

Technical Bulletin

S-4016 P3 (HEPA) Particle Filters & S-4017 A2P3 R SL (Organic Vapor) Cartridges

The Sentinel XE PAPR system with its unique clear hoods is available with multiple filters and cartridges to support a broad range of pharmaceutical operations. The Sentinel XE coupled with its full hoods delivers TH3 level protection (maximum 0.2% inward leakage) making it perfect for use in a number of pharmaceutical unit operations including blending, milling, powder addition, sampling, tablet coating, high shear granulation, API blending, weigh and dispensing and others.



S-4016 P3 (HEPA) PARTICLE FILTER

Used to support operations where API powders are being processed and there is no gas/vapor threat.

S-4017 A2P3 R SL (ORGANIC VAPOR) CARTRIDGE

Provides a broad range of protection against organic vapors and acid gases while incorporating HEPA protection. Required NIOSH chemical data is shown as well as supplemental testing performed on a number of solvents over a range of concentrations between the OEL and the IDLH.

In addition, specific testing for a mixture of solvents including peracetic acid, hydrogen peroxide, and acetic acid (Spor-Klenz® cleaner) is provided.

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The Sentinel XE accommodates 2 particulate filters (S-4016), classified as P3 cartridges (performance data below).

S-4016

Filter Sample	Pre-test Condition	Filter Flow (l/min)	Max Penetration (%)	Measured Penetration (%)
M	MS/TC	107	0.2	0.000123
N	MS/TC	107	0.2	0.000118
O	MS/TC	107	0.2	0.000186

S-4016

Filter Sample	Pre-test Condition	Filter Flow (l/min)	Max Penetration (%)	Measured Penetration (%)
P	MS/TC	107	0.2	0.0000
Q	MS/TC	107	0.2	0.0005
R	MS/TC	107	0.2	0.0000

The S-4017 Cartridge also provides P3 particulate filtration performance and their test data is provided.

S-4017

Filter Sample	Pre-Test Condition	Filter Flow (l/min)	Max Penetration (%)	Measured Penetration (%)
1	TC MS	66	0.2	.00050
2	TC MS	66	0.2	.00006
3	TC MS	66	0.2	.00001

S-4017

Filter Sample	Pre-Test Condition	Filter Flow (l/min)	Max Penetration (%)	Measured Penetration (%)
4	TC MS	66	0.2	.0000
5	TC MS	66	0.2	.0000
6	TC MS	66	0.2	.0000

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S-4017 GAS CAPACITY OF FILTERS AT A CONTINUOUS FLOW RATE OF 66 I/MIN.

Filter	Condition	Test Gas	Type	Breakthrough Time (min)	
				Minimum	Actual
1	MS	Cyclohexane	A2	70	>70
2	MS	Cyclohexane	A2	70	>70
3	TC MS	Cyclohexane	A2	70	>70
4	TC MS	Cyclohexane	A2	70	>70

S-4017 CHEMICAL CARTRIDGE TESTING (SUPPLEMENTAL NIOSH DATA)

Chemical	CAS #	Chemical Class	Chemical Formula	IDLH (ppm)	Equilibration Prior to Test	Challenge Concentration	Test Conditions, RH (%)	NIOSH Required Service Time (min)	Actual Service Time
Carbon Tetrachloride	56-23-5	Solvents / Chlorinated Aliphatic	CCl ₄	200	A/R	1000	50	25	157
				200	25% RH	1000	50	12.5	161
				200	85% RH	1000	50	12.5	20.1
Chlorine Dioxide	10049-04-4	Acid Gas / Oxidizer	ClO ₂	5	A/R	500	50	30	95
				5	25% RH	500	50	30	97
				5	85% RH	500	50	30	87
Chlorine	7782-50-5	Acid Gas / Oxidizer	Cl ₂	10	A/R	500	50	17.5	>60
				10	25% RH	500	50	8.75	>60
				10	85% RH	500	50	8.75	>60
Hydrogen Chloride	7647-01-0	Acid Gas / Inorganic	HCL	50	A/R	500	50	25	>75
				50	25% RH	500	50	25	>75
				50	85% RH	500	50	25	>75
Hydrogen Fluoride	7664-39-3	Acid Gas / Oxidizer	HF	30	A/R	70	50	30	>60
				30	25% RH	70	50	30	>60
				30	85% RH	70	50	30	>60
Sulfur Dioxide	7446-09-5	Corrosive Gas / Inorganic	SO ₂	100	A/R	500	50	15	27.6
				100	25% RH	500	50	7.5	27.1
				100	85% RH	500	50	7.5	62.6

