State of West Virginia
Earl Ray Tomblin, Governor
WV Office of Miners' Health, Safety & Training
Eugene White, Director
#7 Players Club Rd., Suite 2 ▪ Charleston, West Virginia ▪ 25311-1626
Telephone 304-558-1425 ▪ Fax 304-558-1282
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June 14, 2013

Mr. Leonard Urtso
A.L. Lee Corporation
2075 Lester Highway
Lester, WV 25865
(304)-934-5361

After the evaluation of the documentation submitted in support of your request to modify your existing approvals for the A.L. Lee Rescue Chamber™ your request is granted.

The approval modification does not affect any physical aspects of the approved design, rather is simply a refined calculation of the heat dissipation capacity of the design.

The A.L. Lee Rescue Chamber™ Model 4042 (maximum of 35 miners), Model 3236 (maximum of 30 miners), and Model 2428 (maximum of 20 miners) approvals under the Emergency Shelters/Chambers requirements outlined in the West Virginia Emergency Rule Governing Protective Clothing and Equipment, §56-4-8, hereby modified to include the revised calculations for satisfying the maximum apparent temperature to reflect the attached calculations.

AL Lee, Inc. shall, upon request, provide this office with verification of valid orders, delivery dates, and status of delivery as required for this office to enforce §56-4-8.

Any changes required or enhancements to the approved design affecting the ability to meet any provision of §56-4-8 shall require approval of this Office prior to any affected A.L. Lee Rescue Chamber™ being placed into operation.

Thank you,

Eugene White

Eugene White, Director
WV Office of Miners' Health, Safety & Training

Enclosures 2

Seaman Corporation

Technical Services
1000 Venture Blvd. • Wooster, Ohio 44691
Phone: 330/262-1111 • Fax: 330/263-6950
www.seamancorp.com

DATE: November 5, 2008

TEST: Thermal Conductivity of Elastomeric Skin Material

METHOD: For the purpose of the test using the Colora Thermoconductometer, the sample was placed between ground silver plates which could be kept at the given boiling points of two liquids some 15C different by a constant supply of heat to the higher boiling point liquid. When steady equilibrium was attained, the lower boiling point liquid vaporized at a constant rate and was condensed and collected in a measuring vessel. The time for a given volume to distill was measured and from a previously obtained calibration curves for similar sized discs of known thermal conductivity the thermal resistivity and hence conductivity of the test sample was derived. Thermal conductivity of elastomeric materials at 24C. Testing based on 8028 FRTLC DC6/0/DC6.

RESULTS: U = Overall Heat Transfer Coefficient

$$= \frac{1}{\frac{1}{hi} + \frac{x}{k} + \frac{1}{ho}}$$

hi = inside coefficient value taken from published heat transfer reference book for plastic surface = 1.7.

ho = outside coefficient value taken from published heat transfer reference book for similar plastic surfaces = 5 (under 10 miles per hour wind).

X = thickness of fabric

K = thermal conductivity of our fabric = 0.9 $\frac{\text{B.T.U. in.}}{\text{hr. sq.ft. }^{\circ}\text{F.}}$

Plugging in these values for 3914 FRLTC IR459/181 fabric:

$$U = \frac{1}{\frac{1}{1.7} + \frac{0.014}{0.9} + \frac{1}{5}} = \frac{1}{0..804} = 1.235 \frac{\text{B.T.U.}}{\text{hr.sq.ft.}^{\circ}\text{F}}$$

This is interprolated data based on the results of 8028 FRLTC DC6/0/DC6 from a B. Venkataraman report dated 1979.

Sue Uhler
Technical Services

Specifications – Model 4042 (maximum 35 man unit)

A. Complete surface area of shelter

The shelter used in the model 4042 has the following dimensions and total surface area:

Floor is 350" x 170" = 59,500 sq in.

Roof is 310" x 125" = 38,750 sq in.

LH and RH Sides are 310" x 45" x 2 = 27,900 sq in.

Front is 125" x 45" = 5,625 sq in.

- Combined total is 131,775 sq in which is translated to sq ft. by the following:

131,775 sq in. \ 144 = 915.11 sq ft.

