

# Appendix 3

## Figures, Spreadsheets, and Charts

UNITED STATES  
DEPARTMENT OF LABOR  
MINE SAFETY AND HEALTH ADMINISTRATION  
Metal and Nonmetal Mine Safety and Health

Report of Investigation

Fatal Other Accident

October 17, 2002

Storm Exploration Decline  
Barrick Goldstrike Mine Inc.  
Elko, Eureka County, Nevada

| Spreadsheet 1: Visual Inspection  | # 1  | # 7                                 | # 10  | # 15                         |
|---|--|-------------------------------------|---|------------------------------|
| 1) Record readings on chest gauge.  | 0 psi  | 0 psi                               | 0 psi   | 0 psi                        |
| 2) Record type of face piece.   | Scott  | Scott                               | Scott   | Scott                        |
| 3) Record condition of face piece:  |  |                                     |   |                              |
| a) lens   | OK   | OK                                  | OK  | 1 scratch                    |
| b) hoses and connections (for tightness)                                    | Green connector not tightened, retightened with 1/8 th turn                          | OK                                  | Face piece was not connected to breathing hoses.                | OK                           |
| c) parts missing or damaged   | Anti-fog lens missing  | OK                                  | Anti-fog lens missing   | OK                           |
| d) inner cup in place   | OK   | OK                                  | OK  | OK                           |
| e) inhalation and exhalation valves   | OK   | OK                                  | OK  | OK                           |
| f) Face piece part number   | D46A011  | D46A011                             | D46A011   | D46A011                      |
| 4) Check approval label   | TC-13F-466   | TC-13F-466                          | TC-13F-466  | TC-13F-466                   |
| 5) Check serial number  | 00001  | 00007                               | 00010   | 00022                        |
| 6) Check if there are any worn, missing or loose parts/damage.              | a) Small dent in scrubber cannister, b) Botton clip on scrubber housing not engaged. | 2 large dents in scrubber cannister | a) Small dent on scrubber cannister, b) Cylinder strap reversed | Oxygen cylinder not secured. |
| 7) Check and record cylinder pressure gauge.                                | 0 psi  | 0 psi                               | 0 psi   | 0 psi                        |
| 8) Record position of cylinder valve and the number of turns it is opened . | Closed   | Closed                              | Closed  | Closed                       |
| 9) Check yoke and handle for oxygen cylinder.                               | OK   | OK                                  | OK  | OK                           |
| 10) Check hydrostatic date  | Mar-99   | Mar-00                              | Mar-99  | Mar-99                       |
| 11) Check pressure rating on cylinder                                       | #N/A   | #N/A                                | #N/A  | #N/A                         |
| 12) Check serial number   | BA253 (See Note)   | WJ173                               | WJ135   | WJ112                        |
| 13) Manufacturing date cylinder   | Aug-94   | Sep-88                              | Sep-88  | Sep-88                       |
| 14) Check cylinder, valves and gauge for damage.                            | OK   | OK                                  | OK  | OK                           |
| 15) Check oxygen cylinder sealing washer for damage.                        | OK   | OK                                  | OK  | OK                           |

Note: Columns highlighted in blue refer to units taken into the mine by the mine rescue team, while the yellow highlighted columns refer to units worn by the victims.

Note: Apparatus #1, Item 15: Cylinder guage is different from the other 3. Manufactured by ERIE.

Note: An extra oxygen cylinder was packed in the box which contained Apparatus # 7. Its condition as received was: 0 psi on cylinder guage and valve closed. Hydrostatic test date was Mar-99, Manufactured date Sep-88, and serial number WJ188.



Figure 1a: (From left-to-right.) Apparatus #10, #15, #1 and #7.

| Spreadsheet 7a: Standard Test Protocol | Purpose                    | Regulatory Requirement   |
|--|----------------------------|--|
| RCT-ASR-STP-O135                       | Exhalation Resistance (ER) | Max 2" H <sub>2</sub> O gauge  |
| RCT-ASR-STP-O117                       | Inhalation Resistance (IR) | 4"- (ER) H <sub>2</sub> O gauge  |
| RCT-ASR-STP-O138                       | Relief Valve Pressure      | 0.28"-0.75" H <sub>2</sub> O gauge   |
| RCT-ASR-STP-O137                       | Constant Flow (CF)         | =/> 1.5 lpm  |
| RCT-ASR-STP-O136                       | Demand Gas Flow (DGF)      | =/>30 lpm  |
| RCT-ASR-STP-O127                       | By-Pass Flow (BPF)         | =/> 30 lpm   |
| RCT-ASR-STP-O128                       | Accuracy Gauge             | +/- 5% Full Scale @5 = intervals   |
| RCT-ASR-STP-O124A                      | Alarm Pressure             | 20-25% Cylinder Pressure   |
| RCT-ASR-STP-0148A                      | Remote Gauge Leak          | =/ < 70 lpm w/ gauge shutoff or<br>Z=X -1.75Y w/o gauge shutoff.<br><br>[Z= liters gas leak (5% x X measured at 20% full cylinder),<br>X=Total liters cylinder,<br>Y=Duration in min.] |
| RCT-ASR-STP-0145                       | Alarm Sound Level          | =/> 80dBA  |

| Spreadsheet 6: Bench Testing Summary | # 1 | # 7 | # 10 | # 15   |
|--------------------------------------|-----|-----|------|--|
| High pressure leak test              | OK  | OK  | OK   | Failed. Leak at T-connection and chest guage. (See engineering drawing.) |
| Low pressure leak test               | OK  | OK  | OK   | OK   |
| Flow test                            | OK  | OK  | OK   | OK   |
| Face piece leak test                 | OK  | OK  | OK   | OK   |

Note: "T" connection tightened with a 1/2 turn. Chest guage replace with a new one.



Figure 6a: Leak at chest gauge.on Apparatus #15



Figure 6c: Leak at T-connection on Apparatus #15

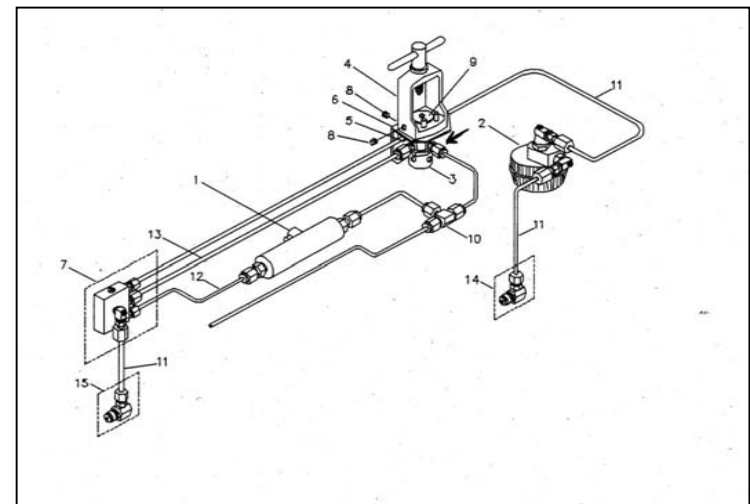


Figure 6b: Engineering drawing showing the location (at arrow) of the leak at the T-connection on Apparatus #15

**Spreadsheet 5: 2 hr BMS Test Summary**

| Apparatus | Exh Press, mm H2O | Inh Press, mm H2O | Avg Inh O2, % | Avg Inh CO2, % | Min Inh CO2, % | DB Temp, C - F |    | Exceptions                                 |
|-----------|-------------------|-------------------|---------------|----------------|----------------|----------------|----|--|
| #1        | 67                | 11                | 77            | 1.4            | 0.2            | 30             | 86 | None                                       |
| #7        | 65                | 11                | 83            | 1.3            | 0.2            | 29             | 84 | None                                       |
| #10       | 104               | 13                | 73            | 1.6            | 0.3            | 29             | 84 | None                                       |
| #15       | 62                | 11                | 88            | 1.4            | 0.2            | 30             | 86 | Audible leak from chest guage. (See Note.) |
| Baseline  | 63                | 11                | 85            | 1.3            | 0.2            | 30             | 86 | None                                       |

Note: Chest guage leak rate was later measured at 243 ml/min.

| <b>Spreadsheet 4b: Results of Scrubber Material Analysis</b> | <b># 1</b> | <b># 7</b> | <b># 10</b> | <b># 15</b> | <b>Unused Limepak</b> | <b>Sample from MR Station</b> |
|--|------------|------------|-------------|-------------|-----------------------|-------------------------------|
| H2O %  | 18.9%      | 16.4%      | 17.5%       | 17.3%       | 15.1%                 | 15.4%                         |
| Aluminum ug/g  | 450        | 410        | 480         | 460         | 470                   | 450                           |
| Calcium ug/g   | 380,000    | 360,000    | 380,000     | 390,000     | 400,000               | 400,000                       |
| Iron ug/g  | 350        | 330        | 380         | 360         | 380                   | 350                           |
| Magnesium ug/g   | 1500       | 1400       | 1500        | 1500        | 1600                  | 1400                          |
| Manganese ug/g   | 98         | 90         | 100         | 100         | 98                    | 97                            |
| Potassium ug/g   | 100        | 90         | 120         | 110         | 110                   | 110                           |
| Sodium ug/g  | 1200       | 1200       | 1300        | 1200        | 1300                  | 1100                          |
| Zinc ug/g  | 17         | 17         | 17          | 18          | 17                    | 17                            |

Notes: 1) Unused Limepak was from a new sealed container.