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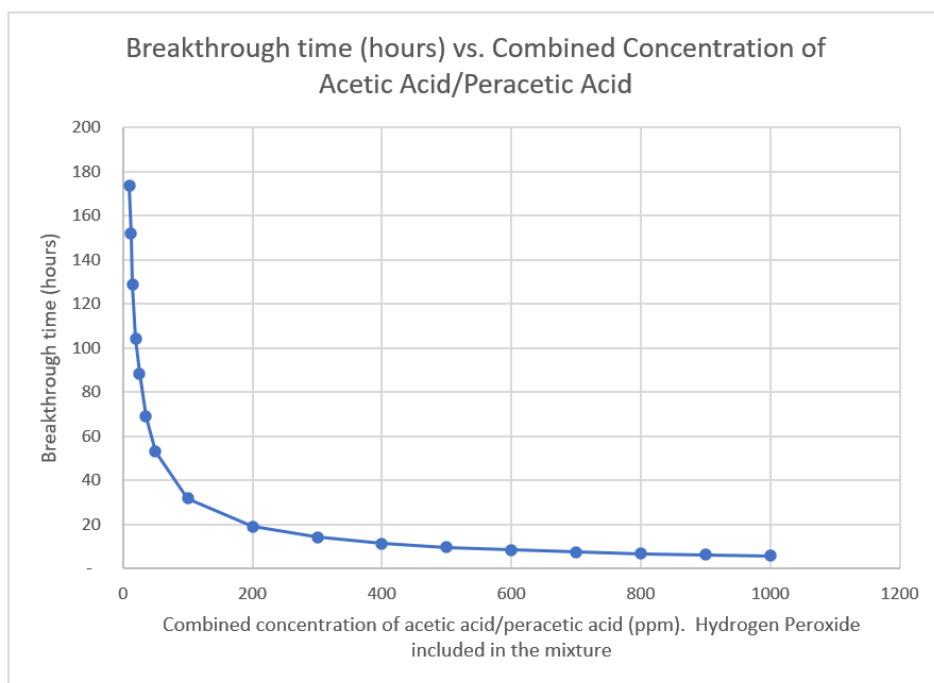
S-4017 SUPPLEMENTAL TESTING - SPORICIDAL DISINFECTANTS

Cartridges were tested against a mixture of 210 ppm acetic acid, 130 ppm hydrogen peroxide and 80 ppm peracetic acid at a flow rate of 57 lpm and 50% relative humidity. Service life was at least 19 hours with acetic acid breaking through first. Because the respirator uses 3 cartridges, this flow rate is appropriate for a loose fitting PAPR hood in which the minimum flow rate is 170 lpm.

Chemical	Acetic Acid (ppm)	Peracetic Acid (ppm)	Hydrogen Peroxide (ppm)	Flow Rate (lpm)	RH (%)	Break Concentration (ppm)	Time (min)
Peracetic Acid Mixture	210	80	130	57	50	5	1149
						5	1207
						5	1154

Additional testing against sporicidal disinfectants (e.g. SporKlenz®) was performed over a range of acetic acid/peracetic acid concentrations shown in green below. Breakthrough times in hours/days of continuous use are provided.

Combined Concentration (ppm)*	Hours	Days
7	226	28.2
10	174	21.7
12	152	19.0
15	129	16.1
20	104	13.0
25	88	11.1
35	69	8.6
50	53	6.6
100	32	4.0
200	19	2.4
300	14	1.8
400	11	1.4
500	10	1.2
600	9	1.1
700	8	1.0
800	7	0.9
900	6	0.8
1000	6	0.7



Notes: *Combined concentration of acetic acid/peracetic acid. 6:1 ratio by volume. Acetic acid always breaks through first.

