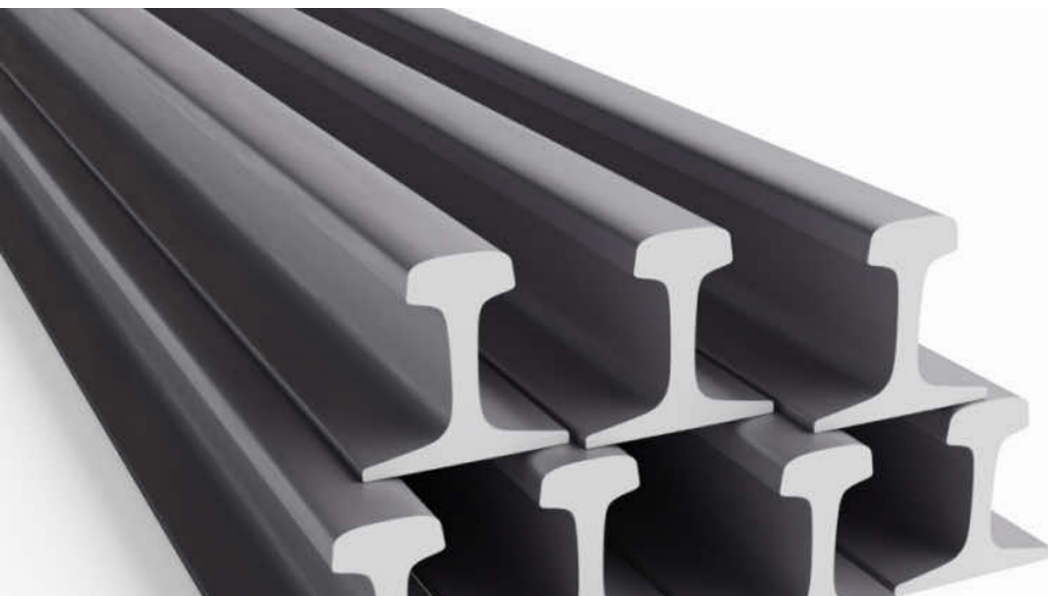


TECHNICAL DATA SHEET



PRODUCT NAME

SAR48kg/m; SAR51kg/m & 60E1
Mainline Rails

CATEGORY

Rail Infrastructure — Track
Components

COMPLIANCE

BS EN 13674-1 | SANS / TFR |
UIC 860 | ISO 9001:2015

SUPPLIER

ZAK Steel (Pty) Ltd

PRODUCT OVERVIEW

ZAK provides industry-leading rail solutions through our strategic supply of SAR48kg/m, SAR51kg/m & 60E1 rail profiles. By combining world-class manufacturing to International and South African standards, we ensure our clients receive rails that offer superior longevity and cost-effectiveness based on the BS EN 13674-1 international standard. Whether supporting general freight or 26-t/axle high-capacity operations, our rail systems are the benchmark for reliability in modern railway infrastructure.

RAIL PROFILE SPECIFICATIONS

- SAR 48kg/m – Standard mainline and secondary freight lines; suitable for axle loads up to 20–22 tonnes; integrates with legacy South African rolling stock.
- SAR 51kg/m – Upgraded mainline freight corridors with higher-capacity general freight lines (22–26 tonne axle loads); enhanced stiffness and wider footprint.
- 60E1 – Ultra-heavy-haul (Coal/Iron Ore export lines) and high-speed rail; supports extreme axle loads of 26–32+ tonnes; 172mm height for maximum moment of inertia.
- Grade R260 – Standard for straight (tangent) track; hardness 260–300 HBW; excellent weldability and ductility.
- Grade 350LHT – Heat-treated for heavy-haul curves; hardness 350–390 HBW; up to 3× service life of R260 in high-stress environments.

KEY FEATURES

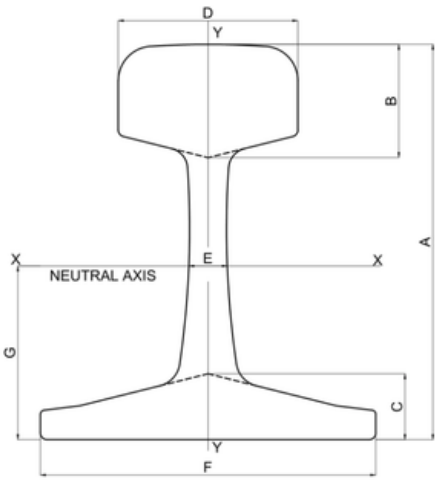
- Multiple High-Performance Rail
- Profiles
- Grade R260 & 350LHT Steel
- Options
- BS EN 13674-1 Compliance
Heavy-Haul & High-Traffic
Optimised
Full Material Traceability & MTC



TECHNICAL SUMMARY

ZAK-supplied mainline rails meet the highest international and local safety standards, manufactured and tested under rigorous quality control to ensure peak performance across SAR 48kg/m, SAR 51kg/m, and 60E1 profiles in all heavy-haul environments.

