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CONTRACT TEST REPORT

CONTRACT TESTS FOR R-859 FIRE SUPPRESSION SYSTEM FOR SPECIAL HAZARDS

Prepared for:

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P.O. Box 31
Easton, PA 18044-0031

Project: 3031726
Class: 5560
Date of Approval: May 13, 2008

Authorized by:

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CONTRACT TESTS FOR R-859 FIRE SUPPRESSION SYSTEM FOR SPECIAL HAZARDS

from

VICTAULIC COMPANY
4901 KESSLERSVILLE ROAD
P.O. BOX 31
EASTON, PA 18044-0031

I INTRODUCTION

1.1 Victaulic Company requested an examination of their R-859 fire suppression system with dual-fluid, nitrogen and water, in accordance with a modified version of the local application fire test protocol of UL 2127, *Inert Gas Clean Agent Extinguishing System Units.*

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1.3 This report is limited to the examination of the R-859 fire suppression system described in Section II, in accordance with specific sections of the following standards, as described in Section III:

Title	Date
Underwriters Laboratories (UL) 2127 Inert Gas Clean Agent Extinguishing System Units	March 1999

II DESCRIPTION

2.1 The *R-859 Fire Suppression System for Special Hazards*, 2007, design, installation, operation, and maintenance manual, describes and illustrates the various system components, their installation, limitations, and necessary system maintenance. This manual is on file at FM Approvals under P.I. 3031726.

2.2 The Victaulic R-859 system is a dual-fluid system, which uses nitrogen and water to create fine water particles. The R-859 system is designed for the protection of special hazard applications. The system is used in total flooding hazards, which can be either normally occupied or unoccupied, as defined by NFPA 2001. The total flooding system is intended to protect enclosed special hazards, such as rooms or spaces involving Class A and Class B flammable liquids under UL 2127. It is suitable for applications where the cylinder ambient storage temperature is between 0 and 130 °F (-18 and 54 °C).

2.3 The R-859 water mist system consists of activation equipment, water and nitrogen supply components, discharge piping, and water mist nozzles.

2.4 System Activation

2.4.1 Activation occurs when the system's main control panel receives an electric signal from detection devices installed in the protected space. The main control panel for the R-859 system sends a signal to the Nitrogen Flow Control Module, which begins the flow of nitrogen to the protected space. When the nitrogen reaches 20 psi (1.4 bar), water flow is also initiated.

2.4.2 For systems servicing multiple zones, the fire detection signal is relayed from the system's main control panel to a Zone Control Module associated with the hazard area. This Zone Control Module includes a nitrogen flow control valve and a water supply control valve to direct and control the flow of nitrogen and water to the appropriate zone. The main control panel will simultaneously provide a signal to the Flow Control Panel, resulting in the flow of nitrogen and water to the initiating zone as described above.

2.4.3 The system may also be operated manually at the control panel.

2.5 Agent Supply

2.5.1 Following fire detection and system activation, the flow of nitrogen and water is initiated. As described previously, for multiple zoned systems, a nitrogen flow control valve and a water supply valve are included in the Zone Control Module to direct the agent flow to the appropriate zone.

2.5.2 A Gas Flow Control Needle Valve is included in the Flow Control Panel to regulate the nitrogen pressure. The inlet to the valve is connected to the main nitrogen gas supply at approximately 2500 psig (170 bar). Each zone is equipped with a separate pressure transducer, where the needle valve is also connected. The pressure transducer communicates with the needle valve, allowing the pressure to be regulated so that each nozzle in the affected zone operates at a nitrogen pressure approximately equal to 25 psi (1.7 bar). The systems are configured to flow 175 scfm (4.25 m^3/min) of nitrogen per water mist nozzle.

2.5.3 Water is supplied from a municipal water source. The water mist nozzles operate at a water pressure equal to 1.0 psi (0.7 bar). The water supply piping includes a 100-mesh strainer to remove any large debris that could potentially block water flow through the water mist nozzles. A supervised water control valve is used to control the water supply to all fire zones. Additionally, A water flow control cartridge is included in close proximity to each nozzle to regulate the water flow to the nozzle to 1 gpm (3.8 lpm), regardless of the inlet pressure.

