# Supply Pressure Requirements & Tables

## *Contents*



The corresponding low pressure supply table should be used whenever low pressure compressors are used or when using surface control panels that are limited to outlet pressures within the range of 220 psig or less.

It is important to ensure the required outlet pressure from the table can be maintained in a stable manner at the surface to ensure adequate supply at depth. When used with high pressure consoles that can regulate pressures greater than 220 psig use the corresponding high pressure regulated source supply table.

## 1.1 Diver Work Rates

The divers work rate, also known as respiratory minute volume (RMV), is basically how hard the diver breathes. As the diver's physical exercise increases, so does the ventilation rate. Proper training teaches the diver to never push the work rate beyond normal labored breathing. (This is in the 30-50 RMV range). To put things in perspective, heavy work for a physically fit person:

| | |
|---|---|
| Swimming at one knot is about | 38 RMV |
| Running at 8 miles per hour is about | 50 RMV |

Once the diver hits 55 RMV, he is entering the extreme range. Many fit divers can do 75 RMV for one to two minutes providing the inhalation resistive effort of the breathing system is not much above 1-1.3

J/L. The divers work rate should never be so heavy that the diver cannot maintain a simple conversation with topside.

When the work rate gets into the moderately heavy to heavy range 40-50 RMV the diver needs to slow down!

Working to the point of being excessively winded should be avoided at all costs!

Working at rates greater than 58 RMV underwater is extreme, and can pose hazards that are not present when doing extreme rates on the surface. When underwater, inhalation and exhalation resistive effort increases due to the density of the breathing gas and resistive effort of the equipment. The increase in resistive effort can cause an increase in blood level $CO_2$ because the diver cannot ventilate as freely as when breathing at the surface. When breathing air at the deeper depths, nitrogen narcosis can mask $CO_2$ symptoms which can then snowball into even heavier breathing, often resulting in confusion, panic, and in rare cases muscle spasm, unconsciousness, sometimes resulting in death. In some rare cases, high ventilation rates have been suspected as the cause of respiratory barotraumas, including arterial gas embolism. The possibility of suffering a respiratory over inflation event during high work rates while underwater could be even greater for divers that smoke, or have previously known or unknown lung disease or respiratory damage. The safest course for the diver is to keep the equipment properly maintained for peak performance and to know and understand the capabilities and limitations of the equipment including all breathing supply systems they use.

The output capability of the supply system, including umbilicals, should be known to all that use it and periodic tests should be done to ensure flow capability.

## 1.2 Use Of Low Pressure Supply Table

The low pressure supply tables were developed to simplify calculation of supply pressure. In order to get the required volume to the diver, you need to have the proper supply pressure. The table starts at 90 psig and increases in 10 psig increments. The user simply selects the lowest pressure that best represents the low cycling pressure of the compressor being used. The table basically shows the maximum depth that can be attained while breathing at RMV's (breathing rates in liters per minute) listed. It is strongly recommended that divers plan for a minimum supply pressure that will allow the diver to work at no less that 50–62.5 RMV.

## 1.3 Work Rate Expressed as Respiratory Minute Volume (RMV)*

| Work Load | RMV | Cubic Feet/Minute (CFM) | Equivalent Land Based Exercise |
|---|---|---|---|
| Rest | 7-10 RMV | 0.2 - 0.35 CFM | |
| Light Work | 10-20 RMV | 0.35 - 0.7 CFM | Walking 2 miles per hour |
| Moderate Work | 20-37 RMV | 0.7 - 1.3 CFM | Walking 4 miles per hour |
| Heavy Work | 37-54 RMV | 1.3 - 1.9 CFM | Running 8 miles per hour |
| Severe Work | 55-100 RMV | 1.94 - 3.5 CFM | |
| * *source: U.S. Navy Diving Manual* | | | |

## 1.4 Surface Supplied MOD-1 Supply Pressures

The proper supply pressure is important to ensure maximum overall breathing performance. The minimum recommended and maximum supply pressures listed below will allow for at least a respiratory work rate of 75 RMV at all depths listed.

| Depth | | Min. Supply Pressure | | Max. Supply Pressure | | Normal/Recommended Supply Pressure | |
|---|---|---|---|---|---|---|---|
| **FSW** | **MSW** | **BAR** | **PSIG** | **BAR** | **PSIG** | **BAR** | **PSIG** |
| 0–50 | 0–15.2 | 7 | 100 | 19.6 | 275 | 8.6 | 125 |
| 50–100 | 15.2–30.5 | 10.3 | 150 | 19.6 | 275 | 12 | 175 |
| 100–125 | 30.5–38 | 12 | 175 | 19.6 | 275 | 13.8 | 200 |
| 125–145 | 38–44 | 13.8 | 200 | 19.6 | 275 | 15.5 | 225 |
| 145–165 | 44–50.3 | 15.5 | 225 | 19.6 | 275 | 17.2 | 250 |
| 165–190 | 50.3–58 | 17.2 | 250 | 19.6 | 275 | 17.2 | 250 |

When the diver is working at light to heavy work rates, (15–50 RMV) the minimum recommended Supply Pressure for a particular depth, should offer the smoothest overall performance. Use of the maximum pressure should only be needed at a depth of 165 FSW (50 MSW) or deeper in the event the diver is breathing at the extreme work rate of 75 RMV or greater. The maximum supply pressure is listed primarily due to European CE requirements which requires the maximum and minimum supply pressures be listed. The minimum supply pressures for the depths listed below will allow for a work rate of 75 RMV IAW the CE requirements of EN15333-1.

