--------|--------------------------|-------------------------|---------------------|--------------------|-------|------------------------|----------------------|--------------|-----------------------|----------------------|------------------------|-----------------|-----------------------------|--------------------------|
|                   |        |                          |                         | Plate               | Bossed & Weld Neck | Blind |                        |                      |              |                       | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts | Overall Thickness Weld Neck | Overall Thickness Bossed |
| mm                | inch   | A                        | B                       | C1                  | C2                 | C3    | D                      | E                    | F            | G                     | H                    | J                      | K               | L                           | M                        |
| 15                | 1/2"   | 21.3                     | 95                      | 14                  | 16                 | 16    | 32                     | 45                   | 22.3         | 2                     | 65                   | 14                     | 4               | 38                          | 22                       |
| 20                | 3/4"   | 26.7                     | 105                     | 16                  | 18                 | 18    | 40                     | 58                   | 27.6         | 2                     | 75                   | 14                     | 4               | 40                          | 26                       |
| 25                | 1"     | 33.4                     | 115                     | 16                  | 18                 | 18    | 46                     | 68                   | 34.5         | 2                     | 85                   | 14                     | 4               | 40                          | 28                       |
| 32                | 1 1/4" | 42.2                     | 140                     | 18                  | 18                 | 18    | 56                     | 78                   | 43.1         | 2                     | 100                  | 18                     | 4               | 42                          | 30                       |
| 40                | 1 1/2" | 48.3                     | 150                     | 18                  | 18                 | 18    | 64                     | 88                   | 49.5         | 3                     | 110                  | 18                     | 4               | 45                          | 32                       |
| 50                | 2"     | 60.3                     | 165                     | 20                  | 20                 | 20    | 74                     | 102                  | 61.9         | 3                     | 125                  | 18                     | 4               | 48                          | 34                       |
| 65                | 2 1/2" | 73                       | 185                     | 22                  | 22                 | 22    | 92                     | 122                  | 74.6         | 3                     | 145                  | 18                     | 8               | 52                          | 38                       |
| 80                | 3"     | 88.9                     | 200                     | 24                  | 24                 | 24    | 110                    | 138                  | 90.6         | 3                     | 160                  | 18                     | 8               | 58                          | 40                       |
| 100               | 4"     | 114.3                    | 235                     | 26                  | 24                 | 24    | 134                    | 162                  | 116.0        | 3                     | 190                  | 22                     | 8               | 65                          | 44                       |
| 125               | 5"     | 141.3                    | 270                     | 28                  | 26                 | 26    | 162                    | 188                  | 143.7        | 3                     | 220                  | 26                     | 8               | 68                          | 48                       |
| 150               | 6"     | 168.3                    | 300                     | 30                  | 28                 | 28    | 190                    | 218                  | 170.6        | 3                     | 250                  | 26                     | 8               | 75                          | 52                       |
| 200               | 8"     | 219.1                    | 360                     | 32                  | 30                 | 30    | 244                    | 278                  | 221.1        | 3                     | 310                  | 26                     | 12              | 80                          | 52                       |
| 250               | 10"    | 273.8                    | 425                     | 35                  | 32                 | 32    | 296                    | 335                  | 276.3        | 3                     | 370                  | 30                     | 12              | 88                          | 60                       |
| 300               | 12"    | 323.8                    | 485                     | 38                  | 34                 | 34    | 350                    | 395                  | 327.1        | 4                     | 430                  | 30                     | 16              | 92                          | 67                       |
| 350               | 14"    | 355.6                    | 555                     | 42                  | 38                 | 38    | 398                    | 450                  | 358.6        | 4                     | 490                  | 33                     | 16              | 100                         | 72                       |
| 400               | 16"    | 406.4                    | 620                     | 48                  | 40                 | 40    | 452                    | 505                  | 409.4        | 4                     | 550                  | 36                     | 16              | 110                         | 78                       |
| 450               | 18"    | 457                      | 670                     | 54                  | 46                 | 50    | 500                    | 555                  | 460.4        | 4                     | 600                  | 36                     | 20              | 110                         | 84                       |
| 500               | 20"    | 508                      | 730                     | 58                  | 48                 | 51    | 558                    | 615                  | 460.0        | 4                     | 660                  | 36                     | 20              | 125                         | 90                       |
| 600               | 24"    | 610                      | 845                     | 68                  | 48                 | 66    | 660                    | 720                  | 511.0        | 5                     | 770                  | 39                     | 20              | 125                         | 100                      |

### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Available with or without raised face
- Weld neck bore is equal to pipe

## 10.12 | Flange Specification (EN 1092-1)



### PN 40

| Nominal Pipe Size |        | Outside Diameter of Pipe | Flange Outside Diameter | Thickness of Flange |                    |       | Hub Diameter Weld Neck | Raised Face Diameter | Slip On Bore | Raised Face Thickness | Drilling Data        |                        |                 | Length Through Hub          |                          |
|-------------------|--------|--------------------------|-------------------------|---------------------|--------------------|-------|------------------------|----------------------|--------------|-----------------------|----------------------|------------------------|-----------------|-----------------------------|--------------------------|
|                   |        |                          |                         | Plate               | Bossed & Weld Neck | Blind |                        |                      |              |                       | Bolt Circle Diameter | Diameter of Bolt Holes | Number of Bolts | Overall Thickness Weld Neck | Overall Thickness Bossed |
| mm                | inch   | A                        | B                       | C1                  | C2                 | C3    | D                      | E                    | F            | G                     | H                    | J                      | K               | L                           | M                        |
| 15                | 1/2"   | 21.3                     | 95                      | 14                  | 16                 | 16    | 32                     | 45                   | 22.3         | 2                     | 65                   | 14                     | 4               | 38                          | 22                       |
| 20                | 3/4"   | 26.7                     | 105                     | 16                  | 18                 | 18    | 40                     | 58                   | 27.6         | 2                     | 75                   | 14                     | 4               | 40                          | 26                       |
| 25                | 1"     | 33.4                     | 115                     | 16                  | 18                 | 18    | 46                     | 68                   | 34.5         | 2                     | 85                   | 14                     | 4               | 40                          | 28                       |
| 32                | 1 1/4" | 42.2                     | 140                     | 18                  | 18                 | 18    | 56                     | 78                   | 43.1         | 2                     | 100                  | 18                     | 4               | 42                          | 30                       |
| 40                | 1 1/2" | 48.3                     | 150                     | 18                  | 18                 | 18    | 64                     | 88                   | 49.5         | 3                     | 110                  | 18                     | 4               | 45                          | 32                       |
| 50                | 2"     | 60.3                     | 165                     | 20                  | 20                 | 20    | 74                     | 102                  | 61.9         | 3                     | 125                  | 18                     | 4               | 48                          | 34                       |
| 65                | 2 1/2" | 73                       | 185                     | 22                  | 22                 | 22    | 92                     | 122                  | 74.6         | 3                     | 145                  | 18                     | 8               | 52                          | 38                       |
| 80                | 3"     | 88.9                     | 200                     | 24                  | 24                 | 24    | 110                    | 138                  | 90.6         | 3                     | 160                  | 18                     | 8               | 58                          | 40                       |
| 100               | 4"     | 114.3                    | 235                     | 26                  | 24                 | 24    | 134                    | 162                  | 116.0        | 3                     | 190                  | 22                     | 8               | 65                          | 44                       |
| 125               | 5"     | 141.3                    | 270                     | 28                  | 26                 | 26    | 162                    | 188                  | 143.7        | 3                     | 220                  | 26                     | 8               | 68                          | 48                       |
| 150               | 6"     | 168.3                    | 300                     | 30                  | 28                 | 28    | 190                    | 218                  | 170.6        | 3                     | 250                  | 26                     | 8               | 75                          | 52                       |
| 200               | 8"     | 219.1                    | 375                     | 36                  | 34                 | 36    | 244                    | 285                  | 221.1        | 3                     | 320                  | 30                     | 12              | 88                          | 52                       |
| 250               | 10"    | 273.8                    | 450                     | 42                  | 38                 | 38    | 306                    | 345                  | 276.3        | 3                     | 385                  | 33                     | 12              | 105                         | 60                       |
| 300               | 12"    | 323.8                    | 515                     | 52                  | 42                 | 42    | 362                    | 410                  | 327.1        | 4                     | 450                  | 33                     | 16              | 115                         | 67                       |
| 350               | 14"    | 355.6                    | 580                     | 58                  | 46                 | 46    | 408                    | 465                  | 358.6        | 4                     | 510                  | 36                     | 16              | 125                         | 72                       |
| 400               | 16"    | 406.4                    | 660                     | 65                  | 50                 | 50    | 462                    | 535                  | 409.4        | 4                     | 585                  | 39                     | 16              | 135                         | 78                       |
| 450               | 18"    | 457                      | 685                     | 66                  | 57                 | 57    | 500                    | 560                  | 460.4        | 4                     | 610                  | 39                     | 20              | 135                         | 84                       |
| 500               | 20"    | 508                      | 755                     | 72                  | 57                 | 57    | 562                    | 615                  | 460.0        | 4                     | 670                  | 42                     | 20              | 140                         | 90                       |
| 600               | 24"    | 610                      | 890                     | 84                  | 72                 | 72    | 666                    | 735                  | 511.0        | 5                     | 795                  | 48                     | 20              | 150                         | 100                      |

#### Note:

- Dimensions are in (mm)
- Larger sizes available on request
- Available with or without raised face
- Weld neck bore is equal to pipe

## 10.13 Chemical Compatibility Table

| Media                      | Chemical Formula       | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                        |       |         |         |     |        |
|----------------------------|------------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|---------|-----|--------|
|                            |                        | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | Peek® | PVDF | Teflon® and Reinforced | PCTFE | UHMWPE® | Vespel® | PFA | KEL-F® |
| Acetaldehyde               | C2H4O                  | B        | B     | C            | C                        | A                  | A      | A       | A     | A            | A           |            | A      | C                   | A      | D                | A        | D     | A                 | A       | B     | D    | A                      | A     | A       | A       | A   | A      |
|                            | HCl                    | B        | B     | B            | B                        | B                  |        |         |       |              |             |            |        | B                   |        | A                |          |       |                   |         |       | A    |                        |       |         |         |     |        |
|                            | Acetamine              | A        | A     | D            | B                        | A                  | A      |         | A     | A            |             |            | A      | B                   | B      | D                | A        | D     | A                 | D       |       | A    |                        |       |         |         |     | B      |
|                            | Acetate Solvents       | C        | D     | D            | C                        | A                  |        | A       | A     | A            |             |            | A      | C                   |        | C                |          | C     | A                 | D       | A     |      |                        |       |         |         |     |        |
|                            | Acetic Acid (aerated)  | C        | D     | D            | C                        | A                  |        | A       | A     | A            |             |            | A      | C                   |        | C                |          | C     | A                 | D       | A     |      |                        |       |         |         |     |        |
|                            | Acetic Acid (air free) | C        | D     | D            | C                        | A                  | A      | A       | A     | A            |             |            | A      | C                   |        | C                |          | D     | A                 | D       | A     |      |                        |       |         |         |     |        |
|                            | Acetic Acid (crude)    | C        | D     | D            | D                        | A                  | A      | A       | A     | A            |             |            | A      | C                   |        | D                |          | D     | A                 | D       | A     |      |                        |       |         |         |     |        |
|                            | Acetic Acid Glacial    | C        | D     | D            | D                        | A                  | B      | A       | A     | A            |             |            | A      | C                   | C      | D                | B        | C     | A                 | D       | A     | B    | A                      | A     |         |         | A   |        |
|                            | Acetic Acid Glacial    | C        | D     | D            | D                        | A                  | A      | A       | A     | A            |             |            | A      | C                   | D      | D                | D        | D     | A                 | D       | A     | C    | A                      |       |         |         | A   |        |
|                            | Acetic Acid (pure)     | C        | D     | D            | D                        | A                  | A      | A       | A     | A            |             |            | A      | C                   | D      | D                | D        | C     | D                 | A       | D     | A    | C                      | A     |         |         | A   |        |
|                            | Acetic Acid 100%       | C2H4O2   | C     | D            | D                        | D                  | A      | A       | A     | A            |             |            | A      | C                   | C      |                  | D        | B     | D                 | A       | B     | A    | A                      | A     | A       | A       | A   |        |
|                            | Acetic Acid 80%        | C2H4O2   | C     | D            | D                        | D                  | A      | A       | A     | A            |             |            | A      | C                   | D      | D                | D        | C     | D                 | A       | D     | A    | C                      | A     |         | B       | A   |        |
|                            | Acetic Acid Vapors     | -        | B     | D            |                          |                    | C      | C       | B     | C            | A           |            |        |                     |        | D                |          |       | A                 |         |       |      |                        |       |         |         |     |        |
|                            | Acetic Anhydride       | C4H6O3   | C     | D            | D                        | D                  | B      | B       | B     | B            | A           |            | A      | C                   | B      |                  | D        | C     | D                 | A       | D     | D    | A                      | A     | A       |         | A   |        |
|                            | Acetone                | C3H6O    | A     | A            | A                        | A                  | A      | A       | A     | A            | A           |            | A      | A                   | B      |                  | D        | A     | D                 | A       | B     | A    | D                      | A     | A       | A       | A   | A      |
| Other Ketones              | RC(=O)R'               | A        | A     | A            | A                        | A                  | A      | A       | A     | A            |             |            |        |                     | D      | B                | D        |       |                   | B       |       | D    | A                      |       |         | A       |     |        |
| Acetyl Chloride            | CH3COCl                | C        | B     | A            | C                        | A                  | A      | A       | A     | A            |             |            | D      | C                   |        | D                | D        | D     |                   | D       | B     | B    | A                      |       |         |         | A   |        |
| Acetylene                  | C2H2                   | A        | C     | A            | A                        | A                  | A      | A       | A     | A            |             | B          | C      | A                   |        | B                | A        | A     | A                 | A       | B     | A    |                        |       |         |         | A   |        |
| Acid Fumes                 | -                      | B        | D     | D            | D                        | B                  |        | B       |       |              |             |            |        |                     | C      |                  |          |       | D                 |         |       | A    | A                      |       |         | A       |     |        |
| Acrylonitrile              | C3H3N                  | B        | A     | A            | C                        | A                  | A      | A       | A     | B            |             | B          | A      | A                   |        | D                | D        | D     | B                 | D       | A     | B    | A                      |       |         |         |     |        |
| Air                        | -                      | A        | A     | A            | A                        | A                  | A      | A       | A     | A            |             | A          | A      | A                   | A      | A                | A        | A     | A                 | A       | A     | A    |                        |       |         |         |     |        |
| Alcohol, Amyl              | C5H11OH                | B        | B     | B            | B                        | A                  | B      | B       | B     | A            |             | A          | B      | A                   |        | C                | A        | B     | A                 | A       | A     | A    | A                      |       |         | A       | A   |        |
| Alcohol, Butyl             | C4H9OH                 | A        | B     | B            | C                        | A                  | B      | A       | A     | A            |             | B          | B      | A                   |        | B                | B        | A     | A                 | A       | A     | A    | A                      |       |         | A       | A   |        |
| Alcohol, Diacetone         | CH3C(O)CH2C(O)H(CH3)2  | A        | B     | B            | B                        | A                  | B      | A       | B     | A            |             | A          | B      | A                   |        | D                | A        | D     | A                 | A       | A     | B    | A                      |       |         | A       | B   |        |
| Alcohol, Ethyl             | C2H6O                  | B        | B     | B            | B                        | A                  | B      | A       | B     | A            |             | A          | B      | A                   |        | A                | A        | A     | A                 | B       | A     | A    | A                      |       |         | A       | A   |        |
| Alcohol, Fatty             | -                      | B        | B     | B            | B                        | A                  | B      | A       | A     |              |             | A          |        |                     | B      |                  |          | A     | A                 | A       | A     | A    |                        |       |         | A       |     |        |
| Alcohol, Isopropyl         | C3H8O                  | B        | B     | B            | B                        | B                  | B      | A       | B     | A            |             | B          | B      | B                   |        | C                | A        | A     | A                 | A       | A     | A    | A                      |       |         | A       | A   |        |
| Alcohol, Methyl            | CH4O                   | C        | B     | B            | B                        | A                  | B      | A       | A     | A            |             | A          | B      | A                   |        | B                | A        | C     | A                 | B       | A     | A    | A                      |       |         | A       | B   |        |
| Alcohol, Propyl            | C3H8O                  | B        | B     | A            | B                        | A                  | B      | A       | A     | A            |             | A          | B      | A                   |        | B                | A        | A     | A                 | A       |       | A    | A                      |       |         | A       | A   |        |
| Alumunia                   | -                      | A        | A     |              |                          |                    |        |         | A     |              |             |            |        |                     |        | A                |          |       |                   | A       |       |      |                        |       |         |         |     |        |
| Aluminum Acetate           | Al(C2H3O2)3            | C        | C     |              | C                        | B                  | B      | A       | B     | B            |             | A          | C      |                     |        | D                | A        | D     |                   | D       |       |      |                        |       |         |         |     |        |
| Aluminum Chloride (dry)    | AlCl3                  | C        | D     | D            | D                        | C                  | B      | D       | B     | A            |             | C          | D      | D                   |        | B                | A        | A     | A                 | C       | A     | A    | A                      | A     | A       | A       | A   |        |
| Aluminum Chloride Solution | -                      | B        | D     | D            | D                        | D                  | C      | B       | B     | A            |             | B          | D      | C                   |        | B                |          | A     | A                 | D       | A     | A    | A                      | A     | A       | A       | A   |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.14 Chemical Compatibility Table

| Media                        | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |                          |             | Elastomers |        |                     |        |                  | Polymers |       |                   |                     |                   |      |                                    |                     |                    |     |                    |   |
|------------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------------------|-------------------|------|------------------------------------|---------------------|--------------------|-----|--------------------|---|
|                              |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C <sup>o</sup> | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin <sup>®</sup> | Peek <sup>®</sup> | PVDF | Teflon <sup>®</sup> and Reinforced | UHMWPE <sup>®</sup> | Vespe <sup>®</sup> | PFA | KEL-F <sup>®</sup> |   |
| Aluminum Fluoride            | AlF3             | C        | D     | D            | D                        | C                  | C      | B       | A     | B                        |             | C          | C      | D                   |        | A                | A        | A     | A                 | C                   |                   | A    | A                                  |                     |                    |     |                    |   |
| Aluminum Hydroxide           | AlH6O3           | B        | D     | D            | D                        | A                  | A      | A       | B     | A                        |             | B          | D      | A                   |        | A                | A        | A     | A                 | B                   |                   | A    | A                                  |                     |                    |     |                    | B |
| Aluminum Nitrate             | AlN3O9           | D        | D     | D            | D                        | B                  | A      | A       | C     | B                        |             | A          | D      | C                   |        | B                | B        | D     | A                 | C                   |                   | B    | A                                  |                     |                    |     |                    | B |
| Aluminum Oxalate             | C6AlO12-3        | B        |       |              | B                        | A                  |        | A       | B     | A                        |             |            | D      |                     |        |                  |          |       |                   |                     |                   |      |                                    |                     |                    |     |                    |   |
| Aluminum Potassium Sulfate   | AlKO8S2          | B        | B     | C            | D                        | B                  | C      | B       | B     | C                        |             | A          | C      | C                   |        | B                | A        | B     | A                 | C                   |                   |      | A                                  |                     |                    |     |                    | A |
| Aluminum Sulfate (Alum)      | Al2O12S3         | C        | C     | D            | D                        | B                  | B      | B       | C     | B                        |             | A          | C      | B                   |        | A                | A        | A     | A                 | C                   |                   | A    | A                                  |                     |                    | A   | A                  | A |
| Amines                       | R3-xNHx          | C        | B     | C            | C                        | A                  | A      | A       | B     | A                        |             | B          | C      | A                   |        | D                | C        | D     | A                 | D                   |                   | A    |                                    |                     |                    |     |                    | A |
| Ammonia Alum                 | AlH28NO20S2      | C        |       |              | C                        | A                  | B      | A       | B     | A                        |             | B          | C      | B                   |        | B                |          |       | A                 | C                   |                   |      | A                                  |                     |                    |     |                    |   |
| Ammonia, Anh. Liquid         | NH3              | A        | D     | A            | B                        | A                  | A      | A       | A     | B                        |             | B          | D      | B                   |        | B                | B        | D     | A                 | D                   |                   | A    | B                                  | A                   |                    |     | A                  | A |
| Ammonia Aqueous              | H5NO             | B        | C     | C            | C                        | A                  |        | A       | B     | A                        |             | B          | D      | A                   |        | D                | B        | C     | A                 |                     |                   | A    | A                                  |                     |                    | A   |                    |   |
| Ammonia Gas (hot)            | H3N              | B        | C     | B            | B                        | B                  | A      | A       | A     | A                        |             | B          | D      |                     |        | A                |          | D     |                   | D                   |                   | A    | A                                  |                     |                    |     |                    |   |
| Ammonia Liquor               | -                | A        | C     | A            | B                        | B                  | A      | A       | A     | B                        |             |            | D      | C                   |        | D                | A        | D     | A                 | D                   |                   |      |                                    |                     |                    |     |                    |   |
| Ammonia Solutions            | -                | B        | D     | B            | C                        | A                  | A      | A       | A     | A                        |             | B          | D      |                     |        | C                | A        | D     | A                 | D                   |                   | A    |                                    |                     |                    |     |                    |   |
| Ammonium Acetate             | C2H3O2NH4        | A        | D     | D            | D                        | B                  | A      | A       | B     | A                        |             |            | D      | B                   |        | C                | A        | D     | A                 | D                   |                   |      |                                    |                     |                    |     |                    |   |
| Ammonium Bicarbonate         | NH4HCO3          | B        | B     | C            | C                        | B                  |        | B       | B     | B                        |             |            | B      |                     |        | B                | A        | A     |                   | B                   |                   | A    |                                    |                     |                    |     |                    |   |
| Ammonium Bromide 5%          | NH4Br            | D        |       |              |                          | B                  |        | B       | B     |                          |             |            |        |                     |        |                  |          |       |                   | B                   |                   |      |                                    |                     |                    |     |                    |   |
| Ammonium Carbonate           | (NH4)2CO3        | B        | D     | B            | B                        | B                  | B      | B       | B     | B                        |             | A          | D      | B                   |        | C                | A        | B     | A                 | D                   |                   | A    | A                                  |                     |                    |     |                    |   |
| Ammonium Chloride            | NH4Cl            | C        | C     | D            | D                        | C                  | C      | B       | B     | B                        |             | C          | D      | D                   |        | B                | A        | A     | A                 | C                   |                   | A    | A                                  |                     |                    | A   | A                  |   |
| Ammonium Hydroxide 28%       | NH4OH            | C        | D     | C            | B                        | B                  | A      | A       | B     | B                        |             | A          | D      | B                   |        | B                | A        | B     | A                 | C                   |                   | A    | A                                  |                     |                    | B   | A                  |   |
| Ammonium Hydroxide Conc.     | NH4OH            | C        | D     | C            | B                        | B                  | A      | A       | C     | B                        |             | A          | D      | A                   |        | C                | A        | B     | A                 | D                   |                   | A    | B                                  |                     |                    | D   |                    |   |
| Ammonium Monosulfate         | -                | D        |       |              |                          | B                  |        | B       | B     | B                        |             |            |        | A                   |        |                  |          |       | D                 |                     |                   |      |                                    |                     |                    |     |                    |   |
| Ammonium Nitrate             | (NH4)(NO3)       | B        | D     | D            | B                        | A                  | A      | A       | A     | A                        |             | A          | D      | A                   |        | A                | A        | B     | A                 | C                   |                   | A    | A                                  |                     |                    |     |                    | A |
| Ammonium Oxalate 5%          | C2H8N2O4         | A        |       | A            | D                        | A                  | A      | A       | B     | A                        |             |            | D      | A                   |        | D                | A        |       |                   | B                   |                   |      |                                    |                     |                    |     |                    |   |
| Ammonium Persulfate          | H8N2O8S2         | D        | D     | C            | D                        | A                  | A      | A       | D     | B                        |             | B          | C      | A                   |        | D                | B        | B     | A                 | D                   |                   | B    | A                                  |                     |                    |     |                    |   |
| Ammonium Phosphate (mono)    | (NH4)3PO4        | B        | C     | D            | D                        | B                  | A      | A       | C     | A                        |             | A          | C      | C                   |        | C                | A        | A     |                   | B                   |                   | A    | A                                  |                     |                    |     |                    |   |
| Ammonium Phosphate Di-basic  | (NH4)2HPO4       | B        | C     | D            | C                        | B                  | B      | B       | C     | A                        |             | A          | D      | B                   |        | A                | A        | A     | A                 | B                   |                   | A    | A                                  |                     |                    |     |                    | A |
| Ammonium Phosphate Tri-basic | -                | B        | C     | D            | C                        | B                  | B      | B       | C     | A                        |             | A          | C      | B                   |        | A                | A        | A     |                   | B                   |                   |      |                                    |                     |                    |     |                    |   |
| Ammonium Sulfate             | (NH4)2SO4        | C        | D     | C            | C                        | C                  | B      | A       | B     | B                        |             | A          | D      | C                   |        | B                | A        | C     | A                 | C                   |                   | A    | A                                  |                     |                    |     |                    | A |
| Ammonium Sulfide             | (NH4)2S          | B        | D     | D            | D                        | B                  | B      | B       | B     | A                        |             |            | D      | C                   |        | A                | A        | D     |                   | B                   |                   |      |                                    |                     |                    |     |                    |   |
| Ammonium Sulfite             | (NH4)2SO4,       | D        | C     | C            | C                        | A                  | B      | B       | D     | A                        |             |            | B      | B                   |        | B                | B        | C     | D                 | D                   |                   |      |                                    |                     |                    |     |                    | A |
| Amyl Acetate                 | CH3COO(CH2)4CH3  | A        | A     | C            | C                        | B                  | A      | A       | A     | A                        |             | A          | B      | A                   |        | D                | B        | C     | A                 | C                   |                   | A    | A                                  |                     |                    |     |                    | A |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information