2.6 Discharge Piping and Emitters

2.6.1 The nitrogen and water are delivered in independent discharge piping to water mist nozzle(s).

2.6.2 The R-859 fire suppression system is installed with balanced piping configurations. The nitrogen supply lines are rated to 3000 psi (206.8 bar). This allows the pressure transducer to be installed at any emitter within the hazard area, to maintain a nitrogen discharge pressure of 25 psi (1.7 bar) at all emitters in each zone. Descriptions of balanced piping methods are included in the *R-859 Fire Suppression System for Special Hazards* manual.

2.6.3 Water flow at the emitter is controlled via the Flow Control Valve prior to the emitter's inlet, as described in Section 2.5.3. Nitrogen flow for each emitter is 175 scfm (4.25 m^3/min), and the pressure is maintained at 25 psi (1.7 bar) by the Gas Flow Control Needle valve and pressure transducer described in Section 2.5.2. The nitrogen and water meet just before the emitter outlet, and water mist is produced when the two fluids exit the emitter.

III EXAMINATION AND TESTS

3.1 The product described in this report was examined and tested at Victaulic's facility in Stewartsville, NJ and witnessed by an FM Approvals Engineer. The following tests were conducted, at the request of Victaulic. All data remains on file at FM Approvals under P.I. 3031726, as well as other documents and correspondence applicable to this program.

3.2 A series of tests were conducted in accordance with UL 2127, Sections 34 and 35. All tests were conducted with R-859 fire suppression system using dual fluids (nitrogen and water).

3.3 The nozzle distribution verification tests were conducted in a minimum height and maximum height enclosure size. Whereas, the Class A and Class B fire tests were conducted in the maximum room height enclosure size. Pendant and sidewall nozzles were installed in both room enclosures, where the tests described in Sections 3.4, 3.5, and 3.6 of this report were conducted in each nozzle configuration.

3.4 The following tests were conducted as part of this examination

<table>
<tr><th>Test#</th><th>Height of O_2 Measurement in. (mm)</th><th>Fuel</th><th>Nozzle Configuration[1]</th></tr>
<tr><td>1</td><td rowspan="4">N/A</td><td rowspan="4">Heptane in 8 Test Cups (Nozzle Distribution Test)</td><td>Pendant[2]</td></tr>
<tr><td>2</td><td>Sidewall[2]</td></tr>
<tr><td>3</td><td>Pendant</td></tr>
<tr><td>4</td><td>Sidewall</td></tr>
<tr><td>5</td><td rowspan="3">Measured at pan height (Pan) = 28 (711)</td><td rowspan="8">Heptane</td><td rowspan="8">Sidewall</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td rowspan="3">0.1 times height of enclosure (0.1H) =15 (381)</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td><td>0.5H=72 (1829)</td></tr>
<tr><td>12</td><td rowspan="3">Pan=28 (711)</td><td rowspan="7">Heptane</td><td rowspan="7">Pendant</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td><td rowspan="3">0.1H =15 (381)</td></tr>
<tr><td>16</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td><td>0.5H=72 (1829)</td></tr>
</table>

[1] Enclosure size is 20'x 20' x 12' high, unless noted otherwise.
[2] Enclosure size is 17'x17'x8' high

Test#	Height of O_2 Measurement in. (mm)	Fuel	Nozzle Configuration[1]
19	Bottom of Crib=28 (711)	Wood Crib	Pendant
20			
21			
22	0.1H =15 (381)		
23			
24			
25	0.9H = 130 (3302)		
26			
27	Bottom of Crib =28 (711)	Wood Crib	Sidewall
28			
29			
30	0.1H =15 (381)		
31			
32			
33	0.9H = 130 (3302)		
34			
35	17.5 (445)	Polypropylene	Sidewall
36			
37			
38			Pendent
39			
40			
41b	17.5 (445)	PMMA	Pendent
42			
43			
44			Sidewall
45			
46b			
47	17.5 (445)	ABS	Sidewall
48			
49			
50			Pendent
51			
52			

3.5 Nozzle Distribution Verification Tests

3.5.1. The Nozzle Distribution Verification Test was conducted in accordance with UL 2127, Section 35. Testing was conducted in two enclosure sizes. The first enclosure included the minimum room height, where one nozzle protected an enclosure of 17 x 17 x 8 ft. high (5.2 x 5.2 x 2.4 m), a coverage volume of 2312 ft^3/nozzle (65.47 m^3/nozzle). The second enclosure included the maximum room height, where two nozzles protected an enclosure of 20 x 20 x 12 ft. high, a coverage volume of 2400 ft^3/nozzle (68 m^3/nozzle).

