RAIL TECHNOLOGY

INNOVATION, TECHNOLOGY AND HIGHEST PRODUCTIVITY

LINSINGER

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SINCE 1959
WE'VE BEEN DOING
WHAT OTHERS ARE NOW
BEGINNING TO ATTEMPT

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CONTENT

RAIL TECHNOLOGY
RAIL MILLING AND GRINDING TECHNOLOGY

All rails from railways, trams to metros are subject to a constant fatigue and wear process. In order to increase safety and at the same time extend the rail life, reduce the whole life costs rails must be maintained regularly. In order to minimise operational disruptions that occur during this process LINSINGER has developed special rail milling machines to maintain the rail profile and remove defective material in situ and remove the need for premature rail replacement. All LINSINGER rail milling machines can be individually adapted for use on main line tracks, suburban trains, metros, trams and private railways as well as for switches, railroad crossings and tunnels.

Increased train speeds, frequencies, traction forces and loads have a negative effect on the wheel / rail system and accelerate rail damage development. Therefore, infrastructure owners are need in to apply new maintenance strategies and procedures. These strategies require a technology that can restore the surface of the rail regardless of the state of damage, but is also applicable to common maintenance strategies. LINSINGER high-performance milling technology fulfills these requirements and contributes in a flexible and economical way to sustainable extension of rail life even under these increased load conditions.

variable gauge | transverse profile measuring device | longitudinal profile measuring device | height measuring device | surface crack detection | processing of switches | processing of grooved rails

CHALLENGES

Increasing freight volumes, rising passenger numbers, shorter train intervals and higher speeds in passenger traffic lead to deformations at the wheel/rail contact area. Resulting rail defects that are accompanied by the following negative aspects:

- Safety risk
- Unplanned reduction of line speeds - increased delays
- Downtime - high failure costs
- Noise pollution
- Reduced service life of rail and increased carbon footprint
- Rail and wheel wear
- Formation of fatigue rail defects, corrugations, rail breaks and other rail defects
- Reduced track quality and driving comfort

These aspects require a modern, flexible and reliable milling technology which sustainably extends the service life of rails. The LINSINGER high-performance milling technology fulfils exactly these requirements - even under increasing load conditions.

THE CHALLENGE

Safety risk

LINSINGER HIGH PERFORMANCE MILLING TECHNOLOGY

LINSINGER milling technology makes it possible, with regular treatment of the rails, to extend the service life of the track and thus reduce costs and the carbon footprint significantly. Through years of experience, it is possible for LINSINGER to remove rail defects of any kind. The cumulative settings of LINSINGER machines allow for a removal rate of up to 6 mm* from the crown and a removal of more than 10 mm* at the running edge in **one working pass**.

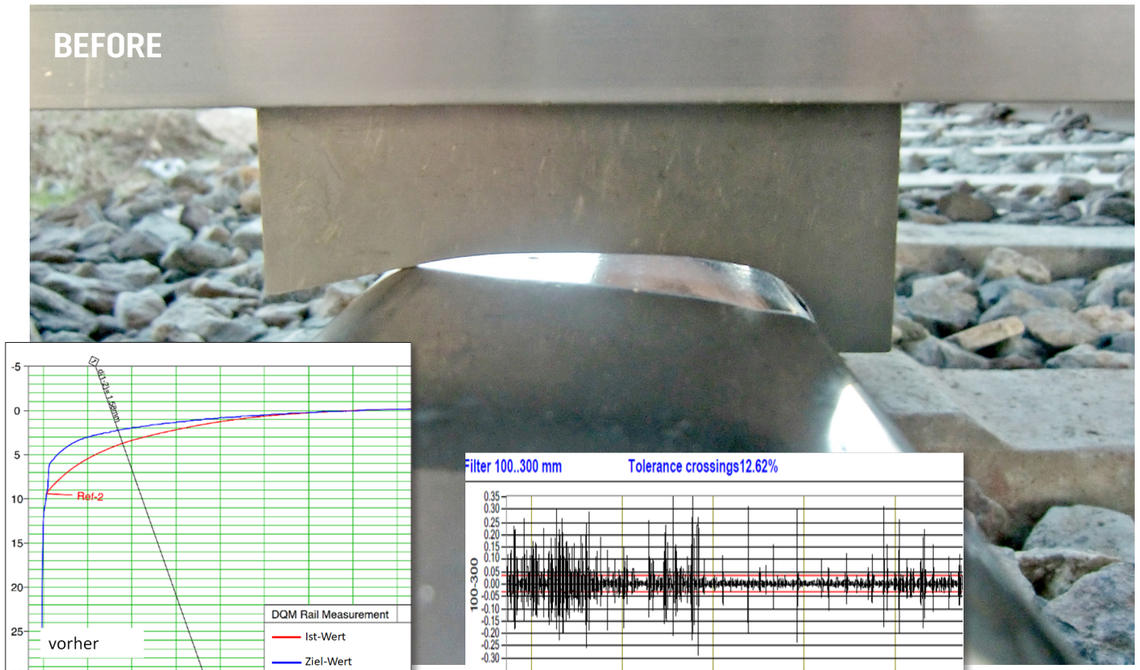
Other important advantages of Linsinger technology are:

