



Theatrical Smoke, Fog and Haze Testing: Calibration Factors

Ramboll (formerly ENVIRON) collected the original exposure measurements on which the guidance levels for theatrical smoke and haze testing are based, and developed the air sampling protocol recommended by the Actors' Equity Association. As such, we are uniquely qualified to provide testing services and documentation that would be responsive to any inquiries made by Equity or your cast.



Ramboll has developed a protocol for using a Thermo Scientific PDR-1000AN aerosol monitor to measure concentrations of theatrical smoke, fog and haze. The monitor measures the light scattering produced by particles in the air and reports the results in terms of mass concentration (milligrams per cubic meter, or mg/m³) with the assumption that the particles in the air are a fine dust. Because different types of particles have different light scattering properties, the readings from the monitor need to be adjusted (or calibrated) when measuring something other than dust (such as fog droplets). The user converts the dust readings to the correct mg/m³ readings for the fog droplets by multiplying the dust readings by a *calibration factor* for the particular fog fluid/fog machine combination being used for the fog, smoke or haze effect. Calibration factors for certain machine-fluid combinations have also been developed for the Particulate Matter (PM) Sensor SPS30 manufactured by Sensirion.

The following calibration factors have been developed and approved by Actors' Equity Association and the Broadway League for use in measuring theatrical smoke, fog and haze:

Approved Calibration Factors for Monitoring Theatrical Smoke, Fog, and Haze (PDR-1000) (Updated April 2024)						
Manufacturer	Machine		Fluid	Fluid Type	Calibration Factor	Reference
Advanced Entertainment Systems (AES) / MT-Electronic	Vario 6	Humidity 100% Fog: 25%	Cryo Fog Fluid	Glycol	0.86	(49)
		Humidity 100% Fog: 50%			1.40	(49)
	Vario 8	Humidity 100% Fog: 25%	Cryo Fog Fluid	Glycol	0.66	(49)
		Humidity 100% Fog: 50%			0.70	(49)
American DJ (ADJ)	Fog Fury 3000		Froggy's Fog Backwood Bay	Glycol	0.39	(35)
			Froggy's Fog Bog Fog	Glycol	1.62	(35)
			Froggy's Fog Cryo Freeze	Glycol	0.64	(35)
			Froggy's Fog Quick Blast	Glycol	0.64	(35)
			Froggy's Fog Velocity	Glycol	0.64	(35)
	Fog Storm 1700 HD		Froggy's Fog Cryo Freeze	Glycol	2.67	(35)
			Froggy's Fog Quick Blast	Glycol	2.67	(35)
Froggy's Fog Velocity			Glycol	2.67	(35)	
Antari	1520 RGB Upshot		Froggy's Fog Quick Blast	Glycol	1.28	(35)

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Manufacturer	Machine	Fluid	Fluid Type	Calibration Factor	Reference	
Antari	CH-1 Cinema Hazer	Antari CHL-2 Fluid	Mineral Oil	0.30	(66)	
	DNG-200 Low Fog	Antari FLC Fog Fluid	Glycol	3.40	(45)	
		Froggy's Fog Cryo Freeze	Glycol	4.99	(35)	
	DNG-250 Low Fogger	Antari FLL Low Fog Fluid	Glycol	3.89	(66)	
	F-1 Fazer	Antari FLG Fog Fluid	Glycol	0.68	(45)	
	F-4 Fazer	Antari FLG Fog Fluid	Glycol	1.06	(45)	
	F-5/F-5D Fazer	Froggy's Fog Faze Haze	Glycol	0.69	(35)	
	F-7 Smaze	Antari FLG Fog Fluid	Glycol	0.97	(45)	
	ICE	Froggy's Fog Cryo Freeze	Glycol	2.54	(35)	
	M-5	Froggy's Fog Amusement Park Fluid	Froggy's Fog Backwood Bay	Glycol	1.41	(35)
			Froggy's Fog Bog Fog	Glycol	1.03	(35)
			Froggy's Fog Cryo Freeze	Glycol	1.74	(35)
			Froggy's Fog Quick Blast	Glycol	1.74	(35)
			Froggy's Fog Velocity	Glycol	1.74	(35)
			Antari FLG Fog Fluid	Glycol	2.17	(45)
	M-8	Froggy's Fog Amusement Park Fluid	Froggy's Fog Backwood Bay	Glycol	1.35	(35)
			Froggy's Fog Bog Fog	Glycol	1.29	(35)
			Froggy's Fog Cryo Freeze	Glycol	2.65	(35)
			Froggy's Fog Quick Blast	Glycol	2.65	(35)
			Froggy's Fog Velocity	Glycol	2.65	(35)
			Antari FLG Fog Fluid	Glycol	2.17	(45)
	M-10	Froggy's Fog Bog Fog	Froggy's Fog Cryo Freeze	Glycol	2.46	(35)
			Froggy's Fog Quick Blast	Glycol	2.46	(35)
			Froggy's Fog Velocity	Glycol	2.46	(35)
			Antari FLG Fog Fluid	Glycol	1.12	(45)
	W-515D	Antari FLG Fog Fluid	Glycol	1.12	(45)	
	W-715x Fog Jet	Antari FLC Fog Fluid	Glycol	1.58	(44,45)	
	X-515	Froggy's Fog Amusement Park Fluid	Froggy's Fog Backwood Bay	Glycol	1.07	(35)
Froggy's Fog Bog Fog			Glycol	1.43	(35)	
Froggy's Fog Cryo Freeze			Glycol	1.74	(35)	
Froggy's Fog Quick Blast			Glycol	1.74	(35)	
Froggy's Fog Velocity			Glycol	1.74	(35)	
Froggy's Fog Beam Splitter			Glycol	1.90	(35)	
Z-350	Froggy's Fog Beam Splitter	Glycol	1.90	(35)		
Z-380 Fazer	Antari FLG Fog Fluid	Glycol	0.49	(45)		
Aspire	K4 Vape Pen**	Damokee E-Liquid Daily Dose Fluid	Glycol	0.10	(48,72)	
		American Patriots by Naked 100 E-Liquid	Glycol	0.02	(69,72)	
Blue Haze Entertainment (BHE)	1550	Froggy's Fog Amusement Park Fluid	Glycol	1.07	(35)	
		Froggy's Fog Backwood Bay	Glycol	1.07	(35)	
		Froggy's Fog Bog Fog	Glycol	1.43	(35)	
		Froggy's Fog Cryo Freeze	Glycol	1.74	(35)	
		Froggy's Fog Quick Blast	Glycol	1.74	(35)	
		Froggy's Fog Velocity	Glycol	1.74	(35)	
Chauvet	AmHaze ECO	Premium Haze Fluid	Glycol	0.17	(53)	
	AmHaze II	Froggy's Fog Faze Haze	Glycol	0.83	(35)	
	Amhaze Stadium	Grignard Pure	Glycol	0.16	(60)	
		Premium Haze Fluid	Glycol	0.33	(57)	
	Cloud 9	LLG Fog Fluid	Glycol & Glycerol	0.47	(57)	
	Geyser	Froggy's Fog Quick Blast	Glycol	1.62	(35)	
	Hurricane 1800 Flex	Froggy's Fog Amusement Park Fluid	Glycol	1.00	(35)	
		Froggy's Fog Backwood Bay	Glycol	1.00	(35)	

