

JSPL'S INSPECTION AND TESTING FACILITIES

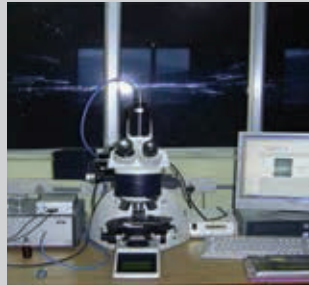
JSPL's strong focus on quality assurance systems are equipped with modern testing facilities for online and offline testing conforming to stringent quality standards,

OFFLINE TESTING:

Offline testing equipments include Image Anaylser Microscope, Spectrometer, Ultimate Tensile Measurement Machine, Residual Stress Measurement, Fracture Toughness Measurement, Falling Weight Test, Decarburization and Inclusion Rating Study.



Spectrometer: Sprectro Lab, Germany
PURPOSE: used to measure the chemical composition of the product samples under analysis.



Residual Stress Measurement: Vishay Micro Measurements, USA
PURPOSE: Used to measure the residual stresses developed in the rails.

Fracture Toughness & Fatigue Test : Material Systems Corporation, USA
Purpose: Used to evaluate ability of rails to resist fracture propagating through pre-existing internal flaw.



Falling Weight Test
Purpose: Used to determine the ability of rail to resist cracking when a heavy load falls from a certain height. It gives an idea about material toughness.



ONLINE TESTING:

Online Non Destructive testing includes Profile checking Machine, Laser Straightness MeasurementSystem, Eddy Current Measurement, Ultrasonic Testing Facility, Color Marking Unit, HYDRIS Online Hydrogen Measurement System.



Online Profile Checking Machine: TECHNOGAMMA, ITALY
PURPOSE: Monitoring system for profile geometry and surface defects.



Online Ultrasonic Testing Machine: Krautkammer, Germany
Purpose: For checking internal defects in Rails produced.

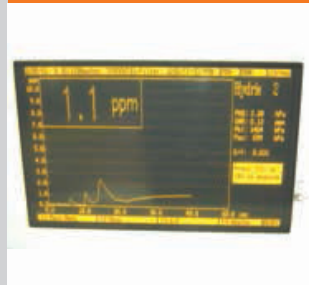
Online Laser Straightness Measurement Machine: Knorr Technik GmbH, Austria
Purpose: It ensures to check body straightness along with complete NDT line integration



Colour Marking Unit: Knorr Technik GmbH, Austria
PURPOSE: For online defect marking and quality protocol generation.



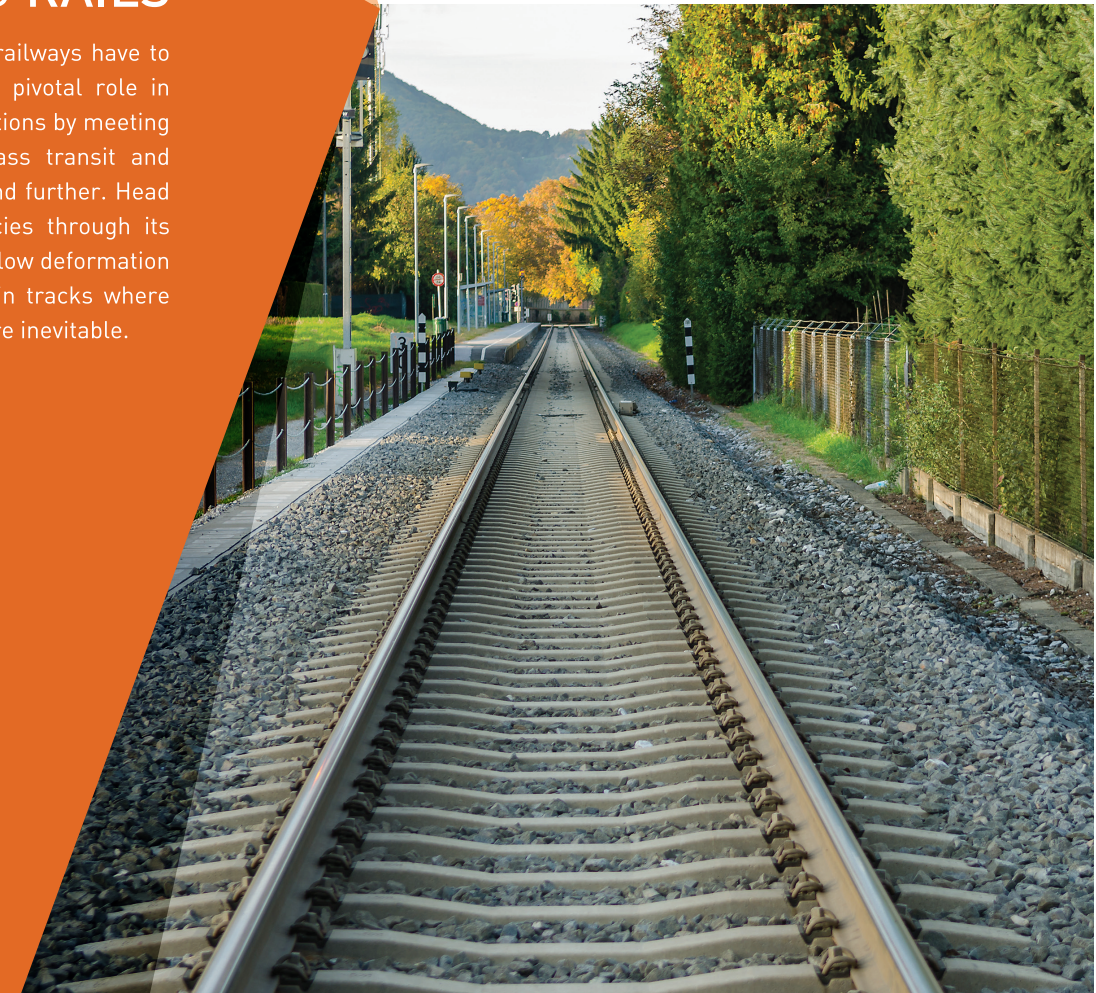
Online Eddy Current TESTING MACHINE: institut Dr forster, Germany
PURPOSE: Helps in detecting surface defects