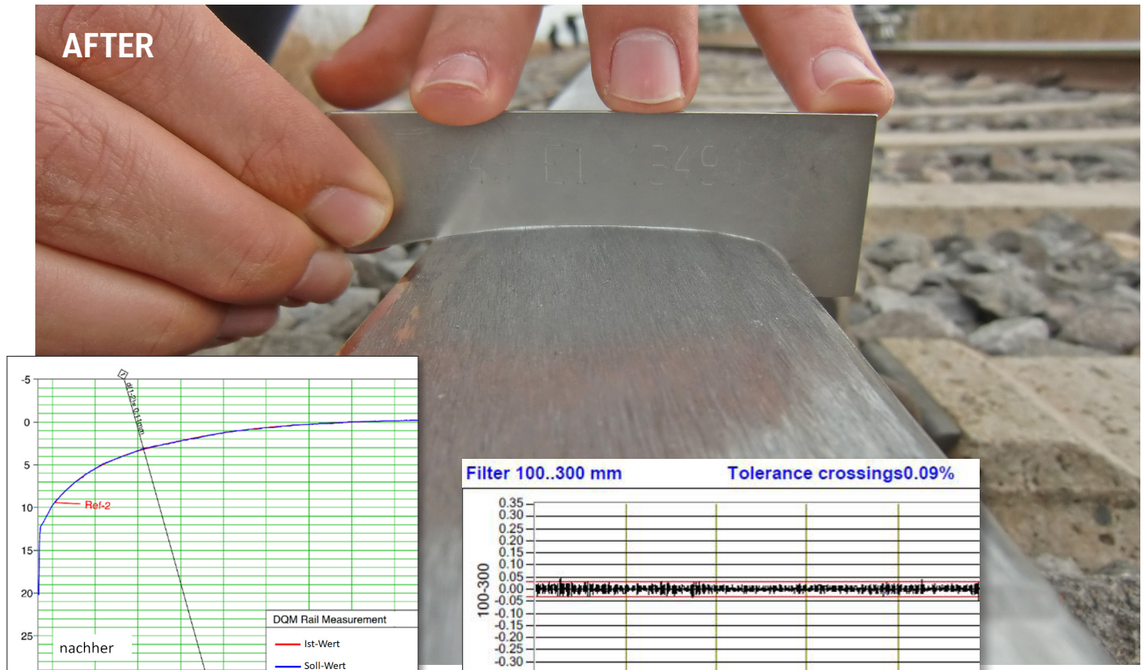
- Restoration of the rail head target profile
- Removed material is extracted and can be recycled
- No dust pollution
- No water, no extinguishing agent required
- Material removal of 0.1 - 6 mm in ONE WORKING PASS*
- Any finishing sparks are contained - no risk of fire
- No metallurgical change (blue colouration) of the rail surface - the heat is dissipated via the chip
- Highest accuracy of longitudinal and transverse profile correction
- Lowest surface roughness
- Track correction
- Track quality recording after processing*
- Surface crack detection*
- No „concealment" of rail defects
- Low carbide requirement - lower processing costs
- Environmentally friendly fuel cell drive concept available

*depending on machine type

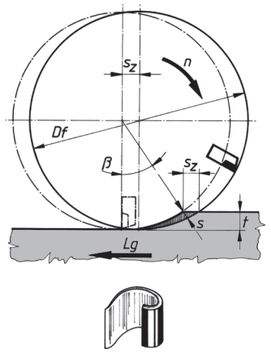
THE LINSINGER TECHNOLOGY

Material removal from 0.1 - 6 mm in one working pass





THE PROCESS



LINSINGER's high-performance milling technology uses a patented circumferential milling process, which restores the lateral and longitudinal profile within the strictest tolerances and completely removes all surface defects in just one pass. Because this is a rotary cutting process, only milling chips (and no dust) are produced, and these are temporarily stored in a chip bunker on the machine for later recycling.