2) Sample from the Barrick Mine Rescue (MR) Station was obtained by MSHA District personnel

| Spreadsheet 4a: Restoration of Oxygen and Scrubber   | # 1  | # 7                                 | # 10  | # 15  |
|--|--|-------------------------------------|---|---|
| 1) Second visual inspection of all components and housings for signs of wear, abuse, damage or loose connections or parts that may impair the ability of the Biopak to function under use. | a) Small dent in scrubber cannister, b) Bottom clip on scrubber housing not engaged. | 2 large dents in scrubber cannister | a) Small dent on scrubber cannister, b) Cylinder strap reversed | Oxygen cylinder not secured. Chest gauge leaks and pressure reading does not match cylinder gauge reading |
| 2) Inspect housing and scrubber assembly, as well as O rings.  | OK   | OK                                  | OK  | OK  |
| 3) Check scrubber foam pad.  | OK   | OK                                  | OK  | OK  |
| 4) Verify that the scrubber foam pad not less than 1/8" thick over the absorbent coverage area and 1/32" on the outside diameter and must overlap the outer edge of the canister body.     | OK   | OK                                  | OK  | OK  |
| 5) Verify the condition of the absorbent and check to see that it is up to the filler line on the center post.   | OK   | OK                                  | OK  | OK  |
| 6) Obtain and analyze samples.   | #N/A   | #N/A                                | #N/A  | #N/A  |
| 7) Note color change   | None   | None                                | None  | None  |
| 8) Check canister end cap and check O ring seal.   | OK   | OK                                  | OK  | OK  |
| 9) Gel Tube freeze form  | OK   | OK                                  | Missing   | Missing   |
| 10) Check for foam moisture absorbent pad.   | Pad next to removable cover  | OK                                  | OK  | OK  |



Figure 4a: Restoration process



Figure 4c: Apparatus #1 with GelPak installed



Figure 4b: Apparatus #10 with GelPak missing

### Spreadsheet 3: 30 min BMS Test Summary

| Apparatus | Exh Press, mm H <sub>2</sub> O | Inh Press, mm H <sub>2</sub> O | Avg Inh O <sub>2</sub> , % | Avg Inh CO <sub>2</sub> , % | Min Inh CO <sub>2</sub> , % | DB Temp, C - F |    | Exceptions                                 |
|-----------|--------------------------------|--------------------------------|----------------------------|-----------------------------|-----------------------------|----------------|----|--|
| #1        | 70                             | 8                              | 56                         | 1.5                         | 0.4                         | 25             | 77 | None                                       |
| #7        | 52                             | -3                             | 81                         | 1.4                         | 0.3                         | 26             | 79 | None                                       |
| #10       | 53                             | 1                              | 56                         | 1.4                         | 0.3                         | 26             | 79 | None                                       |
| #15       | 62                             | 9                              | 76                         | 1.4                         | 0.3                         | 26             | 79 | Audible leak from chest guage. (See Note.) |
| Baseline  | 71                             | 8                              | 78                         | 1.2                         | 0.2                         | 24             | 75 | None                                       |

Note: Chest guage leak rate was later measured at 243 ml/min.



Figure 3: 30 min BMS test on Apparatus #7



| Spreadsheet 2: Oxygen Cylinder Gas Analysis | Spare  | # 1    | # 7    | # 10   | # 15   |
|---|--------|--------|--------|--------|--------|
| Cylinder serial number                      | WJ188  | BA253  | WJ173  | WJ135  | WJ112  |
| Cylinder Pressure                           | 0 psi  | 0 psi  | 0 psi  | 0 psi  | 0 psi  |
| Oxygen                                      | 95.97% | 92.58% | 85.98% | 73.03% | 76.40% |
| Nitrogen                                    | 2.00%  | 5.54%  | 12.74% | 26.29% | 22.76% |
| Carbon Dioxide                              | 0.01%  | 0.01%  | 0.02%  | 0.04%  | 0.03%  |
| Carbon Monoxide                             | 0.00%  | 0.00%  | 0.00%  | 0.00%  | 0.00%  |

Note: Oxygen cylinder WJ188 was packed in the box which contained Apparatus # 7



Figure 2: Cylinder BA253, with a non-standard gauge, next to cylinder WJ173, with standard gauge.

| Spreadsheet 7b: NIOSH Bench Tests Summary                  |           | Requirement                      | # 1                       | # 7                       | # 10                      | # 15                      |
|--|-----------|----------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 137 Constant Flow (CF)                                     |           | ≥ 1.5 L/min                      | 1.640 L/min               | 1.510 L/min               | 1.570 L/min               | 1.735 L/min               |
| 138 Relief Valve Pressure                                  |           | 0.28 - 0.75 in. H <sub>2</sub> O | 0.24 in. H <sub>2</sub> O | 0.20 in. H <sub>2</sub> O | 0.25 in. H <sub>2</sub> O | 0.25 in. H <sub>2</sub> O |
| 135 Exhalation Resistance (ER)                             |           | ≤ 2.0 in. H <sub>2</sub> O       | 2.6 in. H <sub>2</sub> O  | 2.2 in. H <sub>2</sub> O  | 3.2 in. H <sub>2</sub> O  | 2.6 in. H <sub>2</sub> O  |
| 135 Exhalation Resistance (ER) [Recheck after maintenance] |           | ≤ 2.0 in. H <sub>2</sub> O       |                           |                           | 2.45 in. H <sub>2</sub> O |                           |
| 127 By-Pass Flow (BPF)                                     |           | ≥ 30 L/min                       | 220 L/min                 | 227 L/min                 | 210 L/min                 | 230 L/min                 |
| 117 Inhalation Resistance (IR)                             |           | ≥ 0 in. H <sub>2</sub> O         | -1.5 in. H <sub>2</sub> O | -0.5 in. H <sub>2</sub> O | -0.2 in. H <sub>2</sub> O | 0 in. H <sub>2</sub> O    |
| 124A Alarm Pressure  |           | 600 - 750 psi                    | 683 psi                   | 692 psi                   | 675 psi                   | 705 psi†                  |
| 145 Alarm Sound Level                                      |           | ≥ 80 dBA                         | 79.4 dBA                  | 81.6 dBA                  | 84.1 dBA                  | 80.8 dBA                  |
| 136 Demand Gas Flow (DGF)                                  |           | ≥ 30 L/min                       | 223 L/min                 | 175 L/min                 | 170 L/min                 | 229 L/min                 |
| 148A Remote Gauge Leak                                     |           | ≤ 3.67 L/min                     | 0.09 L/min                | 0.05 L/min                | 0.07 L/min                | 0.10 L/min                |
| 128 Accuracy Gauge:  |           | Difference                       |                           |                           |                           |                           |
|  | @500 psi  | ± 150 psi                        | 0 psi                     | -55 psi                   | -30 psi                   | +5 psi                    |
|  | @1000 psi | ± 150 psi                        | -10 psi                   | -45 psi                   | -20 psi                   | -10 psi                   |
|  | @1500 psi | ± 150 psi                        | -15 psi                   | -25 psi                   | -5 psi                    | -10 psi                   |
|  | @2000 psi | ± 150 psi                        | -40 psi                   | +10 psi                   | +10 psi                   | +15 psi                   |
|  | @2500 psi | ± 150 psi                        | -30 psi                   | +20 psi                   | +25 psi                   | +5 psi                    |
|  | @3000 psi | ± 150 psi                        | -40 psi                   | +25 psi                   | +45 psi                   | -30 psi                   |