AJE report actual test concentrations - 6/23/2023, 8/29/2023

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S-4017 CHEMICAL CARTRIDGE SUPPLEMENTAL DATA

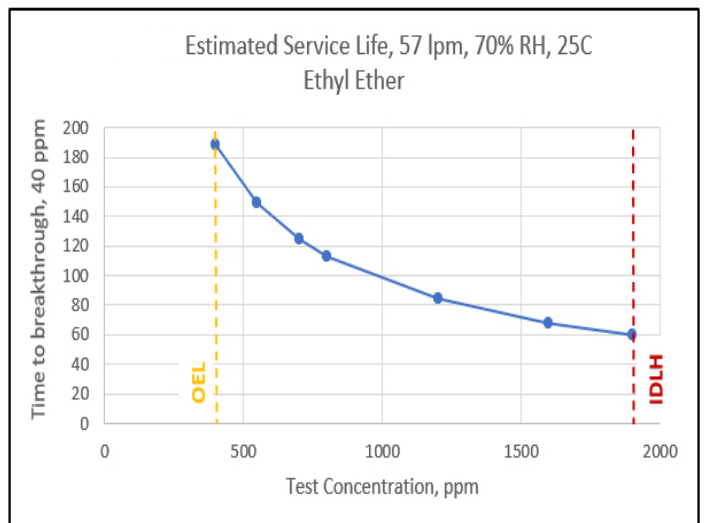
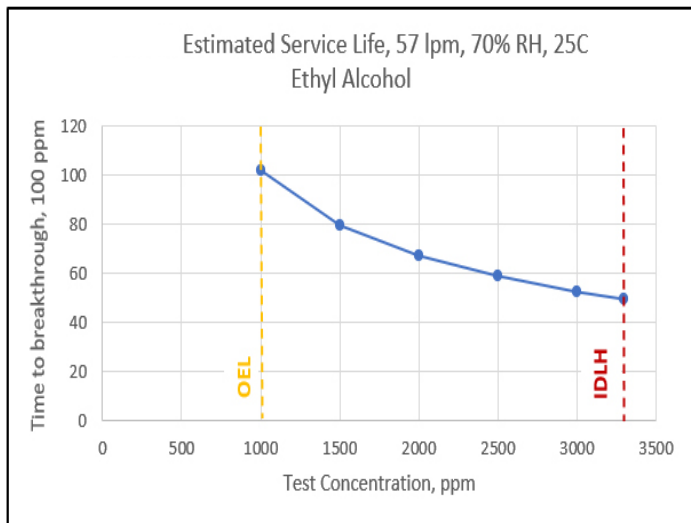
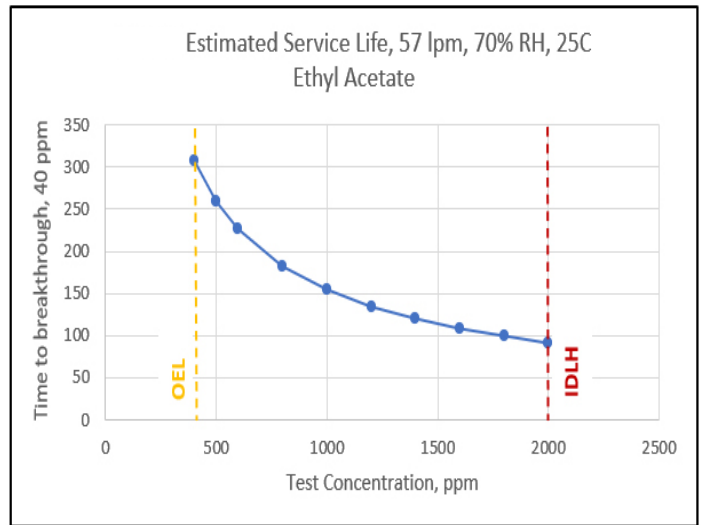
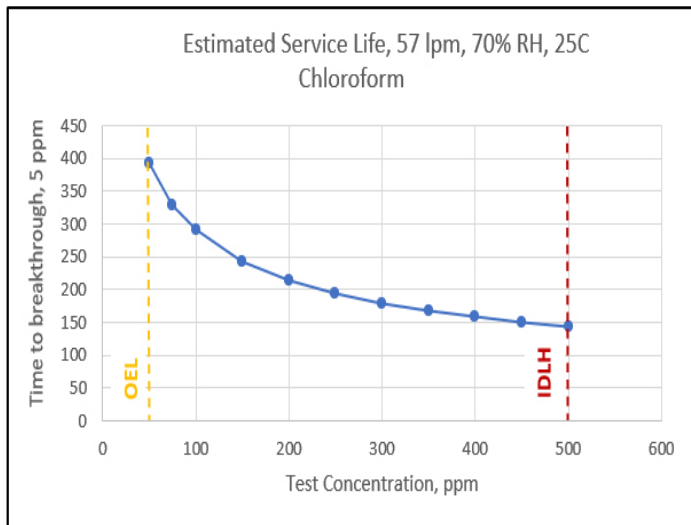
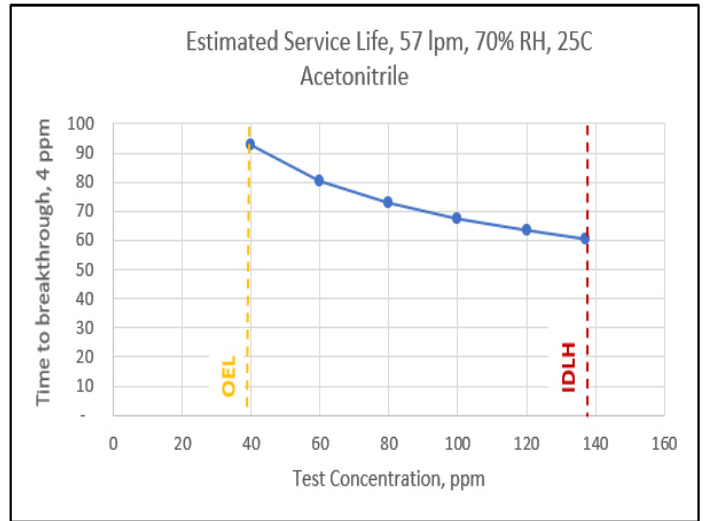
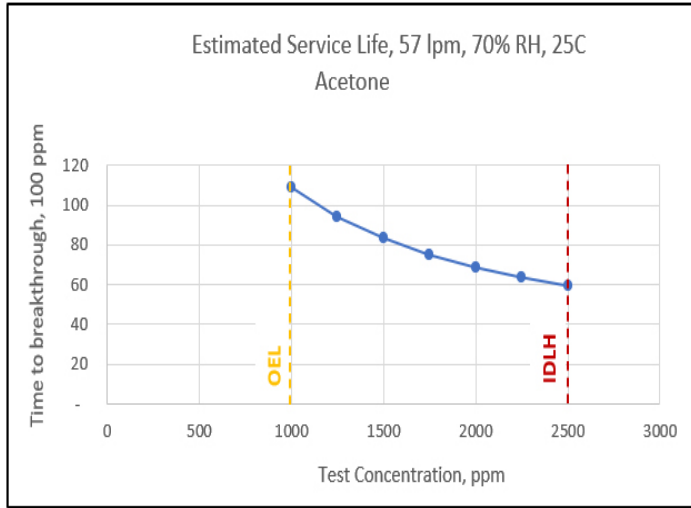
Chemical	CAS #	Chemical Class	Chemical Formula	OEL (ppm)	IDLH (ppm)	Challenge Concentration (ppm)	BT Concentration (ppm)	Test Conditions, RH (%)	Actual Service Time (min)
Acetone	67-64-1	Solvents / Ketones	$(\text{CH}_3)_2\text{CO}$	1000	2500	1000	100	70	109
						1580	100	70	80
						2500	100	70	59
Acetonitrile	75-05-8	Nitrogen Compounds / Nitriles	CH_3CN	40	137	40	4	70	93
						74	4	70	75
						137	4	70	60
Chloroform	67-66-3	Solvents / Chlorinated Aliphatics	CHCl_3	50*	500	50	5	70	393
						158	5	70	238
						500	5	70	144
Ethyl acetate	141-78-6	Solvents / Esters	$\text{CH}_3\text{COOC}_2\text{H}_5$	400	2000	400	40	70	308
						894	40	70	168
						2000	40	70	92