Years of research and development of the most important factors, such as the optimal cutterhead diameter and perfectly matched cutting performance, which in turn affect vehicle weight and the resulting vibration behaviour of the substructure, put the **LINSINGER technology clearly in pole position**. Milling machines with the highest levels of efficiency, together with specially developed carbide tools for this application, with up to eight cutting edges per indexable insert, achieve sustainability and lead to better economic results.

Only a completely faultless rail surface with a precisely adjusted profile can make a significant contribution to reducing the travel whole life costs by optimising the rail life.
Because LINSINGER's milling technology produces a defined, reproducible and documented track condition with the highest quality (free from defects, accurate longitudinal and transverse profile tolerances, low profile discontinuities and low surface roughness), this process is well suited to preventive, corrective and other bespoke maintenance strategies.

THE GOAL - SUSTAINABILITY

Waste? Not at LINSINGER!
Our milling chips are 100% recyclable.

Maintenance process with the LINSINGER high-performance rail milling technology can deliver the right solution for every strategy:

- A **preventive maintenance strategy** that aims to remove damage shortly after its emergence with minimal material removal, thus keeping the surface of the rail virtually free of damage.
- A **cyclical maintenance strategy** is a modification of the preventive approach.
  Here, maintenance is performed not based on level of damage but on operational experience with respect to damage and/or wear in a specified time or load interval.
- For flaws with medium to high failure depth, a corrective maintenance strategy is suitable.
  As soon as the **corrective maintenance** threshold with regard to failure depth is reached, the rail must be maintained or exchanged. The location of this intervention threshold depends on local maintenance options.

These maintenance concepts will increase the service life of the tracks many times, so that whole life costs (WLC) can be drastically reduced.

WHY WE INVENTED RAIL MILLING

TO REDUCE LIFE-CYCLE COSTS
TO PROTECT THE ENVIRONMENT
TO NOT CHANGE THE METALLURGICAL COMPOSITION
TO AVOID RAIL DEFECTS IN THE FUTURE

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MG 31

The most efficient rail milling train in the world

RAIL MILLING TRAIN MG31
FOR LARGE WORKLOADS

APPLICATION:

High-speed lines, main lines

ADVANTAGES

- Fastest processing thanks to newly developed milling units
- Large material removal possible with coarse rail defects
- Automatic tool change for long consistent adaption
- Transfer speed up to 100 km/h
- Long service life of the tools
- Continuously accessible
- Integrated measuring system
- Robust construction

POSSIBLE OPTIONS

transverse profile measuring device

longitudinal profile measuring device

height measuring device

surface crack detection

processing of switches

TECHNICAL SPECIFICATIONS

Drive type of units	three milling units per side: electric / one grinding unit: electric
Traction drive	hydraulic
Main engine	830 KW
Weight / max. axle load	205 t / per axle max. 20 t
Gauge	according to customer requirement
Minimal curve radius for processing at gauge system 1,435 mm	150 m
Cant at gauge system 1,435 mm	200 mm
Chip container volume	11 m^3
Maximum speed self propelled	100 km/h
Max. gradient	40 ‰
Variable gauge	no

Driver's cab 1 | Aggregate room | Tool magazine | Engine room | Suction device | Chip container | Crew room | Technique room | Driver's cab 2

3 Processing units + 1 Processing unit | Polishing unit | Mobile measuring device

RAIL MILLING TRAIN SF06-FFS PLUS
FOR LARGE WORKLOADS

SF06-FFS

The most autonomous rail milling train in the world

APPLICATION

Main lines

ADVANTAGES

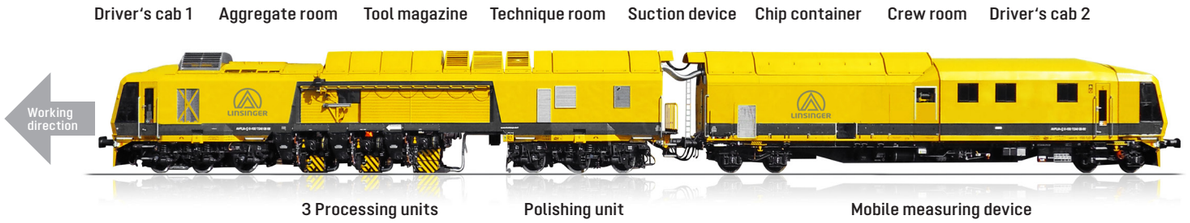
- Continuous operation through autonomous systems
- Customer specific design and arrangements
- Support trailer with office space and social area
- High transfer speeds
- Modular configuration
- Capacity for extension
- Cabin to cabin gangway
- Machine integrated measuring device