Performance is based on a minimum of 75 RMV to depths of 165 FSW (50 MSW) using a ⅜" (9.5 mm) umbilical 600 foot (183 meters) long, made up of two 300 foot (91 meter) sections.

## 1.5 SuperFlow®/SuperFlow® 350 LP Compressor Supply Table

Supply Pressure Requirements for Helmets & Masks equipped with SuperFlow®/SuperFlow® 350 Non-balanced regulators when used with low pressure compressors

| Supply Pressure | RMV | Depth | | ATA | Required SLPM | w/20% safety margin | Required SCFM |
|---|---|---|---|---|---|---|---|
| | | FSW | MSW | | | | |
| **90 PSIG / 6.21 BAR** | **40** | 76 | 23 | 3.30 | 132.12 | 158.55 | 5.60 |
| | **50** | 63 | 19 | 2.91 | 145.45 | 174.55 | 6.17 |
| | **62.5** | 44 | 13 | 2.33 | 145.83 | 175.00 | 6.18 |
| | **75** | 33 | 10 | 2.00 | 150.00 | 180.00 | 6.36 |
| | | | | | | | |
| **100 PSIG / 6.9 BAR** | **40** | 86 | 26 | 3.61 | 144.24 | 173.09 | 6.11 |
| | **50** | 72 | 22 | 3.18 | 159.09 | 190.91 | 6.74 |
| | **62.5** | 55 | 17 | 2.67 | 166.67 | 200.00 | 7.06 |
| | **75** | 42 | 13 | 2.27 | 170.45 | 204.55 | 7.23 |
| | | | | | | | |
| **110 PSIG / 7.59 BAR** | **40** | 100 | 31 | 4.03 | 161.21 | 193.45 | 6.83 |
| | **50** | 83 | 25 | 3.52 | 175.76 | 210.91 | 7.45 |
| | **62.5** | 67 | 20 | 3.03 | 189.39 | 227.27 | 8.03 |
| | **75** | 50 | 15 | 2.52 | 188.64 | 226.36 | 8.00 |
| | | | | | | | |

| Supply Pressure | RMV | Depth | | ATA | Required SLPM | w/20% safety margin | Required SCFM |
|---|---|---|---|---|---|---|---|
| | | FSW | MSW | | | | |
| **120 PSIG / 8.28 BAR** | **40** | 112 | 34 | 4.39 | 175.76 | 210.91 | 7.45 |
| | **50** | 91 | 28 | 3.76 | 187.88 | 225.45 | 7.96 |
| | **62.5** | 71 | 22 | 3.15 | 196.97 | 236.36 | 8.35 |
| | **75** | 57 | 17 | 2.73 | 204.55 | 245.45 | 8.67 |
| **130 PSIG / 8.97 BAR** | **40** | 122 | 37 | 4.70 | 187.88 | 225.45 | 7.96 |
| | **50** | 100 | 31 | 4.03 | 201.52 | 241.82 | 8.54 |
| | **62.5** | 82 | 25 | 3.48 | 217.80 | 261.36 | 9.23 |
| | **75** | 60 | 19 | 2.82 | 211.36 | 253.64 | 8.96 |
| **140 PSIG / 9.66 BAR** | **40** | 137 | 42 | 5.15 | 206.06 | 247.27 | 8.73 |
| | **50** | 108 | 33 | 4.27 | 213.64 | 256.36 | 9.06 |
| | **62.5** | 84 | 26 | 3.55 | 221.59 | 265.91 | 9.39 |
| | **75** | 65 | 20 | 2.97 | 222.73 | 267.27 | 9.44 |
| **150 PSIG / 10.35 BAR** | **40** | 145 | 44 | 5.39 | 215.76 | 258.91 | 9.15 |
| | **50** | 120 | 37 | 4.64 | 231.82 | 278.18 | 9.83 |
| | **62.5** | 95 | 29 | 3.88 | 242.42 | 290.91 | 10.28 |
| | **75** | 69 | 21 | 3.09 | 231.82 | 278.18 | 9.83 |
| **160 PSIG / 11.04 BAR** | **40** | 157 | 48 | 5.76 | 230.30 | 276.36 | 9.76 |
| | **50** | 124 | 38 | 4.76 | 237.88 | 285.45 | 10.08 |
| | **62.5** | 100 | 31 | 4.03 | 251.89 | 302.27 | 10.68 |
| | **75** | 76 | 23 | 3.30 | 247.73 | 297.27 | 10.50 |
| **170 PSIG / 11.73 BAR** | **40** | 167 | 51 | 6.06 | 242.42 | 290.91 | 10.28 |
| | **50** | 135 | 41 | 5.09 | 254.55 | 305.45 | 10.79 |
| | **62.5** | 107 | 33 | 4.24 | 265.15 | 318.18 | 11.24 |
| | **75** | 86 | 26 | 3.61 | 270.45 | 324.55 | 11.46 |
| **180 PSIG / 12.42 BAR** | **40** | 181 | 55 | 6.48 | 259.39 | 311.27 | 11.00 |
| | **50** | 148 | 45 | 5.48 | 274.24 | 329.09 | 11.62 |
| | **62.5** | 115 | 35 | 4.48 | 280.30 | 336.36 | 11.88 |
| | **75** | 93 | 28 | 3.82 | 286.36 | 343.64 | 12.14 |
| **190 PSIG / 13.11 BAR** | **40** | 190 | 58 | 6.76 | 270.30 | 324.36 | 11.46 |
| | **50** | 154 | 47 | 5.67 | 283.33 | 340.00 | 12.01 |
| | **62.5** | 122 | 37 | 4.70 | 293.56 | 352.27 | 12.44 |
| | **75** | 100 | 31 | 4.03 | 302.27 | 362.73 | 12.81 |
| **200 PSIG / 13.8 BAR** | **40** | 192 | 59 | 6.82 | 272.73 | 327.27 | 11.56 |
| | **50** | 166 | 51 | 6.03 | 301.52 | 361.82 | 12.78 |
| | **62.5** | 132 | 40 | 5.00 | 312.50 | 375.00 | 13.25 |
| | **75** | 102 | 31 | 4.09 | 306.82 | 368.18 | 13.01 |
| **210 PSIG / 14.49 BAR** | **40** | 212 | 65 | 7.42 | 296.97 | 356.36 | 12.59 |
| | **50** | 175 | 53 | 6.30 | 315.15 | 378.18 | 13.36 |
| | **62.5** | 137 | 42 | 5.15 | 321.97 | 386.36 | 13.65 |
| | **75** | 108 | 33 | 4.27 | 320.45 | 384.55 | 13.58 |
| **220 PSIG / 15.18 BAR** | **40** | 220 | 67 | 7.67 | 306.67 | 368.00 | 13.00 |
| | **50** | 182 | 56 | 6.52 | 325.76 | 390.91 | 13.81 |
| | **62.5** | 147 | 45 | 5.45 | 340.91 | 409.09 | 14.45 |
| | **75** | 111 | 34 | 4.36 | 327.27 | 392.73 | 13.87 |

