TECHNICAL WHITEPAPER & APPLICATION GUIDE

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AUTOMOTIVE THERMAL PROTECTION GUIDE

Extreme High-Temperature Solutions for Engine Bays & Exhaust Systems

Thermal Barrier, Chemical Resistance & NVH Acoustic Damping for ICE, Hybrid & Heavy-Duty Powertrains

1. Thermal & Environmental Dynamics in Powertrain Environments

Under-hood environments in modern turbocharged, hybrid, and heavy-duty commercial powertrains operate under tight packaging and intense thermal loads. Critical wire harnesses, sensor cables, and fluid hoses require robust barrier protection against multiple simultaneous hazards:

- Extreme Radiant & Convective Heat (Up to +1100°C Transient): Turbocharger housings, EGR pipes, and exhaust manifolds generate localized peak temperatures exceeding +600°C~+800°C. Adjacent electronics and fuel lines must be insulated to prevent premature thermal degradation.
- Aggressive Chemical & Automotive Fluid Immersion: Sleeving materials must withstand continuous exposure to engine oils, transmission fluids, DOT4 brake fluid, battery acids, and glycol-based coolants without coating swelling or delamination.
- Molten Splash & Direct Flame Defense: For commercial vehicles and off-highway equipment, protective sleeving must withstand direct molten slag, open exhaust flame bursts, and welding sparks without breaching.
- Acoustic NVH & Chafing Mitigation: High-velocity fluid lines and engine bay sensor wires require soft-touch damping sleeving to suppress vibration rattling (NVH Class C/D) and prevent contact chafing against metal engine brackets.

2. Engine Compartment & Exhaust Thermal Selection Matrix

Installation Area	Thermal & Risk Factor	Recommended Solution	Core Material & Spec	Key Performance	Standards
Turbocharger & Exhaust Manifold EGR & Catalyst Proximity	500°C ~ 1100°C Continuous radiant heat, direct flame exposure	**Basalt / High-Silica Thermal Sleeving**	Continuous Basalt Filament or High-Purity Silica (SiO□ ≥ 96%)	• Continuous: +750°C • Peak limit: +1100°C • Incombustible, ultra-low thermal conductivity	Incombustible ISO 13997 RoHS/REACH
ECU, Sensor & Ignition Wiring Engine Block Wiring Harness	-70°C ~ +260°C Engine heat soak, high dielectric requirements	**Heavy-Coated Silicone Fiberglass Sleeve**	Dense E-Glass Yarn + Thick Vulcanized Silicone Rubber	• Continuous: -70°C ~ +260°C • Short peak: +300°C (6h) • Dielectric strength: 4.0kV ~ 7.0kV • Oil & fuel resistant	UL 1441 VW-1 RoHS 2.0
Engine Bay AC & Fuel Line Routing Chafing & Noise Zones	-40°C ~ +150°C Inter-line friction, bracket vibration rattling	**Noise-Damping Multifilament Sleeve**	High-Bulk PET Multifilament Textured Weave	• Class C/D NVH Damping • Abrasion: SAE J2192 compliant • 1:2 expansion ratio for easy harness insertion	SAE J2192 FMVSS 302 RoHS 2.0
Exhaust Wrap & Emergency Retrofit Field Repair & Complex Bends	-50°C ~ +260°C Irregular pipe geometries, non-dismantled install	**Self-Fusing High-Temp Silicone Tape**	Specially Formulated Adhesive-Free Self-Amalgamating Silicone	• Bonds into solid layer in 24h • Dielectric: >8.0 kV • Weatherproof, waterproof & ozone resistant	UL 510 MIL-I-46852C RoHS 2.0

3. Engineering Application & Installation Best Practices

- Clearance Optimization for Turbo Proximity: While basalt and silica sleeves provide continuous +750°C barrier protection, maintaining a minimum air clearance of 15mm from direct exhaust touch is recommended to optimize convective dissipation.
- Self-Fusing Tape Application: Apply self-amalgamating silicone tape with 50% tension elongation and 50% overlap. Wrap from the lowest point to the highest point to provide an overlapping watershed effect against engine oil and coolant drips.
- Acoustic Sleeve Clamping: Secure damping sleeves with automotive-grade spring clamps or edge clips at maximum 250mm intervals to eliminate high-frequency engine resonance rattle.

4. CRSleeve Quality & Manufacturing Assurance

Mass Production Capacity & Automotive Standards:

- Dedicated Capacity: 8 specialized high-temperature production lines with daily output exceeding 1,000,000+ meters for fiberglass sleeving alone.
- Facility & Automation: 30,000+ m² modern facility equipped with 800+ automated braiding, extrusion, and testing units (3× efficiency boost).
- Automotive Certifications: Certified under IATF 16949:2016 & ISO 9001:2015. Products compliant with UL 1441, UL 94 V-0, RoHS 2.0, and REACH.
- Global Proven Track Record: Founded in 1997, serving 8,000+ global Tier-1 and OEM manufacturing clients across 50+ countries.