POSSIBLE OPTIONS

transverse profile measuring device | longitudinal profile measuring device | height measuring device | surface crack detection | processing of switches

TECHNICAL SPECIFICATIONS

Drive type of units	two milling units per side: electric / one grinding unit: electric
Traction drive	hydraulic
Main engine	750 KW
Weight / max. axle load	160 t / per axle max. 20 t
Gauge	according to customer requirement
Minimal curve radius for processing at gauge system 1,435 mm	150 m
Cant at gauge system 1,435 mm	130 mm
Chip container volume	15 m^3
Max. speed self propelled	80 km/h
Max. gradient	40 ‰
Variable gauge	no



RAIL MILLING TRAIN SF03-FFS
THE STANDARD MACHINE FOR ALL RAILWAYS

SF03-FFS

The most proven rail milling train in the world

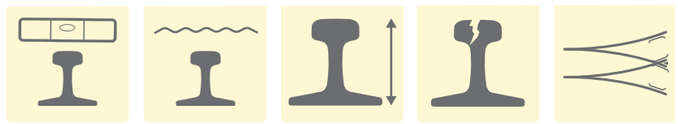
APPLICATION

Universally applicable, customised vehicle design

ADVANTAGES

- Deutsche Bahn-proven and approved
- High efficiency
- Continuous operation through autonomous systems
- Suitable for high-speed lines
- High planning reliability
- Customer specific design
- Modular configuration
- Machine integrated measuring system
- Expansion capacity

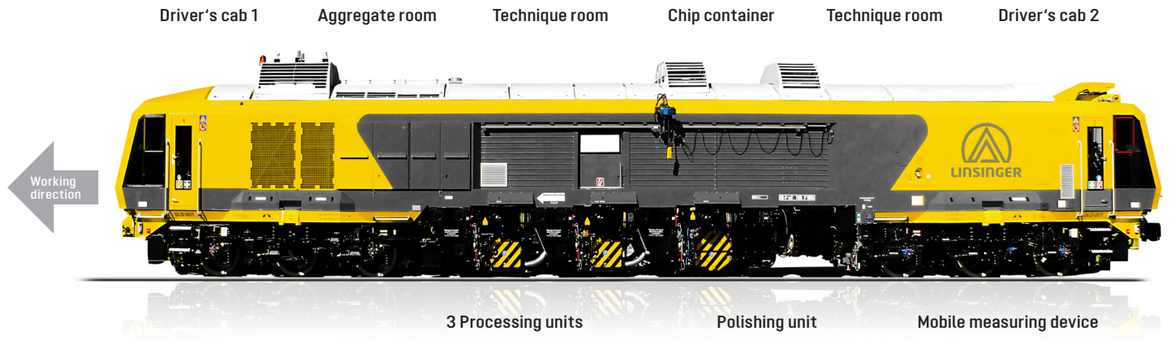
POSSIBLE OPTIONS



transverse profile measuring device | longitudinal profile measuring device | height measuring device | surface crack detection | processing of switches

TECHNICAL SPECIFICATIONS

Drive type of units	two milling units per side: electrical / one grinding unit: electrical
Traction drive	hydraulic
Main engine	750 KW
Weight / max. axle load	120 t / per axle max. 20 t
Gauge	according to customer requirement
Minimal curve radius for processing at gauge system 1,435 mm	150 m
Cant at gauge system 1,435 mm	180 mm
Chip container volume	8 m^3
Max. speed self propelled	100 km/h
Max. gradient	40 ‰
Variable gauge	no



MG31 - The most efficient rail milling train in the world

processing speed up to 2,000 m/h
removal rate per pass 0.1 - 6 mm
total length 48 m
height 3.90 m / width 2.70 m

SF06-FFS Plus - Highest performance requirement in long-term use

processing speed up to 2,000 m/h
max. removal rate per pass 0.1 - 4 mm
total length 44 m
height 4.25 m / width 3.13 m

SF03-FFS - Universally applicable, equipped for any challenge

processing speed up to 2,000 m/h
max. removal rate per pass 0.1 - 4 mm
total length 24 m
height 4.25 m / width 3.13 m

SF02T-FS - The train for special demands

processing speed up to 1,000 m/h
max. removal rate per pass 0.1 - 1.5 mm
total length 23 m
height 3.50 m / width 2.60 m

SF02-TRUCK - Highest flexibility and maximum mobility

processing speed up to 600 m/h
max. removal rate per pass 0.1 - 1 mm
total length 18.43 m
height 3.70 m / width 2.55 m