## 1.6 SuperFlow®/SuperFlow® 350 HP Regulated Supply Table

| Depth | | Regulator Setting Surface Gauge in P.S.I.G. | | Regulator Setting Surface Gauge in BAR | |
|---|---|---|---|---|---|
| FSW | MSW | Minimum P.S.I.G. | Maximum P.S.I.G. | Minimum Bar | Maximum Bar |
| 0-60 | 0-18 | 150 | 225 | 10.3 | 15.5 |
| 61-100 | 19-30 | 200 | 250 | 13.8 | 17.2 |
| 101-132 | 31-40 | 250 | 275 | 17.2 | 18.9 |
| 133-165 | 41-50 | 250 | 300 | 17.2 | 19.6 |
| *166-220 | 51-67 | 300 | 325 | 20.6 | 22.4 |

*May not be capable of performing at 75 RMV deeper than 165 FSW.

Performance is based on a minimum of 75 RMV to 165 FSW (50 MSW) and 62.5 RMV to 220 FSW (67 MSW) using a ⅜" (9.5 mm) umbilical 600 foot (183 meters) long, made up of two 300 foot (91 meter) sections.

## 1.7 REX® LP Compressor Supply Table

| Supply Pressure | RMV (Respiratory Minute Volume) | Maximum Recommended Depth | | Required SCFM** | Required SLPM** |
|---|---|---|---|---|---|
| | | FSW | MSW | | |
| **90 P.S.I.G . (6.21 BAR)** | 40 (heavy work) | 104 | 32 | 7.0 | 198 |
| | 50 (heavy work) | 76 | 23 | 7.0 | 198 |
| | 62.5 (severe work) | 61 | 18.8 | 7.5 | 212 |
| | 75 (severe work) | 50 | 15.4 | 8.0 | 227 |
| **100 P.S.I.G. (6.9 BAR)** | 40 (heavy work) | 108 | 33 | 7.25 | 205 |
| | 50 (heavy work) | 90 | 27 | 7.9 | 223 |
| | 62.5 (severe work) | 75 | 22.9 | 8.7 | 246 |
| | 75 (severe work) | 59 | 18 | 8.9 | 252 |
| **110 P.S.I.G. (7.59 BAR)** | 40 (heavy work) | 117 | 35 | 7.7 | 218 |
| | 50 (heavy work) | 100 | 30 | 8.6 | 244 |
| | 62.5 (severe work) | 83 | 25 | 9.3 | 263 |
| | 75 (severe work) | 68 | 21 | 9.7 | 275 |
| **120 P.S.I.G. (8.28 BAR)** | 40 (heavy work) | 127 | 38.7 | 8.2 | 232 |
| | 50 (heavy work) | 113 | 34 | 9.4 | 266 |
| | 62.5 (severe work) | 93 | 28 | 10 | 283 |
| | 75 (severe work) | 75 | 23 | 9.7 | 275 |
| **130 P.S.I.G. (8.97 BAR)** | 40 (heavy work) | 145 | 44 | 9.1 | 258 |
| | 50 (heavy work) | 125 | 38 | 10 | 283 |
| | 62.5 (severe work) | 106 | 32 | 11 | 311 |
| | 75 (severe work) | 85 | 26 | 11.36 | 322 |