Online Hydrogen Measurement: Ardee Technologies, India
Purpose: Gases dissolved in steel may have high detrimental effects like shatter-cracks during usage. For the same, it is important to control the same in very close limits. At JSPL, Ruhrstahl Heraeus Degasser is used for cleaning steel from dissolved gases like Hydrogen, Oxygen and Nitrogen.

HEAD HARDENED RAILS

As a lifeline for mass transportation, railways have to continually innovate and steel play a pivotal role in providing choice for heavy haul applications by meeting the demanding conditions of the mass transit and freight networks in becoming faster and further. Head hardened rail offers greater efficiencies through its ability to handle higher axle loads with low deformation and wear. These rails are also used in tracks where higher acceleration and deceleration are inevitable.



JSPL pioneered in setting up Online Head Hardened Rails Facility with technical consultation with (SMS Meer, Germany) and successfully commissioned its head hardening facility in May 2016. The Head hardened process would include Tilting of Rails after Tandem Mill, Induction Heating as required and Quenching through Selective Cooling technology through water. These would have higher resistance to wear and is made possible with greater hardness of rail head, which is the upper part of a rail and supports the wheels of railroad cars.

SPECIFICATION	GRADE	HARDNESS	ULTIMATE TENSTILE STRENGTH (MPA)
IRS T-12 2009	NORMAL GRADE RAIL	≥260 BHN	880
	HEAD HARDENED RAIL	340-390 BHN	1080
EN 13674-2011	NORMAL GRADE RAIL	260-300 HBW	880
	HEAD HARDENED RAIL	350-390 HBW	1175

ADVANTAGES OF HEAD HARDENED RAILS

JSPL took the lead by setting up a state of the Art Technology for Online Rail Head Hardening. Head Hardened Rails with enhanced wear resistance required for High Speed Track, Metro Rail and Heavy haul applications with very high strength & low residual stress allowing improved lifecycle and thereby making it cost efficient.