Ethyl alcohol	64-17-5	Solvents / Alcohols	$\text{CH}_3\text{CH}_2\text{OH}$	1000	3300	1000	100	70	102
						1825	100	70	71
						3300	100	70	50
Ethyl ether	60-29-7	Solvents / Ethers	$\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$	400	1900	400	40	70	189
						872	40	70	106
						1900	40	70	60
Isopropyl alcohol	67-63-0	Solvents / Alcohols	$(\text{CH}_3)_2\text{CHOH}$	400	2000	400	40	<10	336
						894	40	<10	184
						2000	40	<10	100
Methyl alcohol	67-56-1	Solvents / Alcohols	CH_3OH	200	6000	200	20	70	15
						1095	20	70	8
						6000	20	70	4
Methyl ethyl ketone	78-93-3	Solvents / ketones	$\text{C}_4\text{H}_8\text{O}$	200	3000	200	20	70	530
						775	20	70	197
						3000	20	70	73
Methyl isobutyl ketone	108-10-1	Solvents / ketones	$\text{CH}_3\text{COCH}_2\text{CH}(\text{CH}_3)_2$	100	500	100	10	70	1379
						224	10	70	630
						500	10	70	289
Methylene chloride	75-09-2	Solvents / Chlorinated Aliphatics	CH_2Cl_2	25	2300	25	2.5	70	132.2
						240	2.5	70	56
						2300	2.5	70	24
Tetrahydrofuran	109-99-9	Solvents / Ethers	$\text{C}_4\text{H}_8\text{O}$	200	2000	200	20	70	338
						632	20	70	164
						2000	20	70	80