| Supply Pressure | RMV (Respiratory Minute Volume) | Maximum Recommended Depth | | Required SCFM** | Required SLPM** |
|---|---|---|---|---|---|
| | | FSW | MSW | | |
| **140 P.S.I.G. (9.66 BAR)** | 40 (heavy work) | 160 | 48 | 10 | 283 |
| | 50 (heavy work) | 135 | 41 | 11 | 311 |
| | 62.5 (severe work) | 114 | 35 | 12 | 340 |
| | 75 (severe work) | 92.5 | 29 | 12 | 340 |
| **150 P.S.I.G. (10.35 BAR)** | 40 (heavy work) | 170 | 52 | 10.5 | 297 |
| | 50 (heavy work) | 149 | 45 | 11.7 | 331 |
| | 62.5 (severe work) | 126 | 38 | 13 | 368 |
| | 75 (severe work) | 105 | 32 | 13.3 | 377 |
| **160 P.S.I.G . (11.04 BAR)** | 40 (heavy work) | 186 | 57 | 11.3 | 320 |
| | 50 (heavy work) | 157 | 48 | 12.2 | 345 |
| | 62.5 (severe work) | 134 | 41 | 13.4 | 379 |
| | 75 (severe work) | 112 | 34 | 14 | 396 |
| **170 P.S.I.G. (11.73 BAR)** | 40 (heavy work) | 203 | 62 | 12.2 | 345 |
| | 50 (heavy work) | 170 | 52 | 13 | 368 |
| | 62.5 (severe work) | 143 | 43 | 14 | 396 |
| | 75 (severe work) | 121 | 37 | 14.9 | 422 |
| **180 P.S.I.G. (12.42 BAR)** | 40 (heavy work) | 219 | 67 | 13 | 368 |
| | 50 (heavy work) | 180 | 55 | 13.7 | 388 |
| | 62.5 (severe work) | 158 | 48 | 15.4 | 436 |
| | 75 (severe work) | 130 | 39 | 15.7 | 445 |
| **190 P.S.I.G. (13.11 BAR)** | 40 (heavy work) | 220 | 67 | 13 | 368 |
| | 50 (heavy work) | 192 | 58 | 14.5 | 411 |
| | 62.5 (severe work) | 165 | 50 | 16 | 453 |
| | 75 (severe work) | 141 | 43 | 16.8 | 476 |
| **200 P.S.I.G. (13.80 BAR)** | 40 (heavy work) | 220 | 67 | 13 | 368 |
| | 50 (heavy work) | 205 | 62 | 15.3 | 433 |
| | 62.5 (severe work) | 174 | 53 | 16.7 | 473 |
| | 75 (severe work) | 147 | 45 | 17.4 | 493 |
| **210 P.S.I.G. (14.49 BAR)** | 40 (heavy work) | 220 | 67 | 13 | 368 |
| | 50 (heavy work) | 214 | 65.8 | 16 | 453 |
| | 62.5 (severe work) | 186 | 56 | 17.6 | 498 |
| | 75 (severe work) | 159 | 48 | 18.5 | 524 |
| **220 P.S.I.G. (15.18 BAR)** | 40 (heavy work) | 220 | 67 | 13 | 368 |
| | 50 (heavy work) | 220 | 67 | 16.3 | 462 |
| | 62.5 (severe work) | 194 | 59 | 18.2 | 515 |
| | 75 (severe work) | 165 | 50 | 19 | 538 |

*These values were derived from actual breathing simulator tests using an ANSI wet simulator with 600' long umbilical 3/8" I.D (9.5mm) at Dive Lab, Inc. The respiratory work rates and test procedures used are based on internationally recognized test practices and procedures.*

*** includes a 20% safety factor*

NOTE

Most sustained work rates by professional divers average between 20 to 40 RMV. When calculating supply requirements, KMDSI® recommends using no less than 40 RMV.

*For more information, check the Dive Lab website,* www.divelab.com.

## 1.8 REX® HP Regulated Supply Table

| Depth | | Regulator Setting P.S.I.G. | | Regulator Setting BAR | |
|---|---|---|---|---|---|
| FSW | MSW | Optimum P.S.I.G. | Maximum P.S.I.G. | Optimum BAR | Maximum BAR |
| 0-60 | 0-18 | 140 | 200 | 9.7 | 13.8 |
| 61-100 | 19-30 | 165 | 220 | 11.4 | 15 |
| 101-132 | 31-40 | 180 | 250 | 12.4 | 17 |
| 133-165 | 41-50 | 220 | 300 | 15 | 20.7 |
| 166-220 | 51-67 | 270 | 300 | 18.6 | 20.7 |

Performance is based on a minimum of 75 RMV to depths of 220 FSW (67 MSW) using a 3/8 (9.5mm) umbilical 600 foot (183 meters) long, made up of two 300 foot (91 meter) sections.