3.5.2. The piping networks for both enclosures were installed as illustrated in Appendix A, Figure 1 and Figure 2. In the second enclosure, 20 x 20 x 12 ft. high (6.1 x 6.1 x 3.7 m), two pendant nozzles were centered in the room, spaced by 12 ft (3.7 m), and two sidewall nozzles, spaced by 10 ft. (3 m).

3.5.3. The test specifications of the Nozzle Distribution Verification Test, states that the extinguishing system shall extinguish all fires within 30 seconds after the end of discharge. The R-859 system is a pre-engineered system and did not have a pre-determined discharge time, as outlined in UL 2127, Section 23 Discharge Test. Rather, during the Nozzle Distribution Verification Tests, the system was discharged until extinguishment.

3.5.4. Listed in Appendix B, Table B1 are the critical results for the Nozzle Distribution Tests.

3.6 Class A and B Fire Clean Agent Extinguishment Tests

3.6.1. The R-859 fire suppression system was witnessed as a fire extinguishing system for use in Class A and B hazards, in accordance with UL 2127, Section 34. Testing was conducted in an enclosure with dimensions of 20 x 20 x 12 ft. high (6.0 x 6.1 x 3.7 m high). The total volume of the enclosure was 4800 ft^3 (136 m^3), as required by UL 2127.

3.6.2. Various Class A (wood and plastics) and Class B (heptane) materials were used as test fuels. Specific details of the fire test scenarios, including pre-burn times and extinguishment criteria, are described in UL 2127.

3.6.3. The system was configured to include a piping layout and nozzle arrangement as illustrated in Appendix A, Figure 2.

3.6.4. Listed in Appendix B, Tables B2 through to Table B6, are the critical results for the Class A and B Fire Tests.

3.6.5. The pressure and flow data measured at the emitters were consistent throughout all Class A and Class B fire tests, with the exception of the water pressure measurements. The calculated average water flow rate was 1.74 gpm (3.79 l/min), the average total nitrogen flow rate was 289 scfm, and the average nitrogen pressure was 24.1 psi (1.66 bar). The average water pressure was 0.92 psi (0.063 bar), where the average water pressure varied between 0.32 psi and 1.8 psi (0.022 and (0.124 bar). Typically the water pressure measured at the pendant nozzles had a consistent water pressure of 0.4 psi (0.028 bar), where the pressure measured at the sidewall nozzles was approximately 1.7 psi (0.117 bar). The storage containers were approximately 70 °F (21 °C) and the air temperature inside the test enclosure varied between 49-82°F (9-28°C) prior to each test.

3.6.6. The percent of oxygen was continuously measured at the following elevations:
- Class A, Polymeric Fuels: Fuel source
- Class A, Wood Crib: Bottom of the wood crib, 0.1 and 0.9 times the height of the enclosure
- Class B, Heptane: Test pan , 0.1 and 0.5 times the height of the enclosure

3.6.7. Section 34.1.3.4. of UL 2127 requires that the agent extinguishing concentration for each test be 83.34 percent of the intended end use design concentration. This concentration was not specified during testing. Victaulic will calculate the required amount of nitrogen

needed to be discharged in an area which would cause the oxygen level to be reduced to 15%. The average oxygen concentration in the room at extinguishment varied between 12.5% to 16.45% for Polymeric Fuels, 14.9% to 16.2% for the Wood Crib fire tests, and 15.9% to 17.3% for Class B fire tests.

3.6.8. Section 34.2.3.8 of UL 2127 requires that the percent of oxygen within the enclosure at a level of the polymeric fuel source be within 0.5 units of the normal atmospheric conditions at the time of system discharge. Oxygen concentrations fall within this range and were deemed satisfactory.

3.6.9. Section 34.2.3.11 of UL 2127 requires that the weight loss of polymeric materials shall not exceed 15 grams between 10 seconds and 600 seconds after the end of discharge. The mass loss of Class A, Polymeric Fuel fires was continuously measured from ignition until 10 minutes after end of discharge. Refer to Appendix B, Table B6 for a summary of the mass loss data. The average mass loss data for the polypropylene and the ABS fuels were deemed satisfactory. The average mass loss data for PMMA exceeded the maximum permitted mass loss.

IV REMARKS

The testing described in this report does not meet the requirements of Underwriters Laboratories (UL) 2127 Standard *Inert Gas Clean Agent Extinguishing System Units or any* FM Approval Standard. This report does not constitute an FM Approval of the R-859 Fire Suppression System.

