# TECHNICAL DATA SHEET

## TOR Armor®
## Biodegradable Top-of-Rail Friction Modifier

Whitmore® TOR Armor® is a water-based bio-lubricant that consists of water, plant-based oil, and other additives. It is specifically designed to provide a friction coefficient between 0.3 and 0.4 at the wheel-rail interface. Whitmore TOR Armor substantially reduces noise, wear, and lateral forces. High lateral forces lead to loosened tie plates and fasteners and can result in low rail rollover.

During normal rolling, Whitmore TOR Armor acts as a lubricant. But when wheel creep occurs the sliding friction immediately converts to "positive friction", controlling the creep condition and returning the wheels to a healthy rolling motion. The result is a substantial reduction of vibrations, corrugations and high-frequency squealing.

The positive friction generated by Whitmore TOR Armor reduces lateral creep, thus reducing lateral forces. This has been measured on instrumented track at TTCI and Class 1 and 2 railways.

Whitmore TOR Armor offers a year-round solution by using regular Whitmore TOR Armor in hot to moderate climates and adding Whitmore TOR Armor Artic in areas where temperatures dip below 10°F (-12°C) for extended periods of time. Both grades of Whitmore TOR Armor are fully compatible and can be mixed in trackside applicators without changes to the performance characteristics other than the low temperature usage.

Whitmore TOR Armor contains no solvents or latex or toxic materials. It dries quickly between the wheel and the rail due to frictional heat, but it will not harden in the holding tank or at the ports of the applicator. The small amount of vegetable oil used in Whitmore TOR Armor is emulsified into the base carrier, but leaves zero oily residue on rail head, after it has been applied and has dried. It will not corrode holding tanks, pumps or other steel components. The carry-down distance will depend on conditions such as curvature, braking and gradient, but 3 miles (5 km) is achievable in the vast majority of cases. In some cases, reductions in lateral forces have been measured at 6 miles from the applicator. The long carry distance often results in a reduction in the number of applicators needed.

Whitmore TOR Armor does not affect braking or tractive effort.

**BENEFITS:**

- WEAR - Reduces or eliminates creep, hunting (also known as yaw), and corrugations.
- NOISE - Stops or substantially reduces high-pitched squeal.
- REDUCES FUEL CONSUMPTION IN CURVES – Studies have shown that using TOR friction modifiers reduce fuel consumption 3– 15% depending on the radius of the curve.
- LATERAL FORCES - Greatly reduces rail damage by reducing lateral forces and angle of attack.
- QUIET - Smoother, quieter ride for transit customers.
- LONG CARRY DOWN – Will carry 3-5 miles (5-8 km).
- WIDE TEMPERATURE RANGE – TOR Armor can be used from -10°F (-12°C) to 140°F (60°C) while TOR Armor Arctic can be used from -31°F (-35°C) to 90°F (32°C) which allows year-round use with one grade in some areas. In climates with both extreme high and low temperatures, a combination of TOR Armor and TOR Armor Artic can be used to achieve a temperature range of -31°F (-35°C) to 140°F (60°C).
- ADHESION - Improves adhesion on stretches of track that are prone to low friction. This can result in allowing more cars to be added.
- LOW CONSUMPTION – 300 – 425 ml per 1000 axles for freight, 175 ml per 1000 axles for transit rail.
- SAFE - contains no heavy metals, petroleum solvent or hazardous ingredients. Easily passes the OECD 301B test for "Ready Biodegradability".

**APPLICATIONS:**

Whitmore TOR Armor optimizes friction at the wheel / rail interface with applicators.

US Patent No. 9,617,498, No. 10,214,225, No. 10,814,890 and patents pending.

| CHARACTERISTICS | | |
|---|---|---|
| | TOR Armor | TOR Armor Arctic |
| **Brookfield Visc.** (Spindle 6 @ 60 rpm, 23°C) | 15,000 | 8,000 |
| **Specific Gravity**, g/cc @ 60°F (15.5°C) | 1.270 | 1.260 |
| **Flash Point** (closed cup). | None | None |
| **% Effective solids** | 10 - 15 | 10 - 15 |
| **Application Rate** (Per 1000 Axles)<br>Transit<br>Freight<br>Mixed | <br>175 ml<br>300 ml<br>220 ml | <br>175 ml<br>300 - 425 ml<br>220 - 300 ml |
| **Appearance** | Smooth Dark Gray Paste | Smooth Dark Gray Paste |
| **Usable Temperature range**, °F (°C) | 10 (-12) to 140 (60) | -31 (-35) to 90 (32) |

**PACKAGING**

| Plastic Totes (Non-returnable) | Drums | Kegs | Pails |
|---|---|---|---|

**For warranty information, scan the QR code.**

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