



清研锐为（洛阳）轨道交通科技有限公司

TsingInst Railway (Luoyang) Rail Transit Technology Co.,Ltd

FGM series Rail Milling Train

 <http://www.tsinginst-railway.com/en>

 jianshengbest@163.com

July 2025





1. Company Profile

源于清华 精研轨道 锐意创新 善为善成



Department of
Mechanical
Engineering,
Tsinghua
University

Tsinghua
University
Institute for
Advanced
Studies

Tsinghua University
Advanced Equipment
Research Institute
Luoyang Base

- Specialty from the Department of Mechanical Engineering of Tsinghua University
- Jointly built by Luoyang High-tech Zone and Tsinghua University Advanced Institute
- Officially started operation in November 2016

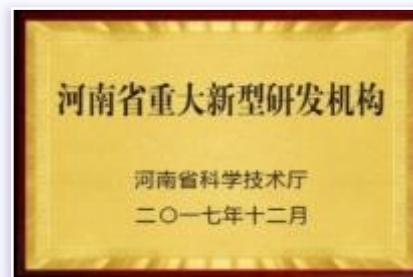
National important industrial base

Self-innovation Zone and Free Trade Zone
"Two Zones Built Simultaneously"

Comprehensive leadership care and resource
introduction

Multiple opportunities and benefits

- National Professional Producer for Intelligent Manufacturing
- The first major new R&D institutions in Henan Province
- The first technology transfer demonstration institutions in Henan Province
- **National Innovation Center (one of the initiators) for Advanced Rail Transit Equipment**
- **National Innovation Center (one of the initiators) for Agricultural Machinery Equipment**
- R&D Center for Luoyang Advanced Manufacturing Equipment Enterprise
- Talent Recruitment Demonstration Park in Luoyang High-tech Zone





1. Company Profile

源于清华 精研轨道 锐意创新 善为善成



Luo Jianbin
Chief Scientist
Chinese Academy of Sciences
Dean of School of Mechanical
Engineering, Tsinghua University



Lu Xinchun
Director
Changjiang Scholars
Professor of Mechanical Engineering
Department, Tsinghua University



Ma Mingxing
Base Executive Director
PhD of Tsinghua University
Former Deputy Secretary of the Department of
Mechanical Engineering, Tsinghua University

121” Talent Structure

- 1/4 Tsinghua Education Background
- 1/2 Have a working background in a large enterprise or government
- 1/4 Outstanding fresh graduates

213 people 
Full-time job, full
commitment

60%
Master's
degree/Associate
professor or above

70%
211/985/Study
Abroad

55%
Under 35 years
old



1. Company Profile

源于清华 精研轨道 锐意创新 善为善成

Focusing on technology transfer and transformation, well connect the industrialization chain



Introducing key scientific research teams to establish research institutes

Provide start-up capital, office location, and test site support.



Carry out technology transfer and achievement transformation

Firmly adhere to the “science and technology & incubation” attributes and transforming the results in basic materials research and development, major equipment research and development projects”.



Accelerate business incubation

Market research, technology promotion, resource matching, administrative management, logistics support, project management, financial services, and post-investment management.



Build a public service platform

Instrument and equipment sharing platform, high-end talent training platform, industry research professional platform, innovation and entrepreneurship service platform.



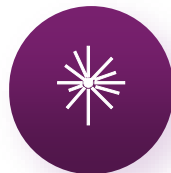
清研锐为（洛阳）轨道交通科技有限公司

TsingInst Railway (Luoyang) Rail Transit Technology Co.,Ltd

TsingInst Railway (Luoyang) Rail Transit Technology Co.,Ltd was founded in September 2017. It is a high - tech enterprise incubated through technology transfer by Tsinghua University Luoyang Institute. The company is committed to building a core technology and equipment R & D platform for intelligent operation and maintenance of rail transit, realizing intelligent detection and efficient maintenance of urban rail transit rails, and improving the safety and economy of rail transit operation and maintenance.