# TECHNICAL DATA

## 10.15 Chemical Compatibility Table

| Media                    | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                        |       |         |        |     |        |
|--------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|--------|-----|--------|
|                          |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin° | Peek° | PVDF | Teflon° and Reinforced | PCTFE | UHMWPE° | Vespe° | PFA | KEL-F° |
| Amyl Chloride            | C5H11Cl          | B        | B     | A            | B                        | B                  | B      | A       | A     | A            |             | C          | A      | B                   |        | D                | D        | D     | A                 | A       | A     | A    |                        |       |         |        |     | A      |
| Aniline                  | C6H7N            | C        | D     | C            | C                        | A                  | A      | A       | B     | B            |             | C          | C      | A                   |        | D                | B        | C     | A                 | B       | A     | B    | A                      | A     | A       | D      | A   | A      |
| Aniline Dyes             | -                | C        | C     | C            | C                        | A                  | A      | A       | A     |              |             |            | C      |                     |        | C                | B        | B     |                   | B       |       |      | A                      |       |         |        |     |        |
| Apple Juice              | -                | B        | C     | D            | D                        | B                  |        | A       | A     |              |             |            |        |                     |        | A                | B        | A     |                   | A       | A     |      |                        |       |         |        |     |        |
| Aqua Regia (Strong Acid) | -                | D        | D     | D            | D                        | C                  | C      | B       |       | C            |             | B          | D      | D                   |        | D                | D        | D     | D                 | D       | D     | A    | A                      | A     | D       |        | A   | A      |
| Aromatic Solvents        | -                | A        | A     | C            | B                        | A                  |        | A       | B     |              |             |            |        |                     |        | D                | D        | A     |                   | A       | A     | A    | A                      | A     |         |        | A   |        |
| Arsenic Acid             | AsH3O4           | D        | C     | D            | D                        | B                  | B      | A       | A     | B            |             | B          | C      | A                   |        | A                | B        | A     | A                 | A       | D     | A    | A                      |       |         |        |     |        |
| Asphalt Emulsion         | -                | C        | B     | B            | B                        | A                  | A      | A       | B     | A            |             |            | B      | A                   |        | D                | D        | A     | A                 | B       | A     | A    | A                      |       |         |        |     | A      |
| Asphalt Liquid           | -                | C        | B     | B            | B                        | A                  | A      | A       | B     | A            |             |            |        |                     |        | C                | D        | A     | A                 | B       | A     | A    |                        |       |         |        |     | A      |
| Barium Carbonate         | CBaO3            | C        | B     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | B      | B                   |        | B                | A        | A     | A                 | A       | A     | A    |                        |       |         |        |     | A      |
| Barium Chloride          | BaCl2            | D        | B     | C            | C                        | B                  | A      | A       | A     | A            |             | A          | B      | A                   |        | A                | A        | A     | A                 | A       | A     | A    | A                      |       |         |        |     | A      |
| Barium Cyanide           | Ba(CN)2          | D        | C     |              | C                        | B                  | A      | B       | C     | A            |             |            | C      | A                   |        | B                | A        | A     |                   | B       |       |      |                        |       |         |        |     |        |
| Barium Hydroxide         | BaH2O2           | D        | D     |              |                          | A                  |        | A       | B     |              |             |            |        |                     |        |                  |          |       |                   | A       |       |      |                        |       |         |        |     |        |
| Barium Hydroxide         | Ba(OH)2          | D        | D     | C            | C                        | A                  | A      | A       | A     | B            |             | B          | D      | B                   |        | A                | A        | A     | A                 | D       | A     | A    |                        |       |         |        |     | A      |
| Barium Nitrate           | Ba(NO3)2         | B        | D     | A            | A                        | A                  | B      | A       |       |              |             | A          | D      | B                   |        | A                | A        | A     | A                 | B       |       |      |                        |       |         |        |     | A      |
| Barium Sulfate           | BaSO4            | C        | B     | B            | C                        | B                  | A      | A       | A     | A            |             | A          | C      | C                   |        | A                | A        | A     | A                 | B       | A     | A    |                        |       |         |        |     | A      |
| Barium Sulfide           | BaS              | D        | C     | C            | C                        | B                  | A      | A       | A     | A            |             | B          | D      | C                   |        | A                | A        | A     | A                 | A       | A     | A    |                        |       |         |        |     |        |
| Beer                     | -                | A        | B     | C            | D                        | A                  | A      | A       | A     | A            |             | A          | A      | A                   |        | B                | A        | A     | A                 | B       | A     | A    | A                      | A     | A       |        | A   | A      |
| Beet Sugar Liquors       | -                | A        | B     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | B      | A                   |        | A                | A        | A     | A                 | B       | A     | A    |                        |       |         |        |     | A      |
| Benzaldehyde             | C7H6O            | B        | B     | B            | C                        | A                  | A      | A       | B     |              |             | A          | A      | C                   |        | D                | A        | D     | A                 | A       | A     | A    | A                      | A     | A       |        | A   | A      |
| Benzene (Benzol)         | C6H6             | B        | A     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | A      | B                   |        | D                | D        | A     | A                 | A       | A     | A    | A                      | A     | A       | A      | A   | B      |
| Benzoic Acid             | C7H6O2           | B        | C     | D            | D                        | B                  | A      | A       | B     | A            |             | A          | C      | B                   |        | C                | D        | A     | A                 | B       | A     | A    | A                      | A     | A       | A      | A   | A      |
| Beryllium Sulfate        | BeO4S            | B        | B     |              | B                        | B                  |        | A       | B     |              |             |            |        |                     |        | B                | B        | B     |                   | A       |       |      |                        |       |         |        |     |        |
| Bleaching Powder Wet     | -                |          | B     | C            | C                        | C                  |        | B       | A     |              |             |            |        | B                   |        | D                | B        | B     |                   | B       |       |      |                        |       |         |        |     |        |
| Blood (meat juices)      | -                | B        | B     |              | D                        | A                  | A      | A       | A     | A            |             | A          |        | B                   | A      | A                | B        | B     |                   | B       |       |      |                        |       |         |        |     |        |
| Borax (Sodium Borate)    | Na2B4O7·10H2O    | C        | B     | C            | A                        | A                  | A      | A       | A     | A            |             | B          | B      | A                   |        | A                | A        | A     | A                 | B       |       | A    |                        |       | A       |        |     | A      |
| Bordeaux Mixture         | -                |          |       |              |                          | A                  |        | A       |       | A            |             |            |        |                     |        | A                |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Borax Liquors            | -                | C        | A     | C            | C                        | B                  |        | A       | B     | A            |             |            |        |                     |        | A                | A        | A     |                   | B       |       |      |                        |       |         |        |     |        |
| Boric Acid               | BH3O3            | C        | C     | D            | D                        | C                  | B      | A       | A     | A            |             | A          | B      | B                   |        | B                | A        | A     | A                 | A       | A     | A    | A                      | A     | A       | A      | A   | A      |
| Brake Fluid              | -                | B        | B     | A            | B                        | A                  | A      | A       | A     | A            |             |            | B      | A                   |        | D                | B        | D     |                   | B       | A     |      |                        |       |         |        |     |        |
| Brines (saturated)       | -                | C        | B     | C            | C                        | B                  | B      | B       | B     | A            |             |            | A      | B                   |        | A                | A        | A     |                   | A       |       |      |                        |       |         |        |     | A      |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                      | Chemical Formula                                | Metals   |       |              |                          |                    |        |          |       |                          |             |          |        | Elastomers          |        |                  |          |       |                   |                     |                   | Polymers |                                    |       |                     |                    |     |                    |
|----------------------------|-------------------------------------------------|----------|-------|--------------|--------------------------|--------------------|--------|----------|-------|--------------------------|-------------|----------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------------------|-------------------|----------|------------------------------------|-------|---------------------|--------------------|-----|--------------------|
|                            |                                                 | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy 20 | Monel | Hastelloy C <sup>o</sup> | Inconel 625 | Titanium | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin <sup>®</sup> | Peek <sup>®</sup> | PVDF     | Teflon <sup>®</sup> and Reinforced | PCTFE | UHMWPE <sup>®</sup> | Vespe <sup>®</sup> | PFA | KEL-F <sup>®</sup> |
| Bromine (dry)              | Br                                              | D        | C     | D            | D                        | D                  | C      | B        | B     | A                        | A           | B        | D      | D                   |        | D                | C        | A     | D                 | D                   | D                 | A        | A                                  | A     | D                   |                    | A   | A                  |
| Bunker Oils (Fuel)         | -                                               | A        | B     | A            | B                        | A                  |        | A        | A     | A                        |             |          | A      | A                   |        | B                | C        | A     |                   | A                   | A                 | A        | A                                  |       |                     |                    |     |                    |
| Butadiene                  | C <sub>4</sub> H <sub>6</sub>                   | A        | B     | B            | B                        | A                  | A      | A        | A     | B                        |             | A        | C      | A                   |        | C                | C        | A     | A                 | A                   | A                 | A        | A                                  |       |                     |                    |     | A                  |
| Butane                     | C <sub>4</sub> H <sub>10</sub>                  | A        | A     | B            | C                        | A                  | A      | A        | A     | A                        |             | A        | B      | A                   | A      | B                | D        | A     | A                 | A                   | A                 | A        | A                                  | A     |                     |                    |     | A                  |
| Butter                     | -                                               | A        |       |              | D                        | A                  |        | A        |       |                          |             |          | D      | C                   |        | B                | A        | A     |                   | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Buttermilk                 | -                                               | A        | D     | D            | D                        | A                  |        | A        | D     | A                        |             |          | D      | A                   |        | A                | B        | A     | A                 | A                   | A                 |          |                                    |       |                     |                    |     | A                  |
| Butyl Acetate              | C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>   | B        | B     | B            | B                        | B                  | A      | A        | A     | A                        |             | B        |        | C                   |        | D                | C        | D     |                   | B                   | A                 | A        | A                                  | A     |                     |                    | A   | A                  |
| Butylene                   | C <sub>4</sub> H <sub>8</sub>                   | A        | A     | A            | A                        | A                  | A      | A        | A     | A                        |             |          |        | A                   |        | D                | D        | D     | A                 | A                   | A                 | A        | A                                  |       |                     |                    |     | C                  |
| Butyric Acid               | C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>    | B        | B     | D            | D                        | B                  | A      | A        | A     | A                        |             | A        | C      | C                   |        | C                | C        | C     | A                 | B                   | A                 | A        | A                                  |       |                     |                    |     | A                  |
| Calcium Bisulfite          | CaH <sub>2</sub> O <sub>6</sub> S <sub>2</sub>  | C        | D     | D            | D                        | B                  | B      | A        | D     | B                        |             | A        | C      | B                   |        | A                | D        | A     | A                 | D                   | A                 | A        | A                                  |       |                     |                    |     | A                  |
| Calcium Carbonate          | CaCO <sub>3</sub>                               | C        | D     | C            | D                        | B                  | A      | A        | A     | A                        |             | A        | C      | A                   |        | B                | B        | A     | A                 | A                   | A                 | A        | A                                  |       |                     |                    |     | A                  |
| Calcium Chlorate           | Ca(ClO <sub>3</sub> ) <sub>2</sub>              | B        | C     | B            | C                        | B                  |        | A        | A     | B                        |             | B        | B      | B                   |        | B                | B        | B     | B                 | C                   |                   | A        |                                    |       |                     |                    |     |                    |
| Calcium Chloride           | CaCl <sub>2</sub>                               | D        | C     | C            | C                        | B                  | B      | A        | A     | A                        |             | A        | B      | C                   |        | A                | A        | A     | A                 | D                   | A                 | A        | A                                  | A     |                     | A                  | A   |                    |
| Calcium Hydroxide          | Ca(OH) <sub>2</sub>                             | C        | D     | C            | C                        | B                  | A      | A        | A     | A                        |             | A        | A      | C                   |        | A                | A        | A     | A                 | D                   | A                 | A        | A                                  |       |                     | D                  | A   | A                  |
| Calcium Nitrate            | Ca(NO <sub>3</sub> ) <sub>2</sub>               | C        | B     | C            | C                        | B                  | B      | A        | A     | B                        |             | B        | B      | C                   |        | B                | B        | A     | B                 | D                   | A                 | A        | A                                  |       |                     | A                  | B   |                    |
| Calcium Phosphate          | Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> | D        | C     |              | C                        | C                  |        | B        |       |                          |             |          |        |                     |        | B                | B        | B     |                   | B                   |                   |          |                                    |       |                     |                    |     |                    |
| Calcium Silicate           | Ca <sub>2</sub> SiO <sub>4</sub>                | D        | C     |              | C                        | C                  |        | B        |       | A                        |             |          |        |                     |        | B                | B        | B     |                   | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Calcium Sulfate            | CaO <sub>4</sub> S                              | C        | B     | C            | C                        | C                  | A      | A        | A     | B                        |             | A        | B      | B                   |        | A                | B        | A     | A                 | D                   | A                 | A        | A                                  |       |                     | A                  | A   |                    |
| Caliche Liquor             | -                                               |          |       | B            |                          | A                  |        | A        |       |                          |             |          |        |                     |        | B                |          |       |                   | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Camphor                    | C <sub>10</sub> H <sub>16</sub> O               | C        | C     | B            | C                        | B                  | A      | A        | C     |                          |             |          | B      |                     |        | B                | B        | B     |                   | A                   | A                 |          |                                    | A     |                     |                    |     |                    |
| Cane Sugar Liquors         | C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> | B        | B     | A            | B                        | A                  | A      | A        | A     | A                        |             |          | A      | A                   |        | B                | A        | B     |                   | A                   |                   | A        |                                    |       |                     |                    |     |                    |
| Carbonated Beverages       | -                                               | B        | B     | D            | B                        | B                  | B      | B        | C     | A                        |             |          |        |                     |        | B                | B        | B     | A                 | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Carbonated Water           | -                                               | A        | D     | B            | C                        | A                  | B      | A        | B     |                          |             |          | B      | A                   |        | A                | A        | A     | A                 | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Carbon Bisulfide           | CS <sub>2</sub>                                 | B        | C     | B            | B                        | B                  | A      | B        | B     | B                        |             |          | B      | A                   |        | D                | D        | A     | A                 | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Carbon Dioxide (dry)       | CO <sub>2</sub>                                 | B        | B     | B            | B                        | A                  | A      | A        | A     | A                        |             | A        | B      | A                   | A      | C                | B        | B     | A                 | A                   | A                 | A        |                                    |       |                     | A                  | A   |                    |
| Carbonic Acid              | CH <sub>2</sub> O <sub>3</sub>                  | A        | D     | B            | D                        | B                  | A      | A        | A     | B                        |             | B        | C      | A                   | B      | B                | B        | A     | A                 | B                   | A                 | A        | A                                  | A     |                     | A                  | A   |                    |
| Carbon Monoxide            | CO                                              | A        | A     | B            | B                        | A                  | A      | A        | A     | A                        |             |          |        | A                   |        | B                | B        | B     | A                 | A                   | A                 | A        | A                                  |       |                     | A                  | A   |                    |
| Carbon Tetrachloride (dry) | CCl <sub>4</sub>                                | C        | B     | C            | C                        | A                  | A      | A        | A     | A                        |             | A        | B      | B                   |        | D                | D        | B     | B                 | B                   | A                 | A        | A                                  |       |                     | A                  | A   | D                  |
| Carbon Tetrachloride (wet) | CCl <sub>4</sub>                                | D        | C     | D            | D                        | B                  | A      | B        | A     | A                        |             | A        | C      | A                   |        | D                | D        | B     | B                 | B                   |                   | A        | A                                  |       |                     | A                  | A   | B                  |
| Casein                     | -                                               | C        | C     |              | C                        | B                  |        | B        | C     | B                        |             |          |        |                     |        | B                | B        | B     |                   | A                   |                   |          |                                    |       |                     |                    |     |                    |
| Castor Oil                 | -                                               | A        | A     | A            | A                        | A                  | A      | A        | A     | A                        |             |          | B      | A                   |        | A                | B        | A     | A                 | A                   | A                 |          |                                    |       |                     |                    |     |                    |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                 | Chemical Formula          | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                        |       |         |          |     |        |
|-----------------------|---------------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|----------|-----|--------|
|                       |                           | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | PEEK® | PVDF | Teflon® and Reinforced | PCTFE | UHMWPE® | Vespele® | PFA | KEL-F® |
| Caustic Potash        | HKO                       | C        | C     | B            | B                        | A                  | A      | A       | A     | A            |             |            | C      |                     |        | B                |          |       | A                 | D       | A     |      | A                      | A     | A       |          |     |        |
|                       | HNaO                      | D        | D     | B            | B                        | A                  | A      | A       | A     | A            |             |            | B      | A                   |        | C                | B        | C     | A                 | D       | A     | A    | A                      | A     | A       | A        |     |        |
|                       | -                         | B        | B     | B            | B                        | B                  |        | B       | B     |              |             |            |        |                     |        | D                | B        | D     |                   | C       |       |      | A                      |       |         | A        |     |        |
| China Wood Oil (Tung) | -                         | A        | C     | C            | C                        | A                  | A      | A       | A     | A            |             |            |        | A                   |        | A                | D        | A     |                   | A       |       |      |                        |       |         |          |     |        |
|                       | -                         | C        | C     | C            | C                        | C                  |        | A       | B     | A            |             |            | A      |                     |        | D                | D        | C     |                   | A       | B     |      | A                      |       |         |          |     |        |
|                       |                           | D        | D     | C            | D                        | C                  | C      | A       | C     | B            |             |            | A      | C                   |        | B                | C        | A     | B                 | D       | D     | A    | A                      | A     |         |          |     | A      |
| Chlorine Gas (dry)    | Cl2                       | C        | D     | C            | B                        | B                  | B      | A       | A     | A            |             | C          | D      | B                   |        | C                | D        | B     | A                 | D       | D     | A    | A                      | A     | B       | A        | A   | D      |
|                       | C6H5Cl                    | B        | B     | C            | C                        | A                  | A      | A       | A     | A            |             | B          | B      | A                   |        | D                | D        | A     | A                 | C       | C     | B    | A                      | A     | A       | A        | A   | B      |
|                       | CHCl3                     | C        | B     | C            | C                        | A                  | A      | A       | A     | B            |             | A          | B      | A                   |        | D                | D        | B     | A                 | B       | A     | C    | A                      | A     | B       | A        | A   | C      |
| Chloroform (dry)      | -                         | B        | B     | B            | B                        | B                  |        | A       | B     | A            |             |            |        |                     |        | B                | B        | B     |                   |         |       |      |                        |       |         |          |     |        |
|                       | Chlorophyll (dry)         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |
|                       | Chlorosulfonic Acid (dry) | C        | C     | C            | B                        | C                  | C      | B       | A     | B            |             | A          | C      | D                   |        | D                | D        | D     | A                 | D       | B     | D    | A                      | A     | D       | A        | A   | A      |
| Chrome Alum           | GrKO8S2                   | C        | C     | B            | C                        | A                  |        | A       | B     |              |             |            |        |                     |        | B                | B        | B     |                   | B       |       |      |                        |       |         |          |     |        |
|                       | Chromic Acid<50%          | D        | D     | D            | D                        | C                  | B      | B       | C     | C            |             | A          | D      | B                   |        | D                | C        | C     | C                 | D       | D     | A    | A                      | A     | A       | D        | A   | A      |
|                       | Chromic Acid>50%          | D        | D     | D            | D                        | C                  | C      | B       | D     | C            |             | B          | D      | C                   |        | D                | C        | C     | C                 | D       | D     | A    | A                      | A     | A       | D        | A   | B      |
| Chromium Sulfate      | Cr2O12S3                  | B        | C     |              | D                        | B                  | B      | C       | B     |              |             |            |        | B                   |        | B                | B        | B     |                   | C       |       |      |                        |       |         |          |     |        |
|                       | Cider                     | B        |       |              | D                        | A                  | A      | B       | A     | A            |             |            | A      | A                   |        | A                | A        | A     |                   | A       |       |      |                        |       |         |          |     |        |
|                       | Citric Acid               | C        | D     | D            | D                        | C                  | A      | A       | A     | A            |             | A          | D      | B                   |        | B                | B        | A     | A                 | C       | A     | A    | A                      | A     | A       | A        | A   | A      |
| Citrus Juices         | -                         | C        | B     | D            | D                        | B                  | A      | A       | A     | A            |             |            |        |                     |        | A                |          | A     |                   | A       |       |      |                        |       |         |          |     |        |
|                       | -                         |          |       |              |                          | A                  |        |         | A     | A            |             |            |        | A                   |        | B                |          | B     |                   | A       | A     |      |                        |       |         |          |     |        |
|                       | -                         | B        | B     | C            | C                        | A                  | A      | A       | B     | A            |             |            | B      | A                   |        | A                | A        | A     |                   | A       | A     | A    | A                      | A     |         |          |     |        |
| Coffee                | -                         | A        | A     | C            | C                        | A                  | A      | A       | B     | A            |             | A          | A      | A                   |        | A                | A        | A     |                   | A       |       |      |                        |       |         |          |     |        |
|                       | -                         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |
|                       | -                         | A        | C     | B            | B                        | A                  | A      | A       | B     |              |             | B          |        |                     |        | C                | D        | B     |                   | C       |       |      |                        |       |         |          |     |        |
| Coke Oven Gas         | -                         | B        | B     | B            | B                        | A                  |        | A       | A     | A            |             |            |        |                     |        | A                | D        | A     |                   | A       | A     |      |                        |       |         |          |     |        |
|                       | -                         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |
|                       | -                         | D        | D     | C            | D                        | A                  |        | A       | B     | A            |             | C          |        |                     |        | C                | B        | D     |                   | C       | A     | A    | A                      | A     |         |          |     |        |
| Copper Acetate        | C4H6CuO4                  | D        |       |              |                          | A                  |        |         | A     | A            |             |            |        |                     |        |                  |          |       |                   | A       | A     | A    | A                      | A     |         |          |     |        |
|                       | CCuO3                     | D        |       |              |                          |                    |        |         | A     | A            |             |            |        |                     |        |                  |          |       |                   | A       | A     | A    | A                      | A     |         |          |     |        |
|                       | CCuN                      | D        | D     | C            | D                        | A                  |        | A       | C     | A            |             | A          | D      | B                   |        | A                | B        | B     | A                 | B       | A     | A    | A                      | A     |         |          |     |        |
| Copper Cyanide        | -                         | D        | D     | D            | D                        | B                  |        |         | A     | D            | B           |            | B      | D                   | A      |                  | A        | B     | A                 | A       | A     | A    | A                      | A     |         |          |     |        |
|                       | Cu(NO3)2                  | D        | D     | D            | D                        | B                  |        |         | A     | D            | B           |            |        |                     |        | A                | B        | A     | A                 | D       | A     | A    | A                      | A     |         |          |     | A      |
|                       | CuO4S                     | D        | D     | D            | D                        | B                  | A      | A       | D     | A            |             | A          | D      | B                   |        | A                | A        | A     | A                 | D       | A     | A    | A                      | A     |         | A        | A   | A      |
| Copper Sulfate        | -                         | B        | B     | B            | C                        | B                  | A      | A       | B     | A            |             |            | B      | A                   |        | A                | C        | A     |                   | A       | A     | A    | A                      | A     |         | A        | A   |        |
|                       | -                         | B        | B     | B            | C                        | B                  | A      | A       | B     | A            |             |            | A      | B                   | A      |                  | A        | C     |                   | A       | A     |      |                        |       | A       | A        |     |        |
|                       | -                         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |
| Cotton seed Oil       | -                         | B        | B     | B            | C                        | B                  | A      | A       | B     | A            |             | A          | B      | A                   |        | A                | C        | B     |                   | B       | A     | A    | A                      |       |         |          |     |        |
|                       | -                         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |
|                       | -                         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.18 Chemical Compatibility Table

| Media                         | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        |                  | Polymers |       |                   |         |       |      |                        |       |         |         |     |        |
|-------------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|---------|-----|--------|
|                               |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | PEEK® | PVDF | Teflon® and Reinforced | PCTFE | UHMWPE® | VespeI® | PFA | KEL-F® |
| Cresol                        | C7H8O            | A        | C     | A            | C                        | B                  | A      | B       | B     | B            |             | B          | A      | A                   |        | D                | D        | D     | A                 | D       | D     | B    | A                      | A     | A       |         |     | B      |
|                               | -                | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | B      | A                   |        | C                | D        | A     |                   | D       | A     |      | A                      |       | A       |         |     |        |
|                               | C7H8O            | C        | B     | C            | D                        | B                  | A      | A       | A     | A            |             | A          | C      | A                   |        | D                | D        | B     | A                 | D       | A     | C    | A                      | A     |         | A       |     |        |
| Crude Oil, sour               | -                | A        | C     | C            | C                        | B                  | A      | A       | B     | A            | A           |            | D      | B                   | A      | A                | D        | A     |                   | A       | A     |      | A                      |       | A       |         |     |        |
|                               | Crude Oil, sweet | A        | B     | A            | B                        | A                  | A      | A       | A     | A            | A           |            | B      | A                   | A      | A                | D        | A     |                   | A       | A     |      | A                      |       | A       |         |     |        |
| Cupric Nitrate                | CuN2O6           | D        |       |              |                          | A                  |        | A       | D     |              |             |            |        |                     |        |                  |          |       |                   | D       |       |      |                        |       |         |         |     |        |
| Cutting Oils, Water Emulsions | -                | A        | A     | B            | B                        | A                  | A      | A       | A     |              |             | A          | A      |                     |        | A                |          | A     |                   | A       | A     |      |                        |       |         |         |     |        |
| Cyanide Plating Solution      | -                | D        | D     |              | D                        | B                  |        | B       | D     | A            |             |            |        |                     |        | B                | B        | B     |                   | D       |       |      |                        |       |         |         |     |        |
| Cyclohexane                   | C6H12            | A        | A     | A            | B                        | A                  | A      | A       | A     | A            |             | A          | A      | A                   |        | C                | D        | A     | A                 | A       | A     | A    | A                      | A     | A       |         | A   |        |
| Cyclohexanone                 | C6H10O           | A        | B     | B            | B                        | A                  | A      | A       | B     | B            |             |            | B      | A                   |        | D                | B        | D     | A                 | A       | A     | C    | A                      | A     |         |         | B   |        |
| Detergents, Synthetic         | -                | B        | B     | A            | B                        | B                  | A      | A       | A     | A            |             | A          | B      | A                   |        | B                | B        | A     | A                 | A       | A     | A    | A                      | A     | A       |         | A   |        |
| Dextrin                       | C18H32O16        | B        | A     | B            | B                        | B                  |        | A       | B     |              |             |            | A      |                     |        | B                | B        | B     |                   | A       |       |      |                        |       |         |         |     |        |
| Dichloroethane                | C2H4Cl2          | B        | B     |              | C                        | A                  | B      | B       | B     | A            |             | B          | D      | B                   |        | D                | D        | B     | A                 | B       | A     | A    | A                      |       |         |         | A   |        |
| Dichloroethyl Ether           | C4H8Cl2O         | B        | B     | A            | B                        | B                  |        | B       | A     |              |             |            | B      | A                   |        | D                | C        | D     |                   | C       | A     |      | A                      |       | D       |         |     |        |
| Diesel Oil Fuels              | -                | A        | A     | A            | A                        | A                  | A      | A       | A     | A            |             | C          | A      | A                   | A      | A                | D        | A     | A                 | A       | A     | B    | A                      | A     | A       |         | B   |        |
| Diethylamine                  | C4H11N           | B        | C     | C            | C                        | B                  | A      | A       | B     | A            |             | B          | A      | A                   |        | B                | C        | D     | A                 | B       | A     | B    | A                      |       |         |         | A   |        |
| Diethyl Benzene               | -                |          |       |              |                          | B                  |        | B       |       |              |             |            |        |                     |        | D                | D        | A     |                   | C       |       |      |                        |       |         |         |     |        |
| Diethylene Glycol             | C4H10O3          | B        | B     | A            | A                        | A                  | B      | A       | B     | B            |             | A          | A      | B                   |        | A                | A        | B     | A                 | B       | A     |      |                        |       |         |         |     |        |
| Diethyl Sulfate               | (C2H5)2SO4       | A        | B     | A            | B                        | B                  |        | B       | B     | A            |             |            | A      |                     |        | C                | C        | B     |                   | A       | A     |      |                        |       |         |         |     |        |
| Dimethyl Formamide            | C3H7NO           | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             |            | C      | A                   |        | B                | B        | D     |                   | C       | A     | A    | A                      |       |         | D       | A   |        |
| Dimethyl Phthalate            | C10H10O4         |          |       |              |                          | A                  |        |         |       |              |             |            |        |                     |        | B                | B        | D     |                   | C       | A     |      |                        |       |         |         |     |        |
| Dioxane                       | C4H8O2           | B        | A     | A            | B                        | B                  | A      | B       | A     | A            |             |            | A      |                     |        | D                | C        | D     | A                 | C       | A     |      |                        |       |         |         |     |        |
| Dipentane (Pinene)            | C10H16           | A        | A     |              | A                        | A                  |        | A       |       |              |             |            | A      | A                   |        | B                | D        | B     |                   | A       |       |      |                        |       |         |         |     |        |
| Disodium Phosphate            | HNaz2O4P         | B        | B     |              | B                        | B                  |        | A       | B     |              |             |            | B      |                     |        | B                |          | B     |                   | A       |       |      |                        |       |         |         |     |        |
| Dowtherm                      | C24H20O          | A        | A     | B            | B                        | A                  | A      | A       | A     | A            |             |            | A      | A                   |        | D                | D        | A     | A                 | A       | B     |      |                        |       |         |         |     |        |
| Drilling Mud                  | -                | B        | B     | A            | A                        | A                  | A      | A       | A     | A            |             |            | B      | A                   | A      | B                | A        | A     |                   | A       |       |      |                        |       |         |         |     |        |
| Dry Cleaning Fluids           | -                | A        | C     | B            | B                        | A                  |        | A       | A     |              |             |            |        |                     |        | B                | A        | B     |                   | D       |       |      |                        |       |         |         |     |        |
| Drying Oil                    | -                | C        | C     | C            | B                        | B                  |        | B       | B     |              |             |            |        |                     |        | B                | A        |       |                   | A       |       |      |                        |       |         |         |     |        |
| Enamel                        | -                |          | A     |              |                          |                    |        |         |       |              |             |            |        |                     |        | A                |          |       | B                 |         |       |      |                        |       |         |         |     |        |
| Epsom Salts                   | MgO4S            | B        | A     | C            | A                        | B                  | A      | B       | B     | B            |             | A          | B      | A                   |        | B                | A        | A     | A                 | B       |       |      |                        |       |         |         | A   |        |
| Ethanol                       | C2H6             | A        | B     | B            | A                        | A                  | A      | B       | B     | A            |             |            | A      | A                   | A      | A                | D        | A     | A                 | B       | A     |      |                        |       |         |         |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                       | Chemical Formula      | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                        |       |         |        |     |        |
|-----------------------------|-----------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|--------|-----|--------|
|                             |                       | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | Peek® | PVDF | Teflon® and Reinforced | PCTFE | UHMWPE® | Vespe® | PFA | KEL-F® |
| Ethers                      | H2O                   | B        | A     | B            | B                        | A                  | A      | A       | A     | B            |             | A          | B      | A                   | A      | D                | C        | C     | A                 | C       | A     | C    | A                      | A     | A       | A      | A   | C      |
| Ethyl Acetate               | C4H8O2                | B        | B     | B            | B                        | B                  | A      | A       | A     | B            |             | A          | B      | B                   |        | D                | C        | D     | A                 | A       | A     | B    | A                      |       | A       | A      | B   |        |
| Ethyl Acrylate              | C5H8O2                | B        | B     | A            | B                        | A                  | A      | A       | A     | B            |             |            | A      | A                   |        | D                | C        | D     |                   | B       | A     |      | A                      |       |         |        |     |        |
| Ethyl Benzene               | C8H10                 | A        |       | A            | B                        | B                  | B      | A       | A     | A            |             |            | B      | B                   |        | C                | D        | A     |                   | A       | A     |      | A                      |       |         |        |     |        |
| Ethyl Bromide               | C2H5Br                | B        | A     | B            | B                        | B                  |        | C       | B     |              |             |            | B      |                     |        | B                | B        | B     |                   | A       |       |      | A                      |       |         |        |     |        |
| Ethyl Chloride (dry)        | C2H5Cl                | B        | B     | B            | B                        | A                  | A      | A       | A     | C            |             | A          | B      | A                   |        | C                | C        | B     | A                 | B       | A     | B    | A                      |       |         |        | B   |        |
| Ethyl Chloride (wet)        | C2H5Cl                | D        | C     | C            | D                        | B                  | B      | B       | B     | C            |             |            | C      | C                   |        | C                | C        | B     | B                 | B       | A     |      | A                      |       |         |        |     |        |
| Ethylene Chloride           | C2H4Cl                | B        |       |              | C                        | A                  | B      | A       | A     | B            |             | B          | A      | B                   |        | D                | D        | D     | A                 | B       |       | B    | A                      |       | A       |        | B   |        |
| Ethylene Dichloride         | C2H4Cl2               | B        | B     | B            | A                        | A                  | A      | A       | A     | C            |             | B          | B      | B                   |        | D                | D        | D     | A                 | C       | A     | B    | A                      |       | B       | A      | B   |        |
| Ethylene Glycol             | C2H6O2                | A        | B     | B            | B                        | A                  | A      | A       | A     | B            |             | A          | B      | B                   |        | A                | A        | A     | A                 | B       | A     | A    | A                      |       | A       | A      | A   |        |
| Ethylene Oxide              | C2H4O                 | D        | D     | B            | C                        | B                  | B      | A       | B     | A            |             |            | B      | B                   |        | D                | C        | D     | A                 | C       | A     | A    |                        |       |         |        | A   |        |
| Ethyl Ether                 | C4H10O                | B        | B     | A            | B                        | A                  | B      | A       | A     | B            |             | A          | B      | B                   |        | D                | D        | D     |                   | B       | A     | B    | A                      |       |         |        | B   |        |
| Ethyl Silicate              | C8H20O4Si             | B        | B     |              | B                        | B                  |        | B       | B     | A            |             |            |        |                     |        | B                | B        | B     |                   | A       |       |      | A                      |       |         |        |     |        |
| Ethyl Sulfate               | C4H10O4S              | A        |       |              | D                        |                    |        | B       |       |              |             |            |        | D                   |        | B                | C        | A     | A                 | A       |       | A    |                        |       |         |        | A   |        |
| Fatty Acids                 | R-COOH                | C        | C     | D            | D                        | B                  | A      | A       | A     | A            |             | A          | C      | B                   |        | B                | D        | A     | A                 | B       | A     | A    | A                      | A     | A       | A      | A   |        |
| Ferric Hydroxide            | FeH3O3                | C        |       |              | D                        | A                  |        | A       | A     | B            |             |            |        |                     |        | B                |          |       |                   | A       |       | A    |                        |       |         |        |     |        |
| Ferric Nitrate              | FeH3O9                | D        | D     | D            | D                        | B                  | A      | A       | D     | A            |             | A          | D      | B                   |        | A                | A        | A     | A                 | D       | A     | A    | A                      |       |         |        | A   |        |
| Ferric Sulfate              | Fe2O12S3              | D        | C     | D            | D                        | B                  | A      | A       | D     | B            |             | A          | D      | B                   |        | A                | A        | A     | A                 | D       | A     | A    | A                      |       | A       |        | A   |        |
| Ferrous Ammonium Citrate    | C6H15(+4y)Fe(x)N(y)O7 | B        |       |              |                          | B                  |        | B       |       |              |             |            |        |                     |        |                  |          |       |                   | A       |       | A    |                        |       |         |        |     |        |
| Ferrous Chloride            | Cl2Fe                 | D        | D     | D            | D                        | D                  | D      | D       | D     | C            |             | A          | C      | D                   |        | A                | A        | A     | A                 | D       | A     | C    | A                      |       |         |        | C   |        |
| Ferrous Sulfate             | FeH2O4S               | C        | C     | D            | D                        | B                  | A      | A       | A     | B            |             | A          | C      | B                   |        | A                | A        | A     | A                 | D       | A     | A    | A                      | A     |         | A      | A   |        |
| Ferrous Sulfate (Saturated) | -                     | C        | C     | C            | C                        | A                  |        | A       | B     | B            |             | A          |        |                     |        | C                | B        | B     | A                 | B       |       |      | A                      |       |         |        |     |        |
| Fertilizer Solutions        | -                     | D        | C     | A            | A                        | A                  | A      | B       | B     | A            |             |            | D      | A                   |        | B                | A        | A     |                   | A       |       |      | A                      |       |         |        |     |        |
| Fish Oils                   | -                     | B        | B     | A            | B                        | A                  | A      | A       | A     | A            |             |            | A      | A                   |        | A                | D        | A     |                   | A       |       |      | A                      |       |         |        |     |        |
| Flue Gases                  | CO                    | C        | B     | A            | B                        | A                  | A      | A       | A     | A            |             |            | A      |                     |        | C                | D        | C     |                   | C       |       |      | A                      |       |         |        |     |        |
| Fluoboric Acid              | BF4H                  | C        |       | C            | C                        | B                  | B      | A       | A     | A            |             | D          | C      | B                   |        | A                | A        | A     | A                 | B       |       | B    | A                      |       | A       |        | B   |        |
| Fluorosilicic Acid          | F6H2Si                | D        | B     | D            | D                        | B                  | B      | A       | A     | B            |             | D          | B      | C                   |        | C                | C        | C     | A                 | B       |       | C    | A                      |       | A       |        | C   |        |
| Formaldehyde (cold)         | CH4                   | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             | B          | B      | B                   |        | B                | B        | D     | A                 | A       | A     | A    | A                      | A     | A       | A      | A   |        |
| Formaldehyde (hot)          | CH4                   | B        | B     | C            | D                        | C                  | B      | B       | B     | B            |             |            |        |                     |        |                  |          |       |                   | A       | A     | A    | A                      | A     | A       | A      | A   |        |
| Formic Acid (cold)          | CH2O2                 | B        | D     | D            | D                        | B                  | A      | A       | A     | A            |             | B          | C      | C                   |        | D                | A        | B     | A                 | C       | B     | A    | A                      | A     | A       | A      | B   |        |
| Formic Acid (hot)           | CH2O2                 | B        | D     | D            | D                        | B                  | B      | B       | B     | B            |             | C          |        |                     |        | D                |          | A     | A                 | D       | B     | A    | A                      | A     | A       | A      | A   |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                | Chemical Formula       | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        |                  | Polymers |       |                   |         |       |      |                        |       |         |        |     |        |
|----------------------|------------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|--------|-----|--------|
|                      |                        | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | PEEK® | PVDF | Teflon® and Reinforced | PCTFE | UHMWPE® | Vespe® | PFA | KEL-F® |
| Freon Gas (dry)      | -                      | B        | A     | B            | B                        | A                  | A      | A       | A     | B            |             |            |        | A                   |        | C                | C        | C     | A                 | A       |       |      | A                      |       |         |        |     |        |
|                      | CCl3F                  | D        | A     | B            | C                        | A                  | A      | A       | A     |              | B           | B          | A      |                     |        | C                | C        | C     | A                 | D       | D     | A    | A                      |       |         |        |     | A      |
|                      | Freon 11, MF,112, BF   |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Freon 12, 32, 114, 115 | B        | A     | B            | B                        | A                  | A      | A       | B     | A            | B           | B          | B      | B                   |        | B                | B        | B     | A                 | B       | A     | C    | A                      |       |         |        |     | C      |
|                      | CHCl2F                 | B        | A     | B            | C                        | A                  | A      | A       | B     | A            |             |            | B      | C                   |        | D                | D        | D     | A                 | A       |       |      |                        |       |         |        |     |        |
|                      | Freon 21, 31           |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | CHClF2                 | D        | A     | B            | C                        | A                  | A      | A       | B     | A            | B           | B          | B      | A                   |        | D                | D        | D     | A                 | A       | A     | A    | A                      |       |         |        |     | A      |
|                      | Freon 22               |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Freon 113, TF          | D        | A     | B            | C                        | A                  | A      | A       | B     | A            | C           | B          | C      | C                   |        | B                | D        | D     | D                 | A       | A     | B    |                        |       |         |        |     |        |
|                      | Freon (wet)            | -        | D     | B            |                          | D                  | C      | B       | B     | B            |             | B          |        |                     |        |                  | B        | B     | D                 | A       | B     |      | A                      |       |         |        |     |        |
| Fruit Juices         | -                      | B        | D     | D            | A                        | A                  | A      | A       | B     | A            | A           | B          | A      | A                   |        | A                | A        | A     |                   | C       | A     | A    | D                      | A     | A       |        | A   | A      |
|                      | -                      | B        | B     | A            | B                        | A                  | A      | A       | B     | A            | A           | A          | A      | A                   |        | A                | D        | A     | A                 | A       | A     | B    |                        |       |         |        |     | A      |
|                      | -                      |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Fuel Oil               |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Fumaric Acid           |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | C4H4O4                 |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Furfural               | A        | A     | A            | B                        | A                  | A      | A       | A     | A            | A           | B          | A      | A                   |        | D                | C        | D     | A                 | B       | A     | D    | A                      |       |         |        |     | D      |
|                      | C5H4O2                 |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Gallic Acid 5%         | B        | C     | D            | D                        | B                  | B      | B       | B     | A            | B           | B          | B      | B                   |        | B                | C        | A     | B                 | A       | B     | A    |                        |       |         |        |     | A      |
|                      | C7H6O5                 |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Gas, Manufactured    | -                      | C        | B     | B            | B                        | B                  |        | B       | A     |              |             |            |        | A                   |        | A                |          | A     |                   | A       | A     |      | A                      |       |         |        |     |        |
|                      | -                      | B        | B     | B            | B                        | A                  | A      | B       | A     |              |             |            |        | A                   |        | A                | D        | A     |                   | A       | A     |      | A                      |       |         |        |     |        |
|                      | Gas, Natural           |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | A     | B            | B                        | B                  |        | A       | B     |              |             |            |        | A                   |        | A                | B        | A     |                   | A       |       |      | A                      |       |         |        |     |        |
|                      | Gas, Odorizers         |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | A     | A            | B                        | A                  | A      | A       | A     | A            |             |            |        | A                   |        | C                | D        | A     | A                 | A       |       |      |                        | A     |         |        |     | A      |
|                      | Gasoline (aviation)    |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | A     | A            | A                        | A                  | A      | A       | B     | A            | A           | A          | A      | A                   |        | C                | D        | A     | A                 | A       | A     | B    | A                      |       | A       |        |     | A      |
|                      | Gasoline (leaded)      |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Gasoline (motor)       |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| -                    | A                      | A        | A     | B            | A                        | A                  | A      | B       | A     |              |             |            |        |                     | C      | D                | A        | A     | A                 | A       |       | A    |                        | A     |         |        |     |        |
| Gasoline (refined)   | C12H13N5O6S2           | A        | B     | B            | B                        | A                  |        | A       | B     | A            |             |            |        |                     |        | C                | D        | A     | A                 | A       |       |      | A                      |       | A       |        |     |        |
|                      | -                      | A        | B     | B            | B                        | A                  |        | A       | C     | A            |             |            |        |                     |        | C                | D        | A     | A                 | A       |       |      | A                      |       | A       |        |     |        |
|                      | Gasoline (sour)        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | B     | B            | B                        | A                  |        | A       |       |              |             | B          |        |                     |        | C                | D        | A     | A                 | A       |       |      | A                      |       | A       |        |     |        |
|                      | Gasoline (unleaded)    |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | A     | A            | B                        | A                  | A      | B       | A     | A            | A           | A          | A      | A                   |        | C                | D        | A     | A                 | A       | A     | B    | A                      |       | A       |        |     | A      |
|                      | Gasoline (unleaded)    |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Gelatine               |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | C     | D            | D                        | A                  | A      | A       | B     | A            | A           | B          | A      | A                   |        | A                | A        | A     | A                 | B       |       | A    | A                      | A     | A       |        |     |        |
|                      | Glucose                |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| C6H12O6              |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Glycerine (Glycerol) | -                      | A        | A     | B            | B                        | A                  | A      | A       | A     | A            | A           | A          | A      | A                   |        | A                | A        | A     | A                 | A       |       |      |                        |       |         |        |     |        |
|                      | Glue                   |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | A        | A     | A            | B                        | B                  | A      | A       | A     | A            | A           | A          | A      | A                   |        | A                | B        | B     | A                 | A       |       |      |                        |       |         |        |     |        |
|                      | Glycerine (Glycerol)   |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | C3H8O3                 | A        | B     | B            | B                        | B                  | A      | A       | A     | A            | A           | A          | A      | A                   |        | C                | A        | A     | A                 | A       | A     | A    | A                      |       | A       |        |     | A      |
|                      | -                      | C        | D     | A            | B                        | B                  | A      | A       | A     | B            |             |            |        |                     |        | A                | D        | C     | A                 | C       |       |      |                        |       |         |        |     |        |
|                      | Glycol Amine           |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Glycol                 |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | C2H6O2                 | B        | B     | B            | B                        | B                  | A      | A       | A     | B            |             |            |        |                     |        | A                | B        | A     |                   | C       | A     | A    | A                      | A     | A       |        |     | A      |
| Graphite             | CH4                    | B        | B     |              | C                        | B                  |        | A       | B     |              |             |            |        |                     |        | B                | B        | B     |                   | A       |       |      |                        |       |         |        |     |        |
|                      | Graphite               |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      | B        | B     | A            | A                        | A                  | A      | A       | A     | A            |             |            |        |                     |        | A                | D        | A     |                   | B       |       |      |                        |       |         |        |     |        |
|                      | Grease                 |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Helium Gas             |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | He                     | B        | B     |              | B                        | A                  | A      | A       | B     | A            |             |            |        |                     |        | A                | B        | B     |                   | A       |       |      |                        |       |         |        |     |        |
|                      | Gas                    |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | -                      |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
|                      | Hydrocarbons           | C7H16    | A     | A            | A                        | A                  | A      | A       | A     | A            | A           |            |        |                     |        |                  | A        | D     | A                 | A       | A     | A    |                        |       |         |        |     |        |
| Gasoline             |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| -                    |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Gasoline             |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| -                    |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Gasoline             |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| -                    |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Gasoline             |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| -                    |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| Gasoline             |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |
| -                    |                        |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |        |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                | Chemical Formula          | Metals     |       |              |                          |                    |        |         |       |              |             |          |        | Elastomers          |        |                  |          | Polymers |                   |         |       |      |                               |       |         |        |     |        |
|----------------------|---------------------------|------------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|----------|--------|---------------------|--------|------------------|----------|----------|-------------------|---------|-------|------|-------------------------------|-------|---------|--------|-----|--------|
|                      |                           | Aluminum   | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton    | Flexible Graphite | Delrin® | Peek® | PVDF | Teflon® and Reinforced Teflon | PCTFE | UHMWPE® | Vespe® | PFA | KEL-F® |
| Hexane               | C6H14                     | A          | A     | A            | A                        | A                  | A      | A       | A     | A            | A           | A        | A      | A                   |        | A                | D        | A        | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
|                      | Hexanol, Tertiary         | A          | A     | A            | A                        | A                  | A      | A       | A     | A            |             |          |        |                     |        | A                | D        | B        |                   | A       |       |      |                               |       |         |        |     |        |
|                      | Hydraulic Oil Petr. Base  | A          | B     | A            | A                        | A                  | A      | A       | A     | A            |             |          |        |                     |        | A                | D        | A        | B                 | B       | A     |      |                               |       | A       |        |     |        |
|                      | Hydrazine                 | C          | D     | C            | D                        | B                  | A      | A       | B     | A            |             |          |        |                     |        | C                | B        | C        | A                 | B       | D     | A    | A                             |       | A       | D      | A   |        |
|                      | Hydrocyanic Acid          | C          | D     | D            | C                        | A                  | B      | A       | B     | A            |             | B        | D      | B                   |        | B                | B        | A        | A                 | C       | D     | A    | A                             |       | A       | A      | A   |        |
|                      | Hydrofluoric Acid 20%     | D          | D     | D            | D                        | D                  | C      | B       | A     | B            |             | D        | C      | D                   |        | D                | D        | A        | A                 | D       | D     | B    | B                             | A     | C       |        |     | B      |
|                      | Hydrofluoric Acid 50%     | D          | D     | D            | D                        | D                  | D      | C       | B     | C            |             | D        | C      | D                   |        | D                | D        | B        | A                 | D       | D     | B    | B                             | A     | C       |        |     | B      |
|                      | Hydrofluoric Acid 75%     | D          | D     | D            | D                        | D                  | D      |         |       | C            |             | D        | C      | D                   |        | D                | D        | B        | A                 | D       | D     | B    | A                             | A     | C       |        |     | B      |
|                      | Hydrofluoric Acid 100%    | D          | D     | D            | D                        | D                  | D      |         |       | B            |             | D        | C      | D                   |        | D                | D        | B        | A                 | D       | D     | A    | A                             | A     | C       |        |     | A      |
|                      | Hydrofluosilicic Acid     | H2SiF6     | D     | B            | D                        | D                  | C      | B       | B     | C            |             | D        | B      | C                   |        | B                | B        | A        | B                 |         | B     |      | B                             | A     |         |        |     |        |
| Hydrogen Gas (cold)  | H                         | A          | A     | B            | A                        | A                  | A      | A       | A     | A            |             | A        | A      | A                   |        | A                | B        | A        |                   | A       | A     | B    | A                             |       |         |        |     | B      |
|                      | Hydrogen Gas (hot)        | C          |       | B            |                          | B                  |        | A       |       | A            |             |          |        |                     |        | B                | B        |          |                   | A       |       |      |                               |       |         |        |     |        |
|                      | Hydrogen Peroxide Conc.   | C          | D     | D            | D                        | B                  | A      | A       | C     | B            |             | B        | D      | B                   |        | D                | C        | B        | C                 | D       | A     | B    | A                             | A     |         | A      | B   |        |
|                      | Hydrogen Peroxide, Dilute | C          | D     | D            | D                        | B                  | A      | A       | B     | A            |             | B        | D      | B                   |        | A                | B        | A        | B                 | D       | A     | A    | A                             | A     |         | A      | A   |        |
|                      | Hydrogen Sulfide (dry)    | C          | C     | C            | C                        | C                  | B      | B       | B     |              | A           | D        | C      |                     |        | C                | A        | D        | A                 | C       | A     | B    | A                             | A     | A       | A      | A   |        |
|                      | Hydrogen Sulfide (wet)    | C          | C     | C            | C                        | C                  | C      | B       | C     | B            |             | B        | D      | C                   |        | C                | B        | D        | A                 | C       | A     | B    | A                             | A     | A       | A      | A   | B      |
|                      | Hypo (Sodium Thiosulfate) | Na2S2O3    | B     | C            | D                        | D                  | B      | A       | B     | B            |             |          | B      | B                   |        | C                | A        | A        |                   | A       | A     |      | A                             |       |         |        |     | A      |
|                      | Illuminating Gas          | -          | A     | A            | A                        | A                  | A      |         | A     | A            |             |          |        |                     |        | A                | D        | A        |                   | A       |       |      |                               |       |         |        |     |        |
|                      | Ink-Newsprint             | C11H16O3P+ | C     | C            | D                        | D                  | A      | B       | A     | B            | A           |          |        | B                   | C      |                  | A        | B        | A                 |         | B     |      |                               |       |         |        |     |        |
|                      | Iodoform                  | CHI3       | C     | C            | B                        | C                  | A      | A       | A     | C            | B           |          | B      | C                   | A      |                  | D        | A        | A                 |         | A     |      |                               | C     |         |        |     |        |
| Iso-Butane           | C4H10                     | A          | A     | B            | A                        | A                  | A      | A       | A     | A            |             |          |        |                     |        | B                | D        | A        |                   | A       | A     |      |                               |       |         |        |     |        |
|                      | Iso-Octane                | A          | A     | A            | B                        | A                  | A      | A       | A     | A            |             |          |        |                     |        | A                | D        | A        | A                 | A       | A     | B    | A                             |       | A       |        |     | B      |
|                      | Isopropyl Acetate         | B          |       | B            | C                        | B                  | A      | A       | A     | A            |             |          | B      | B                   |        | D                | D        | D        | A                 | D       | A     |      | A                             |       |         |        |     |        |
|                      | Isopropyl Ether           | A          | A     | A            | B                        | A                  | A      | A       | A     | A            |             |          |        | A                   |        | C                | D        | D        | A                 | D       | A     | B    | A                             |       | A       |        |     | A      |
|                      | JP-4 Fuel                 | -          | A     | A            | A                        | A                  | A      | A       | A     | A            |             | A        |        | A                   |        | A                | D        | A        | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
|                      | JP-5 Fuel                 | -          | A     | A            | A                        | A                  | A      | A       | A     | A            |             | A        |        | A                   |        | B                | D        | A        | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
|                      | JP-6 Fuel                 | -          | A     | A            | A                        | A                  | A      | A       | A     | A            |             | A        |        | A                   |        | A                | D        | A        | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
|                      | Kerosene                  | -          | B     | A            | B                        | B                  | A      | A       | A     | A            |             | A        |        | A                   |        | A                | D        | A        | A                 | A       | A     | A    | A                             |       | A       |        |     | A      |
|                      | Ketchup                   | -          | C     |              | C                        | C                  | A      | A       | A     | A            |             |          |        |                     |        | A                |          | A        |                   | A       | A     |      |                               |       |         |        |     |        |
|                      | Ketones                   | CH2O       | B     | A            | A                        | A                  | A      | A       | A     | A            |             | A        |        | A                   |        | D                | D        | D        | A                 | D       | A     | D    | A                             | A     | A       |        |     | C      |
| Laquer (and Solvent) | -                         | A          | C     | D            | C                        | B                  | B      | A       | A     |              | B           |          | B      | A                   |        | D                | D        | D        | A                 | D       | A     |      | A                             |       |         |        |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.22 Chemical Compatibility Table