* The OSHA PEL for chloroform is a ceiling limit, not an 8 hour TWA

The following pages provide the test data for each chemical in the table above in graphical form, with an equation relating the test concentration to the breakthrough time.

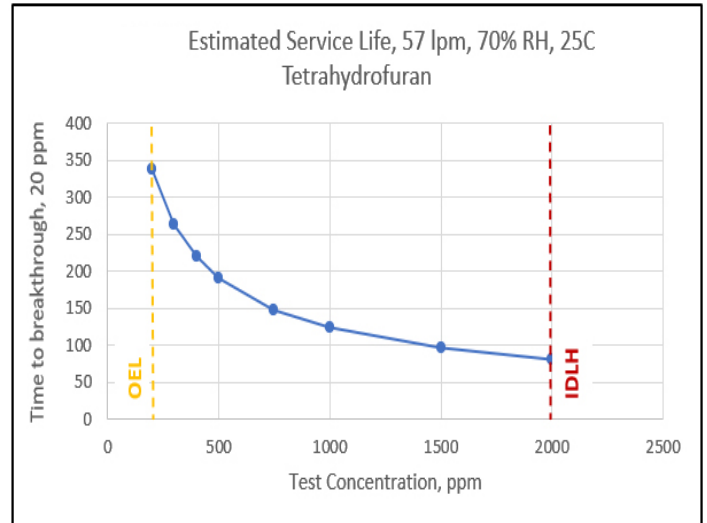
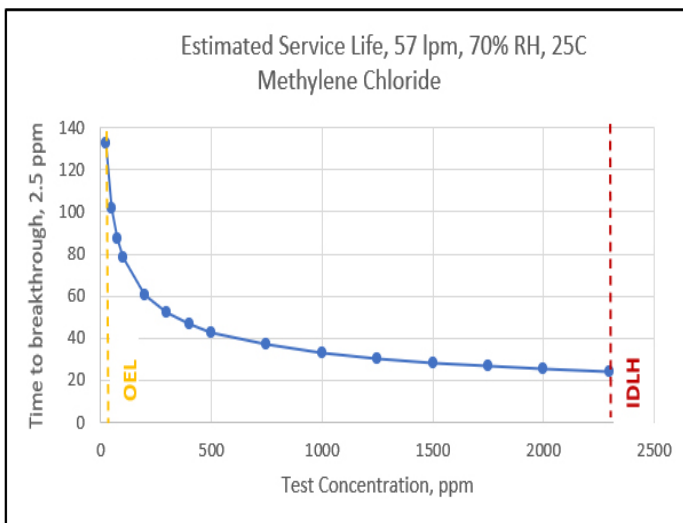
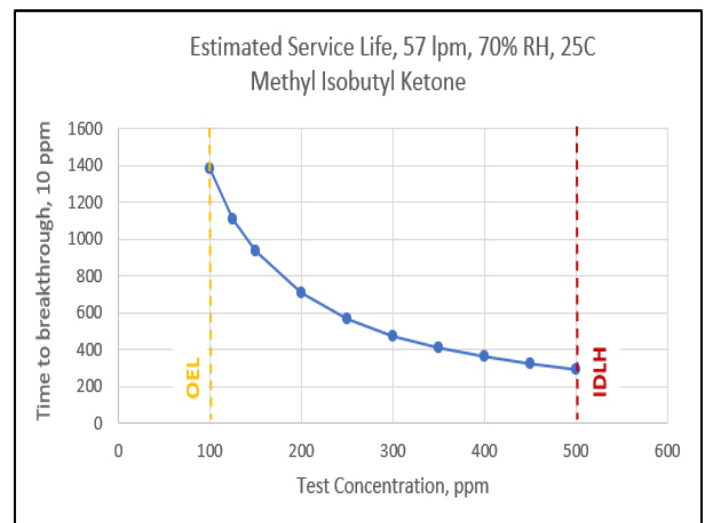
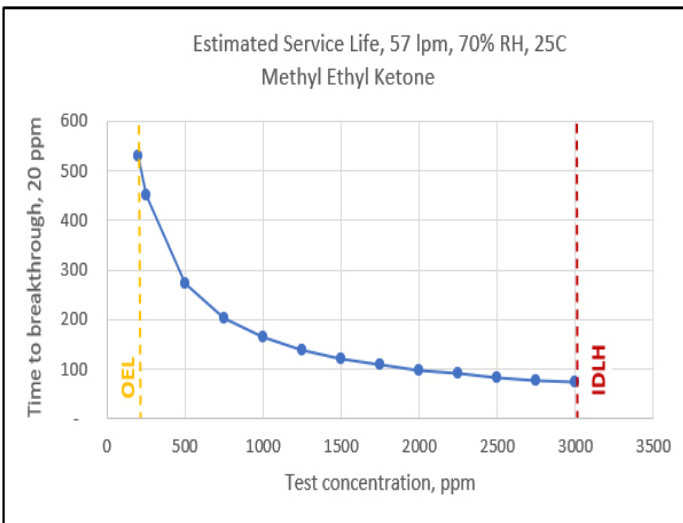
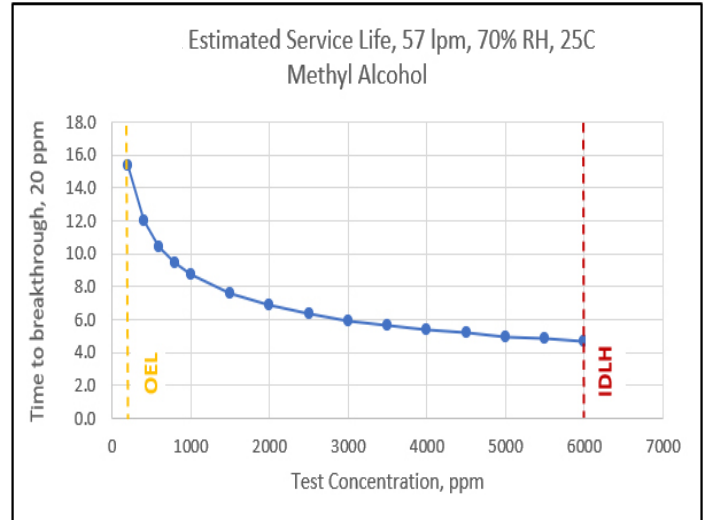
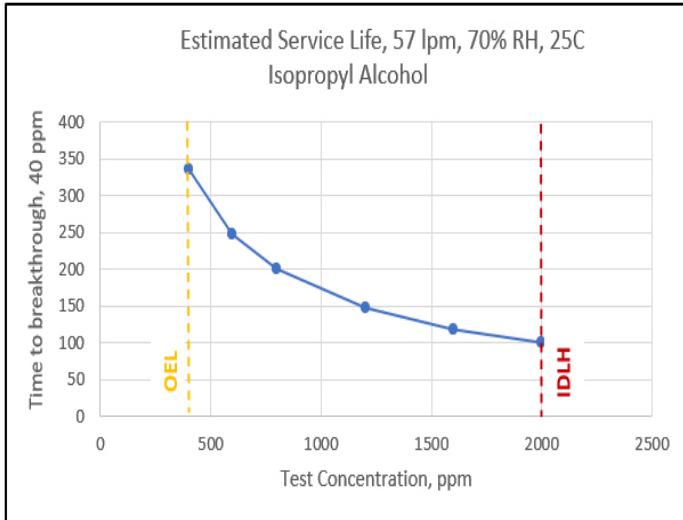
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DATA FOR S-4017 CARTRIDGES



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CAUTION

Please note the chemical breakthrough information is for the specific conditions identified and testing was performed in a laboratory. Results will vary based on the actual usage conditions.

WARNING

Respirators help reduce exposure to specific airborne contaminants. Before use, the wearer must read and understand the User Instructions provided as a part of the product packaging. Misuse could result in sickness or death.



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