## 1.9 455 & KM Diamond LP Compressor Supply Table

| Supply Pressure | RMV (Respiratory Minute Volume) | Maximum Recommended Depth | | ATA | Required SLPM | w/20% safety margin | Required SCFM |
|---|---|---|---|---|---|---|---|
| | | FSW | MSW | | | | |
| **90 P.S.I.G . (6.21 BAR)** | 40 (heavy work) | 101 | 30 | 4.06 | 162.42 | 194.91 | 6.88 |
| | 50 (heavy work) | 84 | 25 | 3.55 | 177.27 | 212.73 | 7.51 |
| | 62.5 (severe work) | 66 | 20 | 3.00 | 187.50 | 225.00 | 7.95 |
| | 75 (severe work) | 51 | 16 | 2.55 | 190.91 | 229.09 | 8.09 |
| **100 P.S.I.G. (6.9 BAR)** | 40 (heavy work) | 115 | 35 | 4.48 | 179.39 | 215.27 | 7.60 |
| | 50 (heavy work) | 97 | 29 | 3.94 | 196.97 | 236.36 | 8.35 |
| | 62.5 (severe work) | 77 | 23 | 3.33 | 208.33 | 250.00 | 8.83 |
| | 75 (severe work) | 62 | 19 | 2.88 | 215.91 | 259.09 | 9.15 |
| **110 P.S.I.G. (7.59 BAR)** | 40 (heavy work) | 130 | 39 | 4.94 | 197.58 | 237.09 | 8.37 |
| | 50 (heavy work) | 100 | 30 | 4.03 | 201.52 | 241.82 | 8.54 |
| | 62.5 (severe work) | 90 | 27 | 3.73 | 232.95 | 279.55 | 9.87 |
| | 75 (severe work) | 73 | 22 | 3.21 | 240.91 | 289.09 | 10.21 |
| **120 P.S.I.G. (8.28 BAR)** | 40 (heavy work) | 145 | 44 | 5.39 | 215.76 | 258.91 | 9.15 |
| | 50 (heavy work) | 125 | 38 | 4.79 | 239.39 | 287.27 | 10.15 |
| | 62.5 (severe work) | 101 | 30 | 4.06 | 253.79 | 304.55 | 10.76 |
| | 75 (severe work) | 83 | 25 | 3.52 | 263.64 | 316.36 | 11.17 |
| **130 P.S.I.G. (8.97 BAR)** | 40 (heavy work) | 157 | 47 | 5.76 | 230.30 | 276.36 | 9.76 |
| | 50 (heavy work) | 130 | 39 | 4.94 | 246.97 | 296.36 | 10.47 |
| | 62.5 (severe work) | 110 | 33 | 4.33 | 270.83 | 325.00 | 11.48 |
| | 75 (severe work) | 91 | 28 | 3.76 | 281.82 | 338.18 | 11.95 |

| Supply Pressure | RMV (Respiratory Minute Volume) | Maximum Recommended Depth | | ATA | Required SLPM | w/20% safety margin | Required SCFM |
|---|---|---|---|---|---|---|---|
| | | FSW | MSW | | | | |
| **140 P.S.I.G. (9.66 BAR)** | 40 (heavy work) | 171 | 52 | 6.18 | 247.27 | 296.73 | 10.48 |
| | 50 (heavy work) | 145 | 44 | 5.39 | 269.70 | 323.64 | 11.43 |
| | 62.5 (severe work) | 120 | 36 | 4.64 | 289.77 | 347.73 | 12.28 |
| | 75 (severe work) | 103 | 31 | 4.12 | 309.09 | 370.91 | 13.10 |
| **150 P.S.I.G. (10.35 BAR)** | 40 (heavy work) | 187 | 57 | 6.67 | 266.67 | 320.00 | 11.30 |
| | 50 (heavy work) | 158 | 48 | 5.79 | 289.39 | 347.27 | 12.27 |
| | 62.5 (severe work) | 134 | 41 | 5.06 | 316.29 | 379.55 | 13.41 |
| | 75 (severe work) | 103 | 31 | 4.12 | 309.09 | 370.91 | 13.10 |
| **160 P.S.I.G . (11.04 BAR)** | 40 (heavy work) | 198 | 60 | 7.00 | 280.00 | 336.00 | 11.87 |
| | 50 (heavy work) | 176 | 54 | 6.33 | 316.67 | 380.00 | 13.42 |
| | 62.5 (severe work) | 147 | 45 | 5.45 | 340.91 | 409.09 | 14.45 |
| | 75 (severe work) | 125 | 38 | 4.79 | 359.09 | 430.91 | 15.22 |
| **170 P.S.I.G. (11.73 BAR)** | 40 (heavy work) | 203 | 61 | 7.15 | 286.06 | 343.27 | 12.13 |
| | 50 (heavy work) | 183 | 56 | 6.55 | 327.27 | 392.73 | 13.87 |
| | 62.5 (severe work) | 154 | 47 | 5.67 | 354.17 | 425.00 | 15.01 |
| | 75 (severe work) | 125 | 38 | 4.79 | 359.09 | 430.91 | 15.22 |
| **180 P.S.I.G. (12.42 BAR)** | 40 (heavy work) | 230 | 70 | 7.97 | 318.79 | 382.55 | 13.51 |
| | 50 (heavy work) | 196 | 60 | 6.94 | 346.97 | 416.36 | 14.71 |
| | 62.5 (severe work) | 163 | 50 | 5.94 | 371.21 | 445.45 | 15.73 |
| | 75 (severe work) | 144 | 44 | 5.36 | 402.27 | 482.73 | 17.05 |
| **190 P.S.I.G. (13.11 BAR)** | 40 (heavy work) | 239 | 73 | 8.24 | 329.70 | 395.64 | 13.98 |
| | 50 (heavy work) | 196 | 60 | 6.94 | 346.97 | 416.36 | 14.71 |
| | 62.5 (severe work) | 173 | 53 | 6.24 | 390.15 | 468.18 | 16.54 |
| | 75 (severe work) | 152 | 46 | 5.61 | 420.45 | 504.55 | 17.82 |
| **200 P.S.I.G. (13.80 BAR)** | 40 (heavy work) | 201 | 61 | 7.09 | 283.64 | 340.36 | 12.02 |
| | 50 (heavy work) | 220 | 67 | 7.67 | 383.33 | 460.00 | 16.25 |
| | 62.5 (severe work) | 187 | 57 | 6.67 | 416.67 | 500.00 | 17.66 |
| | 75 (severe work) | 156 | 48 | 5.73 | 429.55 | 515.45 | 18.21 |
| **210 P.S.I.G. (14.49 BAR)** | 40 (heavy work) | 273 | 83 | 9.27 | 370.91 | 445.09 | 15.72 |
| | 50 (heavy work) | 237 | 72 | 8.18 | 409.09 | 490.91 | 17.34 |
| | 62.5 (severe work) | 201 | 61 | 7.09 | 443.18 | 531.82 | 18.79 |
| | 75 (severe work) | 172 | 52 | 6.21 | 465.91 | 559.09 | 19.75 |
| **220 P.S.I.G. (15.18 BAR)** | 40 (heavy work) | 245 | 75 | 8.42 | 336.97 | 404.36 | 14.28 |
| | 50 (heavy work) | 203 | 62 | 7.15 | 357.58 | 429.09 | 15.16 |
| | 62.5 (severe work) | 194 | 59 | 6.88 | 429.92 | 515.91 | 18.22 |
| | 75 (severe work) | 181 | 55 | 6.48 | 486.36 | 583.64 | 20.62 |