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Manufacturer	Machine		Fluid	Fluid Type	Calibration Factor	Reference
Chauvet	Hurricane 1800 Flex		Froggy's Fog Beam Splitter	Glycol	2.94	(35)
			Froggy's Fog Bog Fog	Glycol	1.07	(35)
			Froggy's Fog Cryo Freeze	Glycol	0.76	(35)
			Froggy's Fog Quick Blast	Glycol	0.76	(35)
			Froggy's Fog Techno	Glycol	2.94	(35)
			Froggy's Fog Velocity	Glycol	0.76	(35)
	Hurricane Haze 1XD	Grignard Pure	Glycol	0.21	(60)	
	Vesuvio II		Ultratec Quick Dissipating Fluid	Glycol	1.2	(65)
CITC	AquaMax		Organic Haze Fluid	Glycerol	1.36	(33)
	Fantasy FX spray can		Fantasy FX Professional Haze	Mineral Oil	0.87	(20)
	Fog Max		Natural Fogging Fluid	Glycol	0.66	(4)
	HazeMax		Water Vapor Haze Fluid	Glycerol	1.87	(33)
	Starhazer		High Performance Fluid	Mineral Oil	0.87	(4)
Elation	Magma Prime		AEF Fog Fluid	Glycol	0.43	(58)
ePuffer	D-1500/Robusto Electronic Cigar**		e-Liquid	Glycol	1.04	(30,42,72)
	Snaps Rev4 E-Cigarette**		e-Liquid	Glycol	0.054	(63,72)
FireBase	SG-1300		Froggy's Fog Training Smoke FR-Fire Rescue Formula	Glycol	0.58	(35)
			Froggy's Fog Training Smoke Q-Quick Dissipating	Glycol	1.69	(35)
			Froggy's Fog Training Smoke XD-Extreme Density	Glycol	0.86	(35)
	SG-2600		Froggy's Fog Training Smoke FR-Fire Rescue Formula	Glycol	0.99	(35)
			Froggy's Fog Training Smoke XD-Extreme Density	Glycol	3.11	(35)
			Froggy's Fog Training Smoke FR-Fire Rescue Formula	Glycol	1.41	(35)
	SG-M1500		Froggy's Fog Training Smoke Q-Quick Dissipating	Glycol	1.74	(35)
			Froggy's Fog Training Smoke XD-Extreme Density	Glycol	1.03	(35)
			Froggy's Fog Training Smoke FR-Fire Rescue Formula	Glycol	1.35	(35)
	SG-M1800		Froggy's Fog Training Smoke Q-Quick Dissipating	Glycol	2.65	(35)
			Froggy's Fog Training Smoke XD-Extreme Density	Glycol	1.29	(35)
			Froggy's Fog Training Smoke FR-Fire Rescue Formula	Glycol	1.35	(35)
	SG-M3000		Froggy's Fog Training Smoke Q-Quick Dissipating	Glycol	2.46	(35)
			Froggy's Fog Training Smoke XD-Extreme Density	Glycol	2.62	(35)
Froggy's Fog	Poseidon	Humidity: 50-100% Fan: 15-65% Fog: 50%	Froggy's Fog Aqua Fog Fluid/Long Distance Formula	Glycol	0.43	(54)
		Humidity: 50-100% Fan: 15-65% Fog: 70%	Froggy's Fog Aqua Fog Fluid/Long Distance Formula	Glycol	0.55	(54)
		Humidity: 50% Fan: 35-65% Fog: 80%	Froggy's Fog Aqua Fog Fluid/Short Distance Formula	Glycol	0.67	(54)
hazebase	Base Classic		Froggy's Fog Amusement Park Fluid	Glycol	0.58	(35)
			Froggy's Fog Backwood Bay	Glycol	0.58	(35)
			Froggy's Fog Bog Fog	Glycol	0.86	(35)
			Froggy's Fog Cryo Freeze	Glycol	1.69	(35)
			Froggy's Fog Quick Blast	Glycol	1.69	(35)
			Froggy's Fog Velocity	Glycol	1.69	(35)