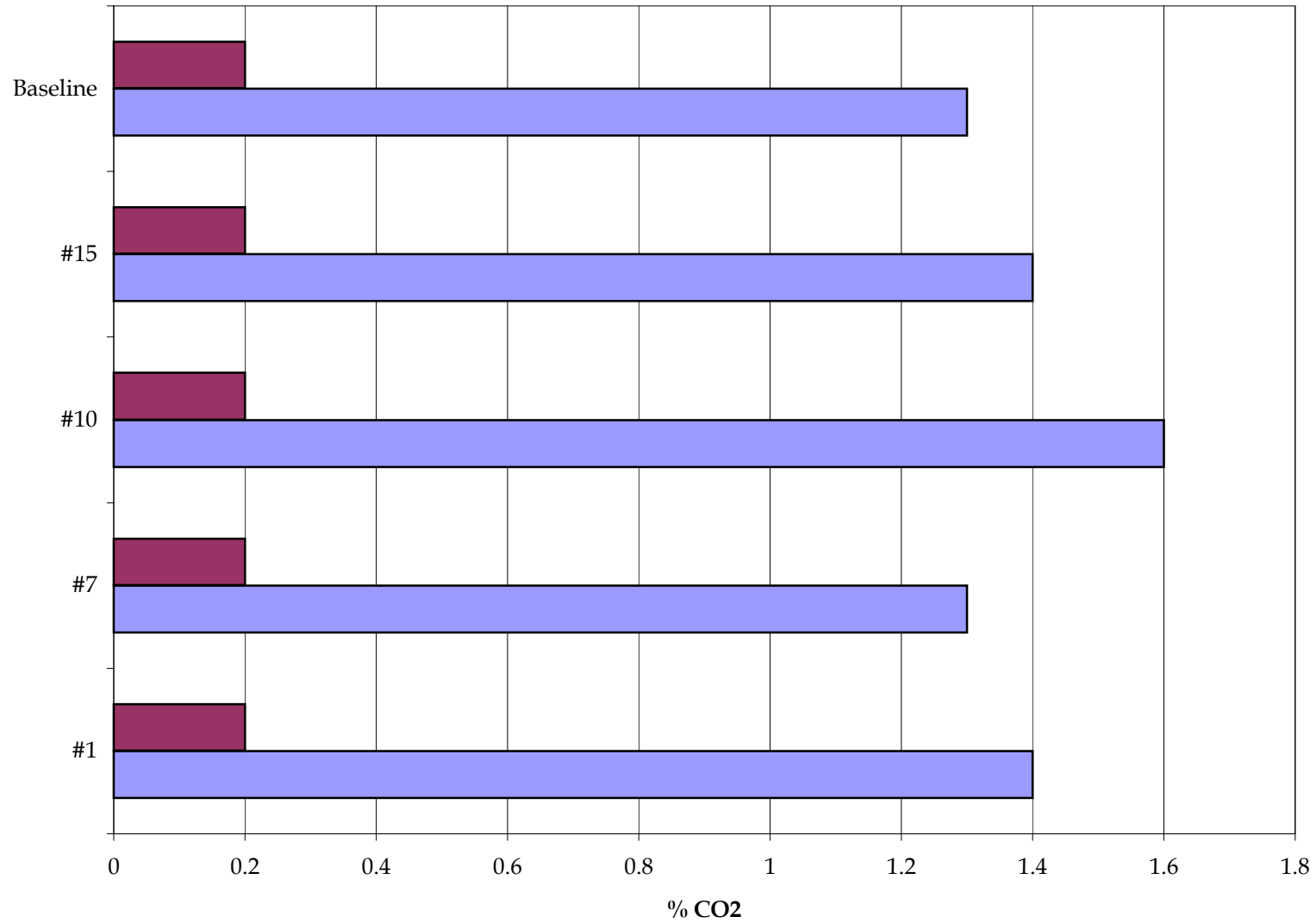
Note: Failing results are indicated in red text.

† Figure shown is the average of five runs - alarm failed to activate during first run performed.

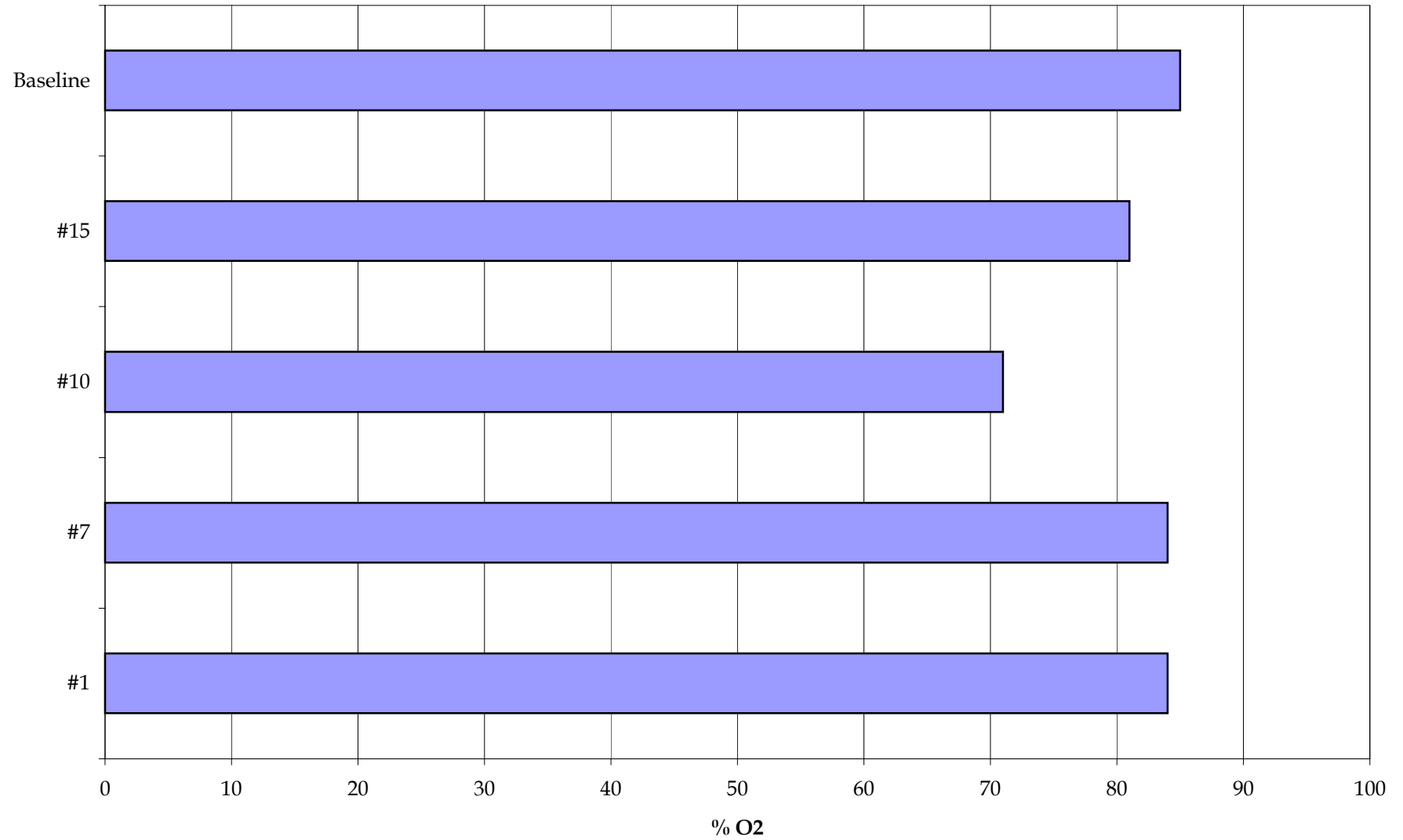


Figure 7: Photograph of NIOSH Test 136- Demand Gas Flow on Apparatus #10.