## 1.10 455 HP Regulated Supply Table

| Depth | | Regulator Setting P.S.I.G. | | Regulator Setting BAR | |
|---|---|---|---|---|---|
| FSW | MSW | Optimum P.S.I.G. | Maximum P.S.I.G. | Optimum BAR | Maximum BAR |
| 0-60 | 0-18 | 100 | 150 | 7 | 10 |
| 61-100 | 19-30 | 125 | 150 | 8.6 | 10.3 |
| 101-132 | 31-40 | 175 | 225 | 12 | 15.5 |
| 133-165 | 41-50 | 200 | 250 | 14 | 17 |
| 166-190 | 51-61 | 225 | 275 | 15.5 | 19 |
| 191-220 | 58-67 | 225 | 300 | 15.5 | 20.6 |

Performance is based on a minimum of 75 RMV to depths of 220 FSW (67 MSW) using a ⅜" (9.5 mm) umbilical 600 foot (183 meters) long, made up of two 300 foot (91 meter) sections.

## 1.11 KM Diamond HP Regulated Supply Table

| Depth | | Regulator Setting P.S.I.G. | | | Regulator Setting BAR | | |
|---|---|---|---|---|---|---|---|
| FSW | MSW | Minimum P.S.I.G. | Maximum P.S.I.G. | Recommended P.S.I.G. | Minimum BAR | Maximum BAR | Recommended BAR |
| 0-60 | 0-18 | 101 | 275 | 145 | 7 | 19 | 10 |
| 61-100 | 19-30 | 145 | 275 | 174 | 10 | 19 | 12 |
| 101-132 | 31-40 | 174 | 275 | 203 | 12 | 19 | 14 |
| 133-165 | 41-50 | 218 | 275 | 245 | 15 | 19 | 17 |

The proper supply pressure is important to ensure maximum overall breathing performance. The minimum recommended and maximum supply pressures listed below will allow for at least a respiratory work rate of 75 RMV at all depths listed.

When the diver is working at light to heavy work rates, (15–50 RMV) the minimum recommended Supply Pressure for a particular depth, should offer the smoothest overall performance. **Use of the maximum pressure should only be needed at a depth of 165 fsw (50 MSW) or deeper in the event the diver is breathing at the extreme work rate of 75 RMV or greater.** The maximum supply pressure is listed primarily due to European CE requirements which requires the maximum and minimum supply pressures be listed. The minimum supply pressures for the depths listed below will allow for a work rate of 75 RMV IAW the CE requirements of EN15333-1.

# 1.12 Standard Kirby Morgan Surface Supply Pressure Formula - Old Method

## 1.12.1 Old Pressure Table Calculation

The old method of determining supply pressure was to multiply the dive depth by .445 PSI and then add the over-bottom pressure called out in the depth ranges for the depth from the KMDSI operations manual. The old method was based on a minimum RMV of 62.5. This method can still be used. The old method used the formula and called out over bottom pressures for depth as follows [(FSW x .445) + PSIG for depth] from the table below.

| Depth in Feet and Meters | | Over Bottom Pressure | |
|---|---|---|---|
| 0-60 FSW | (0-18 MSW) | 90 PSIG | (6.2 Bar) |
| 61-100 | (18-30) | 115 | (7.9) |
| 101-132 | (30-40) | 135 | (9.3) |
| 133-165 | (40-50) | 165 | (11.4) |
| 166-220 | (50-67) | 225 | (15.5) |

For more information on determining supply pressure related information check the Dive Lab web site at www.divelab.com.