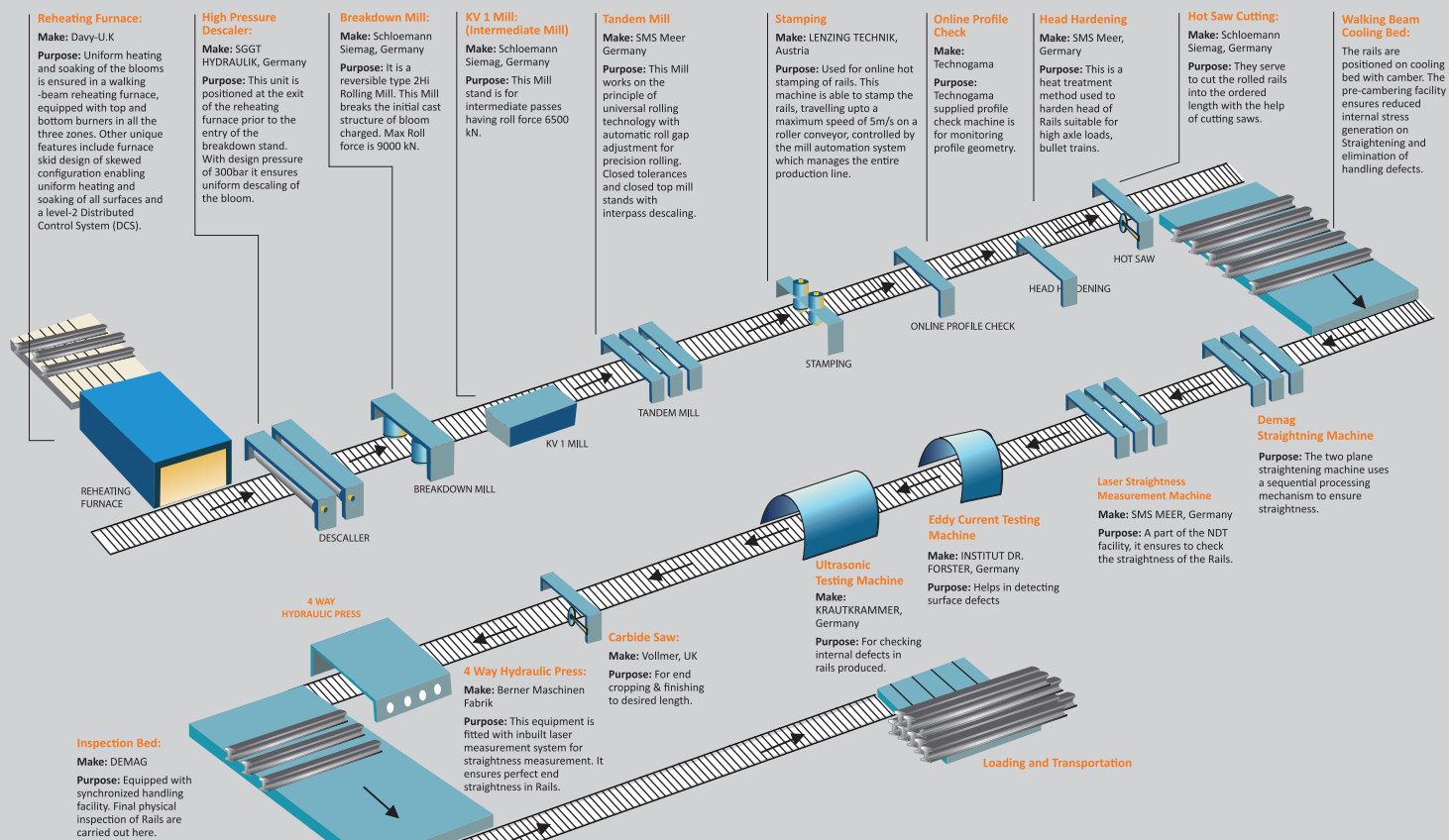
- UNIFORM HEAD HARDENED LAYER
- EXCELLENT WEAR RESISTANCE
- LOWER RESIDUAL STRESSES
- EXCELLENT SYMMETRY IN CROSS-SECTION
- SUPERIOR QUALITY & GOOD ECONOMY

Rails with enhanced wear resistance for high speed, Metro Rail & Heavy haul applications