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Research Institutes



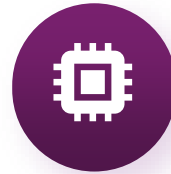
Laser Additive
Manufacturing
Institute



Institute of Quantum
Communication Technology



Institute of Robotics
Control and Visual Sensing



Institute of Automation Equipment and
Precision Measurement and Control
Technology

2

Research Centers



Rail Transit Intelligent Operation
and Maintenance Equipment
Research Institute



Intelligent Detection and Image
Technology Research Institute

12

Incubated companies



New Energy Equipment and
Forming Technology Research
Institute



Industrial Internet and Supply Chain
Finance Collaborative Research Center



Special Metal
Materials Research
Institute



Precision Bearing
Research Institute



2. Products and Technologies

源于清华 精研轨道 锐意创新 善为善成



FGM500A Rail Milling Train



FGM500B Dual power Rail Milling Train



FGM500C Rail Milling Train

► FGM series Rail Milling Train

- The FGM series rail milling and grinding train is independently developed by TsingInst Railway (Luoyang) Rail Transit Technology Co.,Ltd . It is positioned as a major railway transit equipment that is lightweight, intelligent, safe and reliable, efficient and clean, and has low maintenance costs.
- It mainly targets rail defects such as corrugation, head checking, shatter crack, etc. Through efficient milling and grinding, it can achieve precise profile repair and perfect smoothness improvement of rails. The milling operation process is clean, without fire hazards, and the iron chips collection rate reaches 99%.
- It has the function of turnout milling and grinding, which can conduct automatic operation of tracks with obstacles such as expansion rail joints, level crossings, and civil air-tighted door areas.
- The milling machine is equipped with a rail measuring device that can measure corrugation and profile to meet EN13231-3.
- Meet relevant EN standards.

Market sales performance

The light line of MTR Hong Kong
Line 8 of Zhengzhou Metro, China
Guangzhou Metro, China

Milling service performance

Beijing Metro, Nanjing Metro, Luoyang Metro, Shenyang metro,
Suzhou metro,etc.





2. Products and Technologies

源于清华 精研轨道 锐意创新 善为善成

The urgency of rail maintenance



Rail Spalling



Rail Corrugation



**Shatter crack and
head checking**



Rail side wear

Improve riding
comfort

Improved safety

Extend rail life

Reduce noise

Save power of
revenue operation

Scientific rail maintenance



2. Products and Technologies

源于清华 精研轨道 锐意创新 集为集成

Industry "Pain Points"

01

Major safety hazard



The operation generates a lot of sparks, which can easily cause fire hazards

02

Poor working environment



Frequent exposure to exhaust gas and dust is extremely harmful to health

03

Low operating efficiency



Grinding 8 to 10 passes to remove 0.2mm from rail top

04

Higher cost



The price is as high as 100 million yuan per unit. The maintenance cost is high.



2. Products and Technologies

源于清华 精研轨道 锐意创新 善为善成

Revolutionary product - FGM series lightweight, intelligent and efficient Rail Milling & Grinding Train



FGM500A Rail Milling Train
(Light Rail of MTR, Hong Kong)



FGM500B dual-power Rail Milling Train
(Guangzhou Metro, China)



FGM500C Rail Milling Train
(Zhengzhou Metro, China)