V CONCLUSION

The R-859 Fire Suppression System completed a modified version of UL 2127 test protocol for Class A and Class B fires. During the fire testing, the system successfully extinguished wood crib fires, heptane fires, and polymeric fires (Polypropylene, ABS, and PMMA).

EXAMINATION AND TESTING BY:	**Angèle Morcos – FM Approvals** **Victaulic Company Personnel** **Underwriters Laboratories (UL) Personnel**
PROJECT DATA RECORD:	**3031726**
ATTACHMENTS:	**APPENDIX A – Room Enclosures** **APPENDIX B – Summary of Results**

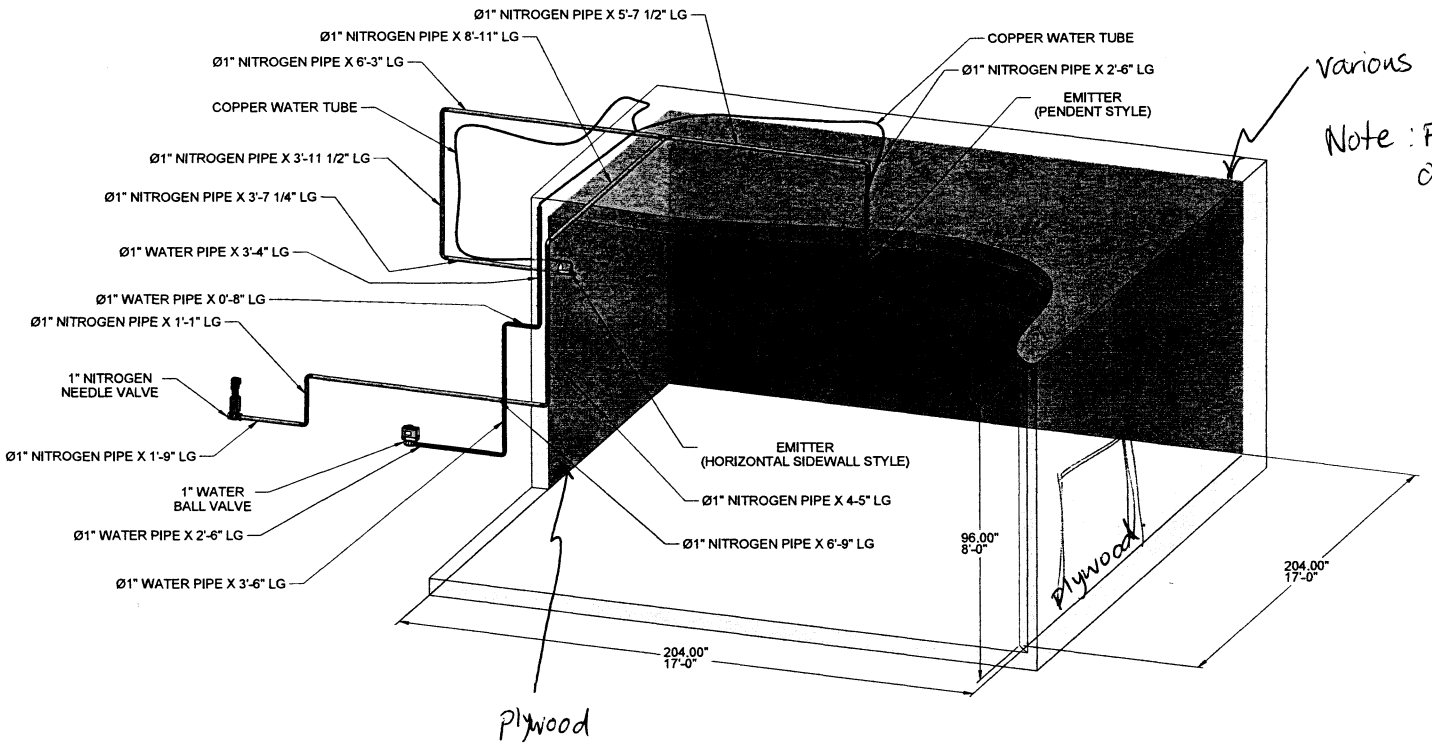
REPORT BY:

Angèle Morcos
Engineer
Hydraulics Section

REPORT REVIEWED BY:

Brian K. MacDonald
Technical Team Manager
Hydraulics Section

Appendix A: Room Enclosures



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REV	DESCRIPTION	CCD	DATE	BY APPR
A	RELEASED FOR SUBMITTAL	---	DOMAIN 2008	RLC SL

Victaulic®

Fire Safety Company, LLC
EASTON, PA 18040
LELAND, NC 28451

TITLE: ROOM LAYOUT, UL/FM VORTEX TESTING
17'-0" X 17'-0" X 8'-0" ROOM

THIRD ANGLE PROJECTION	DRAWN RLC	DWG NO Figure 1	REV
	DATE 07JAN2008		
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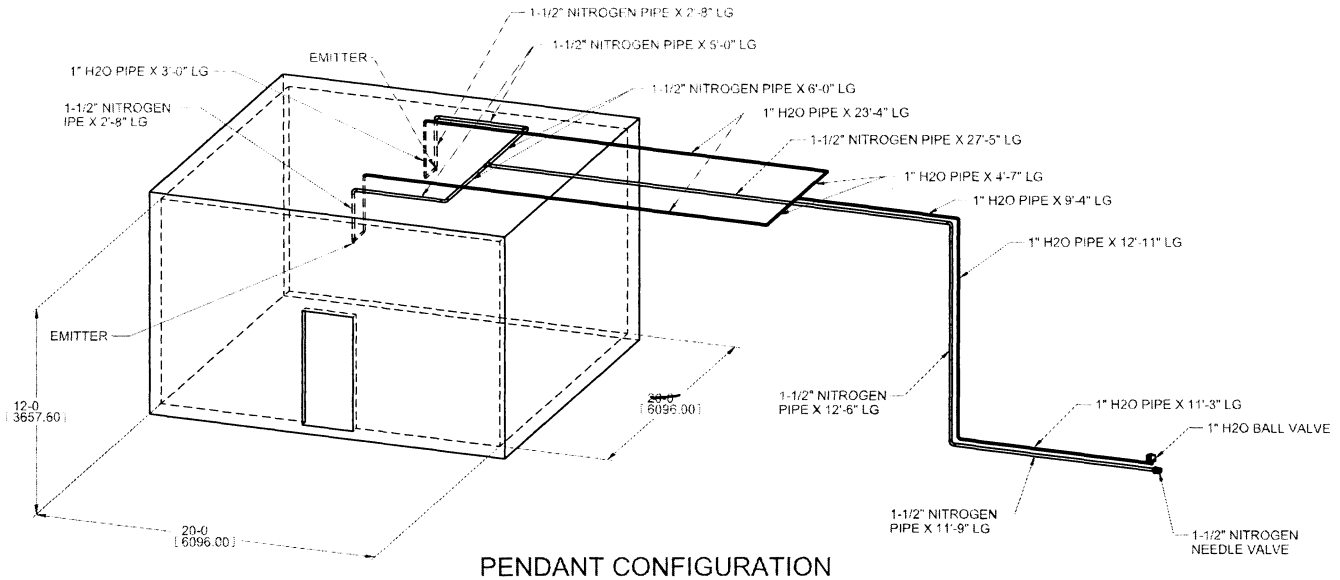
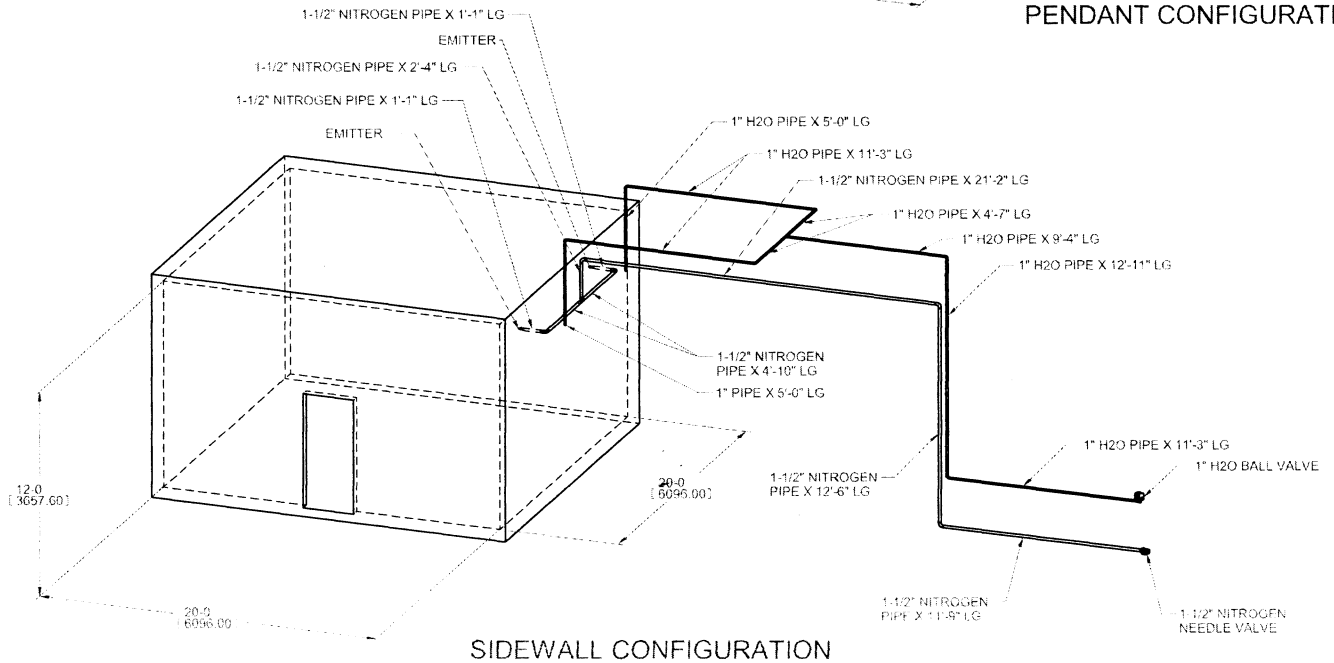
- All elevations constructed of plywood