# 1.13 KM Diamond Exhaust Back Pressure Flow Table

## 1.13.1 Back Pressure System

When the KM Diamond surface return line helmet reaches 90 to 100 fsw (27–30.48 msw) in depth, the combination of differential pressure and air density starts having a significant effect on the exhalation effort at heavy respiratory work rates above 60 RMV. The increase in exhalation effort at depths in excess of 100 fsw (30.48 msw) is primarily due to the high differential pressure on the 2nd stage exhaust diaphragm on one side and the existing lower pressure found at the surface (topside). Another effect is the flow resistance that is created in the surface return hose due to gas density.

To compensate for the increased gas density and high differential pressure, the topside end of the return hose is attached to a back-pressure regulator system which allows a back pressure to be applied to the hose, reducing this differential pressure, allowing the exhaust regulator second stage to operate with less exhalation effort.

The amount of topside back pressure needed is based on what is required to enable the diver to breathe and exhale at the extreme work rates above 60 RMV while maintaining the helmet exhalation pressure below 18 mbr. The back pressure required is determined using a specially designed table. See “1.13.4 Table” on page SUPR-13.

The table and the topside back pressure system is desirable whenever the diver is breathing at heavy work rates and diving deeper than 100 fsw (30.48 msw) to keep exhalation pressure below the KMDSI 18 mbr limit and to avoid gas from escaping from the overpressure relief and water purge valves installed on the helmet. Exhausting into the water in a contaminated water situation is not desirable and defeats the primary purpose of using a surface return line helmet that vents to the surface (topside). A topside back pressure system will prevent inadvertent activation of these valves on the KM Diamond.

### 1.13.1.1 Topside Exhaust Back Pressure System Operation

Minimum requirements for a Topside Exhaust Back Pressure System:

- A means to secure both the primary and stand by diver's exhaust hose to the unit.
- A Flow meter per diver.
- Means of increasing and decreasing exhaust back pressure.

For optimal exhaust performance (minimum exhalation effort), the topside exhaust back pressure is set according to the flow reading on the flow meter in use and the diver's depth. As an example, a diver at a depth of 100 fsw (30.48 msw) working at the extreme breathing rate of 60 RMV or higher without using the topside back pressure control system, the exhalation pressure would be in a range of 14–16 mbr. With the proper back pressure, it would be in the 6–8 mbr range.

The recommended topside exhaust control system must be capable of controlling the exhaust pressure based on the depth and respiratory rate. One example of a topside back pressure system is the DL-TSC-00 from Dive Lab, Inc. This system is a two-diver system and consists of a simple manifold assembly with back pressure regulator, two flow meters, with shut off valves, and two 0–100 psig pressure gauges. The divers exhaust hose connects to the topside exhaust system via a ½" brass quick connect. The exhaust enters the adjustable back pressure regulator and is regulated according to the depth and divers' breathing rate as shown on the flow meters.

In addition, the flow meter system allows for the calculation of the diver's respiratory work rate which can be useful for planning air usage. By always beginning the dive with zero back pressure and adjusting for optimal back pressure based on depth and flow optimizes for low exhalation effort, this minimizes possible gas from escaping from the valve in the over pressure relief valve and Water Purge Assembly.

### 1.13.1.2 Calculating Work of Breathing

As previously mentioned, the topside back pressure exhaust system is not necessary for minimizing exhaust pressure at depths less than 100 fsw (30 msw), however depending on the diver's respiratory work rate, it can be used starting at depths of 30 fsw to monitor the divers RMV.

As an example, a diver is at a depth of 60 fsw (18 msw) the exhaust flow on the flow meter shows a flow of between 75–95 lpm. The console operator checks the exhaust table and selects the closest depth to the diver's depth and the peak flow, then slowly adjusts the regulator for a back pressure according to the reading on the chart. With the flow meter showing a flow between 75–95 lpm and taking the high number, 95 lpm and dividing it by the depth in ATA (2.8), it will give the respiratory work rate of the diver also known as RMV. The calculation will look like this:
Depth (60 fsw +33 fsw) ÷ 33 = 2.8 ATA.
(95 lpm ÷ 2.8 ATA) = 33.9 RMV. The result is the diver's work of breathing is 33.9 respiratory minute volume which is considered to be in the heavy work category.

## 1.13.2 Instructions

**Step 1**
Determine Depth

**Step 3**
Find the closest matching flow reading from the table

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 110 | 33.5 | 4.33 | Flow LPM | 45–65 | 85–110 | 115–150 | 150–185 | 180–235 | 230–290 | 280–350 |
| | | | BP (psig) | 26–28 | 30–32 | 31–35 | 32–36 | 34–39 | 36–41 | 37–41 |

**Step 2**
Take the average reading from your flow meter. Example is 180 to 210. The average flow is 195


**Step 4**
Recommended Back Pressure Regulator Setting

## 1.13.3 Abbreviations and Formulas

**Abbreviations**

ATA – Atmospheres Absolute
FSW – Feet Sea Water
LPM – Liters Per Minute
MSW – Meter Sea Water
RMV – Respiratory Minute Volume

**Formulas**

(Depth + 33) ÷ 33 = ATA
FSW ÷ 3.28 = MSW
LPM ÷ ATA = RMV

To calculate RMV with the greatest accuracy, simply take the highest and lowest flow reading, add them together, then divide by 2. Take the result and divide by the diver's depth in ATA.