FGM01 Rail Milling Train



FGM500 Rail Milling Train



2. Products and Technologies

源于清华 精研轨道 锐意创新 善为善成

Milling only effect



Milling & grinding effect



Surface roughness



Re-profiling Surface Effect



2. Products and Technologies

源于清华 精研轨道 锐意创新 集为集成

Innovation and competitive advantages

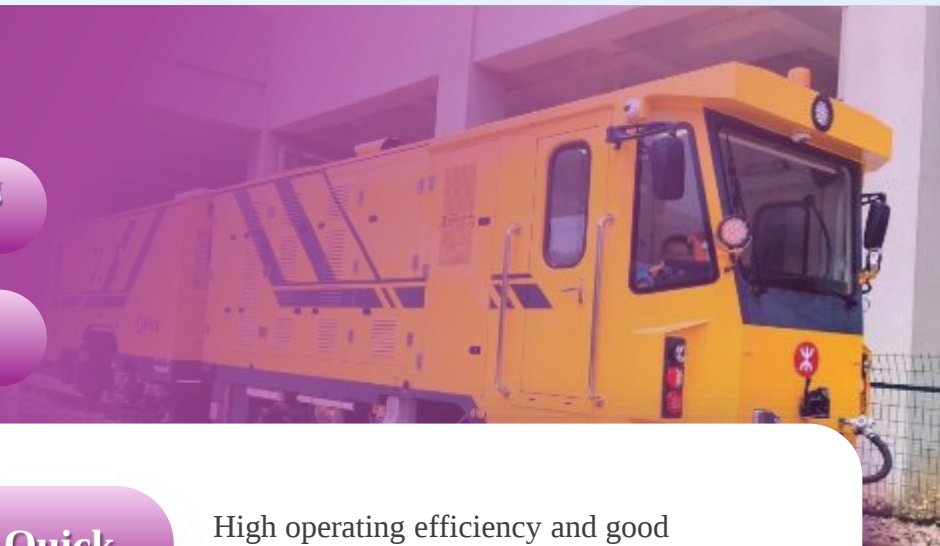
Four Core Technologies

High-efficiency
milling/grinding technology

High-precision tracking
technology

Lightweight system
integration

Intelligent control
technology



Five competitive advantages



New

Core technology has independent intellectual property rights

Small

The train is lightweighted and easy be mobilized

Quick

High operating efficiency and good milling effect

Clean

High iron chips collection rate and low environmental pollution

Cheap

Significantly reduce procurement and operating costs



3. Technical Solutions

源于清华 精研轨道 锐意创新 善为善成

Innovations and competitive advantages of FGM500 Rail Milling Train

Technology Category	Technical Parameters	Technology Category	Technical Parameters	Technology Category	Technical Parameters
Processing methods	Profile milling, curve+ straight line enveloping	Surface burn hazard	None	Rail bottom slope trimming capability	Powerful
Size(weight)	12.85×2.45×2.99m (32t)	Corrugation correct capability	Powerful	Tunnel working environment	Low emissions, no overheating
Operation efficiency	300-1000m/h One pass reprofile	Peeling remove ability	Powerful	Fire Hazard	Low
Maximum milling depth	Top surface 1.5mm/pass Side surface 5mm/pass	Shatter crack capability	Powerful	Cleanliness (dust collection rate)	Milling chips, sparks (less 99%)
Contour accuracy	±0.1mm	Minimum curve passing capability	R20m	Remote control function	Yes
Profile correct capabilities	Powerful	Maximum working slope	80‰	New source of energy	Selectable
Difficulty of control for the re-profiling	Easy	Maximum cant	175mm	Switching cost	Low
Surface Quality	Excellent	Noise	75dB (Driver's cabin)	Purchase cost	Middle



3. Technical Solutions

源于清华 精研轨道 锐意创新 善为善成



Meet EN Standards

Technology Category	Performance
Limit	According to the requirements
Size(weight)	12855mm×2450mm×2990mm
Maximum axle load	8t
Gross weight	32 (1±3%) t
Wheelset inner distance	1353±1mm
Wheel type	Ø640mm According to the requirements
Transmission	Internal combustion-electric drive (can be upgraded to battery power/pantograph power supply)
Maximum self-propelled speed	60km/h
Braking deceleration	1.0m/s ² (normal) 1.2m/s ² (emergency)
Minimum operating curve radius	25m
Maximum working slope	80‰