| Media                           | Chemical Formula                                   | Metals   |       |              |                          |                    |        |         |       |                          |             | Elastomers |        |                     |        |                  | Polymers |       |                   |                     |                   |      |                                    |       |                     |                    |     |                    |
|---------------------------------|----------------------------------------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------------------|-------------------|------|------------------------------------|-------|---------------------|--------------------|-----|--------------------|
|                                 |                                                    | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C <sup>o</sup> | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin <sup>®</sup> | PEEK <sup>®</sup> | PVDF | Teflon <sup>®</sup> and Reinforced | PCTFE | UHMWPE <sup>®</sup> | Vespe <sup>®</sup> | PFA | KEL-F <sup>®</sup> |
| Lactic Acid Concentrated (cold) | C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>       | C        | D     | D            | D                        | A                  | A      | A       | A     | B                        |             | A          | D      | B                   |        | B                | B        | A     | A                 | C                   | A                 | B    | A                                  | A     | A                   | A                  |     | B                  |
|                                 | C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>       | C        | D     | D            | D                        | B                  | B      |         |       | B                        |             | A          | D      | B                   |        | C                | C        | B     | A                 | C                   | A                 | A    | A                                  | A     | A                   |                    |     |                    |
|                                 | C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>       | B        | D     | D            | D                        | A                  | A      | A       | A     | A                        |             | A          | C      | B                   |        | B                | A        | A     | A                 | B                   | A                 | B    | A                                  | A     | A                   |                    | B   |                    |
|                                 | C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>       | B        | D     | D            | D                        | A                  | B      |         |       | B                        |             | A          | C      | B                   |        | C                | C        | B     | A                 | B                   | A                 | C    | A                                  | A     | A                   |                    |     |                    |
| Lactic Acid Dilute (hot)        | C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>       | B        | D     | D            | D                        | A                  | B      |         |       | B                        |             | A          | C      | B                   |        | B                | B        | B     |                   | A                   |                   |      |                                    |       |                     |                    |     |                    |
| Lactose                         | C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>    | B        | B     |              | C                        | B                  |        | B       | B     |                          |             |            |        |                     |        | B                | B        | B     |                   | A                   |                   |      | A                                  |       |                     |                    |     |                    |
| Lard                            | -                                                  | A        | B     |              | A                        | A                  | A      | A       | B     | A                        |             | A          | A      | A                   |        | B                | C        | A     | A                 | A                   |                   | A    |                                    |       |                     |                    |     |                    |
| Lard Oil                        | -                                                  | B        | B     | C            | C                        | B                  |        | A       | B     | A                        |             | C          | A      |                     |        | A                | B        | A     |                   | A                   | A                 |      | A                                  |       |                     |                    |     |                    |
| Lead Acetate                    | C <sub>4</sub> H <sub>6</sub> O <sub>4</sub> Pb    | D        | C     | C            | D                        | B                  | B      | B       | B     | B                        |             | A          | C      | B                   |        | A                | B        | D     | A                 | B                   | A                 | A    | A                                  |       |                     | A                  | A   |                    |
| Lead Sulfate                    | O <sub>4</sub> PbS                                 | D        | C     | C            | D                        | B                  | B      | B       | B     | B                        |             |            | B      | C                   |        | B                | B        | B     | A                 |                     |                   |      |                                    |       |                     |                    |     |                    |
| Lecithin                        | C <sub>46</sub> H <sub>98</sub> NO <sub>8</sub> P+ | B        | C     | C            | C                        | B                  |        | B       | B     | A                        |             |            | A      |                     |        | D                | D        | B     |                   | A                   |                   | A    |                                    |       |                     |                    |     |                    |
| Linoleic Acid                   | C <sub>18</sub> H <sub>32</sub> O <sub>2</sub>     | B        | C     | C            | C                        | B                  | B      | A       | A     | A                        |             |            | C      | B                   |        | B                | D        | B     | A                 | B                   | A                 | A    | A                                  |       |                     |                    |     |                    |
| Linseed Oil                     | -                                                  | A        | A     | A            | A                        | A                  | A      | A       | A     | A                        |             | A          | B      | A                   |        | A                | D        | A     |                   | A                   | A                 |      | A                                  |       | A                   |                    |     |                    |
| Lithium Chloride                | CLi                                                | C        | B     | C            | B                        | B                  | A      | A       | A     | A                        |             |            | B      | A                   |        | B                | B        | B     | A                 | A                   | A                 | A    |                                    |       |                     |                    |     |                    |
| Liquid Petroleum Gas (LPG)      | C <sub>3</sub> H <sub>7</sub> NO <sub>2</sub>      | A        | A     | A            | B                        | B                  |        | B       | B     | A                        |             |            | A      | A                   |        | A                | D        | A     |                   | A                   | A                 |      | A                                  |       |                     |                    |     |                    |
| Lubricating Oil Petroleum Base  | C <sub>6</sub> H <sub>6</sub>                      | A        | A     | A            | A                        | A                  | A      | A       | A     | A                        |             | A          | A      | A                   |        | A                | D        | A     | A                 | A                   | A                 | A    |                                    |       |                     |                    |     |                    |
| Ludox                           | O <sub>2</sub> Si                                  | C        | D     | A            | B                        | B                  | A      | A       | A     | A                        |             |            | C      |                     |        | B                | B        | B     |                   | B                   |                   |      |                                    |       |                     |                    |     |                    |
| Magnesium Bisulfate             | HMgO <sub>4</sub> S+                               | D        | B     | B            | B                        | A                  | A      | A       | B     |                          |             |            | A      | A                   |        | B                | B        | B     | B                 | A                   |                   |      |                                    |       |                     |                    |     |                    |
| Magnesium Bisulfate             | -                                                  | C        | D     |              | D                        | B                  |        | B       | B     |                          |             |            |        |                     |        | B                | B        | B     |                   | A                   |                   |      | A                                  |       |                     |                    |     |                    |
| Magnesium Carbonate             | CMgO <sub>3</sub>                                  | A        | B     | B            | B                        | A                  | A      | A       | A     | B                        |             | A          | B      | B                   |        | B                | B        | B     |                   | A                   | A                 | A    |                                    |       |                     |                    |     |                    |
| Magnesium Chloride              | Cl <sub>2</sub> Mg                                 | D        | C     | C            | D                        | C                  | D      | C       | B     | A                        |             | A          | B      | D                   |        | A                | A        | A     | A                 | A                   | B                 | A    |                                    | A     | A                   | A                  |     |                    |
| Magnesium Hydroxide             | H <sub>2</sub> MgO <sub>2</sub>                    | D        | B     | B            | B                        | A                  | A      | A       | B     | A                        |             | A          | B      | B                   |        | A                | A        | A     | A                 | A                   | A                 | A    |                                    |       |                     |                    | A   |                    |
| Magnesium Hydroxide (hot)       | H <sub>2</sub> MgO <sub>2</sub>                    | D        | C     | B            | B                        | A                  | A      | A       | A     | B                        |             |            |        | B                   |        | B                |          | A     |                   | A                   |                   |      |                                    |       |                     |                    |     |                    |
| Magnesium Nitrate               | MgN <sub>2</sub> O <sub>6</sub>                    | B        | C     | B            | B                        | A                  |        | A       | B     | A                        |             | A          | C      | B                   |        | B                | A        | B     |                   | A                   | A                 | A    |                                    |       |                     |                    |     |                    |
| Magnesium Sulfate               | MgO <sub>4</sub> S                                 | B        | B     | B            | B                        | A                  | A      | A       | B     | B                        |             | A          | C      | A                   |        | A                | A        | A     | A                 | A                   | A                 | A    |                                    |       |                     |                    | A   |                    |
| Maleic Acid                     | C <sub>4</sub> H <sub>4</sub> O <sub>4</sub>       | B        | B     | C            | C                        | B                  | B      | A       | B     | B                        |             | A          | B      | A                   |        | B                | D        | A     | A                 | A                   | A                 | A    | A                                  | A     | A                   | A                  |     |                    |
| Maleic Anhydride                | C <sub>4</sub> H <sub>2</sub> O <sub>3</sub>       | B        | B     |              | B                        | B                  | A      | B       | B     | A                        |             |            |        | A                   |        | D                | D        | B     |                   | D                   |                   | A    |                                    |       |                     |                    |     |                    |
| Malic Acid                      | C <sub>4</sub> H <sub>6</sub> O <sub>5</sub>       | B        | B     | D            | D                        | B                  | A      | B       | B     | B                        |             | A          | C      | A                   |        | A                | D        | A     | B                 | A                   |                   | A    |                                    | A     |                     |                    |     |                    |
| Malt Beverages                  | -                                                  |          |       |              |                          | A                  |        | B       | A     |                          |             |            |        |                     |        | A                | B        | A     |                   | A                   |                   |      |                                    |       |                     |                    |     |                    |
| Manganese Carbonate             | -                                                  | B        |       |              |                          | B                  |        | A       |       |                          |             |            |        |                     |        | B                |          |       |                   | A                   |                   |      |                                    |       |                     |                    |     |                    |
| Manganese Sulfate               | MnO <sub>4</sub> S                                 | B        | D     | B            | D                        | A                  | B      | A       | A     | A                        |             | A          | A      | B                   |        | B                | B        | B     | A                 | B                   | A                 | A    |                                    |       |                     |                    | B   |                    |
| Mayonnaise                      | -                                                  | D        |       | D            | D                        | A                  | B      | A       | B     | A                        |             |            | D      | B                   |        | A                |          | A     |                   | A                   |                   | A    |                                    |       |                     |                    |     |                    |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                    | Chemical Formula                                | Metals   |       |              |                          |                    |        |          |       |                          |             |          |        | Elastomers          |        |                  |          |       |                   |                     |                   | Polymers |                                    |       |                     |                     |     |                    |
|--------------------------|-------------------------------------------------|----------|-------|--------------|--------------------------|--------------------|--------|----------|-------|--------------------------|-------------|----------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------------------|-------------------|----------|------------------------------------|-------|---------------------|---------------------|-----|--------------------|
|                          |                                                 | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 5.5t | 17-4PH | Alloy 20 | Monel | Hastelloy C <sup>o</sup> | Inconel 625 | Titanium | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin <sup>®</sup> | Peek <sup>®</sup> | PVDF     | Teflon <sup>®</sup> and Reinforced | PCTFE | UHMWPE <sup>®</sup> | Vespel <sup>®</sup> | PFA | KEL-F <sup>®</sup> |
| Meat Juices              | -                                               | B        | D     |              |                          | A                  | C      | A        |       | A                        |             |          |        |                     |        | B                | A        |       | C                 | A                   |                   | A        | A                                  | A     |                     | A                   |     |                    |
| Melamine Resins          | C <sub>3</sub> H <sub>6</sub> N <sub>6</sub>    |          | D     |              |                          | C                  | A      | A        |       | A                        |             |          | D      | C                   |        | B                | A        | A     | C                 | A                   |                   | A        | A                                  |       |                     |                     |     |                    |
| Methanol                 | CH <sub>4</sub> O                               | A        | A     | A            | A                        | A                  | A      | A        | A     | A                        |             | B        | A      | A                   |        | B                | D        | B     | A                 | A                   | A                 | A        | A                                  | A     |                     |                     |     |                    |
| Mercuric Chloride        | Cl <sub>2</sub> Hg                              | D        | D     | D            | D                        | D                  | C      | D        | D     | B                        |             | A        | D      | D                   |        | A                | A        | C     | B                 | A                   | A                 | A        | A                                  | A     |                     | A                   | B   |                    |
| Mercuric Cyanide         | C <sub>2</sub> HgN <sub>2</sub>                 | D        | D     | D            | D                        | B                  | C      | A        | D     | A                        |             | A        | D      | C                   |        | A                | B        | A     | A                 | A                   | B                 | A        | B                                  |       |                     |                     |     | D                  |
| Mercurous Nitrate        | HgNO <sub>3</sub>                               | D        | D     | D            | D                        | A                  | A      | A        | D     | A                        |             | A        | D      | A                   |        | B                |          | B     | C                 | A                   | B                 | A        | A                                  |       |                     |                     |     |                    |
| Mercury                  | Hg                                              | C        | D     | A            | A                        | A                  | A      | A        | B     | A                        |             | A        | A      | A                   |        | A                |          | A     | C                 | A                   | A                 | A        | A                                  | A     |                     | A                   | A   |                    |
| Methane                  | CH <sub>4</sub>                                 | A        | A     | A            | A                        | A                  | A      | A        | A     | A                        |             |          | A      | A                   |        | A                | D        | A     | B                 | A                   | A                 | A        | A                                  |       |                     |                     |     |                    |
| Methyl Acetate           | C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>    | A        | A     | B            | B                        | A                  | A      | A        | A     | A                        |             |          | B      | A                   |        | D                | B        | D     | A                 | B                   | A                 | C        | A                                  |       |                     |                     |     | A                  |
| Methyl Acetone           | C <sub>4</sub> H <sub>8</sub> O                 | A        | A     | A            | A                        | A                  | A      | A        | A     | A                        |             |          | A      | A                   |        | D                | A        | D     | B                 | D                   |                   | D        |                                    |       |                     |                     |     |                    |
| Methyl Amine             | CH <sub>5</sub> N                               | B        | C     | B            | B                        | A                  | A      | A        | C     | B                        |             |          | D      | A                   |        | D                | B        | D     |                   | A                   | A                 |          |                                    |       |                     |                     |     |                    |
| Methyl Bromide 100%      | CH <sub>3</sub> Br                              | C        | C     | C            | D                        | B                  | B      | B        | B     | B                        |             |          | D      | B                   |        | B                | D        | A     | A                 | D                   | B                 | A        |                                    |       |                     |                     |     |                    |
| Methyl Cellosolve        | C <sub>3</sub> H <sub>8</sub> O <sub>2</sub>    | B        | A     | B            | B                        | A                  | A      | A        | A     | A                        |             |          | A      | B                   |        | C                | B        | D     | A                 | D                   | A                 | A        |                                    |       |                     |                     |     |                    |
| Methyl Cellulose         | -                                               |          |       |              |                          | A                  | A      | A        | B     |                          |             |          |        |                     |        | D                |          |       | C                 |                     |                   |          |                                    |       |                     |                     |     |                    |
| Methyl Chloride          | CH <sub>3</sub> Cl                              | D        | C     | A            | B                        | A                  | A      | A        | A     | A                        |             | A        | B      | A                   |        | D                | D        | B     | A                 | C                   |                   | A        |                                    |       |                     | A                   |     | B                  |
| Methyl Ethyl Ketone      | C <sub>4</sub> H <sub>8</sub> O                 | B        | A     | A            | A                        | A                  | A      | A        | A     | A                        |             | A        | A      | A                   |        | D                | B        | D     | A                 | B                   | B                 | A        |                                    | A     |                     |                     |     |                    |
| Methylene Chloride       | CH <sub>2</sub> Cl <sub>2</sub>                 | C        | B     | B            | B                        | A                  | A      | A        | A     | A                        |             | B        | B      | B                   |        | D                | D        | C     | A                 | B                   | A                 | C        |                                    | B     |                     | A                   | A   |                    |
| Methyl Formate           | C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>    | B        |       | C            | B                        | A                  | A      | A        | A     | A                        |             |          | A      | A                   |        | D                | B        | D     |                   | A                   |                   |          |                                    |       |                     |                     |     |                    |
| Methyl Isobutyle Ketone  | C <sub>6</sub> H <sub>12</sub> O                | B        |       |              | B                        | B                  | A      | A        | A     | A                        |             | A        | A      | A                   |        | D                | C        | D     | A                 | C                   | B                 | D        |                                    |       |                     |                     |     | A                  |
| Milk & Milk Products     | -                                               | C        | C     | C            | D                        | A                  | A      | A        | A     | A                        |             | A        | B      | A                   |        | A                | A        | A     | A                 | A                   | A                 | A        | A                                  | A     |                     | A                   | A   |                    |
| Mineral Oils             | -                                               | A        | A     | A            | B                        | A                  | A      | A        | A     | A                        |             | A        | A      | A                   |        | A                | D        | A     | A                 | A                   | A                 |          |                                    |       |                     |                     |     |                    |
| Mineral Spirits          | -                                               | A        | B     | B            | B                        | B                  | A      | B        | B     | B                        |             | B        | B      | A                   |        | A                | D        | A     | A                 | A                   | A                 |          |                                    |       |                     |                     |     | A                  |
| Mixed Acids (cold)       | -                                               | D        | D     | C            | C                        | B                  |        | B        | C     |                          |             |          |        |                     |        | D                | D        | B     |                   | D                   |                   |          |                                    |       |                     |                     |     |                    |
| Molasses, crude          | -                                               | B        | B     | A            | A                        | A                  | A      | A        | A     | A                        |             | A        | A      | A                   |        | A                | B        | A     | A                 | A                   | A                 | C        | A                                  | A     |                     |                     |     | A                  |
| Molasses, Edible         | -                                               | A        | B     | A            | C                        | A                  | A      | A        | A     | A                        |             |          | A      | A                   |        | A                | B        | A     | A                 | A                   | A                 | B        | A                                  | A     |                     |                     |     | A                  |
| Molybdic Acid            | H <sub>2</sub> MoO <sub>4</sub>                 |          |       |              |                          | A                  |        | A        |       |                          |             |          |        |                     |        |                  |          |       |                   | A                   |                   |          |                                    |       |                     |                     |     |                    |
| Monochloro Benzene (dry) | C <sub>6</sub> H <sub>5</sub> Cl                | B        |       | B            | A                        | A                  | A      | A        | A     | A                        |             |          | B      | B                   |        | D                | D        | B     | A                 | C                   | B                 |          |                                    |       |                     |                     |     |                    |
| Morphine                 | C <sub>17</sub> H <sub>19</sub> NO <sub>3</sub> | B        | B     | B            | B                        | A                  |        | A        | B     |                          |             |          |        |                     |        | D                | B        | D     | A                 | A                   |                   |          |                                    | A     |                     |                     |     |                    |
| Mustard                  | C <sub>4</sub> H <sub>8</sub> Cl <sub>2</sub> S | B        | A     | B            | B                        | A                  |        | A        | A     | A                        |             | A        | B      | A                   |        | A                | A        | A     | A                 | C                   |                   | A        |                                    |       |                     |                     |     |                    |
| Naptha                   | -                                               | A        | A     | A            | B                        | A                  | A      | A        | A     | A                        |             | A        | A      | A                   |        | B                | D        | A     | A                 | B                   | A                 | A        | A                                  | A     |                     |                     | A   | A                  |
| Napthalene               | C <sub>10</sub> H <sub>8</sub>                  | A        | B     | A            | B                        | A                  | A      | A        | A     | A                        |             | A        | A      | A                   |        | D                | D        | A     | A                 | B                   | A                 | A        | A                                  | A     |                     |                     | A   | A                  |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.24 Chemical Compatibility Table