PENDANT CONFIGURATION



SIDEWALL CONFIGURATION

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A	RELEASED FOR SUBMITTAL	-	DUMMY 2007	

Victaulic®

Fire Safety Company, LLC
EASTON, PA 18040
LELAND, NC 28451

TITLE: UL/FM ROOM LAYOUT VORTEX

THIRD ANGLE PROJECTION | DRAWN: DPN | DATE: 19DEC2007 | SCALE: 1:40 | DWG NO. Figure 2. | REV | DO NOT SCALE DRAWING | SIZE: D | SHEET 1 OF 1

Appendix B: Summary of Results

Table B1: Nozzle Distribution Test

Nozzle Orientation (Number of Nozzles)	**Enclosure Dimensions ft (m)**	**Start of Discharge (s)**	**Time to Extinguishment (s)**	**End of Discharge (s)**
Pendant (1)	17 x 17 x 8 (5.2 x 5.2 x 2.4)	65	358	364
Sidewall (1)	17 x 17 x 8 (5.2 x 5.2 x 2.4)	69	334	346
Pendant (2)	20 x 20 x 12 (6.1 x 6.1 x 3.7)	163	405	419
Sidewall (2)	20 x 20 x 12 (6.1 x 6.1 x 3.7)	90	379	393

Table B2: Wood Crib Fire Extinguishment Tests – Pendant Configuration

Test	Extinguishment Time	O_2 Concentration (%)				Avg. N_2 Flow rate	Avg. N_2 Pressure	Avg. H_2O Flow rate	Avg. H_2O Pressure
	(s)	At Discharge	At Ext.	End of Soak	Atm.	(scfm)	(psi)	(gpm)	(psi)
Oxygen Measurements Taken at Crib (H=28")									
19	175	20.86	16.81	16.02	20.87	288.1	24.4	1.7	0.4
20	199	20.87	16.37	15.29	20.85	287.5	24.4	1.7	0.4
21	221	20.86	15.91	15.54	20.87	282.8	23.8	1.9	0.5
Average	*198.3*	*20.86*	*16.36*	*15.62*	*20.86*	*286.11*	*24.19*	*1.76*	*0.46*
Oxygen Measurements Taken at 0.1H (15")									
22a	N/A	20.86	N/A	N/A	20.82	N/A	N/A	N/A	N/A
22b	249	20.69	15.26	16.16	20.69	284.0	23.9	1.6	0.4
23	300	20.89	14.46	15.29	20.89	284.9	23.7	1.7	0.4
24	225	20.90	15.65	14.98	20.89	283.4	23.8	1.7	0.4
Average	*274.5*	*20.81*	*14.86*	*15.73*	*20.80*	*284.45*	*23.81*	*1.65*	*0.39*
Oxygen Measurements Taken at 0.9H (130")									
25	236	20.72	15.57	15.31	20.78	284.3	23.9	1.7	0.4
26	213	20.72	16.07	15.15	20.82	285.0	23.9	1.6	0.4
Average	*224.5*	*20.72*	*15.82*	*15.23*	*20.80*	*284.68*	*23.89*	*1.64*	*0.40*