All rail products are backed by Mill Test Certificates (MTC) and Certificates of Conformance confirming chemical composition and mechanical test results against the specified standard.



DIMENSIONAL SPECIFICATIONS

SAR 48kg/m	Height: 127mm Head: 68mm Base: 150mm Web: 14mm
SAR 51kg/m	Height: 127mm Head: 68mm Base: 150mm Web: 19mm
60E1	Height: 172mm Head: 72mm Base: 150mm Web: 16.5mm
Dimensional Tolerances	Height ± 0.5 mm Foot Width ± 1.0 mm Head Width ± 0.5 mm Web $+1.0$ mm/ -0.5 mm

Mechanical & Material Requirements

Tensile Strength (UTS)	R260: Min 880 MPa 350LHT: Min 1175 MPa
Hardness (HBW)	R260: 260–300 HBW 350LHT: 350–390 HBW
Elongation	R260: Min 10% 350LHT: Min 9%
Steel Grade	Pearlitic steel per BS EN 13674-1

Manufacturing Process & Quality Control

ZAK-supplied rail profiles are manufactured using advanced metallurgical processes designed to meet the extreme demands of heavy-haul logistics and high-frequency transit. Our production integrates precision rolling with stringent quality benchmarks across all three profiles.

Steelmaking & Rolling Process

Oxygen Converter Steelmaking & Vacuum Degassing	High-purity iron ore is used to produce clean steel. Vacuum degassing reduces Hydrogen to <2.5 ppm, eliminating internal shatter crack risk. Continuous casting ensures a uniform crystalline structure across the full rail bloom length.
Universal Rolling & Dimensional Verification	Precision rolling of SAR 48/51 and 60E1 profiles ensures exact dimensional symmetry. Automated laser measurements verify height, base width, and web thickness against BS EN 13674-1 tolerances. Multi-roller straightening ensures vertical/horizontal deviations <0.3 mm over 3 metres.
In-Line Heat Treatment (350LHT Grade)	Controlled accelerated cooling (water or air) transforms the rail head into a fine pearlitic structure achieving 350–390 HBW hardness. This process delivers up to 3 $\times$ the service life of standard R260 in high-wear curve and braking zones, while maintaining fracture toughness to prevent catastrophic breaks.

Chemical Composition

Grade R260 — Ladle Analysis Limits	Carbon (C): 0.62–0.80% Manganese (Mn): 0.70–1.20% Silicon (Si): 0.15–0.58% Chromium (Cr): ≤0.15% Phosphorus (P): ≤0.025% Sulphur (S): ≤0.025% Aluminium (Al): ≤0.004%
Grade 350LHT — Ladle Analysis Limits	Carbon (C): 0.72–0.80% Manganese (Mn): 0.70–1.20% Silicon (Si): 0.15–0.58% Chromium (Cr): ≤0.15% Phosphorus (P): ≤0.020% Sulphur (S): ≤0.020% Aluminium (Al): ≤0.004% Hydrogen (H ₂): ≤2.5ppm Oxygen (O ₂): ≤20ppm

Non-Destructive Testing (NDT)

Every production run is subject to a comprehensive multi-stage NDT inspection regime before deployment:	Mechanical testing includes tensile strength, elongation, and Brinell hardness (HBW) mapping across the head, web, and foot to ensure uniformity across every batch.
Continuous Ultrasonic Inspection	100% of the rail length is scanned for internal defects, shatter cracks, voids, and inclusions that could lead to 'tache ovale' or internal fatigue failure.
Eddy Current & Visual Inspection	Eddy current testing detects surface-level micro-cracks and longitudinal flaws. Automated laser dimensional checks verify profile symmetry, straightness, and twist to EN 13674-1 tolerances.

Quality & Compliance

Heat Traceability & Branding	Every rail is branded/stamped with the heat number, steel grade, year of manufacture, and factory code, providing a full audit trail from the steel mill to final deployment.
Mill Test Certificates (MTC)	ZAK provides comprehensive MTC documentation for every batch, confirming chemical composition and mechanical test results against BS EN 13674-1. ISO 9001:2015 certified Quality Management Systems are maintained across all production facilities.