| Media                     | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        |                  | Polymers |       |                   |         |       |      |                        |       |         |         |     |        |
|---------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|---------|-----|--------|
|                           |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | PEEK® | PVDF | Teflon® and Reinforced | PTCFE | UHMWPE® | VespeI® | PFA | KEL-F® |
| Natural Gas, Sour         | -                | B        | A     | A            | B                        | A                  | A      | A       | B     | A            |             |            | A      | A                   |        | A                | D        | A     |                   | B       | A     |      | A                      |       |         |         |     |        |
| Nickel Ammonium Sulfate   | H8N2NiO8S2       | D        | D     | D            | D                        | B                  |        | A       | C     |              |             | D          |        |                     |        | A                | B        | B     |                   | C       | A     |      | A                      | A     |         |         |     |        |
| Nickel Chloride           | Cl2Ni            | D        | D     | D            | D                        | B                  |        | A       | C     | A            |             | A          | D      | D                   |        | A                | B        | A     | A                 | A       | A     | A    | A                      | A     |         |         |     | A      |
| Nickel Nitrate            | N2NiO6           | D        | D     | D            | D                        | B                  |        | A       | C     | B            |             | B          | C      | B                   |        | A                | A        | A     | A                 | C       | A     | A    | A                      | A     |         |         |     | A      |
| Nickel Sulfate            | NiO4S            | D        | D     | D            | D                        | B                  |        | A       | B     | C            |             | B          | C      | B                   |        | A                | B        | A     | A                 | B       | A     | A    | A                      | A     |         |         |     | A      |
| Nicotinic Acid            | C6H5NO2          | A        | A     | C            | C                        | A                  |        | A       | B     |              |             | B          |        |                     |        | D                | D        | B     |                   | C       |       |      |                        |       | B       |         |     |        |
| Nitric Acid 10%           | HNO3             | C        | D     | D            | D                        | B                  |        | A       | D     | B            |             | A          | D      | A                   |        | C                | B        | A     | A                 | D       | A     | A    | A                      | A     | A       | D       | A   | B      |
| Nitric Acid 30%           | HNO3             | D        | D     | D            | D                        | B                  |        | A       | D     | A            |             | A          | D      | A                   |        | C                | C        | A     | C                 | D       | B     | B    | A                      | A     | A       |         | A   | B      |
| Nitric Acid 80%           | HNO3             | D        | D     | D            | D                        | B                  |        | A       | D     | B            |             | B          | D      | A                   |        | D                | D        | B     | D                 | D       | D     | B    | A                      | A     | B       |         | A   | B      |
| Nitric Acid 100%          | HNO3             | B        | D     | D            | D                        | B                  |        | A       | D     | B            |             | B          | D      | A                   |        | D                | D        | B     | D                 | D       | D     | B    | A                      | A     |         |         |     | A      |
| Nitric Acid Anhydrous     | -                | B        | D     | D            | C                        | B                  |        | A       | D     |              |             | D          | B      |                     |        | D                | D        | A     | C                 | D       |       |      |                        |       |         |         |     |        |
| Nitrobenzene              | C6H5NO2          | B        | D     | A            | A                        | B                  |        | A       | B     | B            |             | A          | B      | B                   |        | D                | C        | C     | B                 | B       | D     | B    | A                      | A     | A       | A       | A   | B      |
| Nitrogen                  | N2               | A        | A     | A            | A                        | A                  |        | A       | A     | A            |             | A          | A      | A                   |        | A                | B        | A     | A                 | A       | A     | A    |                        |       |         |         |     |        |
| Nitrous Acid 10%          | HNO2             | D        | D     | D            | D                        | B                  |        | B       | D     | C            |             |            | C      | B                   |        | C                | A        | A     |                   | B       | B     | B    | A                      |       |         |         |     | B      |
| Nitrous Gases             | -                | B        | D     | B            | C                        | A                  |        | A       | D     |              |             |            |        |                     |        |                  |          |       |                   | B       |       |      | A                      |       | A       |         |     |        |
| Nitrous Oxide             | N2O              | B        | B     | B            | C                        | B                  |        | B       | D     | B            |             |            | C      | B                   |        | B                | A        | A     | B                 | A       | A     | D    | A                      |       |         |         |     |        |
| Oils&Fats                 | -                | B        |       |              |                          | A                  |        | A       |       |              |             |            |        |                     |        | B                | D        |       |                   | A       |       | A    | A                      |       |         | A       |     |        |
| Oils&Animal               | -                | A        | A     | A            | A                        | A                  |        | A       | B     | A            |             |            |        |                     |        | B                | B        | B     |                   | A       |       | A    | A                      | A     |         | A       |     |        |
| Oils, Petroleum (refined) | C6H6             | A        | B     | A            | B                        | A                  |        | A       | A     | A            |             |            | C      | A                   |        | A                | A        | D     |                   | B       | A     |      | A                      |       |         |         |     |        |
| Oils, Petroleum (sour)    | C6H6             | A        | C     | B            | C                        | A                  |        | A       | A     | A            |             |            | C      | A                   |        | A                | A        | D     |                   | B       |       |      | A                      |       |         |         |     |        |
| Oils, Water Mixture       | -                | A        | A     | B            | B                        | A                  |        | A       | A     | A            |             |            | A      | A                   |        | A                | D        | A     |                   | A       | A     |      | A                      |       |         |         |     |        |
| Olaic Acid                | -                | B        |       |              |                          | B                  |        | B       | A     | A            |             |            |        |                     |        |                  | C        |       |                   | D       |       |      |                        |       |         |         |     |        |
| Oleic Acid                | C18H34O2         | B        | D     | C            | C                        | B                  |        | A       | B     | B            |             | B          | C      | A                   |        | B                | D        | C     | A                 | C       | A     | A    | A                      |       |         | A       | B   |        |
| Oleum                     | H2O4S            | C        | C     | B            | D                        | B                  |        | B       | C     | B            |             | D          | D      | B                   |        | D                | C        | A     | C                 | D       | D     | D    | A                      |       |         | D       |     | A      |
| Oleum Spirits             | -                | D        | D     |              | D                        | B                  |        | B       | D     |              |             |            |        |                     |        | C                | D        | A     |                   | D       |       | C    | A                      |       |         |         |     |        |
| Olive Oil                 | -                | A        | B     | B            | A                        | A                  |        | A       | A     | A            |             | A          | A      | A                   |        | A                | B        | A     | A                 | A       | A     |      | A                      | A     |         |         | A   |        |
| Oxalic Acid               | C2H2O4           | C        | C     | C            | D                        | B                  |        | B       | B     | B            |             | A          | C      | B                   |        | C                | B        | A     | A                 | C       | C     | A    | A                      | A     | A       | A       | A   | D      |
| Oxygen                    | O2               | A        | A     | A            | A                        | A                  |        | A       | A     | A            |             | A          | A      | A                   |        | A                | B        | A     | A                 | D       | A     |      | A                      |       |         |         |     |        |
| Ozone (dry)               | O3               | A        | A     | A            | A                        | A                  |        | A       | A     | A            |             |            | A      | B                   |        | D                | A        | B     | C                 | C       | A     | B    | A                      | A     | B       |         | A   | A      |
| Ozone (wet)               | O3               | B        | B     | B            | C                        | A                  |        | A       | A     | A            |             |            |        |                     |        | D                | B        | B     |                   | C       | A     | B    | A                      | A     | B       |         | A   |        |
| Paints & Solvents         | -                | A        | A     | A            | A                        | A                  |        | A       | A     | A            |             |            | A      | A                   |        | D                | D        | B     |                   | A       |       |      | A                      |       |         |         |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media | Chemical Formula                  | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                        |       |         |         |     |        |
|-------|-----------------------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|---------|-----|--------|
|       |                                   | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin° | Peek° | PVDF | Teflon° and Reinforced | PCTFE | UHMWPE° | VespeI° | PFA | KEL-F° |
|       | Palmitic Acid                     | B        | C     | C            | C                        | B                  | A      | A       | A     | A            |             |            | B      | B                   |        | B                | B        | A     | A                 | A       | A     | B    | A                      |       |         |         |     |        |
|       | Palm Oil                          |          |       |              |                          |                    |        |         |       |              |             |            | A      | C                   | A      |                  | D        | A     |                   | D       | A     | A    |                        |       |         |         |     |        |
|       | Paper Pulp                        | C        | B     |              | B                        | A                  |        | A       | B     |              |             |            |        |                     |        | B                | B        | B     |                   | A       |       |      |                        |       |         |         |     |        |
|       | Paraffin                          | A        | A     | B            | B                        | A                  | A      | A       | A     | A            |             |            | A      | A                   |        | A                | D        | A     | A                 | A       | A     | A    | A                      | A     | A       | A       |     |        |
|       | Paraformaldehyde                  | B        | B     | B            | B                        | B                  |        | B       | B     | A            |             |            |        |                     |        | B                | C        |       |                   | A       |       |      | A                      |       |         |         |     |        |
|       | Paraldehyde                       |          |       |              |                          | B                  |        | B       |       | A            |             |            |        |                     |        | B                | D        |       | A                 | A       |       |      | A                      |       |         |         |     |        |
|       | Pentane                           | A        | A     | B            | B                        | B                  | A      | A       | A     | B            |             |            | B      | B                   |        | A                | D        | A     | A                 | B       | A     | A    | A                      |       |         |         |     |        |
|       | Perchlorethylene (dry)            | B        | C     | B            | B                        | A                  | A      | A       | B     | A            |             |            | A      | B                   | B      | D                | D        | A     | A                 | B       | A     | A    | A                      |       |         |         |     | A      |
|       | Petrolatum (Vaseline Petr. Jelly) | B        | B     | C            | C                        | B                  | A      | A       | A     | A            |             |            | A      | A                   |        | A                | A        | A     | A                 | B       |       | A    |                        |       |         |         |     |        |
|       | Phenol                            | A        | D     | C            | D                        | A                  | A      | A       | A     | A            | A           | B          | A      | B                   |        | D                | B        | B     | A                 | C       | D     | B    | A                      | A     | A       | A       | A   | B      |
|       | Phosphate Ester 10%               | C        | D     | A            | C                        | A                  |        | A       | A     | A            |             |            | C      |                     |        | D                | A        |       |                   | A       |       |      | A                      |       |         |         |     |        |
|       | Phosphate Acid 10%                | C        | D     | D            | D                        | C                  | B      | B       | D     |              |             |            |        |                     |        | B                | B        | A     | A                 | D       |       |      | A                      |       |         |         |     |        |
|       | Phosphoric Acid 50% (cold)        | D        | D     | D            | D                        | C                  | B      | B       | D     | B            |             |            | B      | D                   |        | B                | B        | A     | A                 | D       | A     | B    | A                      | A     | A       | A       | A   |        |
|       | Phosphoric Acid 50% (hot)         | D        | D     | D            | D                        | C                  | C      | B       | D     | B            |             |            | C      | D                   | D      | B                | B        | A     | A                 | D       | A     | B    | A                      | A     | A       | A       | A   |        |
|       | Phosphoric Acid 85% (cold)        | D        | D     | D            | D                        | C                  | C      | B       | D     | B            |             |            | B      | D                   | D      | C                | B        | B     | A                 | D       |       | B    | A                      | A     | A       | A       | A   |        |
|       | Phosphoric Acid 85% (hot)         | D        | D     | D            | D                        | C                  | D      | B       | D     | B            |             |            | C      | D                   | D      | C                | B        |       | A                 | D       | B     | B    | A                      | A     | A       | A       | A   |        |
|       | Phosphoric Anhydride              | C        |       | D            |                          | A                  | B      | A       |       |              |             |            | D      | C                   | B      |                  | D        |       | A                 | D       | A     | D    | A                      |       |         |         |     |        |
|       | Phosphorus Trichloride            | C        |       | B            | C                        | A                  | A      | A       | A     | B            |             |            | A      |                     |        | D                | B        | B     | A                 | D       |       |      | A                      |       |         |         |     | A      |
|       | Phthalic Acid                     | C        | B     | D            | C                        | B                  | A      | A       | B     | A            |             |            | A      | B                   | B      | C                | C        | A     | B                 | C       | A     | B    | A                      | A     | A       | A       | A   |        |
|       | Phthalic Anhydride                | B        | B     | D            | C                        | B                  | A      | B       | A     | A            |             |            | B      | B                   | A      | C                | B        | A     | A                 | C       | A     | A    | A                      |       |         |         |     |        |
|       | Picric Acid                       | C        | D     | D            | D                        | B                  | B      | B       | D     | B            |             |            | A      | C                   | B      |                  | C        | B     | A                 | A       | B     | A    | B                      | A     |         |         | A   | A      |
|       | Pineapple Juice                   | A        | C     | C            | C                        | A                  |        | A       | A     |              |             |            |        |                     |        | A                |          | A     |                   | A       |       |      | A                      |       |         |         |     |        |
|       | Pine Oil                          | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             |            | A      | C                   | A      | A                | D        | A     |                   | D       |       | A    |                        |       |         |         |     |        |
|       | Pitch (Bitumen)                   |          |       |              |                          | A                  |        | A       |       |              |             |            |        |                     |        | C                | D        |       | A                 |         |       |      |                        |       |         |         |     |        |
|       | Polysulfide                       | C        | D     |              | B                        | B                  |        | A       | B     |              |             |            |        |                     |        | B                | B        | B     |                   | C       |       |      |                        |       |         |         |     |        |
|       | Polyvinyl Acetate                 | B        | B     | C            | B                        | B                  | B      | B       | B     | A            |             |            | B      | A                   |        |                  | B        |       | A                 | A       |       |      | A                      |       |         |         |     |        |
|       | Polyvinyl Chloride                | B        | D     |              | B                        | B                  |        | B       | B     |              |             |            |        |                     |        |                  | B        |       | A                 |         |       |      | A                      |       |         |         |     |        |
|       | Potassium Bicarbonate             | C        |       | A            | D                        | A                  | B      | A       | B     | B            |             |            | A      | C                   | B      |                  | B        | A     | A                 | B       | A     | B    | A                      |       |         | D       |     | A      |
|       | Potassium Bichromate              | B        | B     | B            |                          | A                  |        | A       | A     |              |             |            |        |                     |        | B                |          | B     |                   | B       | C     |      | A                      |       |         |         |     |        |
|       | Potassium Bisulfate               | B        |       | C            | C                        | A                  |        | A       | C     |              |             |            | C      |                     |        |                  | B        | A     |                   | A       |       |      | A                      |       |         |         |     |        |
|       | Potassium Bisulfite               | C        | C     | D            | D                        | B                  |        | B       | D     |              |             |            |        |                     |        | A                | B        | A     |                   | A       |       |      | A                      |       |         |         |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media                             | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                               |       |         |        |     |        |
|-----------------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|-------------------------------|-------|---------|--------|-----|--------|
|                                   |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | PEEK® | PVDF | Teflon® and Reinforced Teflon | PCTFE | UHMWPE® | Vespe® | PFA | KEL-F® |
| Potassium Bromide                 | BrK              | C        | C     | C            | D                        | A                  | A      | B       | B     | B            |             | A          | C      | B                   |        | A                | B        | A     | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
| Potassium Carbonate               | CKO3             | C        | B     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | C      | B                   |        | A                | B        | A     | A                 | B       | A     | A    | A                             |       |         | D      |     |        |
| Potassium Chlorate                | CKO3             | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | C      | B                   |        | A                | B        | A     | B                 | B       | A     | A    | A                             |       |         |        |     | A      |
| Potassium Chloride                | KCl              | D        | C     | C            | B                        | B                  | B      | A       | B     | A            |             | A          | C      | B                   |        | A                | A        | A     | A                 | A       | A     | A    | A                             |       | A       |        |     | A      |
| Potassium Chromate                | CrK2O4           | B        | B     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | A      | B                   |        | B                | B        | A     | A                 | C       |       | B    | A                             |       |         |        |     |        |
| Potassium Cyanide                 | KCN              | D        | D     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | D      | B                   |        | A                | A        | A     | A                 | C       |       | A    | A                             |       | A       |        |     | A      |
| Potassium Dichromate              | Cr2K2O7          | B        | D     | C            | C                        | B                  | A      | A       | A     | B            |             | A          | C      | B                   |        | A                | B        | A     | B                 | B       | A     | A    | A                             |       |         | D      |     | A      |
| Potassium Ferricyanide            | C6FeK3N6         | C        | D     | C            | C                        | A                  | B      | A       | A     | B            |             | A          | D      | B                   |        | A                | B        | A     | A                 | C       | A     | B    | A                             |       |         |        |     | B      |
| Potassium Ferrocyanide            | C6FeK4N6+4       | C        | C     | C            | C                        | B                  | A      | A       | A     | B            |             | A          | C      | B                   |        | A                | A        | A     | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
| Potassium Hydroxide Dilute (cold) | HKO              | D        | D     | B            | D                        | B                  | A      | A       | A     | A            | B           | C          | D      | B                   |        | A                | A        | D     | B                 | C       | A     | A    | A                             |       |         | D      |     | B      |
| Potassium Hydroxide to 70% (cold) | HKO              | D        | D     | C            | D                        | B                  | B      | B       | A     | B            |             | C          | D      | B                   |        | B                | B        | D     |                   | C       | A     |      | A                             |       |         | D      |     |        |
| Potassium Hydroxide Dilute (hot)  | HKO              | D        | D     | B            | D                        | B                  | C      | B       | A     | A            |             | D          | D      | B                   |        | B                | A        |       |                   | D       | A     |      | A                             |       |         | D      |     |        |
| Potassium Hydroxide to 70% (hot)  | HKO              | D        | D     | C            | D                        | B                  | C      | B       | A     | B            |             | D          | D      | B                   |        | C                | B        |       |                   | D       | A     |      | A                             |       |         | D      |     |        |
| Potassium Iodide                  | IK               | B        | C     | B            | B                        | B                  | A      | A       | B     | B            |             | A          | D      | A                   |        | A                | A        | A     | B                 | A       |       | B    | A                             |       |         |        |     |        |
| Potassium Nitrate                 | KNO3             | B        | B     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | B      | B                   |        | A                | B        | A     | B                 | B       | A     | A    | A                             |       |         | A      |     |        |
| Potassium Oxalate                 | C2K2O4           | B        |       |              | A                        | B                  | B      | A       |       | A            |             | A          | A      | B                   |        |                  |          |       | B                 | A       |       | A    |                               |       |         |        |     |        |
| Potassium Permanganate            | KMnO4            | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | B      | B                   |        | A                | B        | A     | C                 | C       | A     | A    | A                             |       | A       | D      |     |        |
| Potassium Phosphate (mono)        | KH2PO4           | D        | C     |              | C                        | B                  | A      | B       | B     | B            |             |            |        | A                   |        | A                | A        | A     |                   | A       |       |      | A                             |       |         |        |     |        |
| Potassium Phosphate Di-basic      | K2HPO4           | B        | B     | A            | A                        | A                  |        | A       | B     | B            |             |            |        |                     |        | A                | B        | A     |                   | A       |       |      | A                             |       |         |        |     |        |
| Potassium Phosphate Tri-basic     | K3PO4            | D        | A     | A            | A                        | B                  |        | B       | B     |              |             |            |        |                     |        | B                | B        |       |                   |         |       |      | A                             |       |         |        |     |        |
| Potassium Sulfate                 | K2O4S            | B        | C     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | B      | B                   |        | A                | A        | A     | A                 | B       | A     | A    | A                             |       |         |        | B   |        |
| Potassium Sulfide                 | HK2S+            | C        | D     | D            | C                        | A                  | B      | B       | D     | B            |             | A          | D      | B                   |        | A                | B        | A     | A                 | A       | A     | A    | A                             |       |         |        |     | A      |
| Potassium Sulfite                 | K2O3S            | B        | B     | D            | C                        | A                  | B      | A       | C     | B            |             | A          | C      | B                   |        | B                | A        | A     |                   | A       |       | A    | A                             |       |         |        |     |        |
| Producer Gas                      | -                | B        | B     | B            | B                        | B                  | A      | B       | A     |              |             |            |        | A                   |        | A                | D        | A     |                   | A       |       | A    | A                             |       |         |        |     |        |
| Propane Gas                       | C3H8             | A        | A     | A            | A                        | A                  | A      | A       | B     | A            |             | A          | B      | A                   |        | A                | D        | A     | A                 | B       | A     | A    | A                             |       |         |        |     | A      |
| Propyl Bromide                    | C3H7Br           | B        | B     | B            | B                        | A                  |        | A       | B     |              |             |            | B      |                     |        | B                | B        | B     |                   | A       |       |      | A                             |       |         |        |     |        |
| Propylene Glycol                  | C3H8O2           | C        | B     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | A      | B                   |        | A                | B        | A     | A                 | B       | A     |      | A                             |       | A       |        |     |        |
| Pyridine                          | C5H5N            | B        | B     | B            | B                        | B                  | A      | A       | C     | B            |             | B          | B      | B                   |        | D                | B        | D     | A                 | B       | B     | D    | A                             | A     | A       | A      | A   | B      |
| Pyrololalic Acid                  | -                | B        | B     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | A      | B                   |        | A                | B        | A     | A                 | D       | A     | A    | A                             |       |         |        |     | A      |
| Quench Oil                        | -                | A        | B     | B            | B                        | A                  |        | A       |       | A            |             |            |        |                     |        | A                |          | A     |                   | A       |       | A    | A                             |       |         |        |     |        |
| Quinine Sulfate (dry)             | C40H40N4O8S      |          |       | A            | A                        | A                  | B      | A       | B     | A            |             |            |        | B                   |        |                  |          |       |                   | A       |       |      | A                             |       |         |        |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.27 Chemical Compatibility Table

| Media                      | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        | Polymers         |          |       |                   |         |       |      |                        |       |         |          |     |        |
|----------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|----------|-----|--------|
|                            |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin° | Peek° | PVDF | Teflon° and Reinforced | PCTFE | UHMWPE° | Vespele° | PFA | KEL-F° |
| Resins & Rosins            | -                | A        | A     | A            | A                        | A                  | A      | A       | A     | A            |             |            |        |                     |        | B                |          | A     |                   | A       |       |      | A                      |       |         |          |     |        |
|                            | C6H6O2           | A        | B     | C            | C                        | A                  | A      | A       | A     | A            |             | A          | B      | A                   |        | D                |          | B     |                   | B       |       |      | A                      |       |         |          |     |        |
|                            | C2H4O3           | A        | A     | A            | A                        | A                  |        | A       | A     |              |             |            |        |                     |        | B                |          | A     |                   | A       |       |      | A                      |       |         |          |     |        |
|                            | -                | A        | A     | B            | B                        | A                  |        | A       |       |              |             |            |        |                     |        |                  |          | A     |                   | A       |       |      | A                      |       |         |          |     |        |
|                            | C15H20O6         | A        | A     | A            | A                        | A                  | A      | A       | A     | A            |             | A          | A      | A                   |        | D                |          | C     |                   | C       | A     |      | A                      |       |         |          |     |        |
|                            | -                | B        | B     | C            | C                        | B                  |        | A       | B     | A            |             |            |        |                     |        | A                | B        | A     |                   | B       |       |      | A                      |       |         |          |     |        |
|                            | -                | C        | C     | D            | D                        | A                  | B      | B       | C     | A            |             | A          | B      | B                   |        | A                | B        | B     | A                 | C       | A     | A    | A                      |       |         |          |     | B      |
|                            | -                | B        | B     | C            | C                        | B                  |        | A       | A     |              |             | A          | B      | A                   |        | A                |          | A     |                   | A       |       | A    | A                      |       |         |          |     |        |
|                            | -                | B        | B     |              | D                        | B                  | B      | B       | B     | B            |             | A          | B      | B                   |        | A                | A        | A     |                   | A       |       | A    | A                      |       |         |          |     |        |
|                            | C7H6O3           |          |       |              |                          | B                  |        | B       |       |              |             |            |        |                     |        |                  |          |       |                   | C       |       |      | A                      |       |         |          |     |        |
|                            | NaCl+H2O         | B        | D     | C            | D                        | B                  | B      | B       | A     | A            | A           |            | A      | A                   | C      | B                | A        | A     | B                 | A       |       |      | A                      | A     | A       | A        | A   | A      |
|                            | NaCl             | C        | C     | C            | D                        | B                  | A      | B       | B     | A            |             |            | C      | B                   | B      | A                | B        | B     |                   | B       | A     |      | A                      |       |         |          |     |        |
|                            | Salt Brine       |          |       |              |                          |                    |        |         |       |              |             |            |        |                     |        |                  |          |       |                   |         |       |      |                        |       |         |          |     |        |
|                            | Sauerkraut Brine | -        | A     | B            | A                        | B                  | A      | A       | A     | A            |             |            | A      | A                   | A      |                  | A        | A     | A                 |         | A     |      |                        | A     |         |          |     |        |
|                            | Sea Water        | -        | B     | B            |                          | B                  | B      |         | B     |              |             |            |        |                     |        | B                |          | B     | A                 | A       | A     | A    | A                      | A     | A       | A        | A   | A      |
| Sewage                     | -                | D        |       |              |                          | C                  | C      | A       | B     | A            |             |            | D      | D                   |        |                  |          |       | D                 |         |       |      | A                      |       |         |          | A   |        |
| Shellac                    | -                | D        | D     | D            | D                        | B                  |        | B       | B     | A            |             |            | D      | D                   |        | B                |          | B     |                   | D       |       |      |                        |       |         |          |     |        |
| Silicone Fluids            | Si               | D        | D     | D            | D                        | A                  | B      | A       | D     | A            |             | A          | D      | B                   |        | C                | A        | A     | A                 | A       | A     | A    | A                      | A     | A       | A        | A   |        |
| Silver Bromide             | AgBr             | B        |       |              |                          | A                  |        | A       |       | A            |             | A          |        |                     |        | A                | A        | A     |                   |         |       |      | A                      |       |         |          |     |        |
| Silver Cyanide             | CAGN             | C        | B     | B            | B                        | A                  | A      | A       | B     | A            |             | A          | B      | A                   |        | A                | A        | A     |                   | A       | A     | B    | A                      |       |         |          |     |        |
| Silver Nitrate             | CAGN             | B        | B     | C            | C                        | B                  | B      | A       | B     | A            |             | A          | B      | B                   |        | B                | A        | D     |                   | A       | B     | A    | A                      |       |         |          | A   |        |
| Silver Plating sol.        | -                | D        | B     | B            | C                        | A                  | A      | B       | B     | B            |             | B          | B      | A                   |        | A                | A        | A     |                   | A       | B     | A    |                        |       |         |          |     |        |
| Soap Solutions (Stearates) | C21H42O4         | B        |       |              |                          | B                  |        | B       | A     | A            |             | A          | A      |                     |        | B                |          | B     |                   | A       | B     | A    | B                      | A     | A       |          |     |        |
| Sodium Acetate             | C2H4O2           | C        | B     | C            | C                        | B                  | A      | A       | A     | A            |             | A          | B      | A                   |        | A                | A        | A     |                   | A       | A     | A    | A                      |       |         | D        | A   |        |
| Sodium Aluminate           | AlNaO2           | B        |       |              |                          | A                  | A      | A       | A     | B            |             |            | C      |                     |        | D                |          |       | C                 | A       | A     |      | A                      |       |         |          |     |        |
| Sodium Benzoate            | C7H6O2           | D        | D     | D            | D                        | A                  | A      | A       | B     | B            |             | B          | C      | A                   |        | A                | B        | A     |                   | B       |       | A    | A                      |       |         |          | A   |        |
| Sodium Bicarbonate         | CHNaO3           | C        | B     | D            | D                        | A                  | B      | B       | C     | B            |             | A          | B      | B                   |        | A                | B        | A     |                   | C       |       | A    | A                      |       |         |          |     |        |
| Sodium Bichromate          | Cr2Na2O7         | C        | B     | C            | C                        | B                  | A      | A       | A     | A            |             | B          | A      | B                   |        | A                | B        | A     |                   | A       |       | A    | A                      |       | A       |          |     |        |
| Sodium Bisulfate 10%       | H2NaO4S          | D        | B     | C            | D                        | B                  | B      | B       | B     | B            |             | A          | B      | C                   |        | A                | B        | A     |                   | A       | A     | B    | A                      |       |         |          | B   |        |
| Sodium Bisulfite 10%       | HNaO3S           | D        | B     | D            | D                        | A                  |        | B       | B     | B            |             |            |        |                     |        | A                | B        | A     |                   | D       |       | A    |                        |       |         |          |     |        |
| Sodium Borate              | C15H22O2         | B        | B     | C            | C                        | B                  |        | B       | B     | B            |             |            |        |                     |        | A                | B        | A     |                   |         |       |      | A                      |       | A       |          |     |        |
| Sodium Bromide 10%         | BrNa             | B        | B     | C            | D                        | B                  | B      | B       | B     | B            |             |            |        |                     |        | A                | B        | A     |                   | A       |       | A    |                        |       |         |          |     |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.28 Chemical Compatibility Table