MG11 - Conceived and designed especially for small clearance gauges

processing speed up to 720 m/h
max. removal rate per pass 0.1 - 1.2 mm
total length 11.92 m
height 2.59 m / width 2.21 m

SF02T-FS

The most versatile rail milling train in the world

RAIL MILLING TRAIN SF02T-FS
FOR SPECIAL DEMANDS

APPLICATION

Metros, tunnels

ADVANTAGES

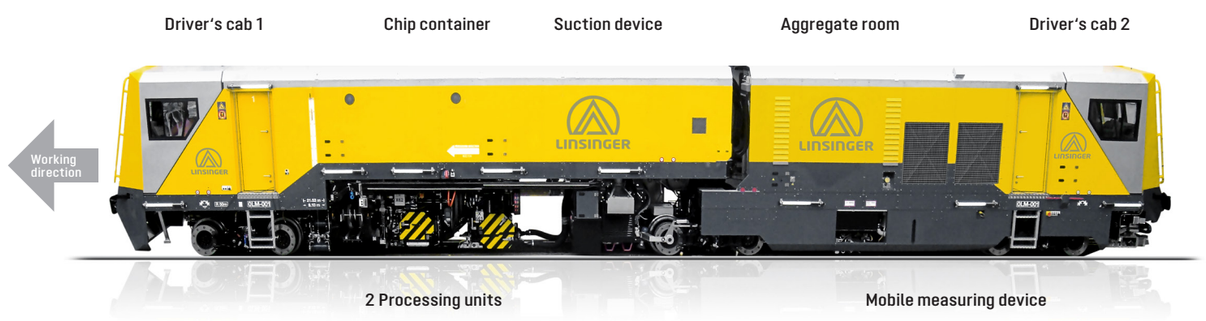
- For small clearance profiles
- Processing of tight curves
- Gauge convertible
- Low axle load
- Dust and spark reduced processing
- No additional track cleaning works
- Customised design
- Modular configuration
- Integrated measuring system
- Suitable for narrow gauge

POSSIBLE OPTIONS

transverse profile measuring device | longitudinal profile measuring device | height measuring device | surface crack detection | processing of switches

TECHNICAL SPECIFICATIONS

Drive type of units	one milling unit per side: hydraulic / one grinding unit: electric
Traction drive	hydraulic
Main engine	470 KW
Weight / max. axle load	71 t / max. axle load 14 t
Gauge	Customised from 1,000 - 1,668 mm possible
Minimal curve radius for processing at gauge system 1,435 mm	50 m
Cant at gauge system 1,435 mm	160 mm
Chip container volume	5 m^3
Max. speed self propelled	60 km/h
Max. gradient	40 ‰
Variable gauge	yes



SF02-FS TRUCK

The most flexible rail milling train in the world

RAIL-ROAD-TRUCK SF02-FS TRUCK
FOR FLEXIBLE DEMANDS

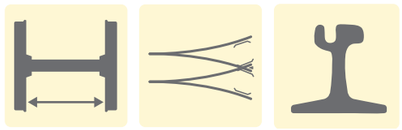
APPLICATION

Road & rail, easy re-railing and transfer

ADVANTAGES

- Highest flexibility, maximum mobility
- No impact on rail traffic
- Transfer trips on roads and rail
- Simple re-railing
- No removal of track switching devices
- Short set-up times
- Suitable for processing grooved rails
- No damage caused by flying sparks on parked cars
- Quick transfer for processing hot spots
- For track processing on wooden bridges