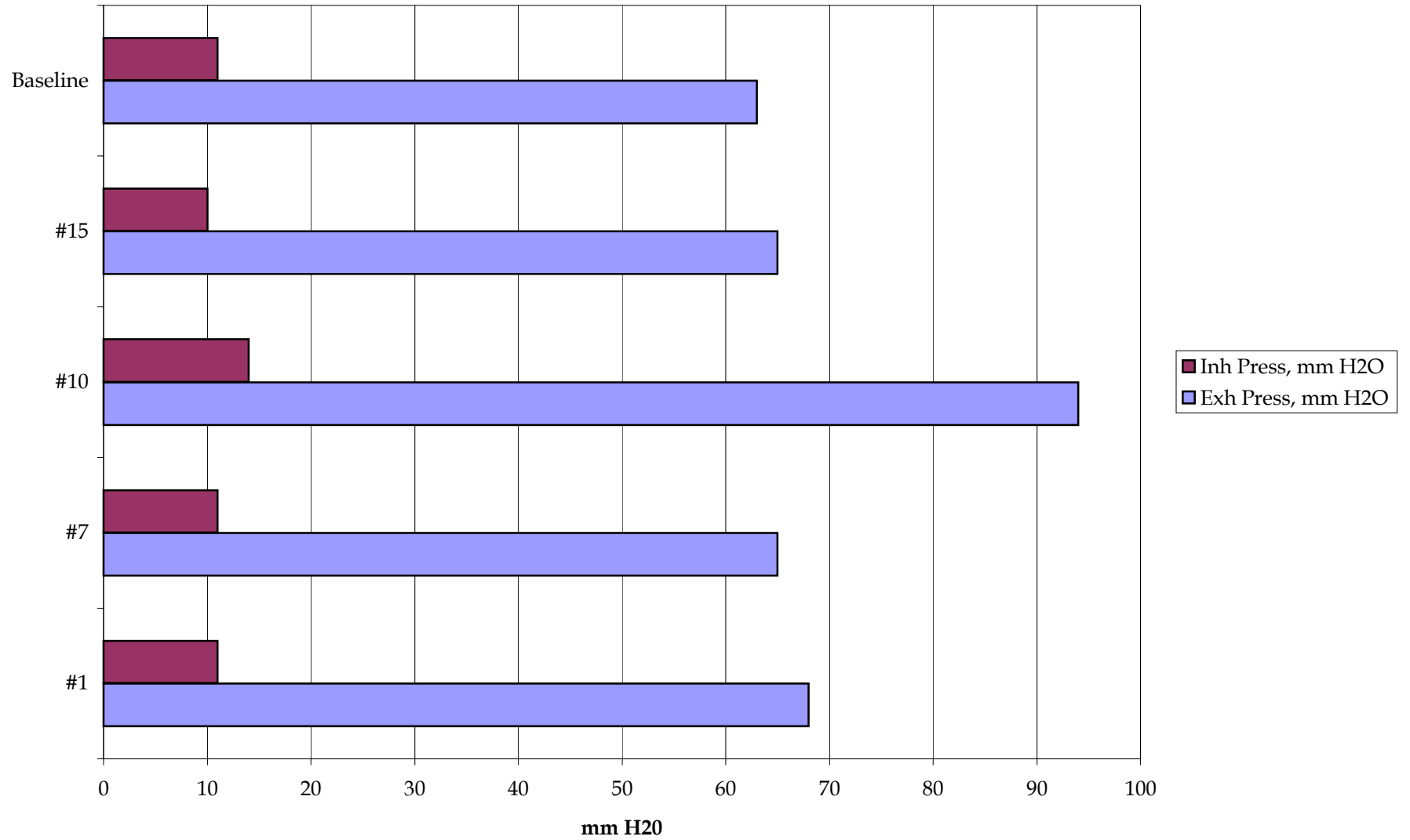
**Chart 8c: Scrubber Performance**



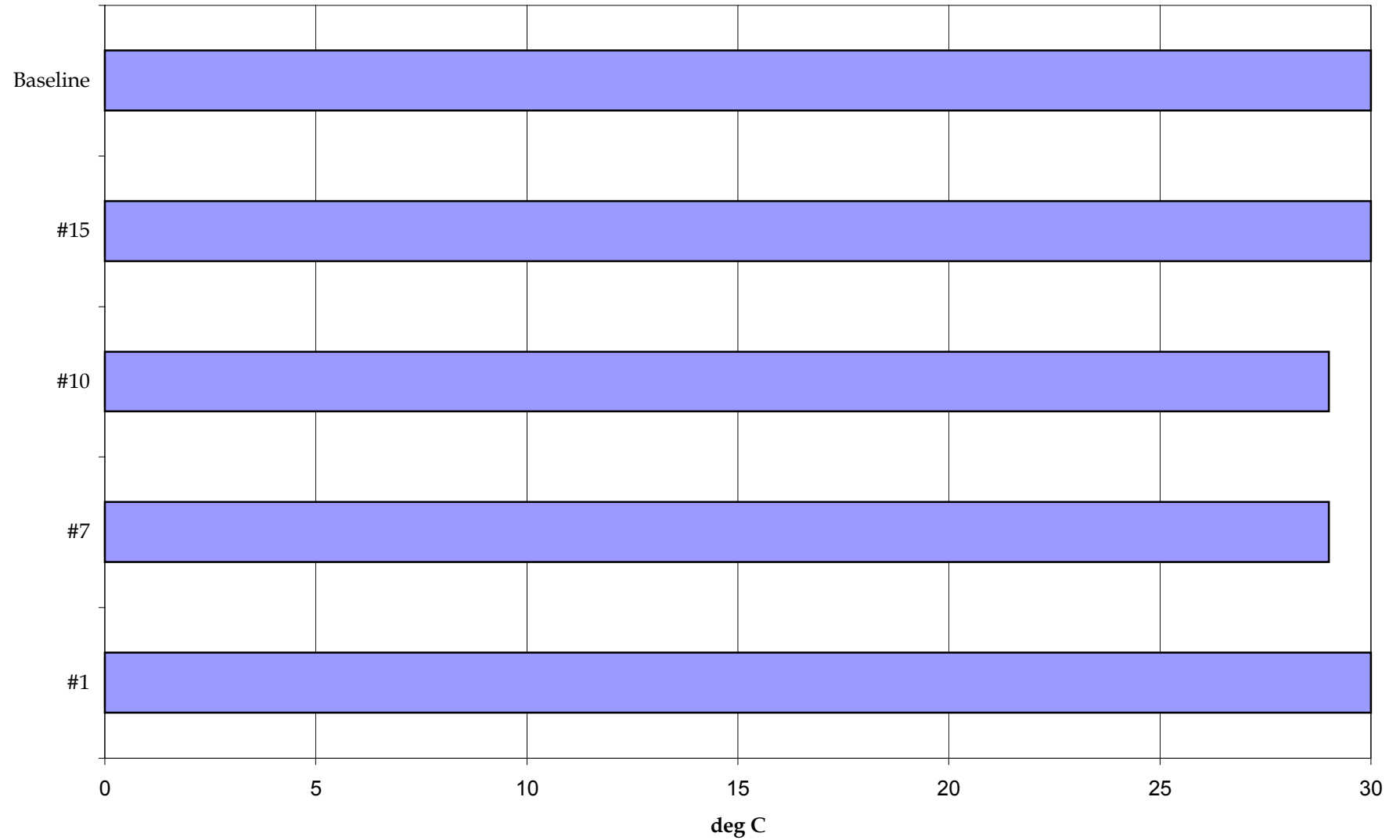
**Chart 8b: Oxygen**



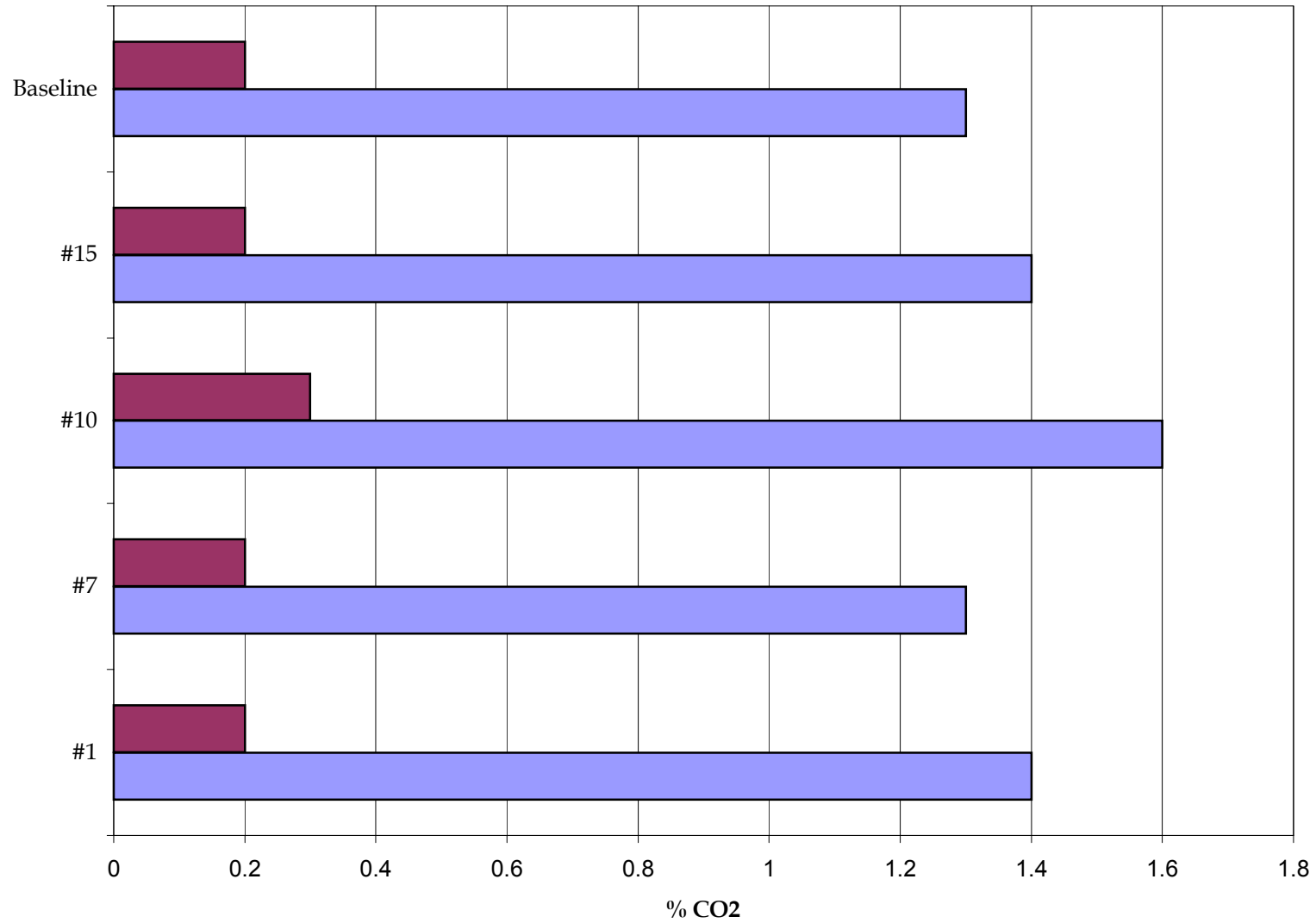
**Chart 8a: Breathing Resistance**



**Chart 5d: Inhalation Temperature**



**Chart 5c: Scrubber Performance**



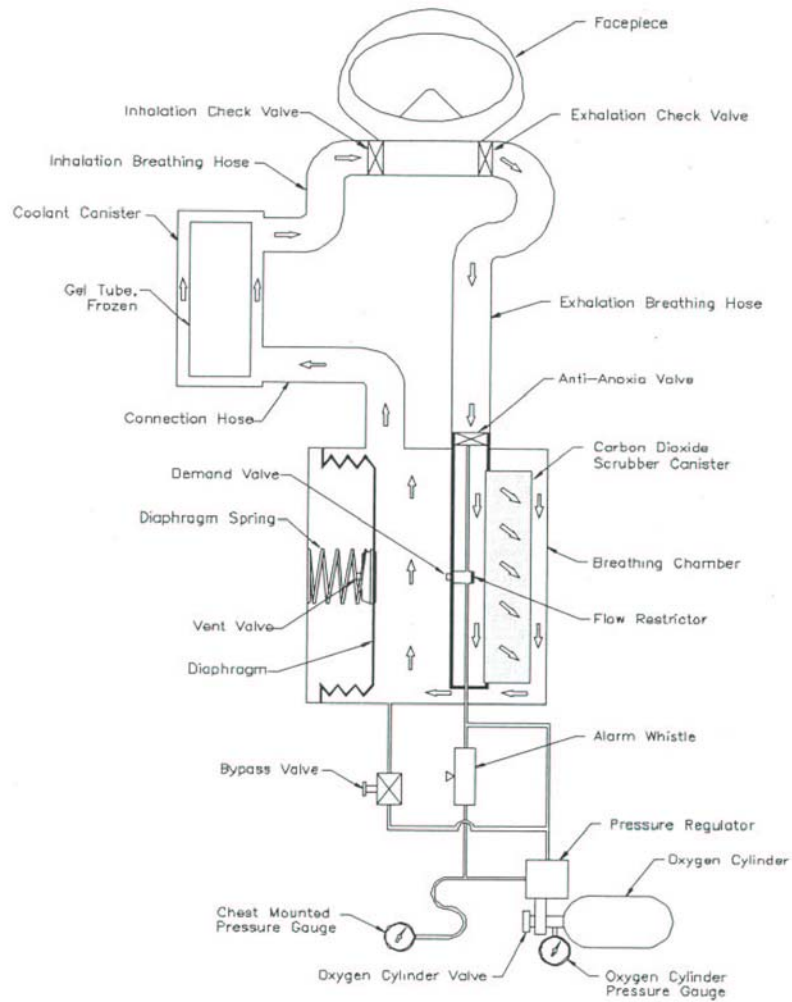


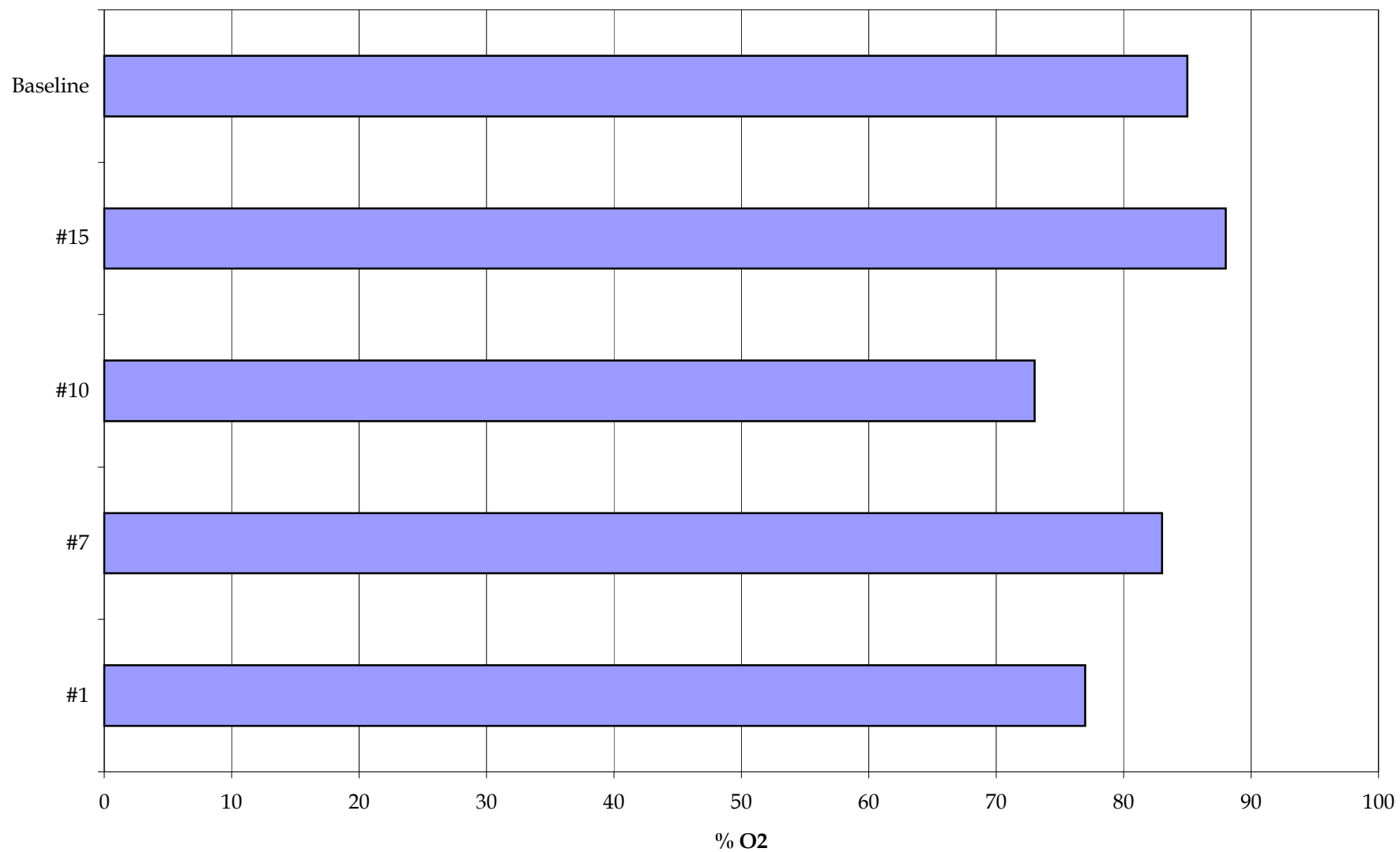
Figure 1: Biopak 240S Flow Diagram

Figure 1b: Engineering Drawing of Biopak 240S  
from Biomarine Benchman Manual

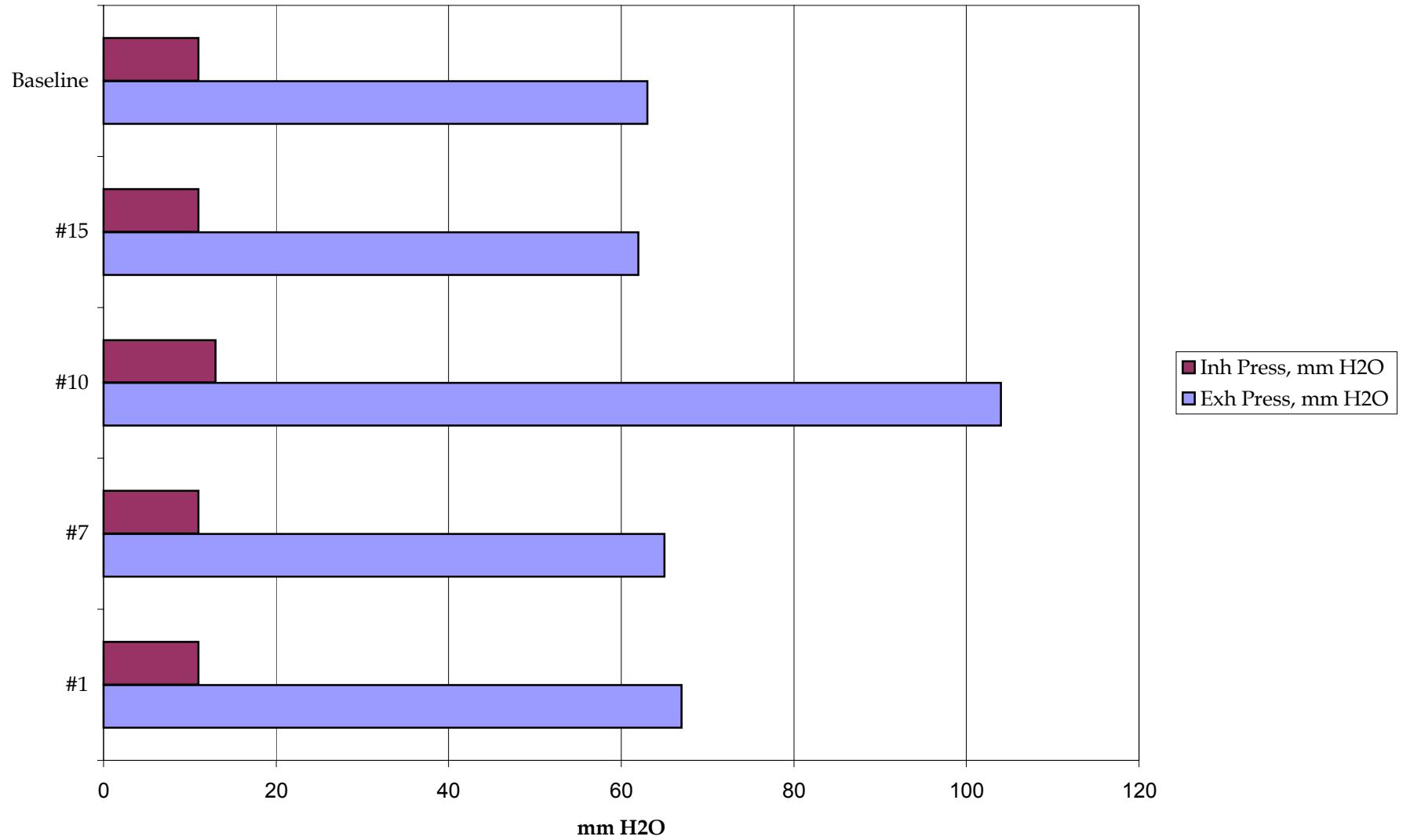




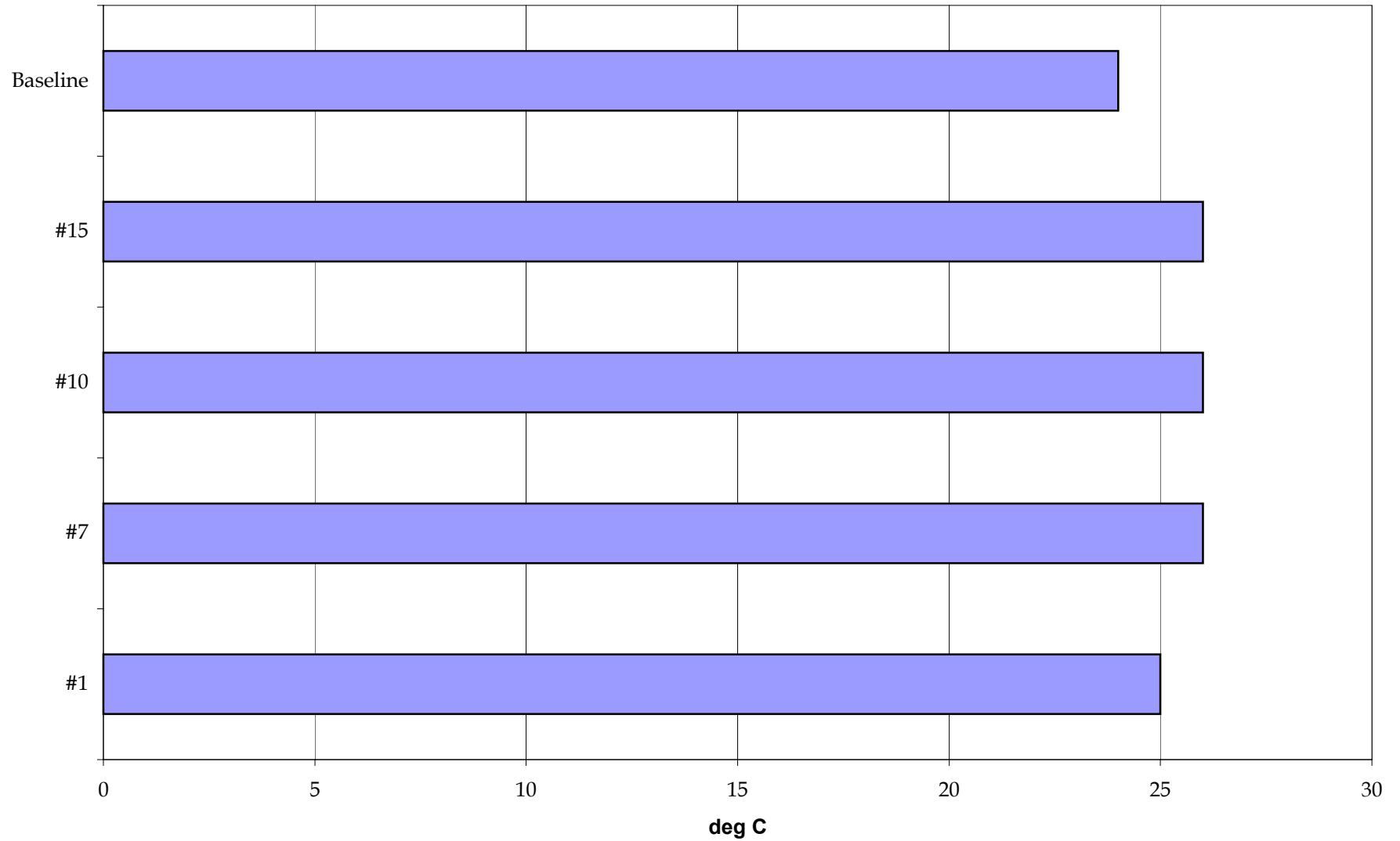
**Chart 5b: Oxygen**



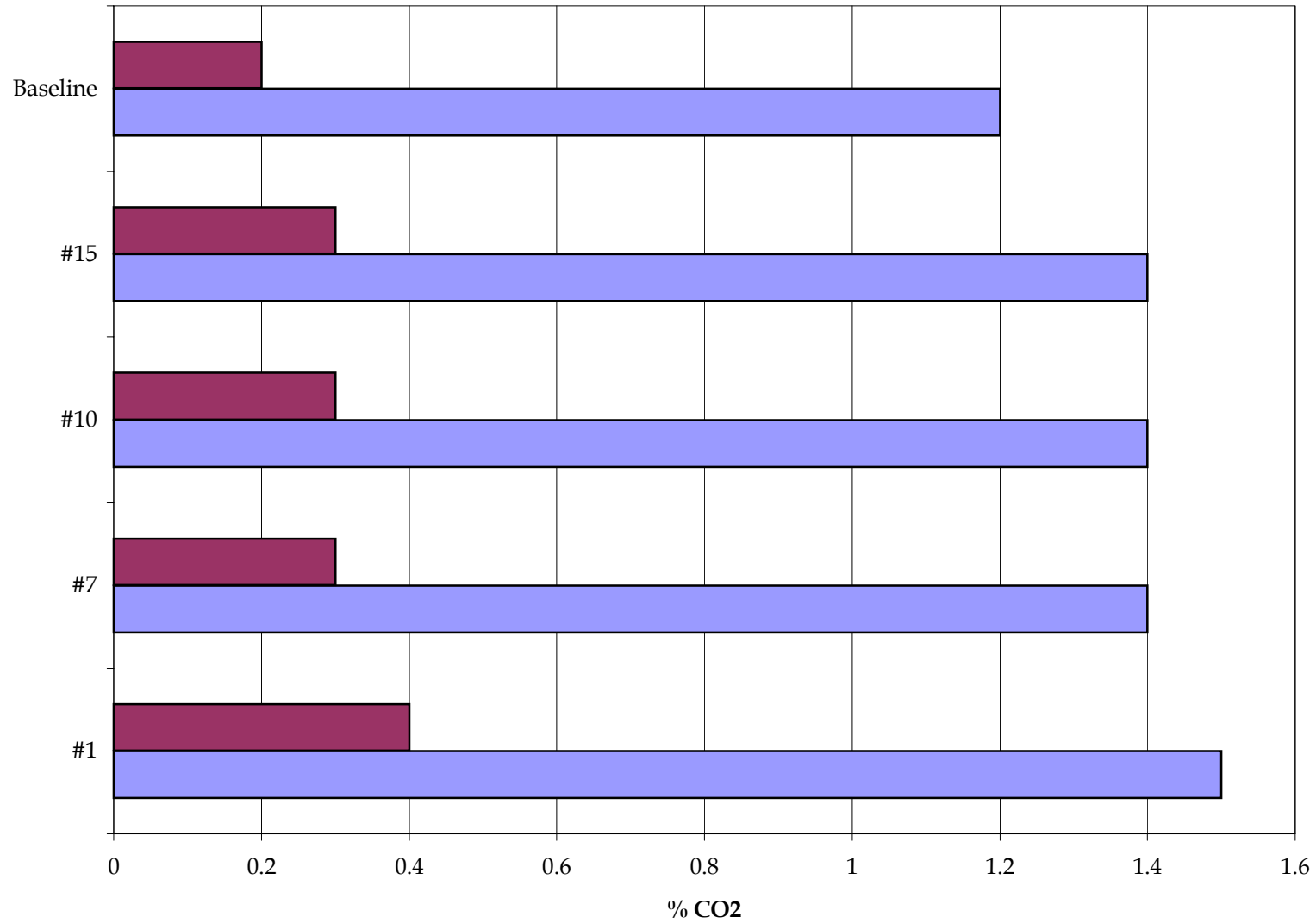
**Chart 5a: Breathing Resistance**



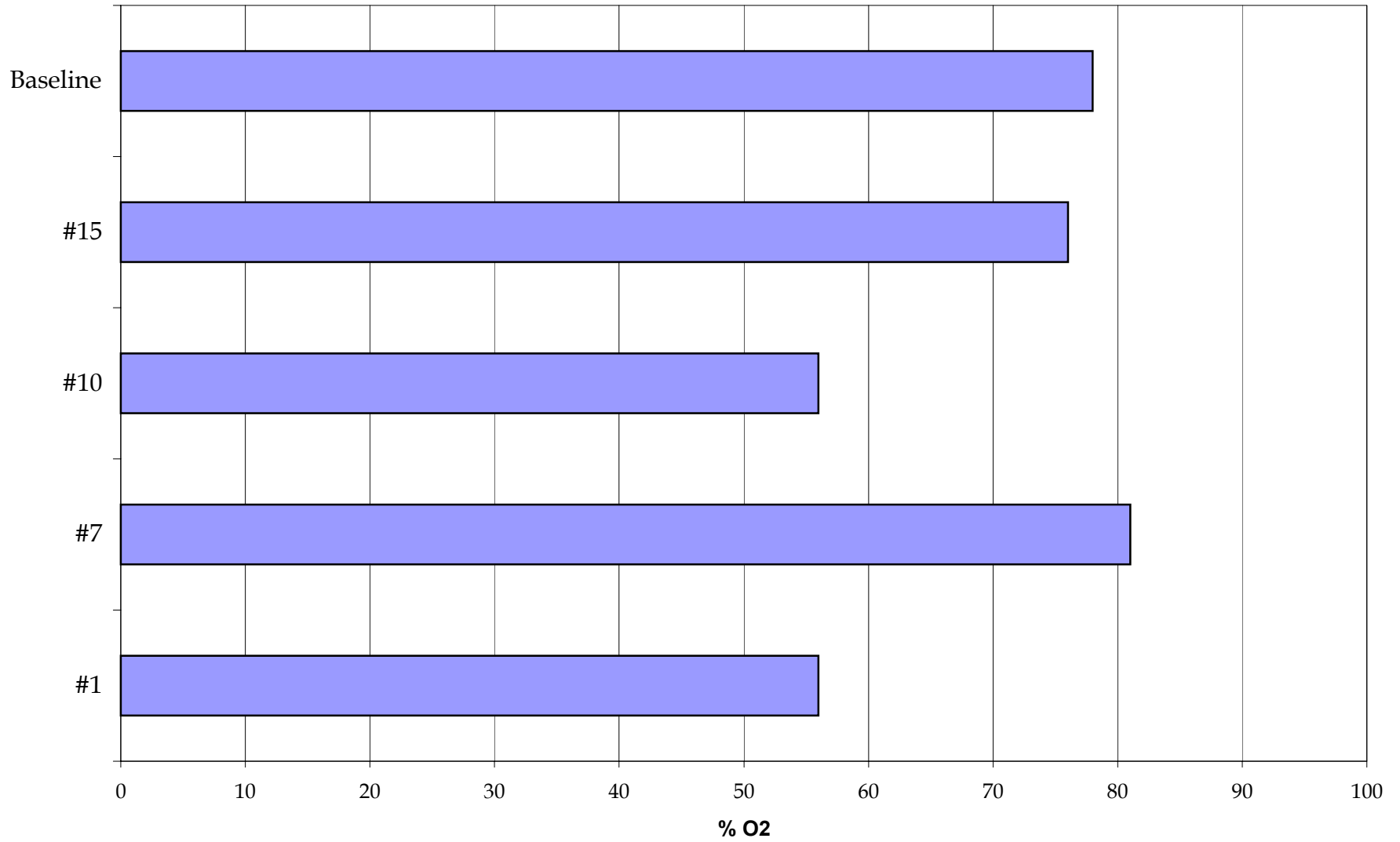
**Chart 3d: Inhalation Temperature**



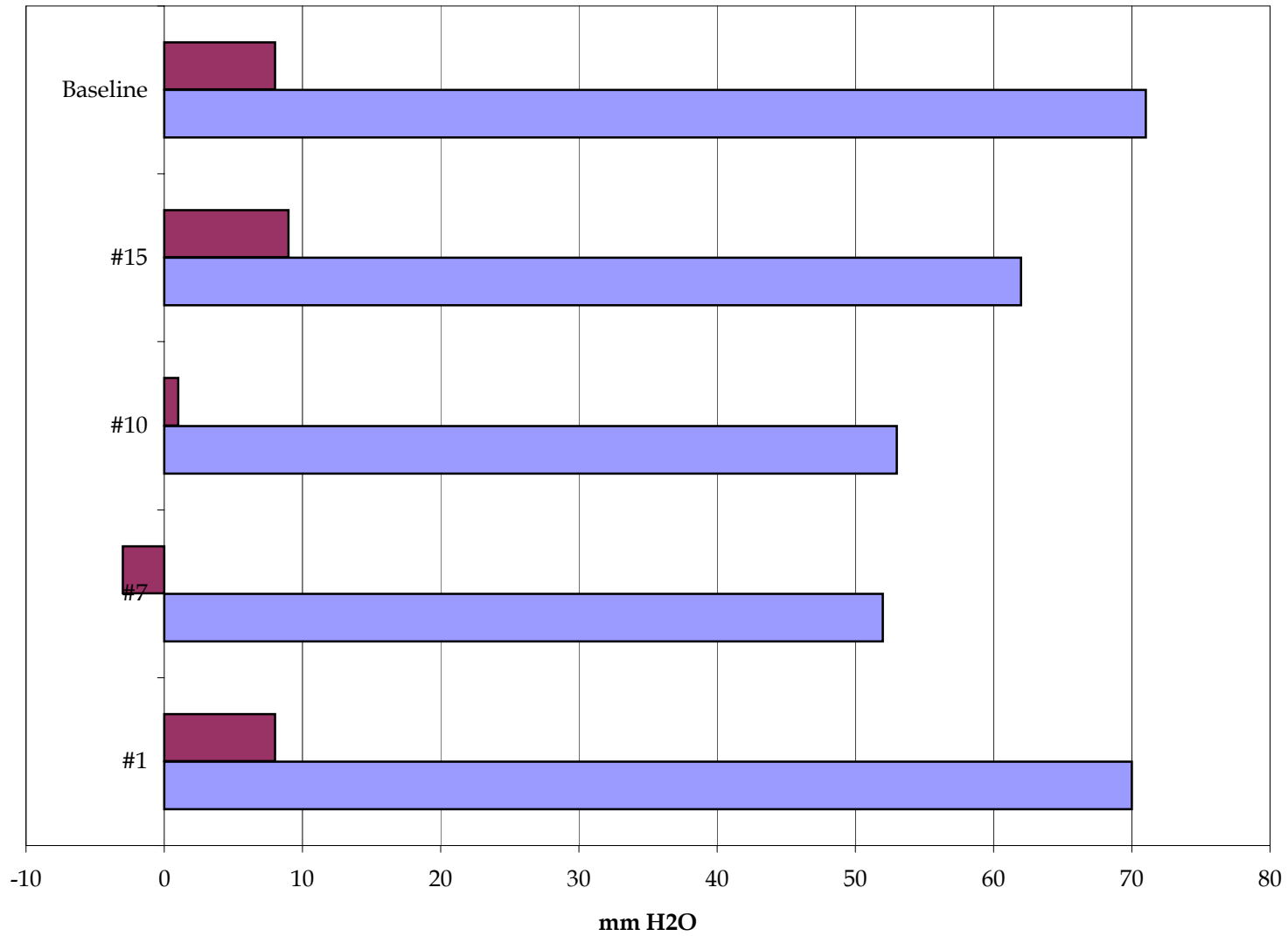
**Chart 3c: Scrubber Performance**



**Chart 3b: Oxygen**



**Chart 3a: Breathing Resistance**



| Spreadsheet 9b: Executive Summary -<br>Test Results Continued | # 1                       | # 7                       | # 10                      | # 15                      | Comment   |