| Media                        | Chemical Formula | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        |                  | Polymers |       |                   |         |       |      |                        |       |         |        |     |        |
|------------------------------|------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|--------|-----|--------|
|                              |                  | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin® | PEEK® | PVDF | Teflon® and Reinforced | PCTFE | UHMWPE® | Vespe® | PFA | KEL-F® |
| Sodium Carbonate (Soda Ash)  | CNa2O3           | D        | B     | B            | B                        | B                  | A      | A       | B     | A            |             | A          | B      | A                   |        | A                | B        | A     | A                 | B       | A     | A    | A                      | A     | A       | D      | A   | A      |
|                              | CINaO3           | C        | B     | B            | C                        | B                  | B      | B       | C     | B            |             | A          | B      | A                   |        | A                | B        | A     | C                 | A       | A     | A    | A                      |       |         |        |     |        |
| Sodium Chloride              | CINa             | B        | C     | B            | C                        | B                  | B      | B       | B     | A            |             | A          | B      | B                   |        | A                | A        | A     | A                 | B       | A     | A    | A                      |       |         |        | A   |        |
| Sodium Chromate              | CrNa2O4          | B        | C     | B            | B                        | A                  | A      | A       | A     | B            |             |            | B      | B                   |        | A                | B        | A     | B                 | D       | A     | A    | A                      |       |         |        | A   |        |
| Sodium Citrate               | C6H5Na3O7        | D        |       |              |                          | A                  |        | B       |       | A            |             |            |        |                     |        |                  |          |       |                   | A       |       |      |                        |       |         |        |     |        |
| Sodium Cyanide               | CNNa             | D        | D     | B            | B                        | A                  | B      | A       | B     | A            |             | A          | D      | A                   |        | A                | A        | A     | A                 | A       |       | A    | A                      |       |         | A      | A   |        |
| Sodium Ferricyanide          | C6FeNaNa3        | B        |       |              | C                        | B                  | B      | A       | B     | B            |             |            | C      | B                   |        |                  |          |       | A                 |         |       | A    |                        |       |         |        |     |        |
| Sodium Fluoride              | FNa              | B        | C     | D            | D                        | B                  | B      | A       | B     | A            |             | A          | B      | D                   |        | A                | B        | A     | A                 | A       | A     | A    | A                      |       |         |        |     |        |
| Sodium Hydroxide 20% (cold)  | NaOH             | D        | C     | A            | A                        | A                  | A      | B       | A     | A            |             | A          | B      | B                   |        | A                | B        | B     | A                 | B       | A     | A    | A                      |       |         |        | A   |        |
| Sodium Hydroxide 20% (hot)   | NaOH             | D        | C     | B            | B                        | A                  | B      | B       | B     | A            |             | A          | B      |                     |        | B                | B        | C     | A                 | C       | A     | A    | A                      |       |         |        |     |        |
| Sodium Hydroxide 50% (cold)  | NaOH             | D        | D     | A            | B                        | A                  | A      | B       | A     | A            |             |            | D      | B                   |        | A                | B        | C     | A                 | C       | A     | A    | A                      |       |         |        | B   |        |
| Sodium Hydroxide 50% (hot)   | NaOH             | D        | D     | B            | B                        | A                  | B      | B       | B     | B            |             |            | D      |                     |        | B                | C        | C     | A                 | C       |       | A    | A                      |       |         |        |     |        |
| Sodium Hydroxide 70% (cold)  | NaOH             | D        | D     | C            | B                        | A                  | A      | B       | A     | A            |             | A          | D      | C                   |        | B                | C        | D     | A                 | D       | A     | A    | A                      |       |         |        | A   |        |
| Sodium Hydroxide 70% (hot)   | NaOH             | D        | D     | C            | B                        | A                  | B      | B       | B     | B            |             |            | D      |                     |        | D                | C        | D     | A                 | D       | A     | A    | A                      |       |         |        |     |        |
| Sodium Hypochlorite (Bleach) | ClNaO            | D        | D     | D            | D                        | D                  | D      | D       | D     | A            |             | C          | D      | D                   |        | B                | C        | B     | B                 | D       | B     | A    | A                      |       |         |        | A   |        |
| Sodium Hyposulfite           | Na2S2O4          | B        |       |              |                          |                    | B      |         | B     | B            |             |            |        |                     |        |                  |          |       |                   |         |       | A    |                        |       |         |        |     |        |
| Sodium Lactate               | C3H5NaO3         | D        |       |              |                          | A                  |        | A       | B     |              |             |            |        |                     |        |                  |          |       | A                 |         |       |      |                        |       |         |        |     |        |
| Sodium Metaphosphate         | Na6O18P6         | C        | D     | C            | B                        | B                  | A      | A       | B     | A            |             |            | B      | A                   |        | A                | A        | A     | B                 | A       | A     | A    | A                      |       |         |        |     |        |
| Sodium Metasilicate (cold)   | Na2O3Si          | D        | B     | B            | C                        | A                  | A      | A       | A     | A            |             |            | A      | A                   |        | B                | B        | B     |                   | D       | A     |      |                        |       |         |        |     |        |
| Sodium Metasilicate (hot)    | Na2O3Si          | D        | B     | C            | D                        | A                  | A      | A       | A     | A            |             |            |        |                     |        |                  |          |       |                   | D       |       |      |                        |       |         |        |     |        |
| Sodium Nitrate               | NNaO3            | B        | B     | B            | B                        | A                  | B      | A       | B     | B            |             | A          | B      | B                   |        | C                | A        | A     | C                 | A       | A     | A    | A                      |       |         |        | A   |        |
| Sodium Nitrite               | NNaO2            | A        |       | B            | B                        | B                  | A      | A       | B     | B            |             |            | B      | A                   |        | C                | A        | B     |                   | B       | A     | A    | A                      |       |         |        |     |        |
| Sodium Perborate             | BNaO3            | C        | D     | B            | C                        | C                  | A      | A       | A     | A            |             |            | B      | B                   |        | C                | A        | A     | C                 | B       | A     |      |                        |       |         |        | A   |        |
| Sodium Peroxide              | Na2O2            | C        | C     | C            | D                        | B                  | A      | A       | A     | B            |             |            | D      | A                   |        | C                | A        | A     | A                 | D       | A     | A    | A                      |       |         |        | A   |        |
| Sodium Phosphate (mono)      | NaH2PO4          | D        | C     | B            | D                        | B                  | A      | A       | B     | A            |             | A          | C      | B                   |        | B                | A        | A     |                   | B       | A     |      |                        |       |         |        |     |        |
| Sodium Phosphate Di-basic    | Na2HPO4          | D        | C     | C            | C                        | B                  | A      | B       | B     | A            |             | A          | C      | A                   |        | A                | A        | A     | A                 | A       | A     | A    |                        |       |         |        |     |        |
| Sodium Phosphate Tri-basic   | Na3PO4           | D        | C     | C            | C                        | B                  | A      | B       | B     | A            |             | A          | C      | A                   |        | B                | A        | A     |                   | A       |       |      |                        |       |         |        |     |        |
| Sodium Polyphosphate         | Na6O18P6         | D        | D     |              | D                        | B                  | B      | B       | B     | A            |             | A          | C      | B                   |        | B                | A        | A     | A                 | B       |       | A    | A                      |       |         |        | A   |        |
| Sodium Salicylate            | C7H5NaO3         |          |       |              | A                        | A                  |        | A       |       |              |             |            |        |                     |        | A                |          |       | C                 |         |       |      |                        |       |         |        |     |        |
| Sodium Silicate              | Na2O3Si          | B        | C     | B            | B                        | B                  | A      | A       | A     | A            |             | A          | D      | A                   |        | A                | A        | A     | C                 | A       | A     | A    | A                      | A     |         | A      | A   |        |
| Sodium Silicate (hot)        | Na2O3Si          | D        | C     | C            | B                        | B                  | B      | B       | B     | B            |             |            | D      |                     |        | B                |          | A     | C                 |         |       |      |                        |       |         |        | A   |        |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information



# TECHNICAL DATA

## 10.29 Chemical Compatibility Table

| Media | Chemical Formula       | Metals   |       |              |                          |                    |        |         |       |              |             | Elastomers |        |                     |        |                  | Polymers |       |                   |         |       |      |                        |       |         |         |     |        |
|-------|------------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------|-------|------|------------------------|-------|---------|---------|-----|--------|
|       |                        | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C° | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin° | Peek° | PVDF | Teflon° and Reinforced | PCTFE | UHMWPE° | VespeI° | PFA | KEL-F° |
|       | Sodium Sulfate         | A        | B     | B            | B                        | A                  | A      | A       | A     | A            | A           | A          | A      | B                   | B      |                  | A        | A     | A                 | A       | B     | A    | A                      | A     |         | A       |     | A      |
|       | Sodium Sulfide         | D        | D     | C            | B                        | B                  | A      | A       | A     | B            |             | A          | D      | B                   |        | A                | A        | A     | A                 | A       | B     | A    | A                      | A     | A       | A       | A   | B      |
|       | Sodium Sulfite         | C        | C     | B            | A                        | A                  | A      | A       | C     | A            |             | A          | B      | B                   |        | A                | A        | B     | A                 |         |       | A    | A                      |       |         |         |     | A      |
|       | Sodium Tetraborate     | C        | D     |              | A                        | A                  | A      | A       |       | B            |             |            | B      | A                   |        | A                | A        | A     | A                 | B       |       |      | A                      |       |         |         |     |        |
|       | Sodium Thiosulfate     | A        | D     | C            | C                        | B                  | A      | B       | B     | B            |             | A          | B      | A                   |        | A                | A        | A     | A                 | C       | A     | A    | A                      |       |         |         |     | A      |
|       | Soybean Oil            | B        | B     | C            | C                        | A                  | A      | A       | A     | A            |             | A          | A      | A                   |        | A                | B        | A     |                   | D       |       |      | A                      |       |         |         |     |        |
|       | Starch                 | B        | B     | B            | B                        | A                  | A      | A       | A     | A            |             |            | B      | A                   |        | A                | C        | A     |                   | A       | A     | A    | A                      | A     | A       | A       | A   | A      |
|       | Steam (212°F)          | B        | B     | A            | A                        | A                  | A      | A       | A     | A            |             |            | B      | A                   | A      | D                | B        | C     | A                 | D       | A     |      | A                      |       |         |         |     |        |
|       | Stearic Acid           | B        | C     | C            | C                        | B                  | A      | A       | A     | A            |             | A          | B      | B                   |        | A                | B        | A     | A                 | A       | A     | A    | A                      |       |         |         |     |        |
|       | Styrene                | A        | A     | B            | B                        | A                  | A      | A       | A     | A            |             |            | B      | A                   |        | D                | D        | B     | A                 | A       | A     |      | A                      |       |         |         |     |        |
|       | Sugar Liquids          | A        | A     | B            | B                        | A                  | A      | A       | A     | A            |             | A          | A      | A                   |        | A                | A        | A     | A                 | A       | A     | A    | A                      | A     | A       |         |     |        |
|       | Sugar, Syrups & Jam    | B        | B     | B            | C                        |                    | A      | A       | A     | A            |             | A          | C      | A                   |        |                  | A        |       | A                 | A       | A     | A    | A                      | A     | A       | A       | A   |        |
|       | Sulfate Black Liquor   | D        | C     | C            | C                        | B                  | A      | B       | B     | B            |             |            | D      | B                   |        | C                | A        | B     | A                 | D       | A     | A    | A                      |       |         |         |     |        |
|       | Sulfate Green Liquor   | D        | C     | C            | C                        | B                  | A      | B       | B     | B            |             |            | D      | B                   |        | C                | A        | B     | A                 | D       | A     | A    | A                      |       |         |         |     |        |
|       | Sulfate White Liquor   | D        | C     | C            | C                        | B                  | B      | B       | C     | B            |             |            | D      | B                   |        | C                | A        | B     | A                 | D       | A     | A    | A                      | A     |         |         |     |        |
|       | Sulfur                 | C        | C     | C            | C                        | B                  | A      | A       | B     | A            |             |            | D      | A                   |        | D                | C        | B     | A                 | B       | A     | A    | A                      | A     | A       | A       | A   |        |
|       | Sulfur Chloride        | D        | D     | D            | D                        | D                  | C      | D       | B     | B            |             | D          | C      | D                   |        | D                | C        | A     | C                 | D       | A     | B    | A                      |       |         |         |     | A      |
|       | Sulfur Dioxide (dry)   | B        | B     | B            | B                        | A                  | A      | B       | B     | A            |             | A          | B      | C                   |        | D                | B        | A     | A                 | B       | A     | A    | A                      | A     | A       | A       | A   | A      |
|       | Sulfur Dioxide (wet)   | B        | D     |              |                          | B                  | C      | B       | A     | A            |             | A          | D      | D                   |        | D                | B        |       | A                 | B       | A     | B    | A                      | A     | A       | A       | A   | A      |
|       | Sulfur Hexafluoride    | A        | B     |              |                          | A                  |        | A       |       | C            |             |            |        |                     |        | B                | B        | B     |                   | D       | A     |      | A                      |       |         |         |     |        |
|       | Sulfur, Molten         | A        | D     | C            | B                        | B                  | A      | A       | C     | B            |             |            |        | A                   |        | D                | B        | B     |                   | D       |       |      | A                      |       |         |         |     |        |
|       | Sulfur Trioxide        | A        | D     | B            | B                        | B                  | A      | A       | A     | A            |             | C          | C      | A                   |        | D                | B        | B     | C                 | D       | A     | D    | A                      |       | D       |         | A   |        |
|       | Sulfur Trioxide (dry)  | A        | C     | B            | B                        | B                  | B      | B       | B     | B            |             | D          | B      | D                   |        | D                | B        | A     | D                 | D       |       | A    |                        | D     |         | A       |     |        |
|       | Sulfuric Acid 0 to 77% | D        | D     | D            | D                        | C                  | C      | B       | C     | A            |             | C          | D      | D                   |        | B                | C        | A     | B                 | D       | D     | A    | A                      | A     | B       | A       | A   | A      |
|       | Sulfuric Acid 100%     | D        | D     | C            | C                        | C                  | C      | B       | C     | B            |             | D          | D      | C                   |        | D                | C        | B     | D                 | D       | D     | A    | A                      | A     | A       | D       | A   | A      |
|       | Sulfurous Acid         | C        | D     | D            | D                        | B                  | B      | B       | B     | B            |             | A          | D      | B                   |        | C                | C        | A     | A                 | C       | B     | B    | A                      |       | A       |         |     | A      |
|       | Tall Oil               | C        | B     | B            | B                        | A                  | A      | A       | A     | A            |             |            | B      | A                   |        | B                | D        | A     |                   | A       |       | A    | A                      |       |         |         |     |        |
|       | Tannic Acid (Tannin)   | C        | B     | C            | C                        | B                  | B      | B       | B     | B            |             | A          | B      | B                   |        | B                | A        | A     | A                 | B       | A     | B    | A                      | A     | A       | A       | A   | A      |
|       | Tanning Liquors        | A        | A     |              |                          | A                  | A      | A       | A     | A            |             | A          | A      | A                   |        | B                | B        | A     | A                 | B       |       |      | A                      |       |         |         |     |        |
|       | Tar & Tar Oils         | B        | A     | A            | A                        | A                  | A      | A       | A     | A            |             |            | A      | A                   |        | C                | D        | A     |                   | A       | A     |      | A                      |       |         |         |     |        |
|       | Tartaric Acid          | B        | D     | D            | D                        | A                  | A      | A       | A     | B            |             | A          | B      | C                   |        | C                | B        | A     | A                 | B       | A     | A    | A                      | A     | A       | A       | A   | A      |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

| Media | Chemical Formula     | Metals   |       |              |                          |                    |        |         |       |                          |             | Elastomers |        |                     |        | Polymers         |          |       |                   |                     |                   |      |                                           |       |                     |                    |     |                    |
|-------|----------------------|----------|-------|--------------|--------------------------|--------------------|--------|---------|-------|--------------------------|-------------|------------|--------|---------------------|--------|------------------|----------|-------|-------------------|---------------------|-------------------|------|-------------------------------------------|-------|---------------------|--------------------|-----|--------------------|
|       |                      | Aluminum | Brass | Carbon Steel | Ductile Iron / Cast Iron | 316/316Ti/321 S.St | 17-4PH | Alloy20 | Monel | Hastelloy C <sup>o</sup> | Inconel 625 | Titanium   | Bronze | 304 Stainless Steel | Duplex | Buna N (Nitrile) | EPDM/EPR | Viton | Flexible Graphite | Delrin <sup>®</sup> | Peek <sup>®</sup> | PVDF | Teflon <sup>®</sup> and Reinforced Teflon | PCTFE | UHMWPE <sup>®</sup> | Vespe <sup>®</sup> | PFA | KEL-F <sup>®</sup> |
|       | Tetraethyl Lead      | B        | B     | B            | C                        | B                  | A      | A       | A     |                          |             | A          | A      | A                   |        | B                | D        | A     |                   | A                   | A                 |      | A                                         |       |                     |                    |     |                    |
|       | Toluol (Toluene)     | A        | A     | A            | A                        | A                  | A      | A       | A     |                          |             | A          | A      | A                   |        | D                | D        | B     | A                 | C                   | A                 | B    | A                                         |       | B                   | A                  |     | B                  |
|       | -                    | A        | C     | B            | C                        | A                  | A      | A       | A     |                          |             | B          | A      |                     |        | A                | A        | A     | A                 | B                   | A                 | A    |                                           |       |                     |                    |     | A                  |
|       | Transformer Oil      | A        | B     | A            | B                        | A                  | A      | A       | A     |                          |             |            | A      | A                   |        | A                |          | A     | A                 | A                   | A                 |      |                                           | A     |                     |                    |     |                    |
|       | Tributyl Phosphate   | A        | A     | A            | A                        | A                  | A      | A       | A     |                          |             |            | B      | A                   | A      | D                | B        | D     |                   | A                   |                   |      | A                                         |       | A                   |                    |     |                    |
|       | Trichlorethylene     | B        | A     | B            | C                        | B                  | A      | A       | A     |                          |             | B          | B      | B                   |        | D                | D        | B     | A                 | C                   | A                 | B    | A                                         |       | A                   | A                  | A   | A                  |
|       | Trichloroacetic Acid | D        | B     |              | D                        | D                  | C      | B       | B     | A                        |             | D          | B      | D                   |        | C                | B        | C     | A                 | D                   | A                 | B    | A                                         |       | A                   |                    |     | A                  |
|       | Triethanolamine      | B        |       | C            | C                        | B                  | A      | A       | A     | A                        |             |            | C      | A                   |        | C                | A        | D     |                   | A                   | A                 | A    |                                           | A     |                     |                    |     | A                  |
|       | Triethylamine        |          | B     | A            |                          | B                  |        | B       |       | A                        |             |            | A      |                     |        | B                | A        | C     | A                 | D                   |                   | B    | A                                         |       |                     |                    |     | A                  |
|       | Trisodium Phosphate  | D        |       | A            | B                        | A                  | A      | A       | A     | A                        |             |            | C      | B                   |        | A                | A        | B     | A                 | A                   | A                 | A    |                                           |       |                     | D                  |     |                    |
|       | -                    | B        | B     | B            | B                        | A                  | A      | A       | A     | A                        |             |            | B      | A                   |        | A                | D        | A     |                   | A                   | A                 | A    |                                           |       |                     |                    |     |                    |
|       | Turpentine           | A        | C     | B            | B                        | B                  | A      | A       | A     | A                        |             | B          | B      | A                   |        | B                | D        | A     | A                 | A                   | A                 | A    |                                           | A     |                     |                    |     | A                  |
|       | Urea                 | B        | B     | C            | C                        | B                  | A      | A       | B     | B                        |             | A          | C      | B                   |        | C                | B        | C     | A                 | A                   | A                 | A    |                                           | A     |                     | A                  |     | A                  |
|       | Uric Acid            | C        |       |              |                          | A                  | B      | A       |       | B                        |             |            | A      | B                   |        |                  |          |       | A                 | B                   |                   |      |                                           |       |                     |                    |     |                    |
|       | Varnish              | A        | B     | C            | C                        | A                  | A      | A       | A     | A                        |             |            | A      | A                   |        | C                | D        | B     | A                 | A                   | A                 |      |                                           |       |                     |                    |     | A                  |
|       | Vegetable Oils       | A        | B     | A            | B                        | A                  | A      | A       | A     | A                        |             |            | B      | A                   |        | A                | C        | A     |                   | A                   | A                 |      | A                                         |       |                     |                    |     |                    |
|       | Vinegar              | D        | C     | D            | D                        | A                  | A      | A       | A     | A                        |             | A          | C      | A                   |        | C                | A        | C     | A                 | B                   | A                 | B    | A                                         |       | A                   | A                  |     | A                  |
|       | Vinyl Acetate        | B        | B     | A            | B                        | B                  | A      | B       | A     | B                        |             |            | C      | B                   |        | D                | B        | C     | A                 | C                   | A                 | B    | A                                         |       |                     |                    |     |                    |
|       | Water (distilled)    | A        | B     | C            | D                        | A                  | A      | A       | A     | A                        |             |            | A      | A                   |        | A                | A        | B     | A                 | B                   | A                 | A    | A                                         | A     | A                   | B                  | A   | A                  |
|       | Water (fresh)        | A        | B     | C            | C                        | A                  | A      | A       | A     | A                        |             | A          | A      | A                   |        | A                | A        | B     | A                 | A                   | A                 | A    | A                                         |       | A                   | B                  | A   | A                  |
|       | Water (acid mine)    | D        | D     | D            | D                        | B                  | A      | A       | B     | B                        |             | A          | C      | B                   |        | A                | A        | D     | A                 | A                   |                   | A    | A                                         |       |                     |                    |     | A                  |
|       | Waxes                | A        | A     | A            | A                        | A                  |        | A       | A     | A                        |             |            |        |                     |        | A                | C        | A     |                   | A                   | A                 |      |                                           |       |                     |                    |     |                    |
|       | Whiskey & Wines      | C        | B     | D            | D                        | A                  | A      | A       | A     | A                        |             |            | A      | B                   | A      | A                | A        | A     | A                 | A                   | A                 | A    |                                           |       |                     |                    |     | A                  |
|       | Xylene, Xylol (dry)  | A        | A     | B            | B                        | A                  | A      | A       | A     | A                        |             |            | A      | A                   | B      | D                | D        | B     | A                 | A                   | A                 | A    |                                           | B     |                     |                    |     | A                  |
|       | Zinc Bromide         | D        | B     |              | D                        | B                  |        | B       | B     | A                        |             |            |        | D                   |        | B                | B        | B     | A                 | A                   |                   |      |                                           |       |                     |                    |     |                    |
|       | Zinc Hydrosulfite    | D        | C     | A            | B                        | A                  |        | A       | B     | B                        |             |            | D      | A                   |        | A                | A        | A     |                   | C                   |                   |      |                                           |       |                     |                    |     |                    |
|       | Zinc Sulfate         | D        | C     | C            | D                        | B                  | A      | A       | B     | B                        |             |            | A      | C                   | B      | A                | A        | A     | A                 | C                   | A                 | A    |                                           | A     |                     | A                  |     | A                  |
|       | Zinc                 | C        |       |              |                          | A                  |        |         |       | A                        |             |            |        | A                   |        |                  | A        | A     |                   |                     |                   |      |                                           |       |                     |                    |     |                    |

Ratings: A - Excellent B - Good C - Poor D - Do not use Blank - No Information

## 10.31 Basic Rubber Compounds

ELASTOMER RUBBER COMPOUNDS TYPES AND REFERENCES

| General Description   | Chemical Description                        | Abbreviation (ASTM 1418) | ISO/DIN 1629 | Other Trade names & Abbreviations | ASTM D2000 Designations |
|-----------------------|---------------------------------------------|--------------------------|--------------|-----------------------------------|-------------------------|
| Nitrile               | Acrylonitrile-butadiene rubber              | NBR                      | NBR          | Buna-N                            | BF, BG, BK, CH          |
| Hydrogenated Nitrile  | Hydrogenated Acrylonitrile-butadiene rubber | HNBR                     | (HNBR)       | HNBR                              | DH                      |
| Ethylene-Propylene    | Ethylene propylene diene rubber             | EPDM                     | EPDM         | EP, EPT, EPR                      | BA, CA, DA              |
| Fluorocarbon (Viton®) | Fluorocarbon Rubber                         | FKM                      | FPM          | Viton®, Fluorel®                  | HK                      |
| Chloroprene           | Chloroprene rubber                          | CR                       | CR           | Neoprene                          | BC, BE                  |
| Silicone              | Silicone rubber                             | VMQ                      | VMQ          | PVMQ                              | FC, FE, GE              |
| Fluorosilicone        | Fluorosilicone rubber                       | FVMQ                     | FVMQ         | FVMQ                              | FK                      |
| Polyacrylate          | Polyacrylate rubber                         | ACM                      | ACM          | ACM                               | EH                      |
| Ethylene Acrylic      | Ethylene Acrylic rubber                     | AEM                      | AEM          | Vamac®                            | EE, EF, EG, EA          |
| Styrene-butadiene     | Styrene-butadiene rubber                    | SBR                      | SBR          | SBR                               | AA, BA                  |
| Polyurethane          | Polyester urethane / Polyether urethane     | AU / EU                  | AU / EU      | AU / EU                           | BG                      |
| Natural rubber        | Natural rubber                              | NR                       | NR           | NR                                | AA                      |

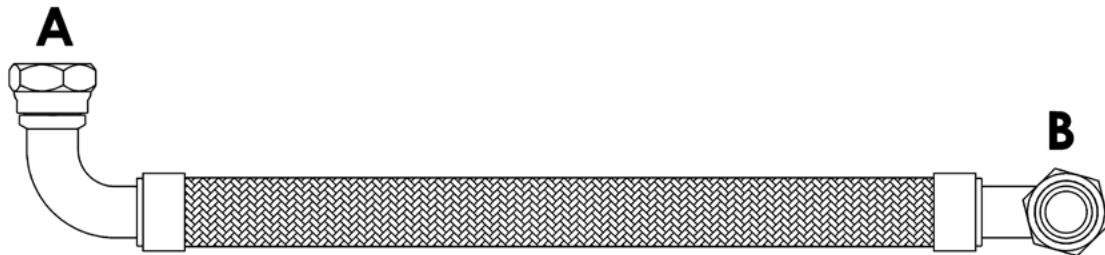
| Basic Property              | NBR   | HNBR  | EPDM  | FKM   | CR    | ACM   | AEM   | SBR   | AU/EU | VMQ   | FVMQ  | NR    |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Economy of Material         | A     | D     | B     | C     | B     | C     | D     | A     | C     | C     | D     | A     |
| Compression Set Resistance  | A     | A     | A     | A     | B     | D     | B     | B     | C     | B     | B     | A     |
| Resilience (Rebound)        | B     | B     | B     | B     | B     | C     | B     | B     | B     | B     | B     | A     |
| Tear Strength               | B     | A     | B     | B     | B     | C     | B     | C     | B     | D     | C     | A     |
| Heat Aging Resistance       | C     | B     | B     | A     | C     | A     | A     | C     | A     | A     | A     | C     |
| Ozone Resistance            | D     | B     | B     | A     | B     | B     | A     | D     | A     | A     | A     | D     |
| Resistance to Oil & Grease  | B     | B     | D     | A     | B     | A     | C     | D     | B     | C     | A     | D     |
| Fuel Resistance             | D     | C     | D     | B     | D     | A     | D     | D     | C     | D     | B     | D     |
| Water Swell Resistance      | B     | B     | A     | B     | C     | D     | B     | A     | D     | A     | A     | A     |
| Gas Impermeability          | B     | B     | C     | B     | B     | C     | B     | C     | B     | D     | D     | C     |
| Abrasion Resistance         | B     | B     | B     | C     | B     | B     | B     | A     | A     | D     | D     | A     |
| High Temperature - Standard | 100°C | 148°C | 148°C | 198°C | 121°C | 148°C | 148°C | 100°C | 80°C  | 232°C | 205°C | 105°C |
| Low Temperature - Standard  | -30°C | -30°C | -51°C | -15°C | -40°C | -51°C | -40°C | -45°C | -51°C | -60°C | -60°C | -51°C |

**Ratings:** A - Excellent B - Good C - Poor D - Do not use

## 10.32 | Hose Orientation

### ORIENTATION OF FITTINGS

Proper positioning of elbow end fittings on a hose is governed by the offset angle, or the amount of angular offset between connecting parts in the installation. If this angle of orientation is not correct in the construction of a hose assembly the performance and life of the assembly will be greatly reduced.

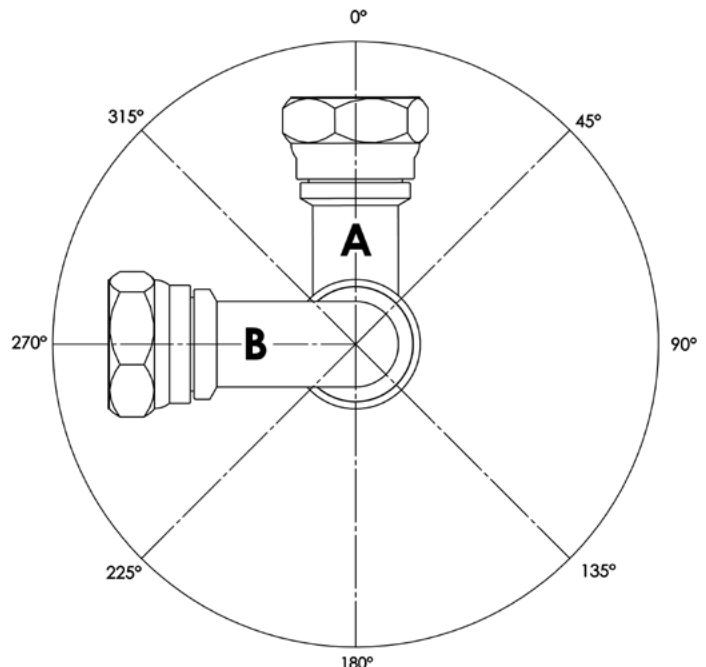


### HOW TO MEASURE

Orientation is determined by the number of degrees measured in a clockwise direction. To measure the orientation angle look along the hose with the furthest fitting (**A**) away from the viewer and the nearest fitting (**B**) closest to the viewer.

Fitting (**A**) must be set at 0 Degrees.

If no angle is given elbows are positioned at 0 Degrees.