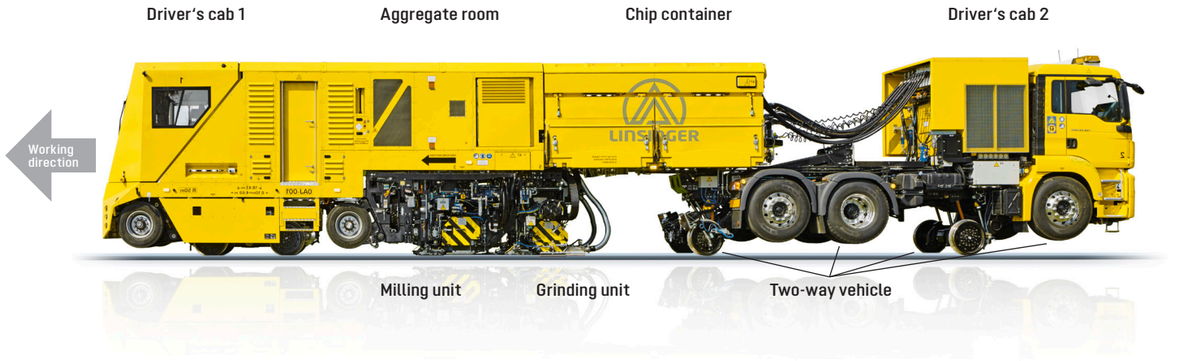
POSSIBLE OPTIONS



gauge convertible | processing of switches | processing of grooved rails

TECHNICAL SPECIFICATIONS

Drive type of units	one milling unit per side: hydraulic / one grinding unit: hydraulic
Traction drive	hydraulic
Main engine	375 KW
Weight / max. axle load	ca. 47 t / max. 14 t axle load
Gauge	Customised from 1,000 - 1,668 mm possible
Minimal curve radius for processing at gauge system 1,435 mm	50 m
Cant at gauge system 1,435 mm	160 mm
Chip container volume	4.5 m^3
Max. speed self propelled	80 km/h road trip, 45 km/h rail trip
Max. gradient	40 ‰
Variable gauge	yes



MG 11

The smallest rail milling train in the world

RAIL MILLING TRAIN MG11
FOR SMALL CLEARANCE GAUGES

APPLICATION

Metros, light rails, trams

ADVANTAGES

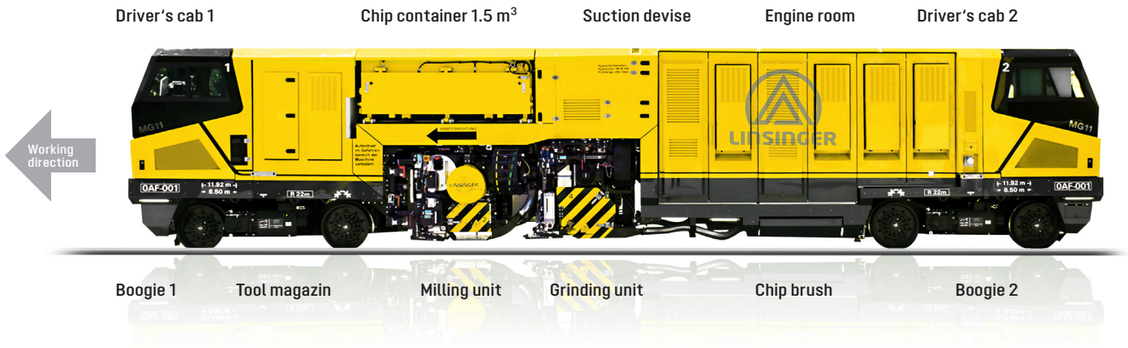
- Diesel electric drive
- High efficient suction system for chips (> 99.5%)
- Processing of the rail head by circumferential milling with combined circumferential grinding
- Emission standard: EPA TIER 4 Final. EU Stage IV
- Transport in a 40 ft shipping container or road haulage on a specific flatbed truck possible
- Low noise emission during processing
- No cooling agents needed
- Driving cab for 2 persons; machine operator position for 1 person
- Suitable for switches and turnouts
- Front access

POSSIBLE OPTIONS

gauge convertible | transverse profile measuring device | longitudinal profile measuring device | processing of switches | processing of grooved rails

TECHNICAL SPECIFICATIONS

Drive type of units	each side one milling unit: electric / one grinding unit: electric
Traction drive	electric
Main engine	277 KW
Weight / max. axle load	total net 31 t / per axle max. 8.5 t
Gauge	customised from 1,000 - 1,668 mm possible
Minimal curve radius for processing at gauge system 1,435 mm	35 m
Cant at gauge system 1,435 mm	150 mm
Chip container volume	1.5 m^3
Max. speed self propelled	50 km/h
Max. gradient	40 ‰
Variable gauge	yes