B. Heat dissipation calculations

According to the manufacturing specifications for the shelter material listed in section 3 of this addendum, we find the following:

The shelter material will dissapate 1.235 BTU per hour, per sq ft. of material, per change in temperature (deg. F)

We also assume the following:

- Each man will generate 400 BTU per hour.
- Because we have two CO2 scrubbing systems, we will add the heat generated by the system that is the greater of the two, in this case LIOH is hotter and therefore we will add an additional 40 BTU per man to the calculation.
- Max inside temperature is 82 deg F @ 100% humidity (the equivalent of 95 deg F apparent temperature as set forth in the WVa code 56-8.4.4). This gives us a temperature change of the following:

82 deg F inside - 68 deg F outside = 14 deg F change

- We also will use the total surface area of the shelter in this calculation, which is 915.11 sq ft

From these assumptions we can find the following:

$$\frac{1.235 \text{ BTU} * 915.11 \text{ sq ft} * 14 \text{ deg F}}{\text{Hr} * \text{sq ft} * \text{deg F}}$$

This equals a total heat dissipation of 15,822 BTU per hour.

And:

(400 BTU per man + 40 BTU per man for CO2 scrubbing) * 35 men = 15,400 BTU per hour.

Taking these two numbers you get: 15,822 BTU per hour output – 15,400 BTU per hour input = 422 BTU per hour excess dissipation capacity.

Specifications – Model 3236 (maximum 30 man unit)

A. Complete surface area of shelter

The shelter used in the model 3236 has the following dimensions and total surface area:

Floor is 350" x 170" = 59,500 sq in.

Roof is 310" x 125" = 38,750 sq in.

LH and RH Sides are 310" x 39" x 2 = 24,180 sq in.

Front is 125" x 39" = 4,875 sq in.

- Combined total is 127,305 sq in which is translated to sq ft. by the following:

127,305 sq in. \ 144 = 884.06 sq ft.

B. Heat dissipation calculations

According to the manufacturing specifications for the shelter material listed in section 3 of this addendum, we find the following:

The shelter material will dissapate 1.235 BTU per hour, per sq ft. of material, per change in temperature (deg. F)

We also assume the following:

- Each man will generate 400 BTU per hour.
- Because we have two CO2 scrubbing systems, we will add the heat generated by the system that is the greater of the two, in this case LIOH is hotter and therefore we will add an additional 40 BTU per man to the calculation.
- Max inside temperature is 82 deg F @ 100% humidity (the equivalent of 95 deg F apparent temperature as set forth in the WVa code 56-8.4.4). This gives us a temperature change of the following:

82 deg F inside - 69 deg F outside = 13 deg F change

- We also will use the total surface area of the shelter in this calculation, which is 884.06 sq ft

From these assumptions we can find the following:

$$\frac{1.235 \text{ BTU} * 884.06 \text{ sq ft} * 13 \text{ deg F}}{\text{Hr} * \text{sq ft} * \text{deg F}}$$

This equals a total heat dissipation of 14,193 BTU per hour.

And:

(400 BTU per man + 40 BTU per man for CO2 scrubbing) * 30 men = 13,200 BTU per hour.

Taking these two numbers you get: 14,193 BTU per hour output – 13,200 BTU per hour input = 993 BTU per hour excess dissipation capacity.

Specifications – Model 2428 (maximum 20 man unit)

A. Complete surface area of shelter

The shelter used in the model 2428 has the following dimensions and total surface area:

Floor is 350" x 96" = 33,600 sq in.

Roof is 350" x 86" = 30,100 sq in.

LH and RH Sides are 350" x 30" x 2 = 21,000 sq in.

Front is 86" x 30" = 2,580 sq in.

- Combined total is 87,280 sq in which is translated to sq ft. by the following:

87,280 sq in. \ 144 = 606.11 sq ft.

B. Heat dissipation calculations

According to the manufacturing specifications for the shelter material listed in section 3 of this addendum, we find the following:

The shelter material will dissapate 1.235 BTU per hour, per sq ft. of material, per change in temperature (deg. F)

We also assume the following:

- Each man will generate 400 BTU per hour.
- Because we have two CO2 scrubbing systems, we will add the heat generated by the system that is the greater of the two, in this case LIOH is hotter and therefore we will add an additional 40 BTU per man to the calculation.
- Max inside temperature is 82 deg F @ 100% humidity (the equivalent of 95 deg F apparent temperature as set forth in the WVa code 56-8.4.4). This gives us a temperature change of the following:

82 deg F inside - 70 deg F outside = 12 deg F change

- We also will use the total surface area of the shelter in this calculation, which is 606.11 sq ft

From these assumptions we can find the following:

$$\frac{1.235 \text{ BTU} * 606.11 \text{ sq ft} * 12 \text{ deg F}}{\text{Hr} * \text{sq ft} * \text{deg F}}$$

This equals a total heat dissipation of 8,982 BTU per hour.

And:

(400 BTU per man + 40 BTU per man for CO2 scrubbing) * 20 men = 8,800 BTU per hour.

Taking these two numbers you get: 8,982 BTU per hour output – 8,800 BTU per hour input = 182 BTU per hour excess dissipation capacity.