Table B3: Wood Crib Fire Extinguishment Tests – Sidewall Configuration

Test	Extinguishment Time	O_2 Concentration (%)			Avg. N_2 Flow rate	Avg. N_2 Pressure	Avg. H_2O Flow rate	Avg. H_2O Pressure
	(Seconds)	At Discharge	At Ext.	End of Soak	(scfm)	(psi)	(gpm)	(psi)
Oxygen Measurements Taken at Crib at 28"								
27	235	20.93	15.71	15.49	290.2	24.3	1.7	1.4
28	215	20.88	16.20	15.51	289.6	23.9	1.8	1.8
29	217	20.93	16.24	15.59	288.3	23.8	1.9	1.4
Average	*222.3*	*20.91*	*16.05*	*15.53*	*289.34*	*24.00*	*1.81*	*1.53*
Oxygen Measurements Taken at 0.1H (15")								
30	211	20.93	16.17	15.14	291.04	24.13	1.81	1.26
31	228	20.85	15.70	15.58	290.8	24.2	1.8	1.1
32	230	20.90	15.78	15.70	290.1	24.3	1.8	1.2
Average	*223.0*	*20.89*	*15.88*	*15.47*	*290.64*	*24.23*	*1.80*	*1.18*
Oxygen Measurements Taken at 0.9H (130")								
33	208	20.62	16.22	15.29	288.9	24.0	1.8	1.2
34	194	20.77	16.62	15.41	289.8	24.1	1.8	1.2
Average	*201.0*	*20.70*	*16.42*	*15.35*	*289.32*	*24.03*	*1.81*	*1.19*

Table B4: Heptane Fire Extinguishment Tests – Pendant Configuration

	Extinguishment Time	O_2 Concentration (%)		Weight of Gas	Avg. N_2 Flow rate	Avg. N_2 Pressure	Avg. H_2O Flow rate	Avg. H_2O Pressure
	(s)	At Discharge	At Ext.	(kg)	(scfm)	(psi)	(gpm)	(psi)
Oxygen Measurements Taken at Pan Height at 28"								
12	132.0	20.9	16.3	20.8	287.9	24.4	1.6	0.5
13	129.0	21.0	16.4	20.3	287.1	24.5	1.7	0.5
14	115.0	20.8	16.9	17.4	276.8	23.6	1.7	0.5
Average	*125.3*	*20.9*	*16.5*	*19.5*	*283.9*	*24.1*	*1.7*	*0.5*
Oxygen Measurements Taken at 0.1H (15")								
15	128.0	20.8	16.9	20.1	287.3	24.4	1.7	0.5
16	117.0	20.9	17.0	18.5	288.2	24.3	1.7	0.5
17	90.0	20.9	18.0	14.1	286.9	24.5	1.7	0.4
Average	*111.7*	*20.8*	*17.3*	*17.6*	*287.5*	*24.4*	*1.7*	*0.5*
Oxygen Measurements Taken at 0.5H (72")								
Test 18	129.0	20.88	16.7	20.3	287.6	24.3	1.7	0.4

Table B5: Heptane Fire Extinguishment Tests – Sidewall Configuration

Test	Extinguishment Time (s)	O2 Concentration (%) At Discharge	O2 Concentration (%) At Ext.	Weight of Gas (kg)	Avg. N2 Flow rate (scfm)	Avg. N2 Pressure (psi)	Avg. H2O Flow rate (gpm)	Avg. H2O Pressure (psi)
Oxygen Measurements Taken at Pan Height at 28"								
5	186.0	20.9	15.3	29.8	292.4	24.5	1.8	1.8
6	147.0	20.9	16.6	23.5	291.9	24.7	1.8	1.8
7	158.0	20.9	15.9	25.4	293.8	24.6	1.8	1.8
Average	*163.7*	*20.9*	*15.9*	*26.2*	*292.7*	*24.6*	*1.8*	*1.8*
Oxygen Measurements Taken at 0.1H (15")								
8	129.0	20.9	16.7	20.6	291.7	24.4	1.8	1.6
9	148.0	20.9	16.2	23.6	291.3	24.4	1.8	1.6
10	152.0	20.9	16.0	24.4	293.2	24.6	1.8	1.7
Average	*143.0*	*20.9*	*16.3*	*68.6*	*292.1*	*24.5*	*1.8*	*1.6*
Oxygen Measurements Taken at 0.5H (72")								
11	142.0	20.81	16.3	22.7	292.0	24.3	1.8	1.6