WORLDWIDE OVER 60 MACHINES IN USE

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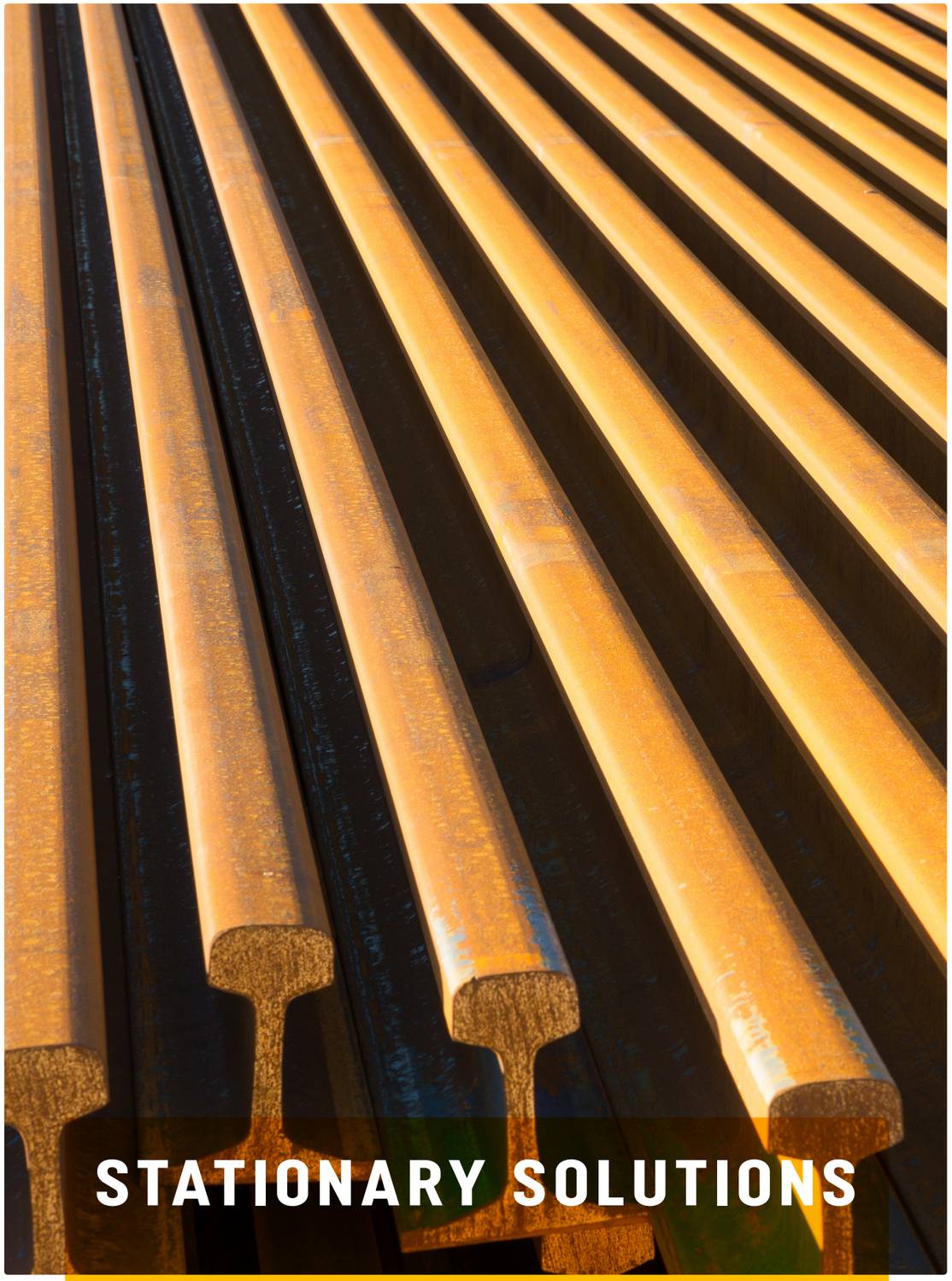
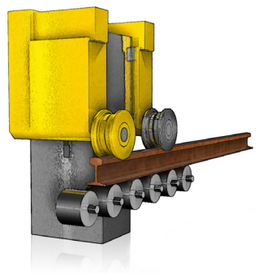




STATIONARY
RAIL HEAD MILLING MACHINE SKF
FOR STATIONARY RAIL HEAD REPROFILING

For centralised rail head processing we developed a stationary rail head milling line.

APPLICATION

- For use in welding, used rail and repair plants in 3-shift operation
- For rail manufacturers to remove the mill scale

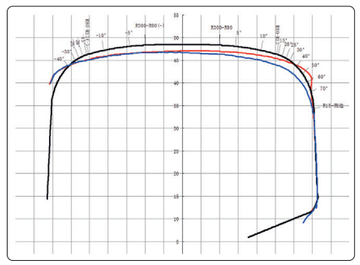
ADVANTAGES

- Any changeable profile shape
- Side of the running edge freely selectable
- Re-profiling by milling and grinding in one simple operation
- Constant machining accuracy thanks to CNC axes
- No subsequent operation necessary

ECONOMICALLY VIABLE PROCESSING

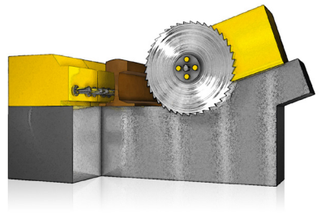
Redoubling of rail life through running gauge changeover