## 10.33 | Pressure Conversions

| psi   | kPa   | Bar   | kg/cm <sup>2</sup> | mm Hg.   | cm Hg.  | METRES H <sub>2</sub> O | Millibar (mb) |
|-------|-------|-------|--------------------|----------|---------|-------------------------|---------------|
| 200   | 1379  | 13.8  | 14                 | 10372.8  | 1037.6  | 140.8                   | 13789.4       |
| 400   | 2758  | 27.6  | 28                 | 20745.6  | 2075.2  | 281.6                   | 27578.8       |
| 600   | 4137  | 41.4  | 42                 | 31118.4  | 3112.8  | 422.4                   | 41368.2       |
| 800   | 5516  | 55.2  | 56                 | 41491.2  | 4150.4  | 563.2                   | 55157.6       |
| 1000  | 6895  | 69    | 70                 | 51864    | 5188    | 704                     | 68947         |
| 1200  | 8274  | 82.8  | 84                 | 62236.8  | 6225.6  | 844.8                   | 82736.4       |
| 1400  | 9653  | 96.6  | 98                 | 72609.6  | 7263.2  | 985.6                   | 96525.8       |
| 1600  | 11032 | 110.4 | 112                | 82982.4  | 8300.8  | 1126.4                  | 110315.2      |
| 1800  | 12411 | 124.2 | 126                | 93355.2  | 9338.4  | 1267.2                  | 124104.6      |
| 2000  | 13790 | 138   | 140                | 103728   | 10376   | 1408                    | 137894        |
| 2200  | 15169 | 151.8 | 154                | 114100.8 | 11413.6 | 1548.8                  | 151683.4      |
| 2400  | 16548 | 165.6 | 168                | 124473.6 | 12451.2 | 1689.6                  | 165472.8      |
| 2600  | 17927 | 179.4 | 182                | 134846.4 | 13488.8 | 1830.4                  | 179262.2      |
| 2800  | 19306 | 193.2 | 196                | 145219.2 | 14526.4 | 1971.2                  | 193051.6      |
| 3000  | 20685 | 207   | 210                | 155592   | 15564   | 2112                    | 206841        |
| 3200  | 22064 | 220.8 | 224                | 165964.8 | 16601.6 | 2252.8                  | 220630.4      |
| 3400  | 23443 | 234.6 | 238                | 176337.6 | 17639.2 | 2393.6                  | 234419.8      |
| 3600  | 24822 | 248.4 | 252                | 186710.4 | 18676.8 | 2534.4                  | 248209.2      |
| 3800  | 26201 | 262.2 | 266                | 197083.2 | 19714.4 | 2675.2                  | 261998.6      |
| 4000  | 27580 | 276   | 280                | 207456   | 20752   | 2816                    | 275788        |
| 4200  | 28959 | 289.8 | 294                | 217828.8 | 21789.6 | 2956.8                  | 289577.4      |
| 4400  | 30338 | 303.6 | 308                | 228201.6 | 22827.2 | 3097.6                  | 303366.8      |
| 4600  | 31717 | 317.4 | 322                | 238574.4 | 23864.8 | 3238.4                  | 317156.2      |
| 4800  | 33096 | 331.2 | 336                | 248947.2 | 24902.4 | 3379.2                  | 330945.6      |
| 5000  | 34475 | 345   | 350                | 259320   | 25940   | 3520                    | 344735        |
| 5200  | 35854 | 358.8 | 364                | 269692.8 | 26977.6 | 3660.8                  | 358524.4      |
| 5400  | 37233 | 372.6 | 378                | 280065.6 | 28015.2 | 3801.6                  | 372313.8      |
| 5600  | 38612 | 386.4 | 392                | 290438.4 | 29052.8 | 3942.4                  | 386103.2      |
| 5800  | 39991 | 400.2 | 406                | 300811.2 | 30090.4 | 4083.2                  | 399892.6      |
| 6000  | 41370 | 414   | 420                | 311184   | 31128   | 4224                    | 413682        |
| 6200  | 42749 | 427.8 | 434                | 321556.8 | 32165.6 | 4364.8                  | 427471.4      |
| 6400  | 44128 | 441.6 | 448                | 331929.6 | 33203.2 | 4505.6                  | 441260.8      |
| 6600  | 45507 | 455.4 | 462                | 342302.4 | 34240.8 | 4646.4                  | 455050.2      |
| 6800  | 46886 | 469.2 | 476                | 352675.2 | 35278.4 | 4787.2                  | 468839.6      |
| 7000  | 48265 | 483   | 490                | 363048   | 36316   | 4928                    | 482629        |
| 7200  | 49644 | 496.8 | 504                | 373420.8 | 37353.6 | 5068.8                  | 496418.4      |
| 7400  | 51023 | 510.6 | 518                | 383793.6 | 38391.2 | 5209.6                  | 510207.8      |
| 7600  | 52402 | 524.4 | 532                | 394166.4 | 39428.8 | 5350.4                  | 523997.2      |
| 7800  | 53781 | 538.2 | 546                | 404539.2 | 40466.4 | 5491.2                  | 537786.6      |
| 8000  | 55160 | 552   | 560                | 414912   | 41504   | 5632                    | 551576        |
| 8200  | 56539 | 565.8 | 574                | 425284.8 | 42541.6 | 5772.8                  | 565365.4      |
| 8400  | 57918 | 579.6 | 588                | 435657.6 | 43579.2 | 5913.6                  | 579154.8      |
| 8600  | 59297 | 593.4 | 602                | 446030.4 | 44616.8 | 6054.4                  | 592944.2      |
| 8800  | 60676 | 607.2 | 616                | 456403.2 | 45654.4 | 6195.2                  | 606733.6      |
| 9000  | 62055 | 621   | 630                | 466776   | 46692   | 6336                    | 620523        |
| 9200  | 63434 | 634.8 | 644                | 477148.8 | 47729.6 | 6476.8                  | 634312.4      |
| 9400  | 64813 | 648.6 | 658                | 487521.6 | 48767.2 | 6617.6                  | 648101.8      |
| 9600  | 66192 | 662.4 | 672                | 497894.4 | 49804.8 | 6758.4                  | 661891.2      |
| 9800  | 67571 | 676.2 | 686                | 508267.2 | 50842.4 | 6899.2                  | 675680.6      |
| 10000 | 68950 | 690   | 700                | 518640   | 51880   | 7040                    | 689470        |
| 10200 | 70329 | 703.8 | 714                | 529012.8 | 52917.6 | 7180.8                  | 703259.4      |

## 10.34 Nominal Dimensions of Tube (ASTM A269)

| Nominal Tube Size | Outside Diameter | Wall Thickness | Weight |
|-------------------|------------------|----------------|--------|
| inches            | mm               | mm             | Kg/m   |
| 3/16"             | 4.76             | 0.50           | 0.05   |
|                   |                  | 0.70           | 0.07   |
|                   |                  | 0.90           | 0.09   |
| 1/4"              | 6.35             | 0.50           | 0.07   |
|                   |                  | 0.70           | 0.10   |
|                   |                  | 0.90           | 0.12   |
|                   |                  | 1.20           | 0.15   |
|                   |                  | 1.60           | 0.19   |
| 5/16"             | 7.94             | 0.50           | 0.09   |
|                   |                  | 0.70           | 0.13   |
|                   |                  | 0.90           | 0.16   |
|                   |                  | 1.20           | 0.20   |
|                   |                  | 1.60           | 0.25   |
| 3/8"              | 9.52             | 0.50           | 0.11   |
|                   |                  | 0.70           | 0.15   |
|                   |                  | 0.90           | 0.19   |
|                   |                  | 1.20           | 0.25   |
|                   |                  | 1.60           | 0.32   |
| 1/2"              | 12.70            | 0.50           | 0.15   |
|                   |                  | 0.70           | 0.21   |
|                   |                  | 0.90           | 0.26   |
|                   |                  | 1.20           | 0.34   |
|                   |                  | 1.60           | 0.44   |
| 5/8"              | 15.88            | 0.50           | 0.19   |
|                   |                  | 0.70           | 0.27   |
|                   |                  | 0.90           | 0.34   |
|                   |                  | 1.20           | 0.43   |
|                   |                  | 1.60           | 0.56   |
| 3/4"              | 19.05            | 0.50           | 0.23   |
|                   |                  | 0.70           | 0.32   |
|                   |                  | 0.90           | 0.41   |
|                   |                  | 1.20           | 0.53   |
|                   |                  | 1.90           | 0.69   |
|                   |                  | 2.00           | 0.84   |
|                   |                  | 3.25           | 1.27   |
| 7/8"              | 22.22            | 0.90           | 0.48   |
|                   |                  | 1.20           | 0.62   |
|                   |                  | 1.60           | 0.81   |
| 1"                | 25.40            | 0.50           | 0.31   |
|                   |                  | 0.70           | 0.43   |
|                   |                  | 0.90           | 0.55   |
|                   |                  | 1.20           | 0.72   |
|                   |                  | 1.60           | 0.94   |
|                   |                  | 2.00           | 1.15   |
|                   |                  | 2.60           | 1.49   |
| 1 1/8"            | 28.58            | 3.20           | 1.78   |
|                   |                  | 1.20           | 0.82   |
|                   |                  | 1.60           | 1.08   |

| Nominal Tube Size | Outside Diameter | Wall Thickness | Weight |
|-------------------|------------------|----------------|--------|
| inches            | mm               | mm             | Kg/m   |
| 1 1/4"            | 31.75            | 0.90           | 0.69   |
|                   |                  | 1.20           | 0.90   |
|                   |                  | 1.60           | 1.19   |
|                   |                  | 2.00           | 1.47   |
|                   |                  | 2.60           | 1.89   |
| 1 3/8"            | 34.92            | 3.20           | 2.29   |
|                   |                  | 0.90           | 0.77   |
|                   |                  | 1.20           | 1.01   |
| 1 1/2"            | 38.10            | 0.90           | 0.83   |
|                   |                  | 1.20           | 1.09   |
|                   |                  | 1.60           | 1.44   |
|                   |                  | 2.00           | 1.78   |
|                   |                  | 2.60           | 2.28   |
|                   |                  | 3.20           | 2.80   |
| 1 3/4"            | 44.45            | 0.90           | 0.98   |
|                   |                  | 1.20           | 1.28   |
|                   |                  | 1.60           | 1.69   |
|                   |                  | 2.00           | 2.09   |
|                   |                  | 2.60           | 2.68   |
| 2"                | 50.80            | 3.20           | 3.25   |
|                   |                  | 0.90           | 1.12   |
|                   |                  | 1.20           | 1.47   |
|                   |                  | 1.60           | 1.94   |
|                   |                  | 2.00           | 2.41   |
| 2 1/2"            | 63.50            | 2.60           | 3.09   |
|                   |                  | 3.20           | 3.76   |
|                   |                  | 1.20           | 1.84   |
|                   |                  | 1.60           | 2.44   |
|                   |                  | 2.00           | 3.03   |
| 3"                | 76.20            | 2.60           | 3.90   |
|                   |                  | 3.20           | 4.76   |
|                   |                  | 1.20           | 2.22   |
|                   |                  | 1.60           | 2.94   |
|                   |                  | 2.00           | 3.66   |
| 3 1/2"            | 88.90            | 2.60           | 4.72   |
|                   |                  | 3.20           | 5.76   |
|                   |                  | 1.60           | 3.44   |
| 4"                | 101.60           | 2.00           | 4.29   |
|                   |                  | 2.60           | 5.53   |
|                   |                  | 3.20           | 6.76   |
|                   |                  | 1.60           | 3.95   |
| 5"                | 127.0            | 2.00           | 4.91   |
|                   |                  | 2.60           | 6.35   |
|                   |                  | 3.20           | 7.76   |
|                   |                  | 1.60           | 4.95   |
| 6"                | 152.4            | 2.00           | 6.16   |
|                   |                  | 2.60           | 7.98   |
|                   |                  | 3.20           | 9.77   |
|                   |                  | 1.60           | 5.95   |
|                   |                  | 2.00           | 7.42   |
|                   |                  | 2.60           | 9.60   |
|                   |                  | 3.20           | 11.84  |

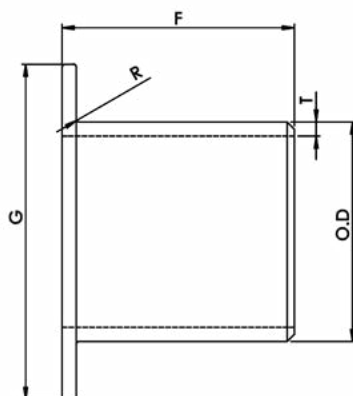
## 10.35 Nominal Dimensions of Pipe (ASTM A312M)

| Nominal Pipe Size |        | Outside Diameter (mm) | Wall Thickness (mm) |         |         |         |              |        |        |        |      |        |        |       |         |         |         |         |       |
|-------------------|--------|-----------------------|---------------------|---------|---------|---------|--------------|--------|--------|--------|------|--------|--------|-------|---------|---------|---------|---------|-------|
|                   |        |                       | Stainless Steel     |         |         |         | Carbon Steel |        |        |        |      |        |        |       |         |         |         |         |       |
|                   |        |                       | Sch 5S              | Sch 10S | Sch 40S | Sch 80S | Sch 10       | Sch 20 | Sch 30 | Sch 40 | STD  | Sch 60 | Sch 80 | XS    | Sch 100 | Sch 120 | Sch 140 | Sch 160 | XXS   |
| 6                 | 1/8"   | 10.3                  | -                   | 1.24    | 1.73    | 2.41    | 1.24         | -      | 1.45   | 1.73   | 1.73 | -      | 2.41   | 2.41  | -       | -       | -       | -       | -     |
| 8                 | 1/4"   | 13.7                  | -                   | 1.65    | 2.24    | 3.02    | 1.65         | -      | 1.85   | 2.24   | 2.24 | -      | 3.02   | 3.02  | -       | -       | -       | -       | -     |
| 10                | 3/8"   | 17.1                  | -                   | 1.65    | 2.31    | 3.20    | 1.65         | -      | 1.85   | 2.31   | 2.31 | -      | 3.20   | 3.20  | -       | -       | -       | -       | -     |
| 15                | 1/2"   | 21.3                  | 1.65                | 2.11    | 2.77    | 3.73    | 2.11         | -      | 2.41   | 2.77   | 2.77 | -      | 3.73   | 3.73  | -       | -       | -       | 4.78    | 7.47  |
| 20                | 3/4"   | 26.7                  | 1.65                | 2.11    | 2.87    | 3.91    | 2.11         | -      | 2.41   | 2.87   | 2.87 | -      | 3.91   | 3.91  | -       | -       | -       | 5.56    | 7.82  |
| 25                | 1"     | 33.4                  | 1.65                | 2.77    | 3.38    | 4.55    | 2.77         | -      | 2.90   | 3.38   | 3.38 | -      | 4.55   | 4.55  | -       | -       | -       | 6.35    | 9.09  |
| 32                | 1 1/4" | 42.2                  | 1.65                | 2.77    | 3.56    | 4.85    | 2.77         | -      | 2.97   | 3.56   | 3.56 | -      | 4.85   | 4.85  | -       | -       | -       | 6.35    | 9.70  |
| 40                | 1 1/2" | 48.3                  | 1.65                | 2.77    | 3.68    | 5.08    | 2.77         | -      | 3.18   | 3.68   | 3.65 | -      | 5.08   | 5.08  | -       | -       | -       | 7.14    | 10.15 |
| 50                | 2"     | 60.3                  | 1.65                | 2.77    | 3.91    | 5.54    | 2.77         | -      | 3.18   | 3.91   | 3.91 | -      | 5.54   | 5.54  | -       | -       | -       | 8.74    | 11.07 |
| 65                | 2 1/2" | 73.0                  | 2.11                | 3.05    | 5.16    | 7.01    | 3.05         | -      | 4.78   | 5.16   | 5.16 | -      | 7.01   | 7.01  | -       | -       | -       | 9.53    | 14.02 |
| 80                | 3"     | 88.9                  | 2.11                | 3.05    | 5.49    | 7.62    | 3.05         | -      | 4.78   | 5.49   | 5.49 | -      | 7.62   | 7.62  | -       | -       | -       | 11.13   | 15.24 |
| 90                | 3 1/2" | 101.6                 | 2.11                | 3.05    | 5.74    | 8.08    | 3.05         | -      | 4.78   | 5.74   | 5.74 | -      | 8.08   | 8.08  | -       | -       | -       | -       | -     |
| 100               | 4"     | 114.3                 | 2.11                | 3.05    | 6.02    | 8.56    | 3.05         | -      | 4.78   | 6.02   | 6.02 | -      | 8.56   | 8.56  | -       | 11.13   | -       | 13.49   | 17.12 |
| 125               | 5"     | 141.3                 | 2.77                | 3.40    | 6.55    | 9.53    | 3.40         | -      | -      | 6.55   | 6.55 | -      | 9.53   | 9.53  | -       | 12.70   | -       | 15.88   | 19.05 |
| 150               | 6"     | 168.3                 | 2.77                | 3.40    | 7.11    | 10.97   | 3.40         | -      | -      | 7.11   | 7.11 | -      | 10.97  | 10.97 | -       | 14.27   | -       | 18.26   | 21.95 |
| 200               | 8"     | 219.1                 | 2.77                | 3.76    | 8.18    | 12.70   | 3.76         | 6.35   | 7.04   | 8.18   | 8.18 | 10.31  | 12.70  | 12.70 | 15.09   | 18.26   | 20.62   | 23.01   | 22.23 |
| 250               | 10"    | 273.1                 | 3.40                | 4.19    | 9.27    | 12.70   | 4.19         | 6.35   | 7.80   | 9.27   | 9.27 | 12.70  | 15.09  | 12.70 | 18.26   | 21.44   | 25.40   | 28.58   | 25.40 |
| 300               | 12"    | 323.9                 | 3.96                | 4.57    | 9.53    | 12.70   | 4.57         | 6.35   | 8.38   | 10.31  | 9.53 | 14.27  | 17.48  | 12.70 | 21.44   | 25.40   | 28.58   | 33.32   | 25.40 |
| 350               | 14"    | 355.9                 | 3.96                | 4.78    | 9.53    | 12.70   | 6.35         | 7.92   | 9.53   | 11.13  | 9.53 | 15.09  | 19.05  | 12.70 | 23.83   | 27.79   | 31.75   | 35.71   | -     |
| 400               | 16"    | 406.4                 | 4.19                | 4.78    | 9.53    | 12.70   | 6.35         | 7.92   | 9.53   | 12.70  | 9.53 | 16.66  | 21.44  | 12.70 | 26.19   | 30.96   | 36.53   | 40.49   | -     |
| 450               | 18"    | 457                   | 4.19                | 4.78    | 9.53    | 12.70   | 6.35         | 7.92   | 11.13  | 14.27  | 9.53 | 19.05  | 23.83  | 12.70 | 29.36   | 34.93   | 39.67   | 45.24   | -     |
| 500               | 20"    | 508                   | 4.78                | 5.54    | 9.53    | 12.70   | 6.35         | 9.53   | 12.70  | 15.09  | 9.53 | 20.62  | 26.19  | 12.70 | 32.54   | 38.10   | 44.45   | 50.01   | -     |
| 550               | 22"    | 559                   | 4.78                | 5.54    | -       | -       | 6.35         | 9.53   | 12.70  | -      | 9.53 | 22.23  | 28.58  | 12.70 | 34.93   | 41.28   | 47.63   | 53.98   | -     |
| 600               | 24"    | 610                   | 5.54                | 6.35    | 9.53    | 12.70   | 6.35         | 9.53   | 14.27  | 17.48  | 9.53 | 24.61  | 30.96  | 12.70 | 38.89   | 46.02   | 52.37   | 59.54   | -     |
| 650               | 26"    | 660                   | -                   | -       | -       | -       | 7.92         | 12.70  | -      | -      | 9.53 | -      | -      | 12.70 | -       | -       | -       | -       | -     |
| 700               | 28"    | 711                   | -                   | -       | -       | -       | 7.92         | 12.70  | 15.88  | -      | 9.53 | -      | -      | 12.70 | -       | -       | -       | -       | -     |
| 750               | 30"    | 762                   | 6.35                | 7.92    | -       | -       | 7.92         | 12.70  | 15.88  | -      | 9.53 | -      | -      | 12.70 | -       | -       | -       | -       | -     |

## 10.36 Pipe Expansion Table

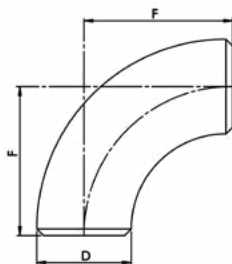
| Coefficient | 13    | 17.3                | 16                  | 90                | 52                | 16.5   |
|-------------|-------|---------------------|---------------------|-------------------|-------------------|--------|
| Material    | Steel | Stainless Steel 304 | Stainless Steel 316 | ABS Thermoplastic | PVC Thermoplastic | Copper |
| Temp °C     | mm/m  | mm/m                | mm/m                | mm/m              | mm/m              | mm/m   |
| -140        | -2.12 | -2.82               | -2.61               | -14.67            | -8.48             | -2.69  |
| -120        | -1.86 | -2.47               | -2.29               | -12.87            | -7.44             | -2.36  |
| -100        | -1.60 | -2.13               | -1.97               | -11.07            | -6.40             | -2.03  |
| -80         | -1.34 | -1.78               | -1.65               | -9.27             | -5.36             | -1.70  |
| -60         | -1.08 | -1.44               | -1.33               | -7.47             | -4.32             | -1.37  |
| -50         | -0.95 | -1.26               | -1.17               | -6.57             | -3.80             | -1.20  |
| -40         | -0.82 | -1.09               | -1.01               | -5.67             | -3.28             | -1.04  |
| -30         | -0.69 | -0.92               | -0.85               | -4.77             | -2.76             | -0.87  |
| -20         | -0.56 | -0.74               | -0.69               | -3.87             | -2.24             | -0.71  |
| -15         | -0.49 | -0.66               | -0.61               | -3.42             | -1.98             | -0.63  |
| -10         | -0.43 | -0.57               | -0.53               | -2.97             | -1.72             | -0.54  |
| -5          | -0.36 | -0.48               | -0.45               | -2.52             | -1.46             | -0.46  |
| 0           | -0.30 | -0.40               | -0.37               | -2.07             | -1.20             | -0.38  |
| 5           | -0.23 | -0.31               | -0.29               | -1.62             | -0.29             | -0.30  |
| 10          | -0.17 | -0.22               | -0.21               | -1.17             | -0.21             | -0.21  |
| 20          | -0.04 | -0.05               | -0.05               | -0.27             | -0.05             | -0.05  |
| 23          | 0.00  | 0.00                | 0.00                | 0.00              | 0.00              | 0.00   |
| 30          | 0.09  | 0.12                | 0.11                | 0.63              | 0.36              | 0.12   |
| 40          | 0.22  | 0.29                | 0.27                | 1.53              | 0.88              | 0.28   |
| 50          | 0.35  | 0.47                | 0.43                | 2.43              | 1.40              | 0.45   |
| 60          | 0.48  | 0.64                | 0.59                | 3.33              | 1.92              | 0.61   |
| 70          | 0.61  | 0.81                | 0.75                | 4.23              | 2.44              | 0.78   |
| 75          | 0.68  | 0.90                | 0.83                |                   | 2.70              | 0.86   |
| 80          | 0.74  | 0.99                | 0.91                |                   | 2.96              | 0.94   |
| 90          | 0.87  | 1.16                | 1.07                |                   | 3.48              | 1.11   |
| 100         | 1.00  | 1.33                | 1.23                |                   | 4.00              | 1.27   |
| 110         | 1.13  | 1.51                | 1.39                |                   | 4.52              | 1.44   |
| 120         | 1.26  | 1.68                | 1.55                |                   | 5.04              | 1.60   |
| 130         | 1.39  | 1.85                | 1.71                |                   | 5.56              | 1.77   |
| 140         | 1.52  | 2.02                | 1.87                |                   |                   | 1.93   |
| 150         | 1.65  | 2.20                | 2.03                |                   |                   | 2.10   |
| 160         | 1.78  | 2.37                | 2.19                |                   |                   | 2.26   |
| 170         | 1.91  | 2.54                | 2.35                |                   |                   | 2.43   |
| 180         | 2.04  | 2.72                | 2.51                |                   |                   | 2.59   |
| 190         | 2.17  | 2.89                | 2.67                |                   |                   | 2.76   |
| 200         | 2.30  | 3.06                | 2.83                |                   |                   | 2.92   |
| 220         | 2.56  | 3.41                | 3.15                |                   |                   | 3.25   |
| 240         | 2.82  | 3.75                | 3.47                |                   |                   |        |
| 250         | 2.95  | 3.93                | 3.63                |                   |                   |        |
| 260         | 3.08  | 4.10                | 3.79                |                   |                   |        |
| 280         | 3.34  | 4.45                | 4.11                |                   |                   |        |
| 290         | 3.47  | 4.62                | 4.27                |                   |                   |        |
| 300         | 3.60  | 4.79                | 4.43                |                   |                   |        |
| 320         | 3.86  | 5.14                | 4.75                |                   |                   |        |
| 340         | 4.12  | 5.48                | 5.07                |                   |                   |        |
| 360         | 4.38  | 5.83                | 5.39                |                   |                   |        |
| 380         | 4.64  | 6.18                | 5.71                |                   |                   |        |
| 400         | 4.90  | 6.52                | 6.03                |                   |                   |        |
| 420         | 5.16  | 6.87                | 6.35                |                   |                   |        |
| 440         | 5.42  | 7.21                | 6.67                |                   |                   |        |
| 460         | 5.68  | 7.56                | 6.99                |                   |                   |        |
| 480         | 5.94  | 7.91                | 7.31                |                   |                   |        |
| 500         | 6.20  | 8.25                | 7.63                |                   |                   |        |
| 520         | 6.46  | 8.60                | 7.95                |                   |                   |        |
| 540         | 6.72  | 8.94                | 8.27                |                   |                   |        |
| 560         | 6.98  | 9.29                | 8.59                |                   |                   |        |
| 580         | 7.24  | 9.64                | 8.91                |                   |                   |        |
| 600         | 7.50  | 9.98                | 9.23                |                   |                   |        |
| 620         | 7.76  | 10.33               | 9.55                |                   |                   |        |
| 640         | 8.02  | 10.67               | 9.87                |                   |                   |        |
| 660         | 8.28  | 11.02               | 10.19               |                   |                   |        |
| 680         | 8.54  | 11.37               | 10.51               |                   |                   |        |
| 700         | 8.80  | 11.71               | 10.83               |                   |                   |        |
| 720         | 9.06  | 12.06               | 11.15               |                   |                   |        |
| 740         | 9.32  | 12.40               | 11.47               |                   |                   |        |
| 760         | 9.58  | 12.75               | 11.79               |                   |                   |        |

## 10.37 Stub End Type B Dimensions (ASTM A403)

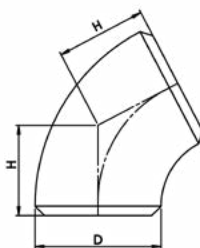


| Nominal Pipe Size |        | Outside Diameter (O.D) (mm) | Wall Thickness (T) (mm) |      |       | Dimensions |     |     |
|-------------------|--------|-----------------------------|-------------------------|------|-------|------------|-----|-----|
| DN                | NPS    |                             | 10S                     | 40S  | 80S   | G          | F   | R   |
| 15                | 1/2"   | 21.7                        | 2.11                    | 2.77 | 3.73  | 35         | 51  | 0.8 |
| 20                | 3/4"   | 27.2                        | 2.11                    | 2.87 | 3.91  | 43         | 51  | 0.8 |
| 25                | 1"     | 34.0                        | 2.77                    | 3.38 | 4.55  | 51         | 51  | 0.8 |
| 32                | 1 1/4" | 42.7                        | 2.77                    | 3.56 | 4.85  | 64         | 51  | 0.8 |
| 40                | 1 1/2" | 48.6                        | 2.77                    | 3.68 | 5.08  | 73         | 51  | 0.8 |
| 50                | 2"     | 60.5                        | 2.77                    | 3.91 | 5.54  | 92         | 64  | 0.8 |
| 65                | 2 1/2" | 76.3                        | 3.05                    | 5.16 | 7.01  | 105        | 64  | 0.8 |
| 80                | 3"     | 89.1                        | 3.05                    | 5.49 | 7.62  | 127        | 64  | 0.8 |
| 90                | 3 1/2" | 101.6                       | 3.05                    | 5.74 | 8.08  | 140        | 76  | 0.8 |
| 100               | 4"     | 114.3                       | 3.05                    | 6.02 | 8.56  | 157        | 76  | 1.6 |
| 125               | 5"     | 139.8                       | 3.40                    | 6.55 | 9.53  | 186        | 76  | 1.6 |
| 150               | 6"     | 165.2                       | 3.40                    | 7.11 | 10.97 | 216        | 89  | 1.6 |
| 200               | 8"     | 216.3                       | 3.76                    | 8.18 | 12.70 | 270        | 102 | 1.6 |
| 250               | 10"    | 267.4                       | 4.19                    | 9.27 | 12.70 | 324        | 127 | 1.6 |
| 300               | 12"    | 318.5                       | 4.57                    | 9.53 | 12.70 | 381        | 152 | 1.6 |

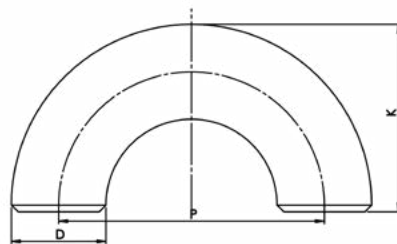
## 10.38 90° & 45° Elbows Dimensions (ASTM A403)



90° ELBOW



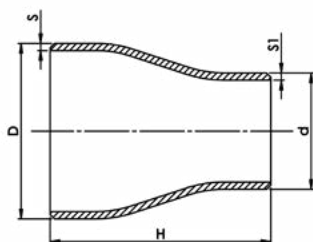
45° ELBOW



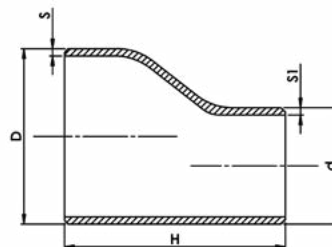
180° ELBOW

| Nominal Pipe Size |        | Outside Diameter (mm) | Center To End |       |               | Center To Center |       | End To End     |       |
|-------------------|--------|-----------------------|---------------|-------|---------------|------------------|-------|----------------|-------|
|                   |        |                       | 90° Elbow (F) |       | 45° Elbow (H) | 180° Elbow (P)   |       | 180° Elbow (K) |       |
|                   |        |                       | Long          | Short | Long          | Long             | Short | Long           | Short |
| 15                | 1/2"   | 21.7                  | 38.1          | -     | 15.8          | 76.2             | -     | 49.0           | -     |
| 20                | 3/4"   | 27.2                  | 38.1          | -     | 15.8          | 76.2             | -     | 51.7           | -     |
| 25                | 1"     | 34.0                  | 38.1          | 25.4  | 15.8          | 76.2             | 50.8  | 55.1           | 42.4  |
| 32                | 1 1/4" | 42.7                  | 47.6          | 31.8  | 19.7          | 95.2             | 63.6  | 69.0           | 53.2  |
| 40                | 1 1/2" | 48.6                  | 57.2          | 38.1  | 23.7          | 114.4            | 76.2  | 81.5           | 62.4  |
| 50                | 2"     | 60.5                  | 76.2          | 50.8  | 31.6          | 152.4            | 101.6 | 106.5          | 81.1  |
| 65                | 2 1/2" | 76.3                  | 95.3          | 63.5  | 39.5          | 190.6            | 127.0 | 133.5          | 101.7 |
| 80                | 3"     | 89.1                  | 114.3         | 76.2  | 47.3          | 228.6            | 152.4 | 158.9          | 120.8 |
| 90                | 3 1/2" | 101.6                 | 133.4         | 88.9  | 55.3          | 266.8            | 177.8 | 184.2          | 139.7 |
| 100               | 4"     | 114.3                 | 152.4         | 101.6 | 63.1          | 304.8            | 203.2 | 209.6          | 158.8 |
| 125               | 5"     | 139.8                 | 190.5         | 127.0 | 78.9          | 381.0            | 254.0 | 260.4          | 196.9 |
| 150               | 6"     | 165.2                 | 228.6         | 152.4 | 94.7          | 457.2            | 304.8 | 311.2          | 235.0 |
| 200               | 8"     | 216.3                 | 304.8         | 203.2 | 126.3         | 609.6            | 406.4 | 413.0          | 311.4 |
| 250               | 10"    | 267.4                 | 381.0         | 254.0 | 157.8         | 762.0            | 508.0 | 514.7          | 387.7 |
| 300               | 12"    | 318.5                 | 457.2         | 304.8 | 189.4         | 914.4            | 609.6 | 616.5          | 464.1 |
| 350               | 14"    | 355.6                 | 533.4         | 355.6 | 220.9         | 1066.8           | 711.2 | 711.2          | 533.4 |
| 400               | 16"    | 406.4                 | 609.6         | 406.4 | 252.5         | 1219.2           | 812.8 | 812.8          | 609.6 |
| 450               | 18"    | 457.2                 | 685.8         | 457.2 | 284.1         | -                | -     | -              | -     |
| 500               | 20"    | 508.0                 | 762.0         | 508.0 | 315.6         | -                | -     | -              | -     |
| 550               | 22"    | 558.8                 | 838.2         | 558.8 | 347.2         | -                | -     | -              | -     |
| 600               | 24"    | 609.6                 | 914.4         | 609.6 | 378.7         | -                | -     | -              | -     |
| 650               | 26"    | 660.4                 | 990.6         | 660.4 | 410.3         | -                | -     | -              | -     |
| 700               | 28"    | 711.2                 | 1066.8        | 711.2 | 441.9         | -                | -     | -              | -     |
| 750               | 30"    | 762.0                 | 1143.0        | 762.0 | 473.4         | -                | -     | -              | -     |

## 10.39 Concentric / Eccentric Reducers (ASTM A403)



Concentric Reducer



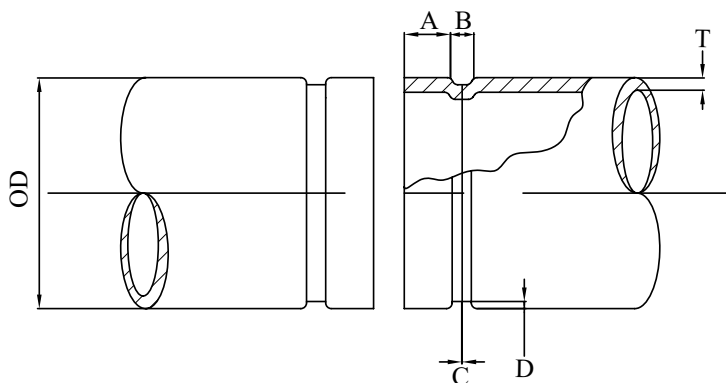
Eccentric Reducer

| NPS             | D     | d     | H   | Wall Thickness |      |        |      | Weights (kg) |        |
|-----------------|-------|-------|-----|----------------|------|--------|------|--------------|--------|
|                 |       |       |     | SCH STD        |      | SCH XS |      | SCH STD      | SCH XS |
|                 |       |       |     | S              | S1   | S      | S1   |              |        |
| 3/4" x 1/2"     | 26.7  | 21.3  | 38  | 2.87           | 2.77 | 3.91   | 3.73 | 0.10         | 0.15   |
| 1" x 3/4"       | 33.4  | 26.7  | 51  | 3.38           | 2.87 | 4.55   | 3.91 | 0.14         | 0.17   |
| 1 x 1/2"        |       | 21.3  |     | 3.38           | 2.77 | 4.55   | 3.73 | 0.14         | 0.16   |
| 1 1/4" x 1"     | 42.2  | 33.4  | 51  | 3.56           | 3.38 | 4.85   | 4.55 | 0.20         | 0.24   |
| 1 1/4" x 3/4"   |       | 26.7  |     | 3.56           | 2.87 | 4.85   | 3.91 | 0.20         | 0.23   |
| 1 1/4" x 1/2"   |       | 21.3  |     | 3.56           | 2.77 | 4.85   | 3.73 | 0.19         | 0.22   |
| 1 1/2" x 1 1/4" | 48.3  | 42.2  | 64  | 3.68           | 3.56 | 5.08   | 4.85 | 0.26         | 0.33   |
| 1 1/2" x 1"     |       | 33.4  |     | 3.68           | 3.38 | 5.08   | 4.55 | 0.24         | 0.31   |
| 1 1/2" x 3/4"   |       | 26.7  |     | 3.68           | 2.87 | 5.08   | 3.91 | 0.22         | 0.27   |
| 1 1/2" x 1/2"   |       | 21.3  |     | 3.68           | 2.77 | 5.08   | 3.73 | 0.20         | 0.26   |
| 2" x 1 1/2"     | 60.3  | 48.3  | 76  | 3.91           | 3.68 | 5.54   | 5.08 | 0.41         | 0.54   |
| 2" x 1 1/4"     |       | 42.4  |     | 3.91           | 3.56 | 5.54   | 4.85 | 0.39         | 0.53   |
| 2" x 1"         |       | 33.4  |     | 3.91           | 3.38 | 5.54   | 4.55 | 0.37         | 0.48   |
| 2" x 3/4"       |       | 26.7  |     | 3.91           | 2.87 | 5.54   | 3.91 | 0.33         | 0.46   |
| 2" x 1/2"       |       | 21.3  |     | 3.91           | 2.77 | 5.54   | 3.73 | 0.31         | 0.42   |
| 2 1/2" x 2"     | 73    | 60.3  | 89  | 5.16           | 3.91 | 7.01   | 5.54 | 0.73         | 0.94   |
| 2 1/2" x 1 1/2" |       | 48.3  |     | 5.16           | 3.68 | 7.01   | 5.08 | 0.68         | 0.86   |
| 2 1/2" x 1 1/4" |       | 42.2  |     | 5.16           | 3.56 | 7.01   | 4.85 | 0.67         | 0.79   |
| 2 1/2" x 1"     |       | 33.4  |     | 5.16           | 3.38 | 7.01   | 4.55 | 0.59         | 0.79   |
| 3" x 2 1/2"     | 88.9  | 73    | 89  | 5.49           | 5.16 | 7.62   | 7.01 | 0.98         | 1.29   |
| 3" x 2"         |       | 60.3  |     | 5.49           | 3.91 | 7.62   | 5.54 | 0.91         | 1.18   |
| 3" x 1 1/2"     |       | 48.3  |     | 5.49           | 3.68 | 7.62   | 5.08 | 0.86         | 1.04   |
| 3" x 1 1/4"     |       | 42.2  |     | 5.49           | 3.56 | 7.62   | 4.85 | 0.77         | 1.04   |
| 3" x 1"         |       | 33.4  |     | 5.49           | 3.38 | 7.62   | 4.55 | 0.73         | 1.04   |
| 3 1/2" x 3"     | 101.6 | 88.9  | 102 | 5.74           | 5.49 | 8.08   | 7.62 | 1.38         | 1.85   |
| 3 1/2" x 2 1/2" |       | 73    |     | 5.74           | 5.16 | 8.08   | 7.01 | 1.34         | 1.75   |
| 3 1/2" x 2"     |       | 60.3  |     | 5.74           | 3.91 | 8.08   | 5.54 | 1.23         | 1.61   |
| 3 1/2" x 1 1/2" |       | 48.3  |     | 5.74           | 3.68 | 8.08   | 5.08 | 1.14         | 1.43   |
| 3 1/2" x 1 1/4" |       | 42.2  |     | 5.74           | 3.56 | 8.08   | 4.85 | 1.14         | 1.43   |
| 4" x 3 1/2"     | 114.3 | 101.6 | 102 | 6.02           | 5.74 | 8.56   | 8.08 | 1.64         | 2.21   |
| 4" x 3"         |       | 88.9  |     | 6.02           | 5.49 | 8.56   | 7.62 | 1.59         | 2.13   |
| 4" x 2 1/2"     |       | 73    |     | 6.02           | 5.16 | 8.56   | 7.01 | 1.52         | 2.01   |
| 4" x 2"         |       | 60.3  |     | 6.02           | 3.91 | 8.56   | 5.54 | 1.44         | 1.78   |
| 4" x 1 1/2"     |       | 48.3  |     | 6.02           | 3.68 | 8.56   | 5.08 | 1.24         | 1.73   |
| 4" x 1 1/4"     |       | 42.2  |     | 6.02           | 3.56 | 8.56   | 4.85 | 1.20         | 1.71   |
| 4" x 1"         |       | 33.4  |     | 6.02           | 3.38 | 8.56   | 4.55 | 1.12         | 1.70   |
| 5" x 4"         | 141.3 | 114.3 | 127 | 6.55           | 6.02 | 9.52   | 8.56 | 2.72         | 3.78   |
| 5" x 3 1/2"     |       | 101.6 |     | 6.55           | 5.74 | 9.52   | 8.08 | 2.65         | 3.65   |

## 10.40 | Rolled Groove Couplings Dimensions - Fig 10

### Specifications

Grooved piping system is reliable and faster to install than welding, threading or flanging. This results in the lowest possible installed cost. It can be adapted to suit standard pipe with cut grooves or standard and light wall pipe with rolled grooves.