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Manufacturer	Machine	Fluid	Fluid Type	Calibration Factor	Reference
hazebase	Base Classic	Ultratec Molecular Fog Fluid	Glycol	2.15	(43)
	Base Hazer Pro	Base Hazer Liquid	Glycol	0.43	(35)
		Froggy's Fog Faze Haze	Glycol	0.76	(35)
	Base Highpower 220V	Froggy's Fog Backwood Bay	Glycol	0.99	(35)
		Froggy's Fog Bog Fog	Glycol	3.11	(35)
	Cube Hazer2	Base V Fluid	Glycerol	0.0007	(67)
FAB	Base V Fluid	Glycerol	0.0006	(67)	
High End Systems (ETC)	F-100	Atmosphere HQ Fluid	Glycol	1.21	(10)
		Atmosphere Cold Flow Formula	Glycol	2.41	(1)
		Atmosphere Stage Formula	Glycol	0.25	(1)
	FQ-100	Atmosphere HQ Fluid	Glycol	1.30	(26)
		Atmosphere Stage Formula	Glycol	0.96	(26)
HQ100 Hazer	HQ100 Haze Fluid	Glycol	0.41	(56)	
Kandypens	Rube Vape Pen**	Lava Flow by Naked 100 E-Liquid	Glycol	0.02	(61,72)
Le Maitre Ltd.	G300	Molecular Fog Fluid	Glycol	0.53	(4,24,25)
		Quick Dissipating	Glycol	2.65	(4,24,25)
		Regular Haze (C-Beam) Fluid	Glycerol	0.09	(10,24,25)
		Standard Smoke Fluid	Glycol	0.30	(4,9,24,25)
	G300/LSG/Freezefog Pro or equivalent chiller	Molecular Fog Fluid	Glycol	4.95*	(7,25,28)
	G-Force, Gforce3	Molecular Fog Fluid	Glycol	0.53	(4,24,28,47)
		Quick Dissipating	Glycol	2.65	(4,24,28,47)
		Standard Smoke Fluid	Glycol	0.30	(4,9,24,25,47)
	G-Force/Gforce3/LSG/Freezefog Pro or equivalent chiller	Molecular Fog Fluid	Glycol	4.95*	(7,25,28,47)
	Mini Mist	Standard Smoke Fluid	Glycol	2.24	(10,25)
	MVS	Froggy's Fog Neutronic Haze Fluid	Glycerol	0.35	(35)
	Neutron XS	Froggy's Fog Neutronic Haze Fluid	Glycerol	0.09	(35)
		Neutron Haze Fluid	Glycerol	0.12	(2,25)
	Opti Mist Ranger	Mini Mist Canister	Glycol	3.01	(1,25)
Look Solutions	Cobra (1.8, 3.1)	Quick-Fog Fluid	Glycol	1.51	(52,74)
		Regular-Fog Fluid	Glycol	0.76	(52,74)
		Slow-Fog Fluid	Glycol	1.10	(52,74)
	Cobra (1.8, 3.1) / CryoGate	Cryo-Fog Fluid	Glycol	3.93	(52,74)
	Cobra (1.8, 3.1) / LSG	Cryo-Fog Fluid	Glycol	1.72	(51,74)
	Cryo-Fog	Cryo-Fog Fluid	Glycol	0.91	(16,21)
	Orka	Regular-Fog Fluid	Glycol	0.23	(8)
	Power Tiny	Tiny Fluid	Glycol	0.49	(15)
	Tiny Compact/Tiny C07	Tiny Fluid	Glycol	0.76	(4,21)
	Tiny Fogger/Tiny F07	Tiny Fluid	Glycol	0.76	(4,21)
	Tiny FX/Tiny CX	Tiny Fluid	Glycol	0.71	(31,37)
	Tiny S	Tiny Fluid	Glycol	0.69	(31)
	Unique/Unique2 Hazer	Unique Fluid	Glycol	0.30	(4,12)
	Uniques Hazer fitted with an accumulator box	Unique Fluid	Glycol	0.26	(46)
	Viper (NT, S, 2.6)	Quick-Fog Fluid	Glycol	2.02	(17,50)
		Regular-Fog Fluid	Glycol	1.46	(4,12,50)
		Slow-Fog Fluid	Glycol	0.90	(31,50)
Viper / LSG MKII or equivalent chiller	Quick-Fog Fluid	Glycol	0.89	(32,50)	
Martin Professional	Jem Compact Hazer Pro	JEM C-Plus Haze Fluid	Glycol	0.70	(38,55)
	Jem Glaciator	JEM Low-Fog Fluid	Glycol	3.41	(4,55)