Key Features of ZAK-Supplied Mainline Rails

Superior Profile Characteristics

- SAR 48kg/m (The Regional Workhorse): Optimized geometry for traditional sleeper spacing; cost-efficient for high-traffic general freight under 22 tonnes; seamlessly integrates with legacy South African rolling stock and older point/crossing designs.
- 60E1 / UIC60 (The Heavy-Haul Standard): Maximum moment of inertia at 172mm profile height; fatigue-resistant large head volume for extended grinding cycles; 150mm base width for superior lateral stability on 26–32 tonne axle-load corridors.

Grade Performance — R260 vs 350LHT

- Grade R260 (Standard Pearlitic): Balanced strength and flexibility; less prone to brittle fractures in varied climates; highly weldable via standard Alumino-Thermic or Flash-Butt methods; ideal for straight tangent track with uniform wear.
- Grade 350LHT (Heat-Treated): 350–390 HBW via precise heat treatment; engineered for 'side wear' in sharp curves and 'corrugation' in high-braking zones; low-alloy chemistry maintains fracture toughness despite increased hardness.



Standards & Compliance

- BS EN 13674-1:2011+A1:2017: The benchmark for the 60E1 profile, covering dimensions, steel cleanliness, and surface quality.
- SANS / TFR Specifications: SAR 48kg/m and 51kg/m comply with South African National Standards and Transnet Freight Rail specifications (historically based on BS 11 and updated regional mandates).
- UIC 860: General international oversight for rail steel quality and technical delivery conditions.

Profile Dimension Table

- Maximum Asset Life: 350LHT in high-wear zones significantly extends the interval between rail replacements, delivering lower total cost of ownership over 20+ years.
- Minimised Downtime: High fatigue resistance of 60E1 profiles reduces emergency repairs and unplanned track closures.
- Heavy-Haul Optimisation: Supporting axle loads up to 32 tonnes allows for increased payload capacity per wagon, maximising throughput on critical export corridors.

Supply Chain & Cost Advantages

Offering both SAR-specific (48kg/51kg) and International (60E1) profiles ensures ZAK can support legacy regional upgrades and new-build global-standard projects. Standardising on R260 and 350LHT ensures compatibility with modern welding and maintenance technologies worldwide.

Profile Selection Guide & Application Context

Selecting the appropriate rail profile is critical for track performance, longevity, and safety. ZAK offers three high-performance profiles tailored to specific operational and load demands across the South African and international rail network.

ZAK-supplied mainline rails reduce total cost of track ownership through extended service life, reduced grinding frequency, minimised downtime, and simplified procurement for both legacy and new-build projects.

PROFILE COMPARISON OVERVIEW

Profile Stepping & Network Transition

- SAR 48kg/m (The Standard): Balanced dimensions for traditional general-purpose mainlines; compatible with legacy South African rolling stock.
- SAR 51kg/m (The Heavy Freight): Taller, stiffer version of the 48kg rail; increased vertical height and web thickness to reduce rail deflection; designed for 22–26 tonne axle loads.
- 60E1 (The Anchor): 172mm height provides the highest moment of inertia; tallest and most rigid profile for extreme heavy-haul loads at 26–32+ tonnes.



Grade Selection: R260 vs 350LHT

- Mixed-Grade Track Strategy: Use R260 for cost-effective straight sections and 350LHT for curves to achieve uniform wear across the network. The grade does NOT change rail dimensions — both grades share the same physical shape for a given profile, allowing seamless joining in transition zones.
- For heavy-haul environments, the 60E1 350LHT combination is the premium choice for maximum uptime; SAR 51kg R260 remains the standard for high-traffic general freight.

Supply Lengths & Drilling Options

- Standard Lengths: Commonly supplied in 12m, 18m, and 36m rail lengths.
- Fishbolt Holes: Typically drilled to client specification (e.g., 32mm diameter holes at 140mm centres) if not intended for continuous welded rail (CWR).
- Note: Both R260 and 350LHT grades are available in all three profiles and standard supply lengths.

Straightness & Tolerance Requirements

- Vertical Straightness: 0.3mm over a 1.5m straight edge.
- Horizontal Straightness: 0.4mm over a 1.5m straight edge (Class A).
- All ZAK-supply rails adhere to BS EN 13674-1 tolerances for seamless welding and track stability.

The ZAK Standard

By combining the legacy reliability of SAR profiles with the modern manufacturing rigour of BS EN 13674-1, ZAK provides mainline rail that minimises rolling contact fatigue (RCF), maximises track uptime, and reduces total cost of ownership across South Africa's freight and export corridors.