COMPOUND OVERVIEW & APPLICATION

GRCL-EPDM-HL3 is an advanced, high-performance, sulfur-cured Ethylene Propylene Diene Monomer (EPDM) Halogen Free compound specifically engineered for high-risk transit networks. Incorporating synergistic, non-halogenated flame retardant (LSOH) technology, this compound meets the stringent European fire safety regulations under **EN 45545-2 Hazard Level 3 (HL3)** for interior (***R22***) and exterior (***R23***) requirements. It is ideally suited for window glazing seals, passenger door profiles, HVAC gaskets, and dynamic sealing applications in modern locomotives, metro cars, and rolling stock sectors where BEML and global specifications dictate structural protection against smoke and fire.

Key Performance Advantages: Full compliance with Hazard Level 3 (HL3) limits, excellent long-term compression set metrics, excellent UV and ozone aging resistance, and fully compliant with ROHS & REACH regulations.

1. MECHANICAL & PHYSICAL PROPERTIES

Tested standard laboratory slabs cured under optimal vulcanization conditions (***160°C @ 15 min}***).

Property Description	Test Standard	Unit	Typical Value
Base Polymer	ISO 1629 / ASTM D1418	—	EPDM (Halogen Free)
Hardness	I IS:3400-2003 PART-2	Shore A	***65 ± 5***
Specific Gravity / Density	IS:3400-2003 PART-9	g/cm³	***1.4 MAX***
Tensile Strength (Minimum)	IS:3400-2003 PART-1	MPa	***MIN 9.0***
Elongation at Break (Minimum)	IS:3400-2003 PART-1	%	***MIN 250***
Tear Strength (Trouser Method)	ISO 34-1 / ASTM D624	N/mm²	***MIN 22***
Compression Set (***24 hrs. @ 70°C***)	IS:3400-2003 PART-20	%	***MAX 35***
Resistance to Bending	IS:638-1979 CL. 3.7.1	Visual	No crack
Service Temperature Range	Continuous Operational	°C	-40 to +120

2. ACCELERATED THERMAL & ENVIRONMENTAL AGEING

Property Metric (After Ageing)	Test standard	Unit	Maximum
Hardness Change	IS:3400-2003 PART-4	Points	*+7 -0*
Tensile Strength Change	IS:3400-2003 PART-4	%	*± 20*
Elongation at Break Change	IS:3400-2003 PART-4	%	*+50% TO -30%*
Ozone Resistance (*50 pphm 30% 100hrs@ 38° C}*)	IS:3400-2003 PART-20	Visual Evaluation	No Cracking (Pass)

3. EN 45545-2 FIRE & FLAMMABILITY REQUIREMENTS

Evaluated according to the specialized test matrices defined for Requirement Sets **R22** (Interior Seals) and **R23** (Exterior Seals) under European Railway Standards.

Fire Parameter & Test Method	Test Protocol	HL3 Target Limit	GRCL Observed Test Value
Limiting Oxygen Index (LOI) Minimum concentration of oxygen to support combustion.	EN ISO 4589-2	*32.0 min*	*36.71%*
Maximum Smoke Density (*Dsmax*) Optical density measured in a closed chamber over 4 min.	EN ISO 5659-2 (25 kW/m² irradiance)	*MAX 150*	*132.15*
Conventional Index of Toxicity (*CITG*) Analysis of lethal combustion gases via FTIR.	EN 17084 METHOD 1	*MAX 0.75*	*0.43*
Vertical Flame Spread Evaluates post-ignition behavior on structural profiles.	EN 60695-11-10	Self-Extinguishing (V-0 classification)	Compliant / Pass

4. PROCESSING & PROCESSING CONFIGURATIONS

Extrusion Parameters: Suitable for continuous vulcanization processes utilizing standard UHF microwave lines, hot air tunnels, or molten salt bath lines. Recommended extruder barrel temperature profiles range between *65°C* and *90°C}* to prevent premature bin scorch, with head temperatures set at *95°C – 105°C}*.

Molding Parameters: Compression, transfer, or injection molding operations can be effectively utilized. Optimal cure cycle requires temperatures between *150°C* and *170°C}* depending on structural profile wall thickness.