Table B6: Polymeric Fire Extinguishment Tests

Test#	Ext. Time No Visible Flames	Mass Loss Data			O2 Data			N2 Data		H20 Data	
		Weight 10s after Discharge	Weight 600s after Discharge	Mass Loss (grams)	O_2 @ Discharge	O_2 @ Atm	O_2 @ 10 min. after extinguishment	Avg. N2 Flow rate SCFM	Avg. N2 Pressure (psi)	Avg. H2O Flow rate (gpm)	Avg. H2O Pressure (psi)
Polypropylene Pendent											
38	221	13022.4	13018.9	3.5	20.78	20.83	16.36	289.75	24.38	1.59	0.44
39	209	13004.7	13003.9	0.8	20.55	20.56	16.40	290.09	24.19	1.62	0.41
40	256	12995.2	12988.1	7.1	20.88	20.87	15.82	290.66	24.23	1.63	0.42
Average	*229*	*13007.4*	*13003.6*	*3.8*	*20.74*	*20.75*	*16.19*	*290.17*	*24.26*	*1.61*	*0.42*
Polypropylene Sidewall											
35	292	13026.4	N/A	#VALUE!	20.79	20.85	15.21	292.36	24.04	1.88	1.10
36	282	13031.3	N/A	#VALUE!	20.90	20.91	15.32	296.46	24.41	1.86	1.12
37	283	13033.8	N/A	#VALUE!	20.83	20.81	15.21	296.35	24.44	1.88	1.26
Average	*286*	*13030.5*	*#DIV/0!*	*#VALUE!*	*20.84*	*20.86*	*15.25*	*295.06*	*24.30*	*1.87*	*1.16*
PMMA Pendent											
41b	458	13274.2	13233.1	41.1	20.92	20.90	12.90	288.97	23.66	1.59	0.38
42	424	13178.3	13167.7	10.6	20.88	20.89	13.17	291.65	24.10	1.61	0.32
43	461	13155.5	13144.9	10.6	20.88	20.87	12.76	259.97	21.27	1.50	0.34
Average	*448*	*13202.7*	*13181.9*	*20.8*	*20.89*	*20.89*	*12.94*	*280.19*	*23.01*	*1.57*	*0.35*
PMMA Sidewall											
44	470	13095.2	13065.1	30.1	20.79	20.76	12.53	292.92	23.68	1.78	1.00
45	457	13075.3	13011	64.3	20.89	20.85	13.39	291.02	23.54	1.91	1.74
46b	496	13073.8	13057.2	16.6	20.88	20.84	12.70	289.80	23.64	1.92	1.65
Average	*474*	*13081.4*	*13044.4*	*37.0*	*20.85*	*20.82*	*12.87*	*291.25*	*23.62*	*1.87*	*1.46*
ABS Pendent											
50	331	13104.4	13101.6	2.8	20.87	20.90	14.31	285.75	24.27	1.69	0.41
51	389	12627.8	12619.5	8.3	20.90	20.90	13.48	288.01	24.18	1.61	0.40
52	331	13061.9	13049.3	12.6	20.96	20.91	14.38	286.61	23.94	1.64	0.40
Average	*350*	*12931.4*	*12923.5*	*7.9*	*20.91*	*20.90*	*14.06*	*286.79*	*24.13*	*1.65*	*0.40*
ABS Sidewall											
47	381	13268.5	13264.1	4.4	20.73	20.73	13.94	292.91	24.16	1.81	1.37
48	387	13153.3	13149.6	3.7	20.88	20.87	14.11	292.72	24.07	1.80	1.30
49	361	13299.9	13277.1	22.8	20.86	20.86	13.72	291.08	23.92	1.72	0.94
Average	*376*	*13240.6*	*13230.3*	*10.3*	*20.82*	*20.82*	*13.92*	*292.23*	*24.05*	*1.78*	*1.20*