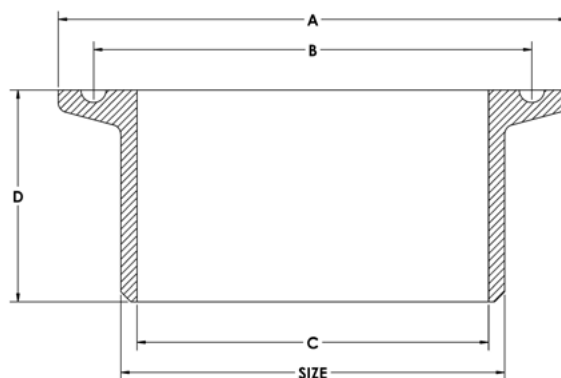
| Standard Roll Groove Specifications |                                 |               |               |                                            |                                             |                     |        |              |                                           |                                               |                                               |                         |
|-------------------------------------|---------------------------------|---------------|---------------|--------------------------------------------|---------------------------------------------|---------------------|--------|--------------|-------------------------------------------|-----------------------------------------------|-----------------------------------------------|-------------------------|
| Nominal Pipe Size                   | Pipe Outside Diameter (mm) 'OD' |               |               | Gasket seat $\pm 0.30$ $\pm .770$ (mm) 'A' | Groove width $\pm 0.30$ $\pm .770$ (mm) 'B' | Groove Diameter 'C' |        | Groove Depth | STD C/S Min allow wall thickness (mm) 'T' | Sch 10s S/S Min allow wall thickness (mm) 'T' | Sch 40s S/S Min allow wall thickness (mm) 'T' | Max Flare Diameter (mm) |
|                                     | Actual                          | Tolerance (+) | Tolerance (-) |                                            |                                             | mm                  | mm     |              |                                           |                                               |                                               |                         |
| 1"                                  | 33.70                           | +0.381        | -0.381        | 15.875                                     | 7.137                                       | 30.226              | -0.381 | 1.600        | 3.38                                      | 2.77                                          | 3.38                                          | 34.5                    |
| 1 1/4"                              | 42.40                           | +0.381        | -0.381        | 15.875                                     | 7.137                                       | 38.989              | -0.381 | 1.600        | 3.56                                      | 2.77                                          | 3.56                                          | 43.3                    |
| 1 1/2"                              | 48.30                           | +0.381        | -0.381        | 15.875                                     | 7.137                                       | 45.085              | -0.381 | 1.600        | 3.65                                      | 2.77                                          | 3.68                                          | 49.4                    |
| 2"                                  | 60.30                           | +0.610        | -0.610        | 15.875                                     | 8.738                                       | 57.150              | -0.381 | 1.600        | 3.91                                      | 2.77                                          | 3.91                                          | 62.2                    |
| *2 1/2"                             | 73.00                           | +0.737        | -0.737        | 15.875                                     | 8.738                                       | 69.088              | -0.457 | 1.981        | 5.16                                      | 3.05                                          | 5.16                                          | 75.2                    |
| 2 1/2"                              | 76.10                           | +0.737        | -0.737        | 15.875                                     | 8.738                                       | 69.088              | -0.457 | 1.981        | 5.16                                      | 3.05                                          | 5.16                                          | 75.2                    |
| 3"                                  | 88.90                           | +0.889        | -0.737        | 15.875                                     | 8.738                                       | 84.938              | -0.457 | 1.981        | 5.49                                      | 3.05                                          | 5.49                                          | 90.3                    |
| 4"                                  | 114.30                          | +1.143        | -0.737        | 15.875                                     | 8.738                                       | 110.084             | -0.508 | 2.108        | 6.02                                      | 3.05                                          | 6.02                                          | 116.2                   |
| 5"                                  | 141.30                          | +1.422        | -0.737        | 15.875                                     | 8.738                                       | 137.033             | -0.559 | 2.134        | 6.55                                      | 3.40                                          | 6.55                                          | 143.5                   |
| 6"                                  | 165.10                          | +1.600        | -0.737        | 15.875                                     | 8.738                                       | 163.957             | -0.559 | 2.159        | 7.11                                      | 3.40                                          | 7.11                                          | 170.7                   |
| *6"                                 | 168.30                          | +1.600        | -0.737        | 15.875                                     | 8.738                                       | 163.957             | -0.559 | 2.159        | 7.11                                      | 3.40                                          | 7.11                                          | 170.7                   |
| 8"                                  | 219.10                          | +1.600        | -0.737        | 19.050                                     | 11.913                                      | 214.401             | -0.635 | 2.337        | 8.18                                      | 3.76                                          | 8.18                                          | 221.5                   |
| 10"                                 | 273.00                          | +1.600        | -0.737        | 19.050                                     | 11.913                                      | 268.28              | -0.687 | 2.387        | 9.27                                      | 4.19                                          | 9.27                                          | 277.4                   |
| 12"                                 | 323.90                          | +1.600        | -0.737        | 19.050                                     | 11.913                                      | 318.29              | -0.758 | 2.697        | 10.31                                     | 4.57                                          | 9.53                                          | 328.2                   |

\* USA pipe size

| Specifications     |                    |                  |
|--------------------|--------------------|------------------|
| PRODUCT            | WORKING PRESSURE   | MAX WORKING TEMP |
| RIGID COUPLING     | 300 PSI / 2068 kPa | 100°C            |
| 90° ELBOW          |                    |                  |
| 45° ELBOW          |                    |                  |
| EQUAL TEE          |                    |                  |
| REDUCING TEE       |                    |                  |
| CONCENTRIC REDUCER |                    |                  |
| CAP                |                    |                  |
| MECHANICAL TEE     | 1600 kPa           |                  |

\*Refer to Section for part numbers - Page 229 - 230

## 10.41 Triclover Ferrule Dimensions



| Size   |       | A     | B     | C     | D  |
|--------|-------|-------|-------|-------|----|
| DN     | (mm)  |       |       |       |    |
| 1/2"   | 12.7  | 25.1  | 20.0  | 9.5   | 21 |
| 3/4"   | 19.1  | 25.1  | 20.0  | 15.9  | 21 |
| 1"     | 25.4  | 50.5  | 43.5  | 22.2  | 21 |
| 1 1/4" | 31.8  | 50.5  | 43.5  | 28.6  | 21 |
| 1 1/2" | 38.1  | 50.5  | 43.5  | 34.9  | 21 |
| 2"     | 50.8  | 64.0  | 56.5  | 47.6  | 21 |
| 2 1/2" | 63.5  | 77.5  | 70.5  | 60.3  | 21 |
| 3"     | 76.2  | 91.0  | 83.5  | 73    | 21 |
| 4"     | 101.6 | 119.0 | 110.0 | 98.4  | 21 |
| 6"     | 152.4 | 166.1 | 157.0 | 148.4 | 27 |
| 8"     | 203.2 | 217.5 | 207.2 | 199.2 | 29 |
| 10"    | 254   | 268.5 | -     | 250   | 29 |
| 12"    | 304.8 | 319.5 | 308.8 | 300.8 | 29 |

\*Refer to Fittings, Section for part numbers - Page 247

## 10.43 Bolt Hole Sequence

To obtain a leak-free flange connection, a proper gasket installation is needed, the bolts must be assigned on the correct bolt tension, and the total bolt strength must be evenly divided over the whole flange face.

With Torque Tightening (the application of preload to a fastener by the turning of the fastener's nut) the correct bolt tension can be realized.

Correct tightening of a bolt means making the best use of the bolt's elastic properties. To work well, a bolt must behave just like a spring. In operation, the tightening process exerts an axial pre-load tension on the bolt. This tension load is of course equal and opposite to the compression force applied on the assembled components. It can be referred to as the "tightening load" or "tension load".

### 4 and 8 Bolt Flanges

- First round - 30% of final torque (flange sequential order)
- Second round - 60% of final torque (flange sequential order)
- Third round - 100% of final torque (flange sequential order)
- One final time - clockwise or counter clockwise sequentially around the flange

### 12 Bolt Flanges and More

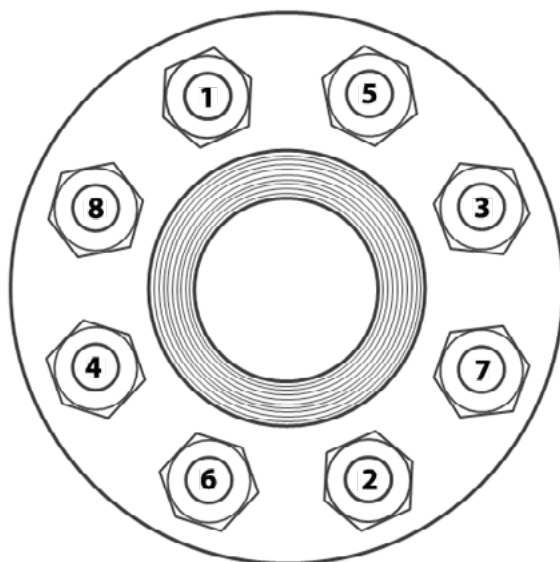
- First round - 20% of final torque (flange sequential order)
- Second round - 40% of final torque (flange sequential order)
- Third round - 80% of final torque (flange sequential order)
- Fourth round - 100% of final torque (sequential order)
- One final time - clockwise or counter clockwise sequentially around the flange



The selection of the proper flange bolt tightening technique requires experience. The successful application of any technique also requires qualification of both the tools that will be used and the crew who will do the work. The following summarizes the most commonly used flange bolt tightening techniques.

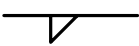
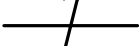
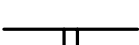
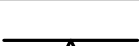
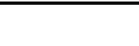
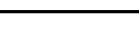
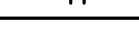
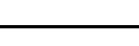
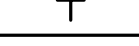
- Manual Wrench
- Impact Wrench
- Hammer Wrench
- Hydraulic Torque Wrench
- Manual Beam and Gear-Assisted Torque Wrench
- Hydraulic Bolt Tensioner

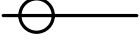
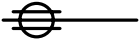
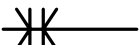
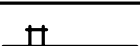
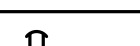
### Tightening Sequence

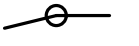
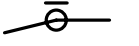
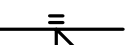
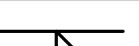
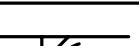
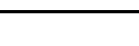
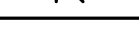


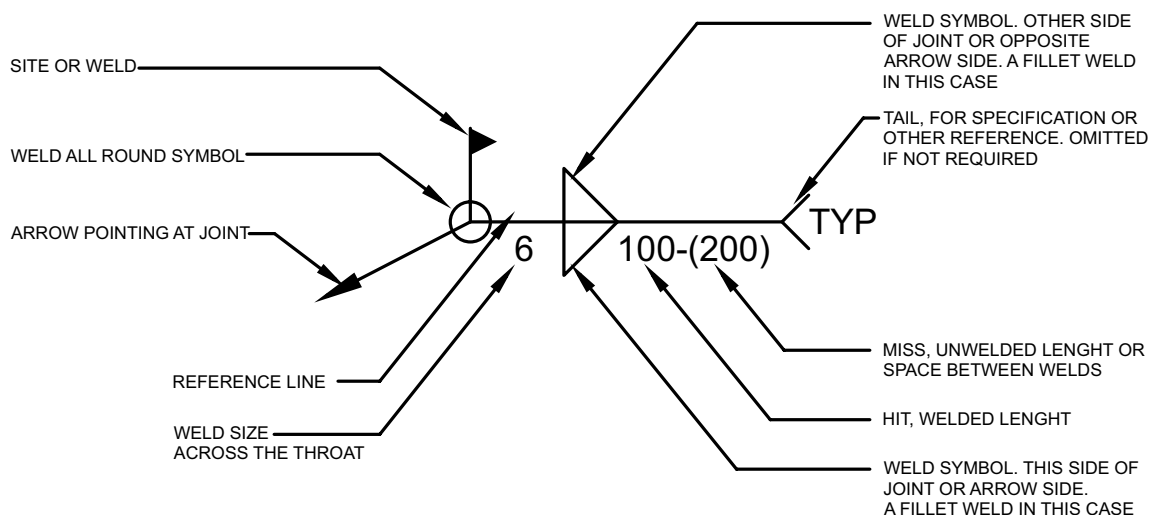
### WELD SYMBOLS

COMMONLY USED IN AUSTRALIA

| BASIC GAS AND ARC WELDING SYMBOLS                                                   |                   |
|-------------------------------------------------------------------------------------|-------------------|
|    | FILLET            |
|    | BEAD              |
|    | GENERAL BUTT      |
|    | SQUARE BUTT       |
|    | SINGLE BEVEL BUTT |
|    | SINGLE VEE BUTT   |
|   | SINGLE 'U' BUTT   |
|  | SINGLE 'J' BUTT   |
|  | PLUG OR SLOT      |
|  | STUD              |
|  | SURFACING         |

| RESIISTANCE WELDING SYMBOLS                                                         |                 |
|-------------------------------------------------------------------------------------|-----------------|
|    | SPOT            |
|    | SEAM            |
|    | MASH SEAM       |
|    | STICH           |
|    | MASH STICH      |
|    | PROJECTION      |
|   | FLASH BUTT      |
|  | RESISTANCE BUTT |

| SUPPLEMENTARY WELDING SYMBOLS                                                         |                        |
|---------------------------------------------------------------------------------------|------------------------|
|    | WELD ALL ROUND         |
|    | FLUSH CONTOUR          |
|    | WELD ON SITE           |
|    | BACKING STRIP OR BAR   |
|    | FLUSH SURFACE FINISH   |
|    | CONVEX SURFACE FINISH  |
|   | CONCAVE SURFACE FINISH |
|  | BACKING WELD RUN       |
|  | TAIL, FOR NOTES        |



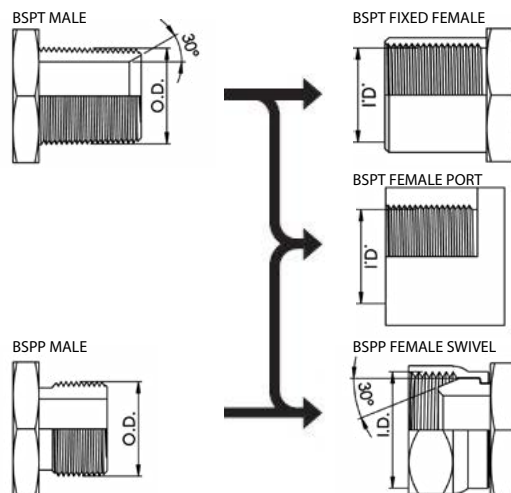
## 10.45 Thread Specification - BSPT & BSPP (BS21)

BSPT male threads seal against threads of fixed BSPT female.

Contact is made on the flanks of the threads.

Use of a thread sealant is recommended for BSPT male to BSPT female connections.

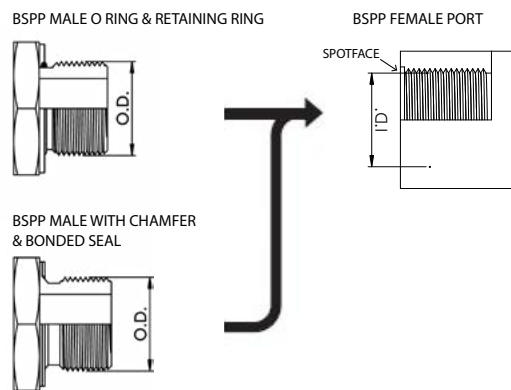
Measure the BSPT male thread OD and female thread ID at the first full thread near the end of the fitting.



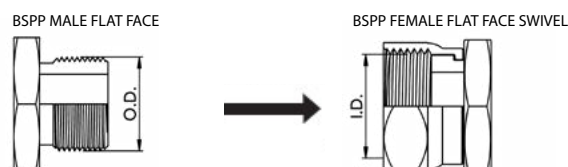
BSPT male and BSPP male with conical 30° seat (60° included angle) seal against matching conical 30° seat of BSPP female swivel.

BSPP O Ring male connector has straight threads and O Ring with metal Retaining Ring. It seals against flat external surface of BSPP female port.

BSPP male, with chamfer to locate Bonded Seal also seals against flat external surface of BSPP female port. Surface irregularities require a Spot Face to ensure effective sealing. Elbows and tees have Lock Nut to allow orientation of fitting to required direction.



BSPP male and BSPP female flat face swivel require a suitable soft washer between faces to seal. For low working pressure.



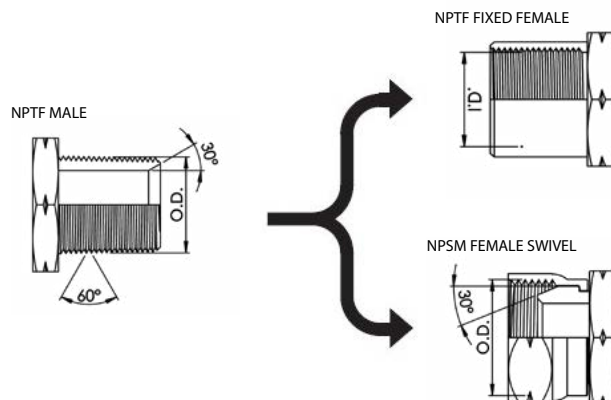
| BSPT & BSPP<br>SIZE & PITCH | DASH<br>SIZE | BSPT MALE<br>THREAD O.D. |      | BSPP MALE<br>THREAD O.D. |      | BSPT FEMALE<br>THREAD I.D. |      | BSPP FEMALE<br>THREAD I.D. |      |
|-----------------------------|--------------|--------------------------|------|--------------------------|------|----------------------------|------|----------------------------|------|
|                             |              | mm                       | inch | mm                       | inch | mm                         | inch | mm                         | inch |
| 1/8 - 28                    | -02          | 9.5                      | 0.37 | 9.6                      | 0.38 | 8.4                        | 0.33 | 8.6                        | 0.34 |
| 1/4 - 19                    | -04          | 12.8                     | 0.50 | 13.0                     | 0.51 | 11.2                       | 0.44 | 11.9                       | 0.47 |
| 3/8 - 19                    | -06          | 16.3                     | 0.64 | 16.5                     | 0.65 | 14.7                       | 0.59 | 15.2                       | 0.60 |
| 1/2 - 14                    | -08          | 20.4                     | 0.80 | 20.8                     | 0.82 | 18.3                       | 0.72 | 19.1                       | 0.75 |
| 5/8 - 14                    | -10          | 22.5                     | 0.89 | 22.8                     | 0.90 | 20.6                       | 0.81 | 20.8                       | 0.82 |
| 3/4 - 14                    | -12          | 25.9                     | 1.02 | 26.3                     | 1.04 | 23.9                       | 0.94 | 24.6                       | 0.97 |
| 1 - 11                      | -16          | 32.6                     | 1.28 | 33.1                     | 1.30 | 29.7                       | 1.17 | 30.7                       | 1.21 |
| 1 1/4 - 11                  | -20          | 41.1                     | 1.62 | 41.8                     | 1.64 | 38.6                       | 1.52 | 39.4                       | 1.55 |
| 1 1/2 - 11                  | -24          | 47.0                     | 1.85 | 47.7                     | 1.88 | 44.5                       | 1.75 | 45.5                       | 1.79 |
| 2 - 11                      | -32          | 58.6                     | 2.31 | 59.5                     | 2.34 | 56.4                       | 2.22 | 57.4                       | 2.26 |
| 2 1/2 - 11                  | -40          | 74.1                     | 2.92 | 75.1                     | 2.95 | 71.9                       | 2.83 | 72.6                       | 2.86 |
| 3 - 11                      | -48          | 86.6                     | 3.41 | 87.9                     | 3.46 | 84.6                       | 3.33 | 85.4                       | 3.36 |

## 10.46 | Thread Specification - NPT & NPSM (ANSI B1.20.1)

National Pipe threads are similar in function to BSP threads, but are not generally interchangeable. NPTF threads (also known as Dryseal) are an improvement to NPT.

Controlled truncation of threads mean the metal-to-metal thread seal is at root and crest of threads, in addition to flanks of threads.

Use of thread sealant is recommended for NPT male and NPT female connection.



Measure NPT male thread OD and NPT female thread ID at first full thread near end of fitting.

### NPT Threads Dimensions

| NPT THREAD SIZE & PITCH | DASH SIZE | MALE THREAD MINOR O.D. |      | FEMALE THREAD I.D. |      |
|-------------------------|-----------|------------------------|------|--------------------|------|
|                         |           | mm                     | inch | mm                 | inch |
| 1/8 - 27                | -02       | 9.9                    | 0.39 | 8.4                | 0.33 |
| 1/4 - 18                | -04       | 13.2                   | 0.52 | 11.2               | 0.44 |
| 3/8 - 18                | -06       | 16.6                   | 0.65 | 14.7               | 0.58 |
| 1/2 - 14                | -08       | 20.6                   | 0.81 | 17.8               | 0.70 |
| 3/4 - 14                | -12       | 26.0                   | 1.02 | 23.4               | 0.92 |
| 1 - 11 1/2              | -16       | 32.5                   | 1.28 | 29.5               | 1.16 |
| 1 1/4 - 11 1/2          | -20       | 41.2                   | 1.62 | 38.1               | 1.50 |
| 1 1/2 - 11 1/2          | -24       | 47.3                   | 1.86 | 43.9               | 1.73 |
| 2 - 11 1/2              | -32       | 59.3                   | 2.33 | 56.4               | 2.22 |
| 2 1/2 - 8               | -40       | 71.5                   | 2.82 | 69.1               | 2.72 |
| 3 - 8                   | -48       | 87.3                   | 3.44 | 84.8               | 3.34 |

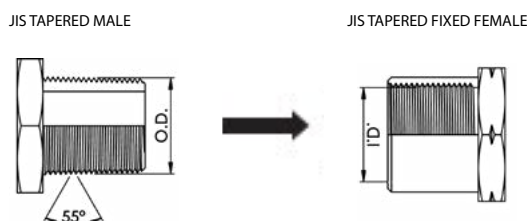
### NPSM Threads Dimensions

| NPT THREAD SIZE & PITCH | DASH SIZE | FEMALE THREAD I.D. |      |
|-------------------------|-----------|--------------------|------|
|                         |           | mm                 | inch |
| 1/8 - 27                | -02       | 8.6                | 0.34 |
| 1/4 - 18                | -04       | 11.9               | 0.47 |
| 3/8 - 18                | -06       | 15.0               | 0.59 |
| 1/2 - 14                | -08       | 19.1               | 0.75 |
| 3/4 - 14                | -12       | 24.6               | 0.97 |
| 1 - 11 1/2              | -16       | 30.5               | 1.20 |
| 1 1/4 - 11 1/2          | -20       | 39.4               | 1.55 |
| 1 1/2 - 11 1/2          | -24       | 45.5               | 1.79 |
| 2 - 11 1/2              | -32       | 57.4               | 2.26 |
| 2 1/2 - 8               | -40       | 68.8               | 2.71 |
| 3 - 8                   | -48       | 84.6               | 3.33 |

### 1. JIS Tapered Pipe Thread

The Japanese tapered pipe thread connector is identical to and interchangeable with the BSPT (tapered) connector. The Japanese male thread does not have a 30° Flare, and will not mate with the BSPP female swivel with conical seat. The seal on the Japanese tapered pipe thread connector is made on the threads. Use of a thread sealant is recommended.

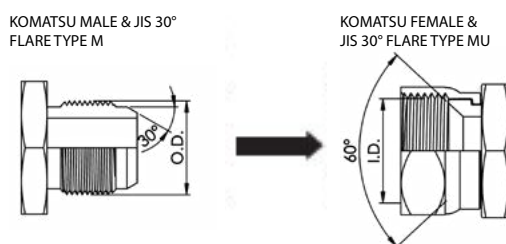
Thread form per JIS B 0203 (identical to BSPT, Refer to BSPT section for dimensions of threads.)



### 2. JIS 30° Flare (Female Internal Cone Seat)

This connection uses a 60° concave (inverted) seat and British Standard Pipe Parallel threads. They are not interchangeable with BSPP conical seat couplings, because the cone seats are opposite.

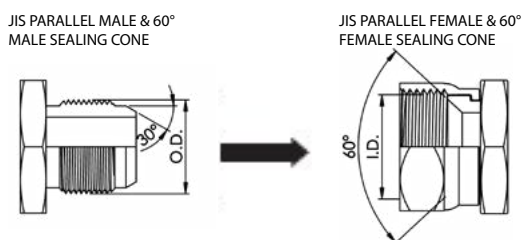
Thread form per JIS B 0203 (identical to BSPT, Refer to BSPT section for dimensions of threads.)



### 3. Komatsu 30° flare (Female Internal Cone Seat)

Threads commonly used on Komatsu equipment (30° cone) have metric thread form.

| MALE THREAD<br>O.D. & PITCH | DASH<br>SIZE | FEMALE<br>THREAD I.D. |
|-----------------------------|--------------|-----------------------|
| M14 x 1.5                   | -1415        | 12.5                  |
| M18 x 1.5                   | -1815        | 16.5                  |
| M22 x 1.5                   | -2215        | 20.5                  |
| M24 x 1.5                   | -2415        | 22.5                  |
| M30 x 1.5                   | -3015        | 28.5                  |
| M33 x 1.5                   | -3315        | 31.5                  |
| M36 x 1.5                   | -3615        | 34.5                  |
| M33 x 1.5                   | -3315        | 31.5                  |



### 4. Komatsu Style Flange Fitting JIS B 8363

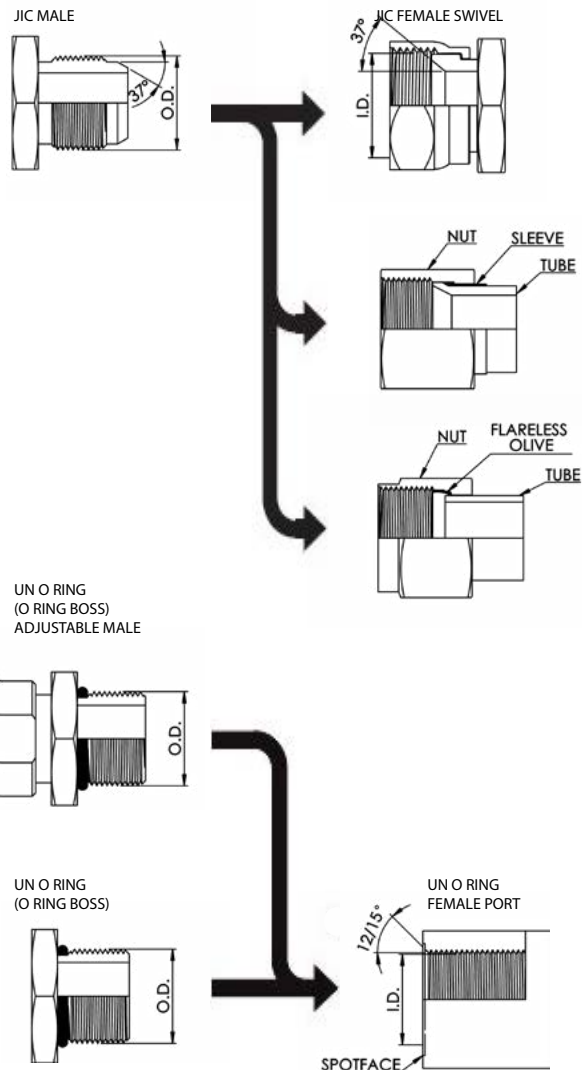
The Komatsu style Flange fitting is nearly identical to, and fully interchangeable with, the SAE Code 61 flange fitting\*. The O Ring dimensions are different between all sizes. When replacing a Komatsu style flange with an SAE style flange, an SAE style O Ring must always be used. \*5/8" is not in the SAE Standards.

## 10.48 | Thread Specification - JIC 37° FLARE & UNO (SAE J514)

JIC male has 37° flare which seals against 37° seat in female. JIC male can also seal against 37° flared tubing with JIC nut and sleeve.