3. Technical Solutions

源于清华 精研轨道 锐意创新 善为善成



Meet EN Standards

Technology Category

Performance

Operation efficiency

(300-1000) m/h

Milling capacity

Top surface (0.2-1.5) mm/pass
Side surface (0.2-5) mm/pass

Milling cutter head diameter

Ø500mm×2

Milling coverage

-87°~+30°

Grinding wheel diameter

Ø400mm×4

Grinding coverage

-45°~+20°

Cross-section profile accuracy

±0.1mm

Surface roughness

≤Ra 5μm

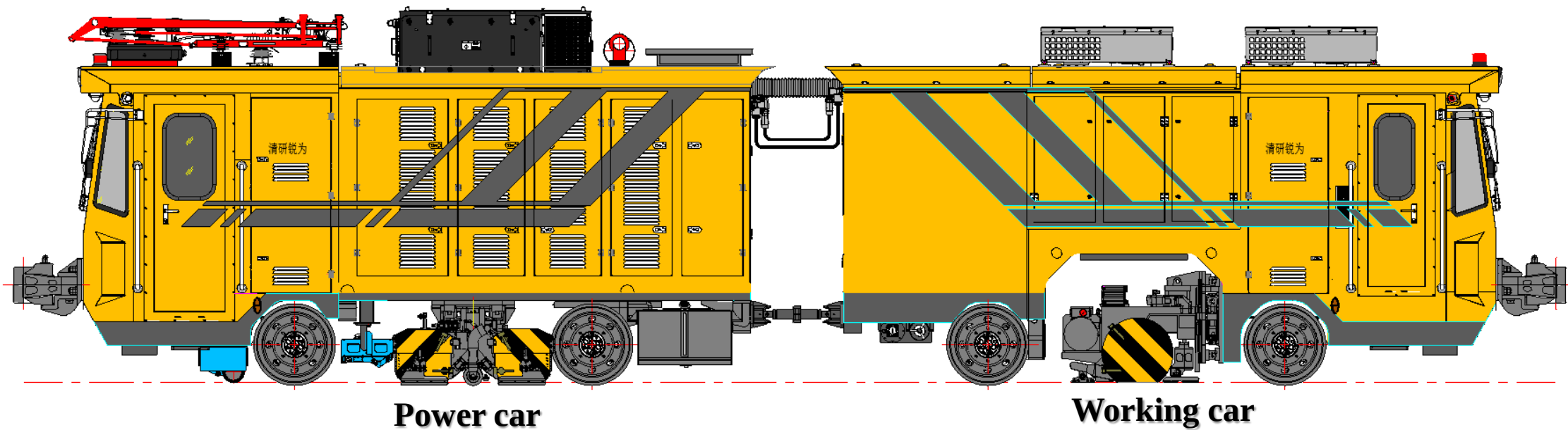
Longitudinal smoothness accuracy

Wavelength $10 < \lambda \leq 100\text{mm}$; ±0.01 mm
Wavelength $100 < \lambda \leq 300\text{mm}$; ±0.015mm
Wavelength $300 < \lambda \leq 1000\text{mm}$; ±0.075mm



3. Technical Solutions

源于清华 精研轨道 锐意创新 善为善成



➤ **FGM500 Rail Milling Train** Combine 2 cars in total, 1×power car and 1× working car.

Power car

Including driver's cab, rail measurement system, grinding system, main diesel generator, auxiliary diesel generator, fire protection system, dust collection system, bogie, etc.

Working car

Including driver's cab, electrical control room, milling system, chip collection system, bogie, CCTV system, communication system, lighting system, etc.



3. Technical Solutions

源于清华 精研轨道 锐意创新 善为善成

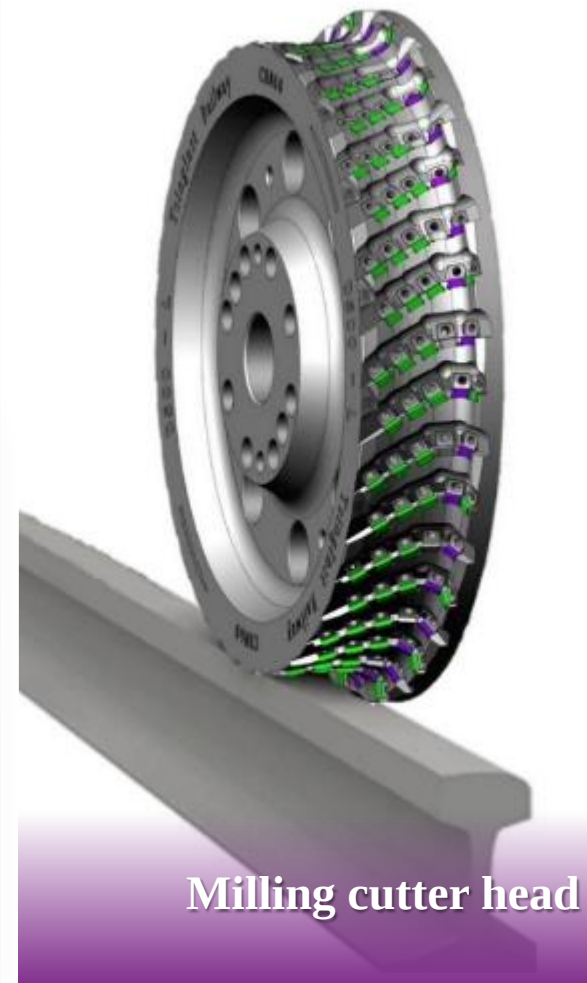
Milling system

The milling device is for rail milling operation. The FGM rail milling and grinding train is equipped with one set of milling devices on each rail. The surface of the rail is cutting by the milling cutter disc to achieve the rail profile correcting operation.