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Manufacturer	Machine	Fluid	Fluid Type	Calibration Factor	Reference
Martin Professional	Jem Glaciator Dynamic	JEM Low-Fog Fluid, High Density	Glycol	1.80	(71)
	Jem Glaciator X-Stream	JEM Low-Fog Fluid, High Density	Glycol	3.23	(23,55)
	Jem Hazer Pro	JEM C-Plus Fluid	Glycol	0.88	(38,55)
	Jem Ready 365	JEM R365 Haze Fluid	Glycol & Glycerol	0.24	(38)
	Jem Roadie	JEM Pro-Fog Fluid	Glycol	0.62	(27,55)
	Jem ZR12-DMX	JEM Pro-Fog Fluid	Glycol	1.12	(4,55)
	Jem ZR24/7 Hazer	RUSH & THRILL Haze Fluid	Glycol	0.76	(5,41,55)
	Jem ZR33 Hi-Mass	Froggy's Fog Cryo Freeze	Glycol	2.20	(35)
	Jem ZR33 Hi-Mass	Froggy's Fog Quick Blast	Glycol	2.20	(35)
		Froggy's Fog Velocity	Glycol	2.20	(35)
		JEM Pro-Fog Fluid	Glycol	0.79	(23,55)
		JEM Pro-Fog Fluid, Extra Quick Dissipating	Glycol	2.31	(23,55)
	Jem ZR44	Froggy's Fog Backwood Bay	Glycol	0.77	(35)
		Froggy's Fog Bog Fog	Glycol	1.40	(35)
		Froggy's Fog Cryo Freeze	Glycol	0.95	(35)
		Froggy's Fog Quick Blast	Glycol	0.95	(35)
		Froggy's Fog Velocity	Glycol	0.95	(35)
	K-1	Froggy's Fog K-razy Haze	Glycol	0.49	(35)
	Magnum 2000	Froggy's Fog Backwood Bay	Glycol	0.93	(35)
		Froggy's Fog Bog Fog	Glycol	1.21	(35)
Froggy's Fog Cryo Freeze		Glycol	1.01	(35)	
Froggy's Fog Quick Blast		Glycol	1.01	(35)	
Froggy's Fog Velocity		Glycol	1.01	(35)	
Magnum 2500Hz	RUSH & THRILL Haze Fluid	Glycol	0.28	(23,41,55)	
MDG Fog Generators	Mini-Max	MDG Dense Fluid	Glycol	3.21	(1)
	ATMe	MDG Neutral Fluid	Mineral Oil	0.78	(70)
	Atmosphere APS	MDG Neutral Fluid	Mineral Oil	0.78	(1)
	MAX 3000 APS	MDG Neutral Fluid	Mineral Oil	0.78	(1)
	MDG MAX 3000 APS through accumulator box	MDG Neutral Fluid	Mineral Oil	0.27	(6)
New Rule FX	Electronic Actor Cigarette Prop**	Cartridge Fluid	Glycol	0.44	(36,72)
Practical Magic & Innovation Co., Ltd.	SmokeGENIE	Cloud Liquid	Glycol & Glycerol	0.089	(62)
	SmokeNINJA	Cloud Liquid	Glycol & Glycerol	0.069	(73)
Pure Smoke	Electronic Cigarette**	Electronic Cigarette Flavors	Glycol	0.33	(29,72)
Reel EFX, Inc.	DF-50	Diffusion Fluid	Mineral Oil	0.78	(1)
		Froggy's Fog DaFiddy Oil-Based Haze	Mineral Oil	0.40	(35)
		Master Fog DEE-EFF-50	Mineral Oil	0.37	(40)
Robe	Fog 1550 FT	Froggy's Fog Amusement Park Fluid	Glycol	1.07	(35)
		Froggy's Fog Backwood Bay	Glycol	1.07	(35)
		Froggy's Fog Bog Fog	Glycol	1.43	(35)
		Froggy's Fog Cryo Freeze	Glycol	1.74	(35)
		Froggy's Fog Quick Blast	Glycol	1.74	(35)
Rosco Laboratories	1500 / 1600	Rosco Clear Fog Fluid	Glycol	1.82	(1)
		Rosco Fog Fluid	Glycol	1.27	(1)
		Rosco Light Fog Fluid	Glycol	1.38	(1)
		Rosco Stage & Studio Fluid	Glycol	1.56	(1)
	1750	Rosco Fog Fluid	Glycol	0.58	(19)
		Rosco Stage & Studio Fluid	Glycol	0.67	(19)
	Alpha 900	Rosco Clear Fog Fluid	Glycol	1.82	(1)
		Rosco Fog Fluid	Glycol	1.27	(1)