JIC male can also be used with RYCO S134 J-Lok Female Nut and Flareless Olive on Imperial OD tubing.

UNO (O Ring Boss) seals with ORing compressed between hex boss of UN male and 12°/15° tapered bore of UN (O Ring Boss) female port. For elbows and tees, Backup Washer and Lock Nut allow orientation of fitting to required direction.



| MALE THREAD<br>O.D. & PITCH | DASH<br>SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD O.D. |      | TUBE SIZE |
|-----------------------------|--------------|---------------------|------|-----------------------|------|-----------|
|                             |              | mm                  | inch | mm                    | inch |           |
| inch - TPI                  |              | mm                  | inch | mm                    | inch | inch      |
| 5/16 - 24 UNF               | -05          | 7.9                 | 0.31 | 6.9                   | 0.27 | 1/8       |
| 3/8 - 24 UNF                | -06          | 9.5                 | 0.38 | 8.5                   | 0.33 | 3/16      |
| 7/16 - 20 UNF               | -07          | 11.1                | 0.44 | 9.9                   | 0.39 | 1/4       |
| 1/2 - 20 UNF                | -08          | 12.7                | 0.50 | 11.4                  | 0.45 | 5/16      |
| 9/16 - 18 UNF               | -09          | 14.3                | 0.56 | 13.0                  | 0.51 | 3/8       |
| 3/4 - 16 UNF                | -12          | 19.1                | 0.75 | 17.5                  | 0.69 | 1/2       |
| 7/8 - 14 UNF                | -14          | 22.2                | 0.88 | 20.3                  | 0.80 | 5/8       |
| 1 1/16 - 12 UN              | -17          | 27.0                | 1.06 | 24.9                  | 0.98 | 3/4       |
| 1 3/16 - 12 UN              | -19          | 30.2                | 1.19 | 28.2                  | 1.11 | 7/8       |
| 1 5/16 - 12 UN              | -21          | 33.3                | 1.31 | 31.2                  | 1.23 | 1         |
| 1 5/8 - 12 UN               | -26          | 41.3                | 1.63 | 39.1                  | 1.54 | 1 1/4     |
| 1 7/8 - 12 UN               | -30          | 47.6                | 1.88 | 45.5                  | 1.79 | 1 1/2     |
| 2 1/2 - 12 UN               | -40          | 63.5                | 2.50 | 61.5                  | 2.42 | 2         |

## 10.49 Thread Specification - Metric DIN (DIN 3852-1)

The same male used with a metal Bonded Seal will mate with a DIN 3852-1 metric threaded port with spotface.

The DIN male 24° internal cone seat will seal with flareless female swivel fittings. These female fittings use either a spherical nose (DKL/DKS) or an O Ring seal (DKOL/DKOS) located on their outward facing 24° cone. Female DKL sizes up to and including M26 have a universal 24°/60° cone and can be used in place of female DKM fittings with 60° cone.

BSPP O Ring male connector has straight threads and O Ring with metal Retaining Ring. It seals against flat external surface of BSPP female port.

BSPP male, with chamfer to locate Bonded Seal also seals against flat external surface of BSPP female port.

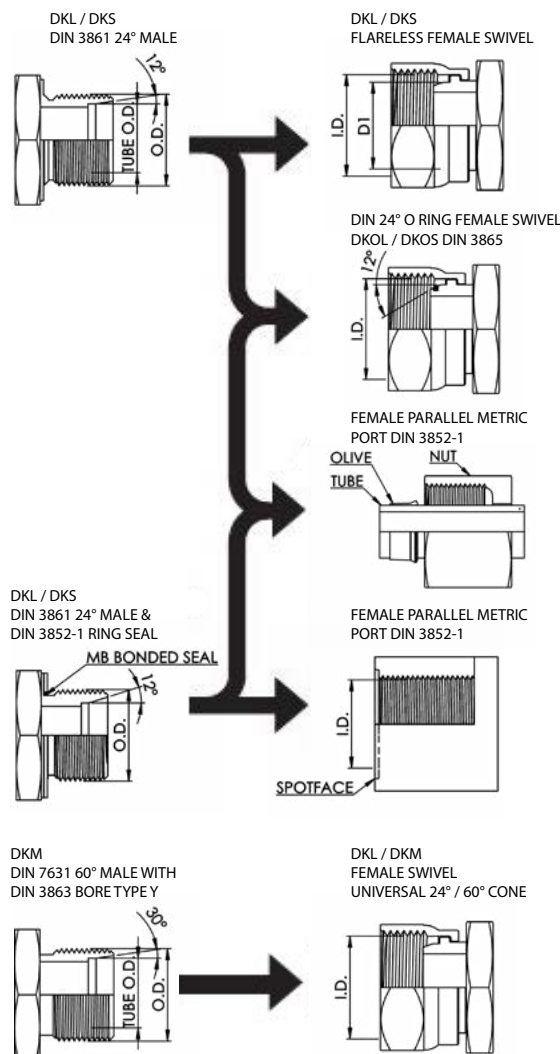
Surface irregularities require a Spot Face to ensure effective sealing. Elbows and tees have Lock Nut to allow orientation of fitting to required direction.

The same male also mates with the DIN system Metric Tube, Tube Nut and Compression Olive (Cutting Ring). Tightening of the female nut compresses the olive causing it to cut into the tube, thereby forming a seal between the tube, olive and 24° male cone.

The same male used with a metal Bonded Seal will mate with a DIN 3852-1 metric threaded port with spotface.

### DKM 60° CONE SEAT

The DIN male 60° internal cone seat will mate with DKL/DKM female universal 24°/60° cone fittings up to and including size M26 and DKM female 60° cone fittings from size M30 up.



| MALE THREAD<br>O.D. & PITCH | FEMALE<br>THREAD I.D. | * LIGHT SERIES - DKL/DKOL |           |        |        | HEAVY SERIES - DKS/DKOS |           |        |        |
|-----------------------------|-----------------------|---------------------------|-----------|--------|--------|-------------------------|-----------|--------|--------|
|                             |                       | DASH<br>SIZE              | TUBE O.D. | D1 DIA | D2 DIA | DASH<br>SIZE            | TUBE O.D. | D1 DIA | D2 DIA |
| mm                          | mm                    |                           | mm        | mm     | mm     |                         | mm        | mm     | mm     |
| M12 x 1.5                   | 10.5                  | -1215*                    | 6         | 7.5    | 6.3    | -                       | -         | -      | -      |
| M14 x 1.5                   | 12.5                  | -1415*                    | 8         | 9.5    | 8.2    | -1415                   | 6         | 7.5    | 6.3    |
| M16 x 1.5                   | 14.5                  | -1615*                    | 10        | 11.5   | 10.2   | -1615                   | 8         | 9.5    | 7.9    |
| M18 x 1.5                   | 16.5                  | -1815*                    | 12        | 14.0   | 12.2   | -1815                   | 10        | 12.0   | 10.0   |
| M20 x 1.5                   | 18.5                  | -                         | -         | -      | -      | -2015                   | 12        | 14.0   | 12.0   |
| M22 x 1.5                   | 20.5                  | -2215*                    | 15        | 17.0   | 15.2   | -2215                   | 14        | 16.0   | 14.2   |
| M24 x 1.5                   | 22.5                  | -                         | -         | -      | -      | -2415                   | 16        | 18.0   | 15.8   |
| M26 x 1.5                   | 24.5                  | -2615*                    | 18        | 20.0   | 18.2   | -                       | -         | -      | -      |
| M30 x 2.0                   | 28.0                  | -3020                     | 22        | 24.5   | 22.2   | -3020                   | 20        | 22.5   | 19.8   |
| M36 x 2.0                   | 34.0                  | -3620                     | 28        | 30.5   | 28.2   | -3620                   | 25        | 27.5   | 24.5   |
| M42 x 2.0                   | 40.0                  | -                         | -         | -      | -      | -4220                   | 30        | 33.0   | 30.0   |
| M45 x 2.0                   | 43.0                  | -4520                     | 35        | 38.0   | 35.4   | -                       | -         | -      | -      |
| M52 x 2.0                   | 50.0                  | -5220                     | 42        | 45.0   | 42.4   | -5220                   | 38        | 41.0   | 36.8   |

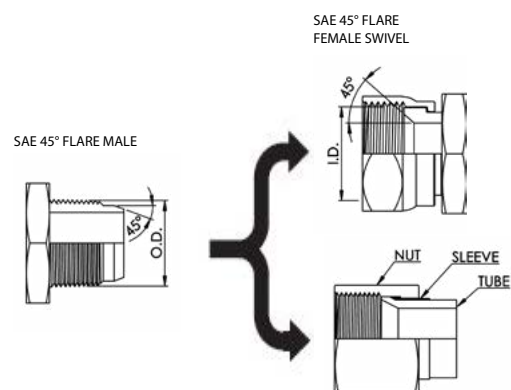
## 10.50 Thread Specification - SAE (SAE J512)

### SAE 45° FLARE- SAE J512

SAE male has 45° flare which seals against 45° seats in females. Males can also seal against 45° flared tubing with nut and sleeve.

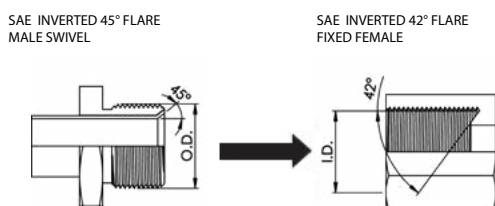
7/16 - 20, 1/2 - 20, 3/4 - 16 & 7/8 - 14 are the same thread form as JIC 37° flare. Some fittings in these sizes have both JIC 37° & SAE 45° seats.

| MALE THREAD<br>O.D. & PITCH | DASH<br>SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|--------------|---------------------|------|-----------------------|------|--------------|
|                             |              | mm                  | inch | mm                    | inch |              |
| inch - TPI                  |              |                     |      |                       |      | inch         |
| 5/16 - 24                   | -05          | 7.9                 | 0.31 | 6.8                   | 0.27 | 1/8          |
| 3/8 - 24                    | -06          | 9.5                 | 0.38 | 8.4                   | 0.33 | 3/16         |
| 7/16 - 20                   | -07          | 11.1                | 0.44 | 9.9                   | 0.39 | 1/4          |
| 1/2 - 20                    | -08          | 12.7                | 0.50 | 11.4                  | 0.44 | 5/16         |
| 5/8 - 18                    | -10          | 15.9                | 0.63 | 14.2                  | 0.56 | 3/8          |
| 3/4 - 16                    | -12          | 19.1                | 0.75 | 17.5                  | 0.69 | 1/2          |
| 7/8 - 14                    | -14          | 22.2                | 0.88 | 20.6                  | 0.81 | 5/8          |
| 1 1/16 - 14                 | -17          | 27.0                | 1.06 | 24.9                  | 0.98 | 3/4          |



### SAE 45° INVERTED FLARE - SAE J512

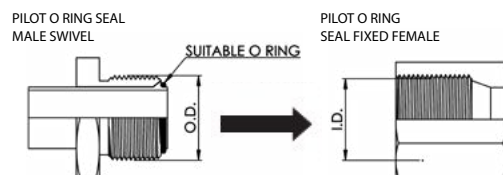
| MALE THREAD<br>O.D. & PITCH | DASH<br>SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|--------------|---------------------|------|-----------------------|------|--------------|
|                             |              | mm                  | inch | mm                    | inch |              |
| inch - TPI                  |              |                     |      |                       |      | inch         |
| 7/16 - 24                   | -07          | 11.1                | 0.44 | 9.9                   | 0.39 | 1/4          |
| 1/2 - 20                    | -08          | 12.7                | 0.50 | 11.4                  | 0.45 | 5/16         |
| 5/8 - 18                    | -10          | 15.9                | 0.63 | 14.2                  | 0.56 | 3/8          |
| 1 1/16 - 18                 | -11          | 17.5                | 0.69 | 16.0                  | 0.63 | 7/16         |



### SAE PILOT O RING SEALS

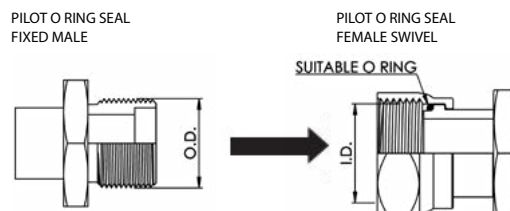
#### Pilot Male Swivel

| MALE THREAD<br>O.D. & PITCH | DASH<br>SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|--------------|---------------------|------|-----------------------|------|--------------|
|                             |              | mm                  | inch | mm                    | inch |              |
| inch - TPI                  |              |                     |      |                       |      | inch         |
| 5/8 - 18                    | -10          | 15.9                | 0.63 | 14.2                  | 0.56 | -6           |
| 3/4 - 18                    | -12          | 19.0                | 0.75 | 17.8                  | 0.70 | -8           |
| 7/8 - 18                    | -14          | 22.2                | 0.88 | 20.6                  | 0.81 | -10          |



#### Pilot Female Swivel

| MALE THREAD<br>O.D. & PITCH | DASH<br>SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|--------------|---------------------|------|-----------------------|------|--------------|
|                             |              | mm                  | inch | mm                    | inch |              |
| inch - TPI                  |              |                     |      |                       |      | inch         |
| 5/8 - 18                    | -10          | 15.9                | 0.63 | 14.2                  | 0.56 | -6           |
| 3/4 - 16                    | -12          | 19.0                | 0.75 | 17.5                  | 0.69 | -8           |
| 3/4 - 16                    | -12          | 19.0                | 0.75 | 17.5                  | 0.69 | -8           |



## 10.51 Thread Specification - Metric French GAZ

Also known as Metric French GAZ 24°

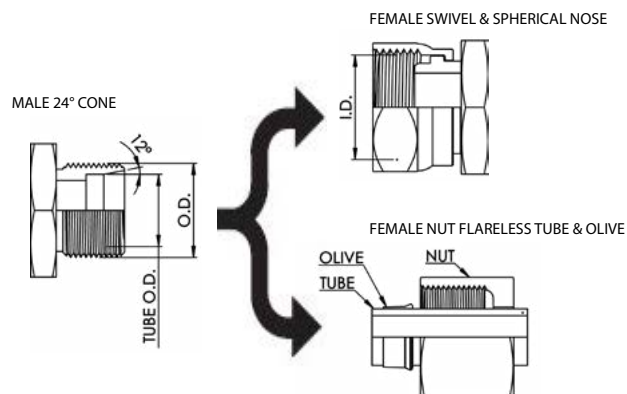
These seal on a 24° cone seat located internally on the male connector using straight fine metric threads.

Metric French GAZ series uses fractional number metric OD tubing, as shown in the table.

Metric French Millimetric series uses whole number metric OD tubing. The two series are not interconnectable.

The male will mate with a straight thread female swivel with spherical nose seat.

The same male also mates with flareless tube, Tube Nut and Compression Olive (Cutting Ring). Tightening of the female nut compresses the olive causing it to cut into the tube, thereby forming a seal between the tube, olive and 24° male cone.



| MALE THREAD<br>O.D. & PITCH | DASH SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|-----------|---------------------|------|-----------------------|------|--------------|
|                             |           | mm                  | inch | mm                    | inch |              |
| inch - TPI                  |           |                     |      |                       |      | mm           |
| M20 x 1.5                   | -20       | 20.0                | 0.78 | 18.5                  | 0.72 | 13.25        |
| M24 x 1.5                   | -24       | 24.0                | 0.94 | 22.5                  | 0.88 | 16.75        |
| M30 x 1.5                   | -30       | 30.0                | 1.18 | 28.5                  | 1.12 | 21.25        |
| M36 x 1.5                   | -36       | 36.0                | 1.41 | 34.5                  | 1.35 | 26.75        |
| M45 x 1.5                   | -45       | 45.0                | 1.77 | 43.5                  | 1.71 | 33.50        |
| M52 x 1.5                   | -52       | 52.0                | 2.04 | 50.5                  | 1.98 | 42.25        |

## 10.52 | Thread Specification - Metric French Millimetric

Also known as Metric Millimetric

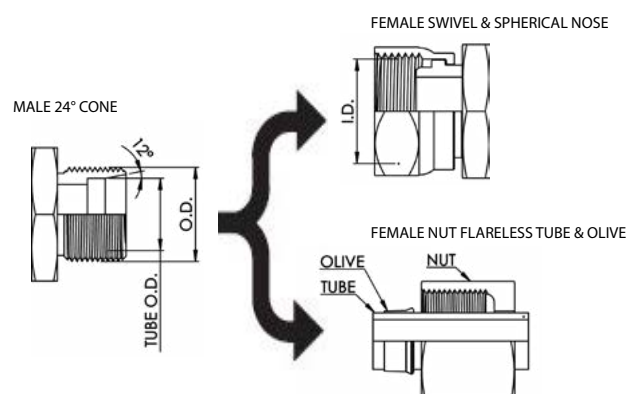
These seal on a 24° cone seat located internally on the male connector using straight fine metric threads.

Metric French GAZ series uses fractional number metric OD tubing, as shown in the table.

Metric French Millimetric series uses whole number metric OD tubing. The two series are not interconnectable.

The male will mate with a straight thread female swivel with spherical nose seat.

The same male also mates with flareless tube, Tube Nut and Compression Olive (Cutting Ring). Tightening of the female nut compresses the olive causing it cut into the tube, thereby forming a seal between the tube, olive and 24° male cone.



| MALE THREAD<br>O.D. & PITCH | DASH SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|-----------|---------------------|------|-----------------------|------|--------------|
|                             |           | mm                  | inch | mm                    | inch |              |
| inch - TPI                  |           | mm                  | inch | mm                    | inch | mm           |
| M27 x 1.5                   | -27       | 27.0                | 1.06 | 25.5                  | 1.00 | 20           |
| M30 x 1.5                   | -30       | 30.0                | 1.18 | 28.5                  | 1.12 | 22           |
| M33 x 1.5                   | -33       | 33.0                | 1.30 | 31.5                  | 1.24 | 25           |
| M36 x 1.5                   | -36       | 36.0                | 1.41 | 34.5                  | 1.35 | 28           |
| M39 x 1.5                   | -39       | 39.0                | 1.54 | 37.5                  | 1.48 | 30           |
| M45 x 1.5                   | -45       | 45.0                | 1.77 | 43.5                  | 1.71 | 35           |

## 10.53 | Thread Specification - ORFS (SAE J1453)

SAE J1453, ISO 8434-3

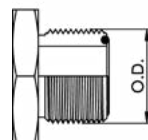
ORFS is O RING FACE SEAL

ORFS system consists of ORFS Male with O Ring in Face, which seals against Flat Seated ORFS Female Swivel Nut fitting.

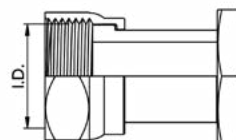
The Swivel Nut can be slipped back to help installation in tight situations.

The prominent position of the O Ring on the Male fitting makes it easy to inspect the condition of the O Ring.

ORFS MALE

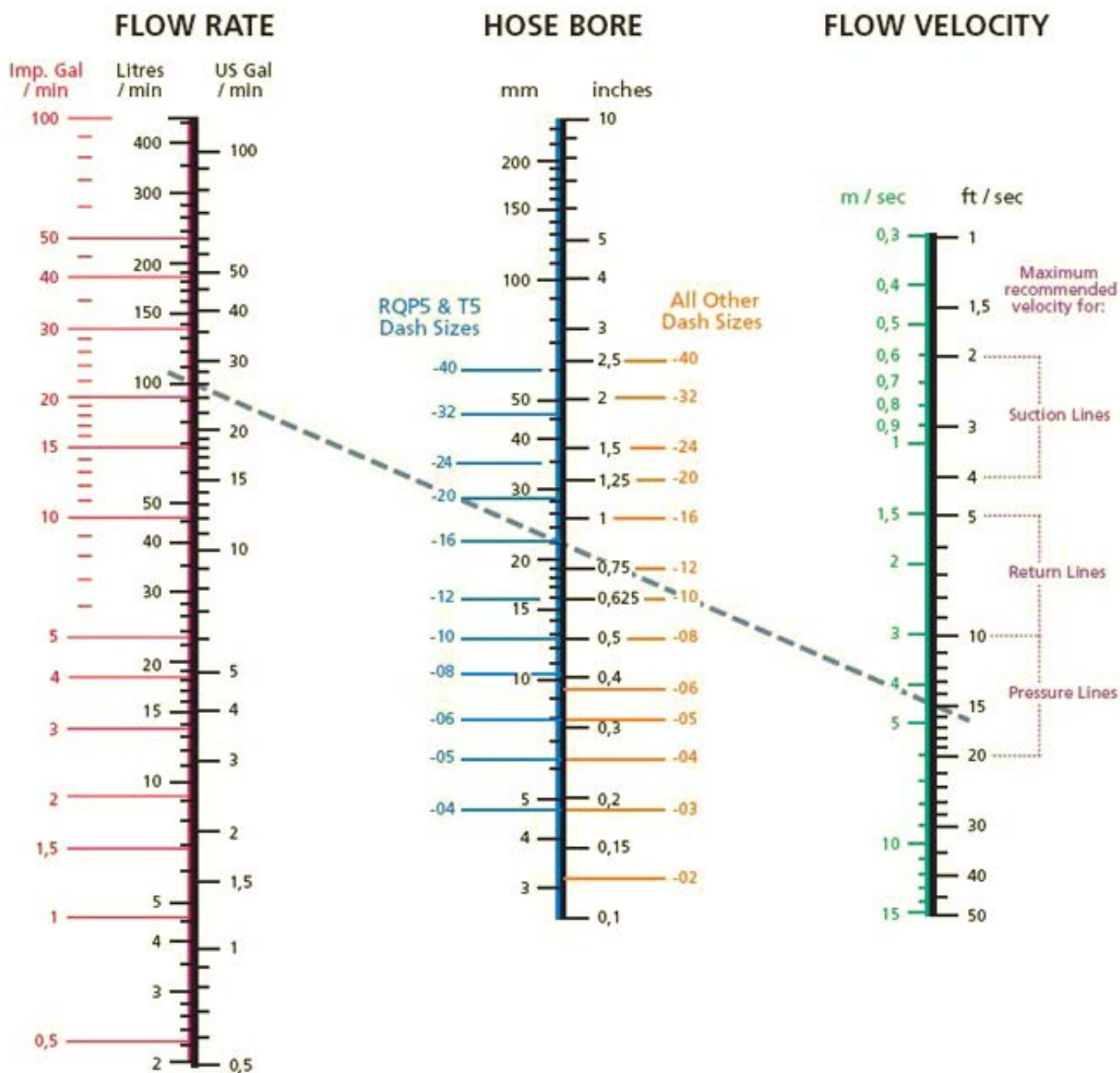


ORFS FEMALE



| MALE THREAD<br>O.D. & PITCH | DASH SIZE | MALE<br>THREAD O.D. |      | FEMALE<br>THREAD I.D. |      | TUBE<br>SIZE |
|-----------------------------|-----------|---------------------|------|-----------------------|------|--------------|
|                             |           | mm                  | inch | mm                    | inch |              |
| 9/16 - 18 UNF               | -09       | 14.3                | 0.56 | 12.9                  | 0.51 | 1/4          |
| 11/16 - 16 UN               | -11       | 17.3                | 0.68 | 16.0                  | 0.63 | 3/8          |
| 13/16 - 16 UN               | -13       | 20.6                | 0.81 | 19.1                  | 0.75 | 1/2          |
| 1 - 14 UNS                  | -16       | 25.4                | 1.00 | 23.6                  | 0.73 | 5/8          |
| 1.3/16 - 12 UN              | -19       | 30.0                | 1.18 | 28.2                  | 1.11 | 3/4          |
| 1.7/16 - 12 UN              | -23       | 36.3                | 1.43 | 34.3                  | 1.35 | 1            |
| 1.11/16 - 12 UN             | -27       | 42.7                | 1.68 | 40.6                  | 1.60 | 1.1/4        |
| 2 - 12 UN                   | -32       | 51.8                | 2.00 | 48.8                  | 1.92 | 1.1/2        |

## 10.54 | Nomograph



1. Pick the two known values.
2. Lay a straightedge to intersect the two values.
3. Intersection on the third vertical line gives the value of that factor.

### Example:

To find the bore size for a Pressure Line consistent with a Flow Rate of 100 litres per minute (26 US or 22 Imperial gallons per minute), and a Flow Velocity of 4.5 metres per second (14.8 feet per second), connect Flow Rate to Flow Velocity and read Hose Bore on centre scale.

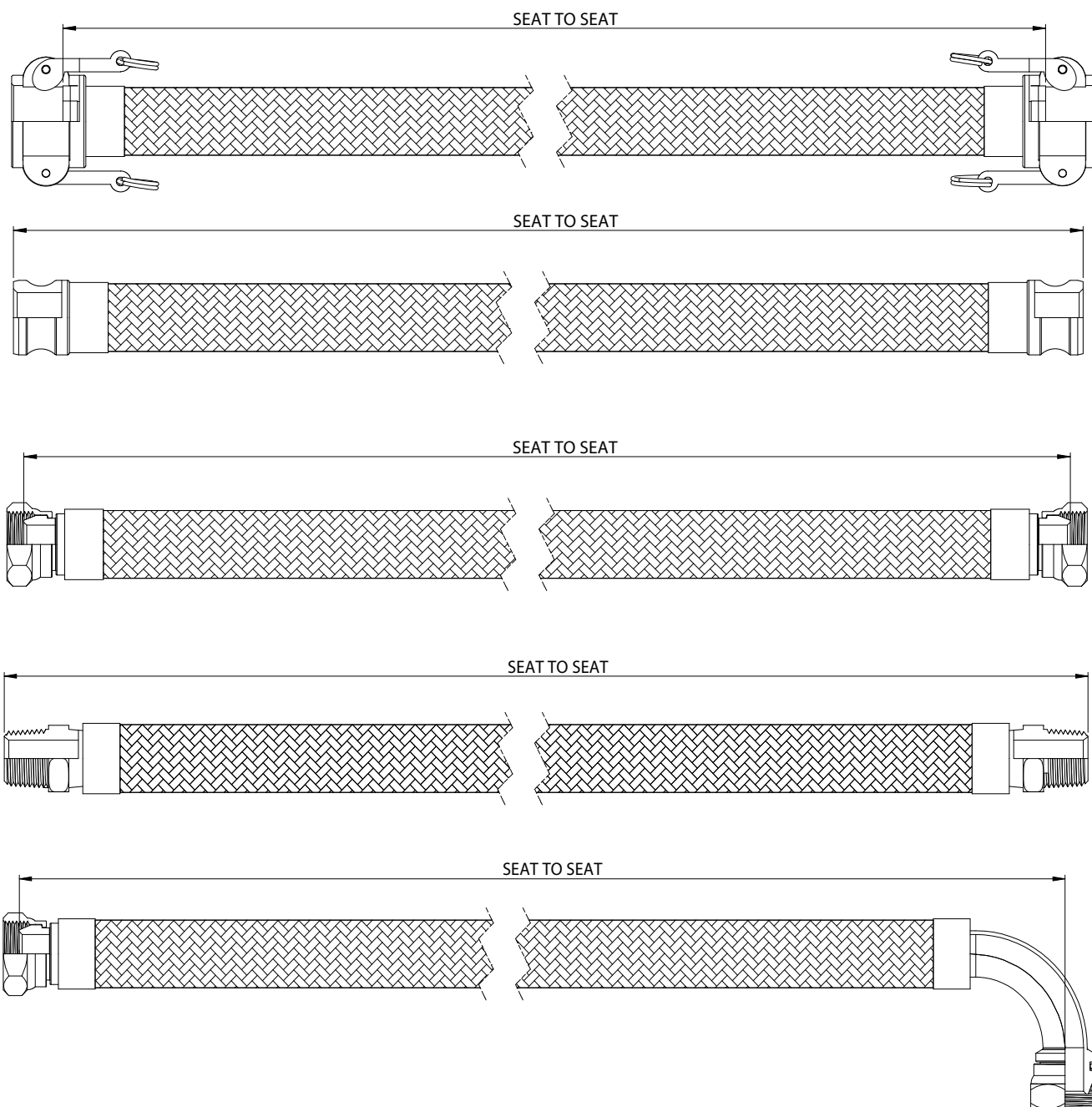
### Answer:

The line crosses Hose Bore between -12 and -16 on "All Other Dash Sizes" side of Hose Bore axis, so a -16 hose is required. If RQP5 or T5 Hose is to be used, for this example -16 would also be required.

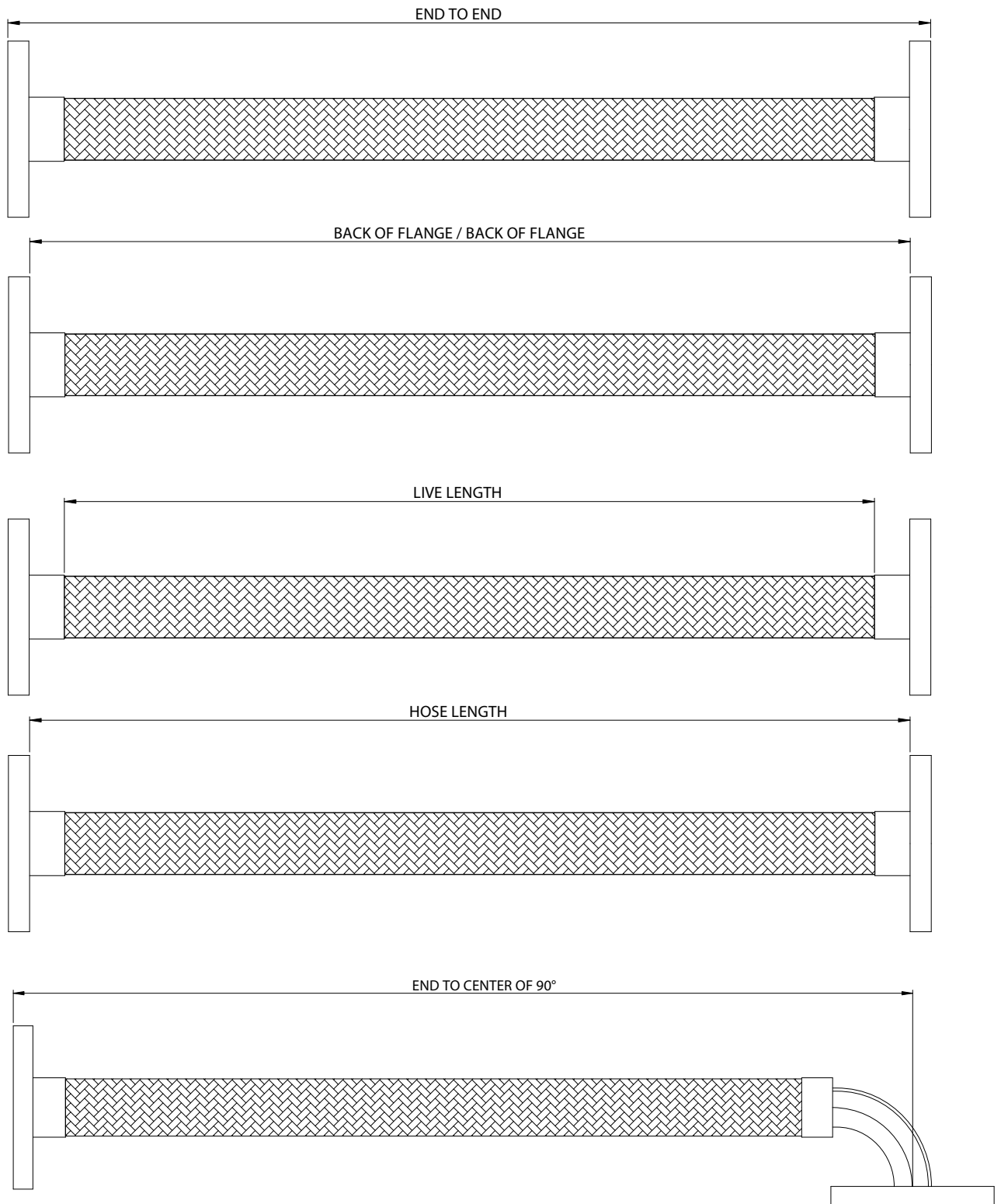
### Based On Formula:

$$\text{Area (SQ. IN.)} = \frac{0.321 \times \text{FLOW (G.P.M.)}}{\text{VELOCITY (FT./SEC)}}$$

## 10.55 | Hose Measurements



## 10.56 | Hose Measurements



## 10.57 | Hose Measurements