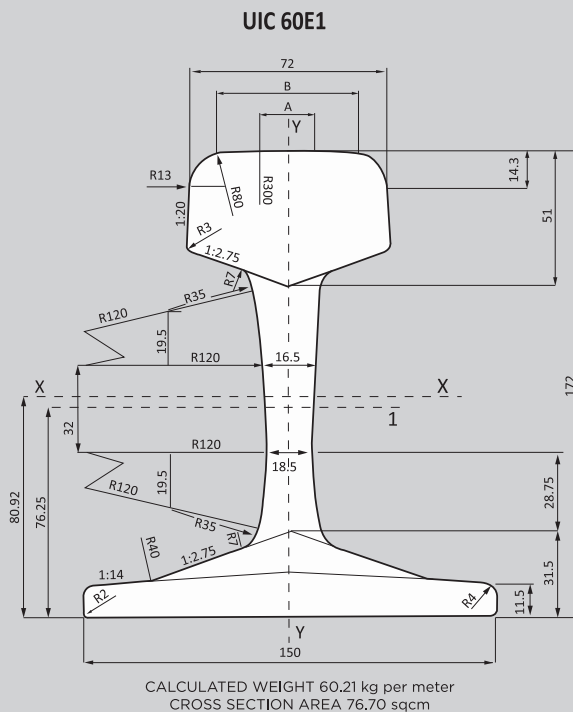
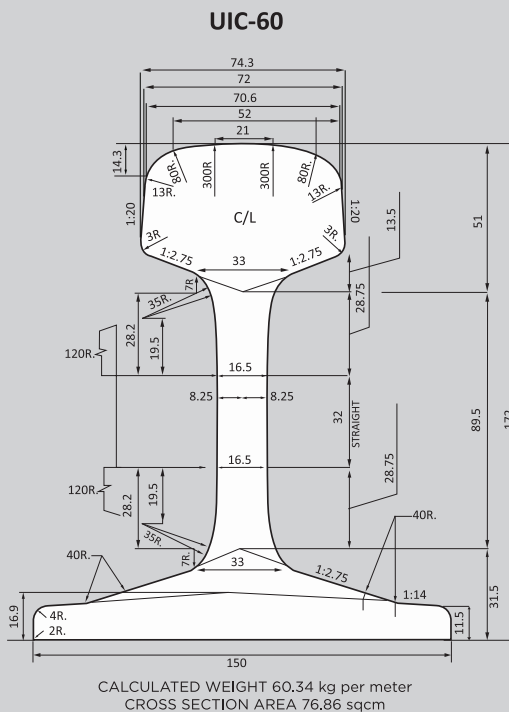
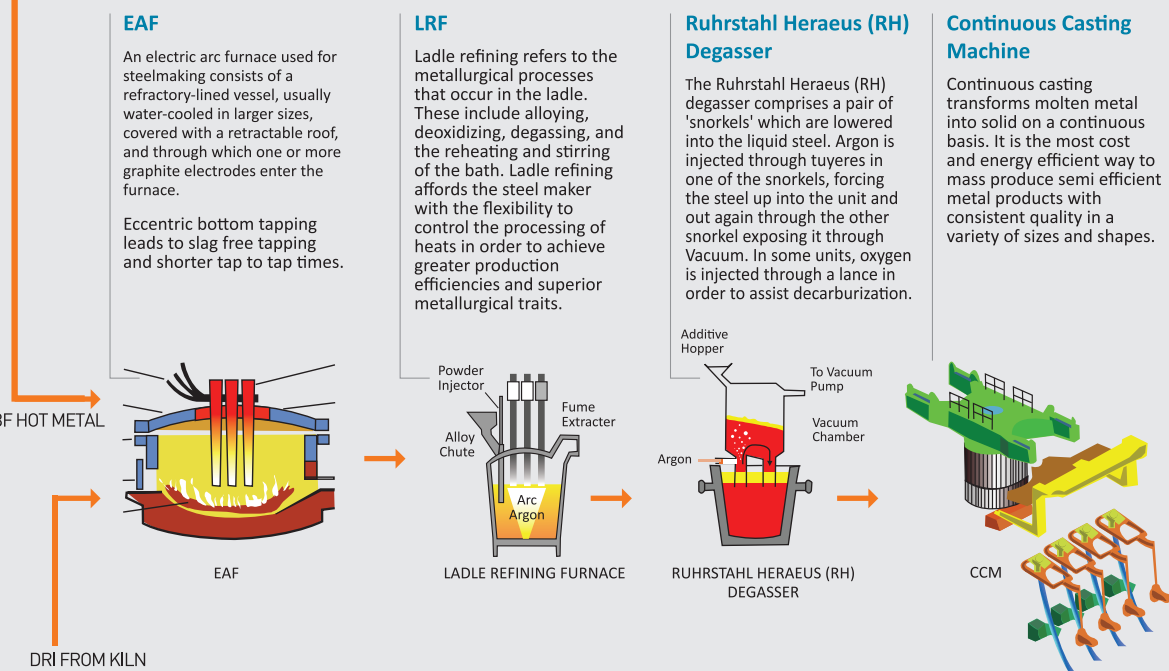
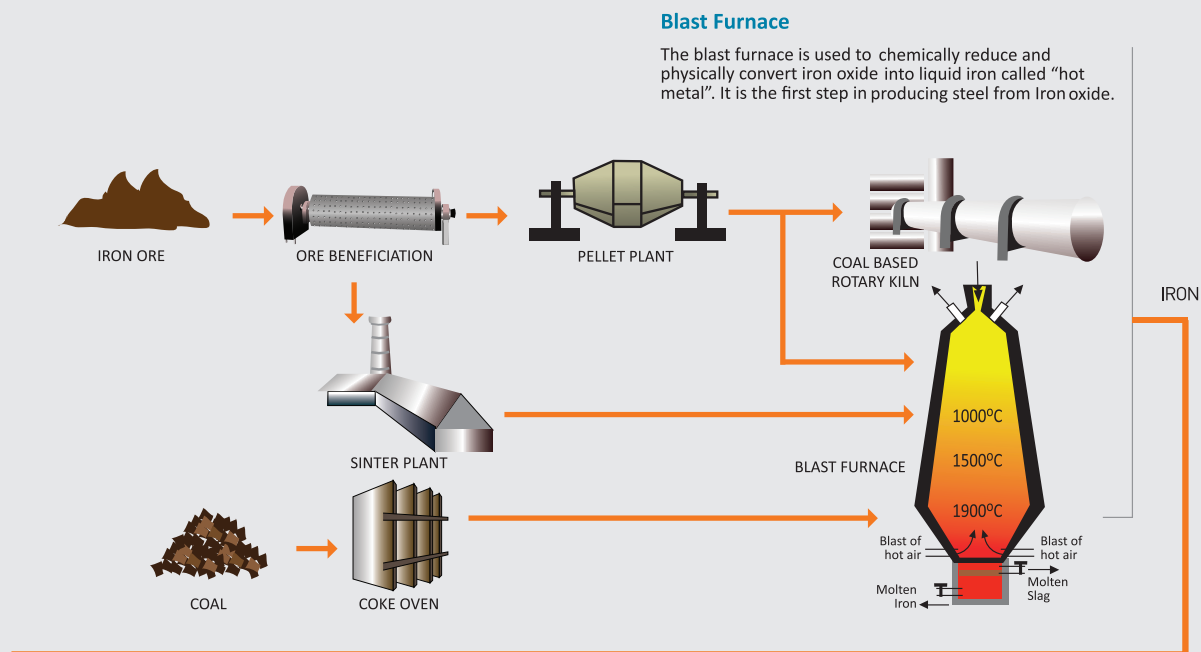
Wear resistant Rails to be produced by head Hardening through an online selective cooling line by SMS MEER, Germany