- The milling system adopts electric driven transmission, without hydraulic system (clean, no oil leakage, low failure rate)
- High-precision and high-response servo spindle
- High-precision and high-reliability profiling detection and positioning system
- Turnout and expansion rail joint automatic milling function is upgradable.
- Wireless remote control and RFID tag automatic control functions is selectable.
- Consumables costs reduced by 30%.



Iron chips after milling operation



Milling cutter head

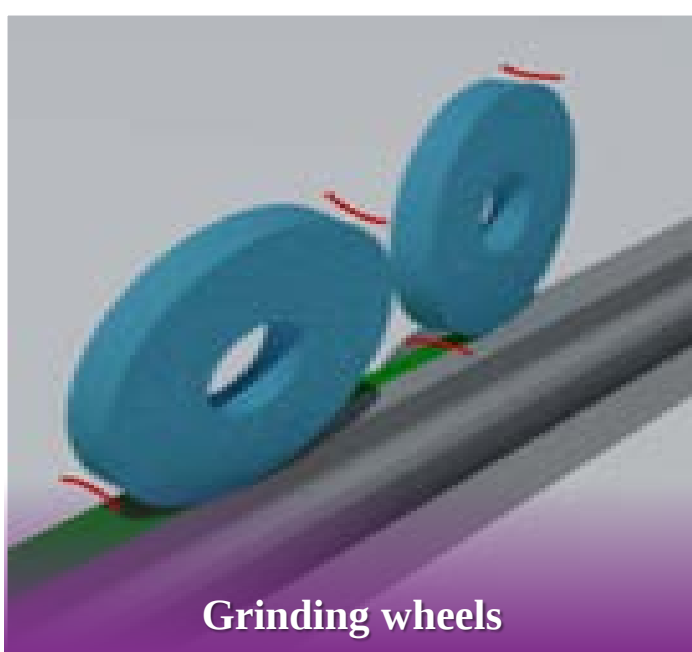


3. Technical Solutions

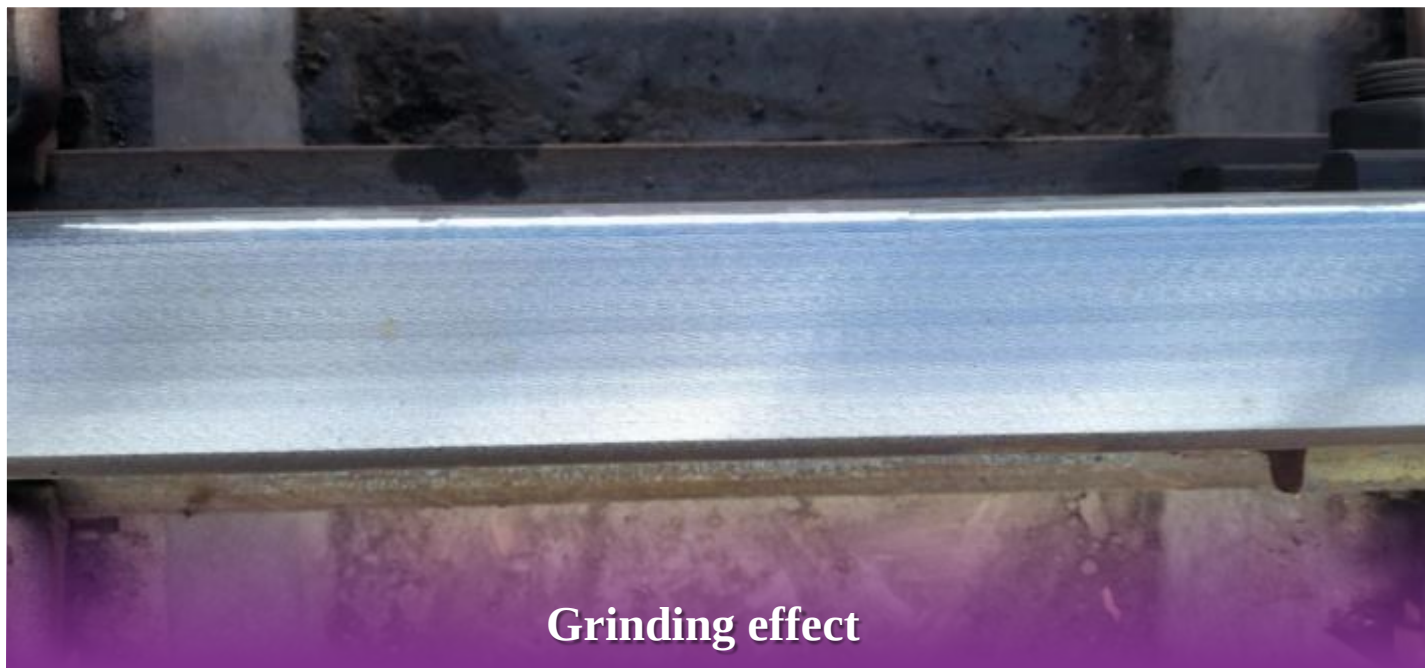
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Grinding system