|---|---------------------------|---------------------------|---------------------------|---------------------------|---|
| 138 Relief Valve Pressure                                     | 0.24 in. H <sub>2</sub> O | 0.20 in. H <sub>2</sub> O | 0.25 in. H <sub>2</sub> O | 0.25 in. H <sub>2</sub> O | All four units failed   |
| 135 Exhalation Resistance (ER)                                | 2.6 in. H <sub>2</sub> O  | 2.2 in. H <sub>2</sub> O  | 3.2 in. H <sub>2</sub> O  | 2.6 in. H <sub>2</sub> O  | All four units failed   |
| 117 Inhalation Resistance (IR)                                | -1.5 in. H <sub>2</sub> O | -0.5 in. H <sub>2</sub> O | -0.2 in. H <sub>2</sub> O |                           | Units #1, #7, and #10 failed  |
| 124A Alarm Pressure   |                           |                           |                           | 705 psi†                  | † Figure shown is the average of five runs - alarm failed to activate during first run performed. |
| 145 Alarm Sound Level   | 79.4 dBA                  |                           |                           |                           | Unit #1 failed  |



| Spreadsheet 9a: Executive Summary - Test Results                   | # 1  | # 7                                 | # 10  | # 15  |
|--|--|-------------------------------------|---|---|
| Face piece parts missing or damaged                                | Anti-fog missing   | OK                                  | Anti-fog missing  | OK  |
| Worn, missing or loose parts/damage                                | a) Small dent in scrubber cannister, b) Botton clip on scrubber housing not engaged. | 2 large dents in scrubber cannister | a) Small dent on scrubber cannister, b) Cylinder strap reversed | Oxygen cylinder not secured.  |
| Oxygen cylinder guage  | Different guage  | Standard                            | Standard  | Standard  |
| 30 Min BMS Test Exceptions   | None   | None                                | None  | Audible leak from chest guage.  |