Low tool costs



Transverse profile before and after processing

LINCUT® APPROVED



RAIL SAWING & DRILLING MACHINE LSB
FOR SAWING AND SIMULTANEOUS DRILLING OF RAILS

APPLICATIONS

Rolling mills, rail welding and switch manufacturing mills

ADVANTAGES

- Sawing and drilling in a single pass
- Inclined saw design
- Fully automated
- Turnkey solutions

OPTIONS

- Drilling hole cold pre-stressing for longer life
- Deburring unit
- Testing sample manipulator
- Longitudinal measuring system with temperature compensation

CYCLE TIME 30 SECONDS

One saw cut and six drilled holes

TYPE	QTY DRILLS	RAIL HXB MAX
KSA 500 S	0	190 x 160 mm
LSB 800	0	200 x 220 mm
LSB 800/S1	1	200 x 220 mm
LSB 800/S2S	1*	200 x 220 mm
LSB 800/S3	3	200 x 220 mm
LSB 800/S6	6	200 x 220 mm

*special design for switch manufacturing mills

RAIL REPAIR AND WELDING PLANT
THE COMPLETE SOLUTION FOR NEW & USED RAILS

The LINSINGER turnkey solution for new and used rails is the rail repair and welding plant. LINSINGER presents itself as the partner for turneky solutions, from basic concepts up to complete solutions.

ADVANTAGES

- A partner for all solutions
- High efficiency through flexible machining in the factory
- Modular assembly according to customer requirements
- Design for 3-shift operation

TURNKEY PACKAGE

Conservation of material resources and environment

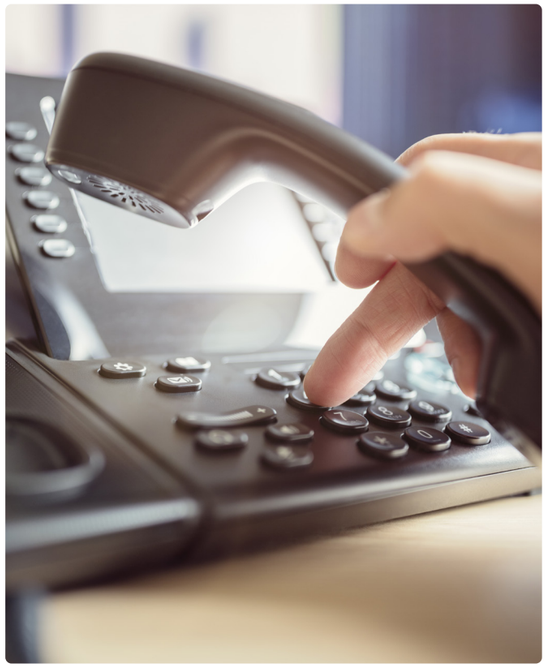
POSSIBLE WORKFLOW FOR USED RAILS

- Preliminary cleaning of rails, preliminary sorting by the customer
- Semi-automatic alignment of the rails
- Reprofiling by using milling and grinding tools
- Defect detection by using ultrasonic inspection and manual marking by the operator
- Removal of previously-marked defects through sawing
- Welding of rail joints, including brushing preparation
- Utrasonic checking of the welding seam
- Fully-automatic removal of excess weld bead
- Cutting to length and drilling

EXAMPLE OF WORKFLOW FOR NEW RAILS

- Welding of rail joints, including brushing preparation
- Fully-automatic removal of excess weld bead
- Ultrasonic checking of the welding seam and sawing samples
- Cutting to length and drilling

TOOL TECHNOLOGY & SERVICE



TOOL TECHNOLOGY
CUTTER HEADS

LINSINGER has invested considerable effort in optimising cutter heads to increase the precision, machining speed, tool life and cost-effectiveness of the rail milling process.
In-house research and development department as well as its own design and mechanical manufacturing ensure that it meets worldwide customer requirements and generates special solutions.
Worldwide active tool technicians support customers on site. These are our guarantees for consistent LINSINGER quality and precision.

SPARE PARTS

Our well-trained service team ensures a fast and reliable supply of original spare parts, perfectly matched to LINSINGER machines.
service@linsinger.com

CUSTOMER SERVICE & MAINTENANCE

The LINSINGER service team offers worldwide (remote) maintenance, repairs and maintenance for LINSINGER machines. Our highly motivated service team tries to handle all service and maintenance requests as quickly as possible, also when demand is high.

In case of emergency, we can be contacted around the clock. Our 24/7 service hotline provides experienced and highly trained LINSINGER service staff 24 hours a day, 7 days a week.

ENGLISCH . 04.2021

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