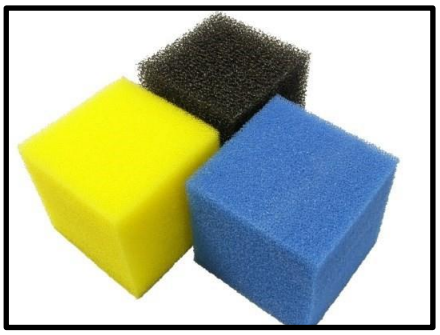
PREMIER
FUEL SYSTEMS LTD

ESF Explosion Suppressant Foam

ESF reticulated polyurethane foams for explosion suppression and surge/noise mitigation are unique, environmentally-friendly materials designed for use in rigid and flexible (bladder type) fuel tanks in virtually any vehicle, vessel, or aircraft. It is suitable for any vehicle where the possibility of fuel tank explosion exists, or where surge / noise mitigation is required. ESF is also ideal for use in fuel storage tanks and containers, both stationary and portable.



Because of its unique characteristics, special advantages and cost-effectiveness, industries, government agencies and organizations around the world are incorporating ESF in special use vehicles of all kinds – aircraft and land vehicles, VIP vehicles, motorsport cars and marine craft – for added safety and/or fuel surge control and noise mitigation.

PRACTICAL, COST EFFECTIVE PROTECTION FOR AIRCRAFT, MARINE AND LAND VEHICLES.

ESF has been used successfully in thousands of installations for over three decades. Proprietary manufacturing processes and special thermal reticulation techniques permit production of flexible skeletal foam structures with precisely controlled pore sizes and without cell membranes. The resultant "open pore" foam exhibits many unique characteristics and offers special advantages.

CONSIDER THESE UNIQUE ADVANTAGES OF ESF:

Safety:	ESF prevents catastrophic explosions of ignited fuel vapors in the tank caused by electrical arcing, overheating of internal components, lightning strikes or by static electrical discharge.
Maintenance:	ESF contains no moving parts or electrical devices.
Operation:	ESF requires no action by operators or crews. It is effective 100% of the time and doesn't need control devices or trigger mechanisms. ESF continues to work as long as it is present and intact.
Efficiency:	The explosion suppression capability of ESF is unaffected by fuel tank punctures, ruptures, fuel level, speed, attitude or altitude.
Any Shape:	ESF may be fabricated to conform to internal structural members and components such as pumps, valves, sensors, filters, fuel lines, etc.
Fuel Spray:	ESF mitigates fuel spray in the event of fuel tank rupture from compressive forces.
Baffling:	ESF effectively baffles fuel tanks to control surge and eliminate sloshing and improves handling in high performance vehicles.
Installation:	ESF can be installed without special tools or skills. Fuel wetting and low swelling characteristics of ESF ensure a snug fit without the need to oversize the foam. ESF can be retro-fitted to existing fuel tanks.
Support:	Once installed inside a fuel tank or bladder there is no need for any external supportive equipment such as required by gas inerting systems.
Cost:	ESF has the lowest initial cost of any other system offering explosion protection, lowest cost to maintain, and low weight penalty.

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ESF type II and IV foams have had an impressive track record of success for many years. They are currently used in military transport / reconnaissance aircraft such as the C-130 Hercules and P-3 Orions, fighter aircraft such as F-4s, F-5s, F-14s, F-15s, F-18s, A-10s, A37s, and the T-1A trainer as well as military helicopters and armored vehicles such as Challanger II, Scorpion, Ridgeback and Mastiff.

ESF Grade I material exhibits outstanding anti-static properties down to -25°F, excellent hydrolytic stability, and a long service life. In fact, ESF Grade 1 foam removed from a Navy P-3 Orion was extensively tested and proved to be just as effective as when installed over ten years earlier, with absolutely no degradation of properties.

TYPICAL PHYSICAL PROPERITES OF EXPLOSION SUPPRESSANT FOAMS (ESF)						
	Grade I		Type II		Type IV	
Property	Spec	G-15M	Spec	S15M	Spec	T15M
Color	Charcoal	Charcoal	Yellow	Yellow	Dark Blue	Dark Blue
Density range (lbs/ ft³)	1.20 - 1.50	1.2 - 1.4	1.20 - 1.45	1.23 - 1.35	1.20 - 1.45	1.25 - 1.40
Maximum Average Density (lbs/ ft³)	Not Specified	1.35				
Porosity (pores per inch)	7.5 - 21.0	15	8 - 18	10	8 - 18	14
Air pressure drop (in. Wg.)	0.150 - 0.250	0.21	0.140- 0.230	0.19	0.140- 0.230	0.2
Tensile strength (psi)	10.0 min	16.3	15 min	23	10 min	19
Ultimate elongation (percent)	100.0 min	180	220 min	280	100 min	170
Tear resistance (psi)	3.0 min	4.1	5 min	6.5	3 min	4
Constant deflection compression set (percent)	45.0 max	29	35 max	20	30 max	15
Compression load deflection at 25 percent (psi)	0.35 min	0.48	0.30 min	0.38	0.35 min	0.55
Compression load deflection at 65 percent (psi)	0.60 min	0.91	0.50 min	0.54	0.60 min	0.9
Fuel displacement (volume percent)	2.50 max	0.67	2.5 max	1.9	2.5 max	<1.0
Fuel retention (volume percent)	2.50 max	2.12	2.5 max	1.9	2.5 max	<1.0
Flammability (in/min)	15.0 max	12.9	15 max	10	15 max	13
Extractable materials (wt. percent)	3.0 max	2.90	3.0 max	1.8	3.0 max	2.6
Volume increase (volume percent) Type I Fluid Type III Fluid JP-4 turbine fuel	 0 - 15.0 0 - 40.0 0 - 25.0	 9.9 20.1 16.8	 0 - 3 0 - 12 0 - 10	 15 37 25	 0 - 15 0 - 37 0 - 25	 8 27 17
Low temperature flexibility	No crack-ing or breaking of strands	No crack-ing or breaking of strands	No crack-ing or breaking of strands	No crack-ing or breaking of strands	No crack-ing or breaking of strands	No crack-ing or breaking of strands
Entrained solid contamination (mg/ ft³)	11.0 max	10.1	11.0 max	9.5	11.0 max	9.2
Steam autoclave exposure (percent tensile loss)	30.0 max	17.8	40 max	20	30 max	17
Electrical resistivity (ohm-cm) at 75°F	1.0×10^{7} to 5.0×10^{11}	1.1×10^{11}				
Electrical resistivity uniformity at 75°F	2 orders of magnitude from top to bottom	<1 order of magnitude from top to bottom				
Effective static dissipation temperature range (°F) Class 1 Class 2	+10 to +160 -25 to 160	0 to +160 -25 to + 160				
TYPICAL PHYSICAL PROPERITES OF EXPLOSION SUPPRESSANT FOAMS (ESF)						

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