| Second visual inspection during restoration of oxygen and scrubber | None   | None                                | None  | Chest guage connection leaks and pressure reading does not match cylinder guage reading |
| Gel Tube   | OK   | OK                                  | Missing   | Missing   |
| Foam pad in coolant canister                                       | Pad next to removable cover  | OK                                  | OK  | OK  |
| 2 Hr BMS Test Exceptions   | None   | None                                | None  | Audible leak from chest guage. Leak rate measured at 243 ml/min.                        |
| High pressure leak bench test                                      | OK   | OK                                  | OK  | Failed. Leak at "T" connector and chest guage.  |

**Spreadsheet 8: Special 2 hr BMS Test Summary**

| Apparatus | Exh Press, mm H2O | Inh Press, mm H2O | Avg Inh O2, % | Avg Inh CO2, % | Min Inh CO2, % | DB Temp, C - F |    | Exceptions                                 |
|-----------|-------------------|-------------------|---------------|----------------|----------------|----------------|----|--|
| #1        | 68                | 11                | 84            | 1.4            | 0.2            | 33             | 91 | None                                       |
| #7        | 65                | 11                | 84            | 1.3            | 0.2            | 34             | 93 | None                                       |
| #10       | 94                | 14                | 71            | 1.6            | 0.2            | 34             | 93 | None                                       |
| #15       | 65                | 10                | 81            | 1.4            | 0.2            | 33             | 91 | Audible leak from chest guage. (See Note.) |
| Baseline  | 63                | 11                | 85            | 1.3            | 0.2            | 30             | 86 | None                                       |

Note: Chest guage leak rate was later measured at 243 ml/min.

**Chart 8d: Inhalation Temperature**