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		Rosco Light Fog Fluid	Glycol	1.38	(1)
Rosco Laboratories	Alpha 900	Rosco Stage & Studio Fluid	Glycol	1.56	(1)
	Delta 3000	Rosco Clear Fog Fluid	Glycol	1.43	(4)
		Rosco Fog Fluid	Glycol	1.00	(4)
		Rosco Light Fog Fluid	Glycol	1.35	(4)
		Rosco Stage & Studio Fluid	Glycol	1.97	(4)
		Rosco Delta Hazer Fluid	Glycol	0.71	(18)
	Mini-V	Rosco Fog Fluid	Glycol	0.55	(34)
		Rosco Stage & Studio Fluid	Glycol	0.85	(34)
	PF-1000	Rosco Clear Fog Fluid	Glycol	1.82	(1)
		Rosco Fog Fluid	Glycol	1.27	(1)
	PF-1000	Rosco Light Fog Fluid	Glycol	1.38	(1)
		Rosco Stage & Studio Fluid	Glycol	1.56	(1)
	V-Hazer	Rosco V-Hazer Fluid	Glycol	0.68	(34)
	Vapour	Rosco Fog Fluid	Glycol	0.44	(34)
		Rosco Stage & Studio Fluid	Glycol	0.85	(34)
Vapour Plus	Rosco Fog Fluid	Glycol	0.82	(34)	
	Rosco Stage & Studio Fluid	Glycol	0.78	(34)	
SFX Design	Fog Master FM-1	AquaFog Fluid	Glycol	0.19	(3)
Smoke Factory	Captain D	Gotham Fog Fluid	Glycol	0.57	(64)
	Tour Hazer	Gotham Haze Fluid	Glycol	0.30	(4)
	Tour Hazer II	Gotham Haze Fluid	Glycol	0.43	(64)
Smoke In Style	Electronic Pipe Prop**	FeelLife E-Liquid	Glycol & Glycerol	0.42	(39,72)
Ultratec Special Effects (fka Le Maitre Special Effects)	G100	Director's Choice	Glycol	4.17	(1,9,25)
		Extra Quick Dissipating	Glycol	3.17	(1,25)
		Quick Dissipating	Glycol	3.45	(1,25)
	G150	Director's Choice	Glycol	4.17	(1,9,25)
		Extra Quick Dissipating	Glycol	3.17	(1,25)
		Molecular Fog Fluid	Glycol	2.58	(1,25)
		Pro Beam (Long Lasting)	Glycol	1.42	(4,25)
		Quick Dissipating	Glycol	3.45	(1,25)
		Director's Choice	Glycol	0.30	(4,9,24,25)
	G3000	Molecular Fog Fluid	Glycol	0.53	(4,24,25)
		Pro Beam (Long Lasting)	Glycol	0.67	(4,24,25)
		Quick Dissipating	Glycol	2.65	(4,24,25)
		Regular Haze Fluid	Glycerol	0.09	(10,24,25)
		Froggy's Fog Amusement Park Fluid	Glycol	1.07	(25,35)
		Froggy's Fog Backwood Bay	Glycol	1.07	(25,35)
		Froggy's Fog Bog Fog	Glycol	0.88	(25,35)
		Froggy's Fog Cryo Freeze	Glycol	2.96	(25,35)
		Froggy's Fog Quick Blast	Glycol	2.96	(25,35)
		Froggy's Fog Velocity	Glycol	2.96	(25,35)
	G3000/LSG or equivalent chiller	Molecular Fog Fluid	Glycol	4.95*	(7,25)
	Handy Fogger	Director's Choice	Glycol	0.49	(59)
		Quick Dissipating	Glycol	1.60	(59)
		Pro Beam	Glycol	1.18	(59)
	Power Fog Industrial (PFI) or PFI 9D	Director's Choice	Glycol	0.99	(4,9,11,25)
		Molecular Fog Fluid	Glycol	2.77	(4,11,25)
		Pro Beam (Long Lasting)	Glycol	1.36	(4,11,25)
		Quick Dissipating	Glycol	1.37	(4,11,25)
Power Fog Industrial 9D (PFI 9D) with LSG-MKII or equivalent chiller	Extra Quick Dissipating	Glycol	1.23	(22,25)	
	Molecular Fog Fluid	Glycol	0.75	(13,25)	
	Quick Dissipating	Glycol	0.21	(22,25)	
		Froggy's Fog Neutronic Haze Fluid	Glycerol	1.06	(25,35)

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Manufacturer	Machine	Fluid	Fluid Type	Calibration Factor	Reference
	Radiance Hazer	Neutron/Luminous 7 Haze Fluid	Glycerol	0.26	(14,25)
Ultratec Special Effects	Show Fogger Pro	Director's Choice	Glycol	0.44	(4,9,25)
		Pro Beam (Long Lasting)	Glycol	0.44	(4,25)
		Quick Dissipating	Glycol	2.56	(4,25)
	Stage Fogger DMX	Director's Choice	Glycol	0.99	(4,9,25)
		Molecular Fog Fluid	Glycol	2.77	(4,25)
		Pro Beam (Long Lasting)	Glycol	1.36	(4,25)
		Quick Dissipating	Glycol	1.37	(4,25)
Vosentech	Microfogger 3 & 4 Pro	Fog Fluid	Glycol	0.10	(68)

Disclaimer: This table does not represent an endorsement of any equipment-fluid combination by Ramboll. Please note that the use of fluids in machines other than those recommended by the manufacturer is subject to the equipment manufacturer's terms and conditions.

Notes:

* Due to monitor overloading during the calibration testing for this combination, the resulting calibration factor of 4.95 is known to be overestimated. This value can be used as a conservative (i.e., health protective) screening value. If monitoring results using this calibration factor result in exposures exceeding the guidance levels, it is recommended that additional testing to refine this calibration factor be conducted.