Advanced State of the art Selective Rail cooling line

PROCESS ROUTE FOR RAIL PRODUCTION



INTEGRATED STEEL MAKING PROCESS



CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES AS PER IRST12-2009

Grade	C	Mn	Si	S (max)	P (max)	Al (max)	Mo (max)	Cr	V (max)	10 ⁻⁴ % (ppm) by mass max	Hydrogen content in liquid steel (max.)	UTS (MPa) (min)	Yield Strength (MPa) (min)	Elongation % on gauge length - 5.65 V ₅₀ (min)	Running surface hardness (BHN)
880	0.60-0.80	0.80-1.30	0.10-0.50	0.030*	0.030*	0.015	-	-	-	-	1.6ppm	880	460	10.0	Min260
1080HH	0.60-0.80	0.80-1.30	0.10-0.50	0.030*	0.030*	0.015	-	-	-	-	1.6ppm	1080	460	10.0	340-390

So = Cross sectional area of tensile test piece in mm²
* 0.035 maximum for finished rail

CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES AS PER EN13674-2011

Steel grade	Sample	C	Si	Mn	P max.	S max.	Cr	Al max.	V max.	N max.	O max.	H max.	Tensile strength R _m min. MPa	Elongation A min. %	Hardness of the rail running surface center line HBW
R200	Liquid	0.40 to 0.60	0.15 to 0.58	0.70 to 1.20	0.035	0.035	≤0.15	0.004	0.030	0.009	20	3.0	680	14	200 to 240
R220	Liquid	0.50 to 0.60	0.20 to 0.60	1.00 to 1.25	0.025	0.025	≤0.15	0.004	0.030	0.009	20	3.0	770	12	220 to 260
R260	Liquid	0.48 to 0.62	0.18 to 0.62	0.95 to 1.30	0.030	0.030	≤0.15	0.004	0.030	0.010	20	2.5	880	10	260 to 300
R350HT	Liquid	0.62 to 0.80	0.15 to 0.58	0.70 to 1.20	0.025	0.025	≤0.15	0.004	0.030	0.009	20	2.5	1175	9	350 to 390