

T E C H N I C A L B U L L E T I N

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SCBA COLD WEATHER “FREEZE-UP”

Reference: Technical Bulletin #56, SCBA Cold Weather Maintenance, August 13, 1991

On occasion, when an SCBA malfunctions in the field, an end-user will establish the cause as “freeze-up.” Survivair has investigated some of these incidents and has found that likely causes of SCBA malfunction related to “freeze-up” are:

- 1) Moisture in the SCBA cylinder air.
- 2) Moisture entering the SCBA when changing cylinders or removing facepieces, regulators, etc.; and then reconnecting these components.

Technical Bulletin #56 provides guidance on prevention of SCBA problems during cold weather operation. This bulletin provides further technical information regarding recommended moisture levels in SCBA cylinders.

Survivair requires that all air used in SCBA cylinders have a moisture dewpoint (the temperature at which water vapor in air becomes liquid) of -65°F or lower. The two tables (Page 3) provide guidelines on when the dewpoint should be reduced below -65°F to prevent regulator freeze-up.

To determine the required dewpoint:

- 1) Estimate the lowest temperature in which the SCBA will be used.
- 2) Find the table which matches the cylinder pressure.
- 3) Find $^{\circ}\text{C}$ or $^{\circ}\text{F}$ in column 3 which is closest to the temperature estimated in 1) above.
- 4) Select a temperature which is at least 9°F (5°C) lower than that found in 3) above.
- 5) The temperature in Column 1, directly opposite this temperature, is the required dewpoint.

Examples

- A) 2216 psig Mark 2 SCBA are used during a fire. The outside temperature is -5°F .
- 1) Outside temperature is -5°F .

- 2) Pressure is 2216 psig; use Table 1
- 3) Column 3 value closest to this temperature is -8°F
- 4) 9°F lower is -17°F ; use -17°F value in Table 1
- 5) Temperature opposite -17°F in column 1 is -90°F

Therefore, the required dewpoint as measured at 14.7 psig and 72°F is -90°F .

B) 4500 psig SIGMA SCBA are used during a HAZMAT incident. The outside temperature during the incident fluctuates from a high of 65°F to a low of 45°F at night.

- 1) The lowest temperature is 45°F .
- 2) Pressure is 4500 psig; use Table 2
- 3) Column 3 value closest to 45°F is 46°F
- 4) 9°F lower is 37°F ; use 37°F value in Table 2
- 5) Temperature opposite 37°F is -65°F

Therefore, the required dewpoint as measured at 14.7 psig and 72°F is -65°F .

Please consider that the outside temperature does not have to be at 32°F or lower to cause freeze-up problems. Example B shows that freeze-up can occur in outside temperatures of 45 - 50°F if the air in the cylinder is not dried properly.

Moisture will enter the breathing circuit when cylinders are changed and outside air condenses onto the cylinder or first stage regulator threads. This moisture is trapped when a new cylinder is reconnected to the SCBA. Moisture also enters the SCBA when regulator quick-connects are opened or the facepiece is removed in outside air, then reconnected or redonnned. This in turn can cause regulator freeze-up or valve malfunction.

Attachment

TABLE 1

APPROXIMATE MOISTURE CONTENT IN COMPRESSED
BREATHING AIR AT 2216 PSIG

Dewpoint at 70°F and Standard Atmospheric <u>Pressure</u>		Water Vapor Content at Standard <u>Atmospheric Pressure</u>	Dewpoint at <u>2216 psig</u>	
°F	°C	PPM/V	°F	°C
-50	-45.5	68	+45	+7
-55	-48.5	48	+36	+2
-60	-51	34	+28	-2
-63	-53	27	+23	-5
-65	-54	24	+21	-6
-70	-56.5	17	+14	-10
-75	-59.5	11.5	+7	-14
-80	-62	8	0	-18
-85	-65	5.5	-8	-22
-90	-68	3.5	-17	-27
-95	-70.5	2.3	-21	-31
-100	-73	1.5	-29	-34

TABLE 2

APPROXIMATE MOISTURE CONTENT IN COMPRESSED
BREATHING AIR AT 4500 PSIG

Dewpoint at 70°F and Standard Atmospheric <u>Pressure</u>		Water Vapor Content at Standard <u>Atmospheric Pressure</u>	Dewpoint at <u>4500 psig</u>	
°F	°C	PPM/V	°F	°C
-50	-45.5	68	+64	+18
-55	-48.5	48	+54	+12
-60	-51	34	+46	+8
-63	-53	27	+39	+4
-65	-54	24	+37	+3
-70	-56.5	17	+28	-2
-75	-59.5	11.5	+21	-8
-80	-62	8	+14	-10
-85	-65	5.5	+5	-15
-90	-68	3.5	-4	-20
-95	-70.5	2.3	-11	-24
-100	-73	1.5	-71	-27