## 1.13.4 Table

| FSW | MSW | ATA | BP-Back Pressure (psig) LPM-Liters Per Minute | RMV 10–15 | RMV 20–24 | RMV 30–34 | RMV 37–40 | RMV 48–50 | RMV 60–63 | RMV 73–75 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 3 | 1.3 | Flow LPM | n/a* | n/a* | n/a* | 40–60 | 35–90 | 55–105 | 70–120 |
| | | | BP (psig) | n/a* | n/a* | n/a* | 1–2 | 1–2 | 1–2 | 1–2 |
| 20 | 6.09 | 1.6 | Flow LPM | n/a* | n/a* | 35–65 | 40–80 | 55–100 | 80–120 | 105–135 |
| | | | BP (psig) | n/a* | n/a* | 1–2 | 1–2 | 1–2 | 2–3 | 3–5 |
| 30 | 9.1 | 1.9 | Flow LPM | n/a* | 30–55 | 50–75 | 55–90 | 75–110 | 100–130 | 115–160 |
| | | | BP (psig) | n/a* | 1–2 | 2–3 | 2–3 | 3–4 | 3–5 | 4–6 |
| 40 | 12.2 | 2.21 | Flow LPM | 10–40 | 40–60 | 45–80 | 70–95 | 90–125 | 120–150 | 140–180 |
| | | | BP (psig) | 2–3 | 3–4 | 4–5 | 4–6 | 5–7 | 6–8 | 7–9 |
| 50 | 15.2 | 2.51 | Flow LPM | 15–45 | 50–70 | 70–85 | 85–105 | 110–135 | 140–170 | 170–200 |
| | | | BP (psig) | 3–4 | 4–6 | 5–7 | 5–8 | 7–9 | 8–13 | 9–13 |
| 60 | 18.3 | 2.82 | Flow LPM | 25–45 | 55–70 | 75–95 | 95–120 | 125–150 | 155–185 | 190–230 |
| | | | BP (psig) | 5–7 | 7–9 | 9–10 | 9–12 | 11–14 | 11–14 | 15–18 |
| 70 | 21.3 | 3.12 | Flow LPM | 30–45 | 65–80 | 85–105 | 110–130 | 135–170 | 170–210 | 200–250 |
| | | | BP (psig) | 7–8 | 10–13 | 13–14 | 13–17 | 15–18 | 15–20 | 16–20 |
| 80 | 24.4 | 3.42 | Flow LPM | 35–50 | 70–85 | 90–110 | 120–145 | 150–190 | 185–225 | 225–275 |
| | | | BP (psig) | 11–13 | 14–16 | 16–18 | 17–19 | 18–22 | 20–23 | 21–24 |
| 90 | 27.4 | 3.72 | Flow LPM | 35–55 | 75–95 | 100–125 | 125–155 | 150–200 | 200–245 | 245–300 |
| | | | BP (psig) | 17–20 | 21–24 | 22–25 | 24–28 | 26–30 | 27–31 | 27–33 |
| 100 | 30.5 | 4.03 | Flow LPM | 40–60 | 80–105 | 110–135 | 135–170 | 170–220 | 220–260 | 260–330 |
| | | | BP (psig) | 22–24 | 25–28 | 28–31 | 28–32 | 29–33 | 33–36 | 31–37 |
| 110 | 33.5 | 4.33 | Flow LPM | 45–65 | 85–110 | 115–150 | 150–185 | 180–235 | 230–290 | 280–350 |
| | | | BP (psig) | 26–28 | 30–32 | 31–35 | 32–36 | 34–39 | 36–41 | 37–41 |
| 120 | 36.6 | 4.63 | Flow LPM | 56–65 | 90–120 | 120–155 | 150–200 | 200–250 | 250–320 | 300–380 |
| | | | BP (psig) | 29–32 | 32–35 | 34–37 | 35–40 | 37–43 | 39–44 | 39–45 |
| 130 | 39.6 | 4.93 | Flow LPM | 50–75 | 95–130 | 130–170 | 165–210 | 210–270 | 270–340 | 320–400 |
| | | | BP (psig) | 32–35 | 36–40 | 39–42 | 39–43 | 42–47 | 44–48 | 44–50 |
| 140 | 42.7 | 5.24 | Flow LPM | 55–80 | 100–135 | 145–170 | 170–220 | 220–290 | 280–350 | 340–425 |
| | | | BP (psig) | 33–35 | 38–41 | 40–44 | 42–45 | 43–48 | 45–50 | 45–51 |
| 150 | 46 | 5.55 | Flow LPM | 55–80 | 110–145 | 145–190 | 170–240 | 230–310 | 300–380 | 355–450 |
| | | | BP (psig) | 37–40 | 41–44 | 44–47 | 43–49 | 47–51 | 50–56 | 50–57 |
| 160 | 49 | 5.84 | Flow LPM | 55–75 | 110–150 | 150–195 | 190–250 | 240–320 | 310–390 | 370–470 |
| | | | BP (psig) | 38–41 | 42–45 | 43–45 | 45–50 | 48–51 | 49–54 | 51–58 |
| 165 | 50.3 | 6 | Flow LPM | 60–85 | 115–155 | 155–205 | 195–260 | 245–330 | 320–410 | 380–480 |
| | | | BP (psig) | 41–43 | 44–48 | 47–50 | 49–53 | 50–55 | 53–59 | 54–60 |

*At this depth and RMV flow accuracy cannot be accurately determined.