** Testing of vape pens, e-cigarettes and related products is limited to secondhand exposure after being exhaled by the user; the initial amount inhaled directly from the product was not measured.

Approved Calibration Factors for Monitoring Theatrical Smoke, Fog, and Haze (Sensirion SPS30) (Updated November 2020)					
Manufacturer	Machine	Fluid	Fluid Type	Calibration Factor	Reference
Chauvet	Amhaze Stadium	Grignard Pure	Glycol	0.21	(60)
	Hurricane 1800 Flex	Grignard Pure	Glycol	0.40	(60)
	Hurricane Haze 1XD	Grignard Pure	Glycol	0.32	(60)

Disclaimer: This table does not represent an endorsement of any equipment-fluid combination by Ramboll. Please note that the use of fluids in machines other than those recommended by the manufacturer is subject to the equipment manufacturer's terms and conditions.

References:

1. *Equipment-Based Guidelines for the Use of Theatrical Smoke and Haze*, prepared by ENVIRON International Corporation for the Equity-League Pension and Health Trust Funds, June 8, 2001.
2. *Theatrical Haze and Fog Testing for Mamma Mia! Winter Garden Theatre*, prepared by ENVIRON International Corporation for Mamma Mia! Broadway and Nina Lannan Associates, December 12, 2001.
3. *Theatrical Smoke and Haze Testing for The Phantom of the Opera, Majestic Theatre*, prepared by ENVIRON International Corporation for Alan Wasser Associates, July 2002.
4. *Calibration Factors for Monitoring Theatrical Smoke and Haze*, prepared by ENVIRON International Corporation for Entertainment Services and Technology Association, December 11, 2002.

5. *Development of Calibration Factors for Monitoring Theatrical Smoke and Haze: Jem 24/7 Hazer with Pro-Haze Fluid*, prepared by ENVIRON International Corporation for Martin Professional, August 2003.
6. *Theatrical Smoke and Haze Testing, Wicked the Musical, Gershwin Theatre*, prepared by ENVIRON International Corporation for Stone Productions, July 2004.
7. *Theatrical Smoke Testing at Bombay Dreams*, prepared by ENVIRON International Corporation for Bombay Dreams NY L.L.C., July 30, 2004.
8. *Development of Calibration Factors for Monitoring Theatrical Smoke and Haze: Look Solutions Orka with Regular-Fog Fluid*, prepared by ENVIRON International Corporation for Look Solutions, April 1, 2005.
9. Letter from Le Maitre Special Effects to ENVIRON International Corporation regarding name change of Regular Fog Fluid to Director's Choice, December 5, 2005.
10. *Theatrical Smoke and Haze Testing for The Phantom of the Opera, Forrest Theatre*, prepared by ENVIRON International Corporation for Alan Wasser Associates, January 2003.
11. Letter from Le Maitre Special Effects to ENVIRON International Corporation regarding Stage Fogger DMX, Power Fog Industrial, and Power Fog Industrial 9D, April 12, 2006.
12. Letter from Look Solutions to ENVIRON International Corporation regarding Viper Fluid, Unique2 Hazer, and Viper II/NT, May 5, 2006.
13. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Le Maitre LSG-MKII with Power Fog Industrial 9D (PFI9D) Low Smoke Generator*, prepared by ENVIRON International Corporation for Le Maitre Special Effects, August 2006.
14. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Le Maitre Radiace Hazer*, prepared by ENVIRON International Corporation for Le Maitre Special Effects, August 2006.
15. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Look Solutions Power Tiny*, prepared by ENVIRON International Corporation for Look Solutions, August 2006.
16. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Look Solutions Low-Fogger*, prepared by ENVIRON International Corporation for Look Solutions, August 2006.
17. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Look Solutions Viper NT*, prepared by ENVIRON International Corporation for Look Solutions, August 2006.
18. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Rosco Delta Hazer*, prepared by ENVIRON International Corporation for Rosco Laboratories, August 2006.
19. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Rosco Model 1750*, prepared by ENVIRON International Corporation for Rosco Laboratories, August 2006.
20. *Development of Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Fantasy FX Professional Haze*, prepared by ENVIRON International Corporation for Richard Frankel Productions Inc., December 14, 2006.
21. Letter from Look Solutions to ENVIRON International Corporation regarding Tiny-Compact, Tiny F07, Tiny C07, and Cryo-Fog, January 24, 2007.
22. *Development of Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Smoke Equipment: Le Maitre LSG-MKII with Power Fog Industrial 9D (PFI9D) Low Smoke Generator with Extra Quick Dissipating and Quick Dissipating Fluid*, prepared by ENVIRON International Corporation for 321 Management, February 2007.

23. *Development of Calibration Factors for Monitoring Theatrical Fog: Jem ZR33 Hi-Mass with ProSmoke Super (ZR-mix) Fluid, Jem ZR33 Hi-Mass with ProSteam Simulation Fluid, Magnum 2500Hz with Pro Haze Fluid, Jem Glaciator X-Stream with C3 Fluid*, prepared by ENVIRON International Corporation for Martin Professional A./S, August 2008.
24. Letter from Le Maitre Special Effects to ENVIRON International Corporation, June 2, 2008.
25. Letter from Ultratec Special Effects Inc. to ENVIRON International Corporation regarding separation of Le Maitre Special Effects Inc. from Le Maitre Ltd., and renaming of Le Maitre Special Effects Inc., to Ultratec Special Effects Inc, June 10, 2009.
26. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: Barco FQ-100 with Atmospheres Stage Fluid and Barco FQ-100 with Atmospheres HQ Fluid*, prepared by ENVIRON International Corporation for Barco Lighting Systems, Inc., December 2010.
27. *Development of Calibration Factors for Monitoring Theatrical Smoke and Haze: Jem Roadie with ZR Fluid*, prepared by ENVIRON International Corporation for Cirque du Soleil, September 2003.
28. E-mail correspondence from Le Maitre Ltd to ENVIRON International Corporation, March 4, 2011.
29. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: Pure Smoke Electronic Cigarette with Electronic Cigarette Flavors*, prepared by ENVIRON International Corporation for Clear Day Broadway LLC, January 2012.
30. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: ePuffer Electronic Cigar with eLiquid*, prepared by ENVIRON International Corporation for Lucky Guy Broadway LLC, June 2013.
31. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: Tiny FX with Tiny Fluid, Tiny S with Tiny Fluid, Viper NT with Slow-Fog Fluid, Viper NT with Regular-Fog Fluid, and Unique 2.1 with Unique Fluid*, prepared by ENVIRON International Corporation for Look Solutions USA, Ltd., February 2014.
32. *Theatrical Smoke and Haze Testing for The Lion King Gazelle Tour, Paramount Theater*, prepared by ENVIRON International Corporation for Disney Worldwide Services, Inc., March 2014.
33. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: Aquamax with Organic Haze Fluid and HazeMax with Water Vapour Haze Fluid*, prepared by ENVIRON International Corporation for CITC, August 2014.
34. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: Vapour with Rosco Stage & Studio Fluid, Vapour with Rosco Fog Fluid, Vapour Plus with Rosco Stage & Studio Fluid, Vapour Plus with Rosco Fog Fluid, Mini-V with Rosco Stage & Studio Fluid, Mini-V with Rosco Fog Fluid, and V-Hazer with V-Hazer Fluid*, prepared by ENVIRON International Corporation for Rosco Laboratories, May 2014.
35. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: Bog Fog/K-razy Haze/Training Smoke XD, Backwood Bay/Faze Haze/Training Smoke FR, Velocity/Cryo Freeze/Quick Blast/Training Smoke Q, Techno Fog/Beam Splitter, Neutronic Haze, DaFiddy, Swamp Juice 2009 Formula, Light Fog*, prepared by ENVIRON International Corporation for Froggy's Fog, December 2014.
36. *Calibration Factors and Time-And-Distance Guidelines for Use of Theatrical Fog Equipment: New Rule FX Electronic Actor Cigarette Prop with Cartridge Fluid*, prepared by ENVIRON International Corporation for New Rule Productions Inc. and Foresight Theatrical, October 2014.

37. Letter from Look Solutions to ENVIRON International Corporation regarding Tiny CX, December 12, 2014.
38. *Calibration Factors for Use of Theatrical Fog Equipment: Jem Compact Hazer Pro with Jem C+ Fluid, Jem Hazer Pro with Jem C+ Fluid, Jem Ready 365 with R365 Haze Fluid*, prepared by ENVIRON International Corporation for Martin Professional, January 2015.
39. *Environmental Testing of Theatrical Fog Equipment: Smoke In Style Electronic Pipe Prop with FeelLife E-Liquid*, prepared by Ramboll Environ, June 2015.
40. *Environmental Testing of Theatrical Fog Equipment: Reel EFX DF-50 with Master Fog DEE-EFF-50 Fluid*, prepared by Ramboll Environ, September 2015.
41. Letter from Harman Professional Solutions to Ramboll Environ regarding RUSH Haze Fluid, March 19, 2017.
42. Telephone discussion with ePuffer regarding rebranding of D-1500 as Robusto, June 8, 2017.
43. *Environmental Testing of Theatrical Fog Equipment: Hazebase Base Classic with Ultratec Molecular Fog Fluid*, prepared by Ramboll Environ, October 2017.
44. *Environmental Testing of Theatrical Fog Equipment: Antari W-715x Fog Jet with Antari FLC Fog Fluid*, prepared by Ramboll Environ, October 2017.
45. *Environmental Testing of Theatrical Fog Equipment: Antari F-1 Fazer, F-4 Fazer, F-7 Smaze, X-380 Fazer, M-8, W-515D, W-715x Fog Jet, and DNG-200 Low Fog*, prepared by Ramboll Environ, December 2017.
46. *Development of Calibration Factor for Monitoring Theatrical Haze: Ghost The Musical*, prepared by ENVIRON International Corporation for Aurora Productions, June 2012.
47. Letter from Le Maitre regarding Gforce3, August 2, 2017.
48. *Environmental Testing of Theatrical Fog Equipment: Aspire K4 Vape Pen with Damokee E-Liquid Daily Dose Fluid*, prepared by Ramboll, February 2019.
49. *Environmental Testing of Theatrical Fog Equipment: Vario 8 and Vario 6 Fog machines with Cryo Fog Fluid*, prepared by Ramboll, March 2019.
50. Letter from Look Solutions to Ramboll regarding Viper S and Viper 2.6, October 9, 2019.
51. *Environmental Testing of Theatrical Fog Equipment: Cobra 1.8 with LSG Chiller*, prepared by Ramboll, October 2019.
52. *Environmental Testing of Theatrical Fog Equipment: Cobra 1.8*, prepared by Ramboll, October 2019.
53. *Environmental Testing of Theatrical Fog Equipment: Chauvet Amhaze ECO*, prepared by Ramboll, October 2019.
54. *Environmental Testing of Theatrical Fog Equipment: Poseidon*, prepared by Ramboll, November 2019.
55. *Effect Fluids Cross References*. August 29, 2018. Available at https://adn.harmanpro.com/site_elements/resources/15128_1535576658/Martin%20Atmospheric%20Effects%20Fluids%20-%20Cross%20References%20-%20B_08-2018_original.pdf
56. *Environmental Testing of Theatrical Fog Equipment: HQ100 Hazer*, prepared by Ramboll, August 2020.
57. *Environmental Testing of Theatrical Fog Equipment: Chauvet Amhaze Stadium Hazer and Cloud 9 Fogger*, prepared by Ramboll, August 2020.
58. *Environmental Testing of Theatrical Fog Equipment: Magma Prime Fogger*, prepared by Ramboll, August 2020.
59. *Environmental Testing of Theatrical Fog Equipment: Handy Fogger*, prepared by Ramboll, October 2020.

60. *Environmental Testing of Theatrical Fog Equipment: Amhaze Stadium Hazer, Hurricane 1800 Flex Fogger, and Hurricane Haze 1XD Hazer with Grignard Pure*, prepared by Ramboll, October 2020.
61. *Environmental Testing of Theatrical Fog Equipment: Kandypens Rubi Vape Pen with Lava Flow by Naked 100 E-Liquid*, prepared by Ramboll, August 2022.
62. *Environmental Testing of Theatrical Fog Equipment: SmokeGENIE with Cloud Fluid*, prepared by Ramboll, October 2022 (revised April 2024).
63. *Environmental Testing of Theatrical Fog Equipment: Epuffer Snaps Rev4 E-Cigarette with E-Liquid*, prepared by Ramboll, October 2022.
64. *Environmental Testing of Theatrical Fog Equipment: Tour Hazer II with Gotham Haze Fluid and Captain D with Gotham Fog Fluid*, prepared by Ramboll, March 2023.
65. *Environmental Testing of Theatrical Fog Equipment: Chauvet Vesuvio II with Ultratec Quick Dissipating Fluid*, prepared by Ramboll, April 2023.
66. *Environmental Testing of Theatrical Fog Equipment: DNG-250 Low Fogger with FLL Low Fog Fluid and CH-1 Cinema Hazer with CHL-2 Fluid*, prepared by Ramboll, April 2023.
67. *Environmental Testing of Theatrical Fog Equipment: FAB and Cube Hazer2 with Base V Fluid*, prepared by Ramboll, May 2023.
68. *Environmental Testing of Theatrical Fog Equipment: Vosentech Microfogger 3 Pro*, prepared by Ramboll, October 2021.
69. *Environmental Testing of Theatrical Fog Equipment: Aspire K4 Vape Pen with American Patriots by Naked 100 E-Liquid*, prepared by Ramboll, November 2021.
70. Letter from Ramboll to Actors' Equity Association regarding MDG ATMe, June 26, 2023.
71. *Environmental Testing of Theatrical Fog Equipment: JEM Glaciator Dynamic with JEM Low Fog High Density Fluid*, prepared by Ramboll, December 2023.
72. Memo from Ramboll to Actors' Equity Association regarding Time & Distance Guidelines for E-Cigarettes and Vape Pens, March 28, 2024.
73. *Environmental Testing of Theatrical Fog Equipment: SmokeNINJA with Cloud Fluid*, prepared by Ramboll, April 2024.
74. Letter from Look Solutions to Ramboll regarding Cobra foggers, April 15, 2024.

Manufacturers:

AES – <http://aesaquafog.com>

Antari – <http://www.antari.com>

Crawford International Theatrical Corporation (CITC) - <http://www.citcfx.com/>

Elation – <https://www.elationlighting.com/>

ETC/High End Systems - <https://www.etconnect.com/Products/Automated-Lighting/Atmospherics/>

Froggy's Fog - <http://www.froggysfog.com/>

Hazebase – <http://hazebase.com>

Le Maitre Ltd. - <http://www.lemaitreusa.com>

Look Solutions - <http://www.looksolutionsusa.com/products/machines/>

Martin Professional - https://www.martin.com/en-US/product_families/atmospheric-effects

Master Fog - <http://www.master-fog.com/>

MDG Fog Generators - <http://www.mdgfog.com/en/index.html>

MT-Electronic – <http://mt-electronic.com>

New Rule FX - <http://www.newrulefx.com/>

Reel EFX - <http://www.reelefx.com/index.php?c=product.list>

Rosco Laboratories - <http://www.rosco.com/us/products/fog.cfm>

Theatrical Smoke, Fog and Haze Testing: Calibration Factors

SFX Design, Inc. - <http://www.sfxdesigninc.com/>

Smoke Factory (Inner Circle Distribution) - <https://www.icd-usa.com/pages/smoke-factory>

Ultratec Special Effects, Inc. - <http://www.ultratecfx.com/>

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