Grinding wheels



Grinding effect

The FGM Rail Milling and Grinding Train is equipped with a set of grinding devices on each rail (two soft grinding wheels on one rail). The grinding device is used for fine grinding of the rail surface after milling to eliminate residual ripples; the grinding range covers the full rail top; the grinding operation will not create burn marks on rail surface, and the grinding debris collection rate is greater than 95%.



3. Technical Solutions

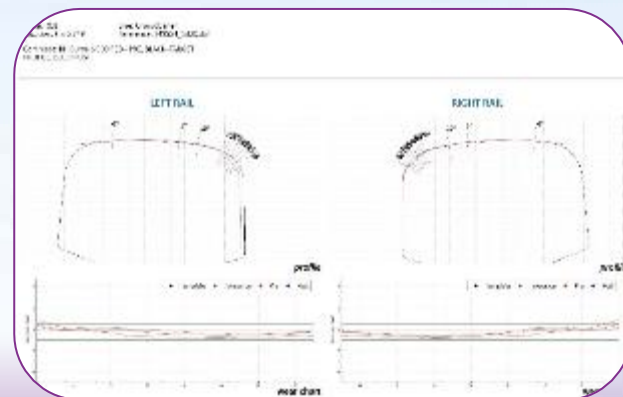
源于清华 精研轨道 锐意创新 集为集成



Rail Measurement System

The FGM500 rail milling and grinding train equips with on-board rail profile and rail corrugation measurement system.

- The accuracy of the profile measuring system is $\pm 0.1\text{mm}$;
- The accuracy of the corrugation measuring system is $\pm 0.0001\text{mm}$;
- Rail measurement system meets the **EN13231-3 Standard**.



Rail profile measurement equipment and report



Rail corrugation measurement equipment and report



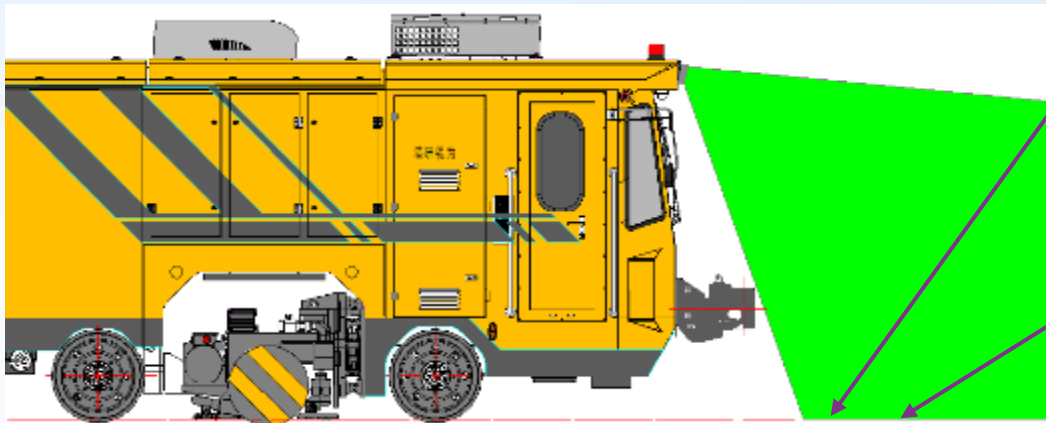
3. Technical Solutions

源于清华 精研轨道 锐意创新 集为集成



Rail obstacle recognition system

The rail obstacle recognition system powered by image recognition technology, the camera installed at the front end of the milling train which identify and detect obstacles along the rails (such as trackside lubricator, axle counters, etc.) and alert the operators before the incident.



Working diagram of rail obstacle recognition system



Obstacle recognition process



4. Test verification and application performance

源于清华 精研轨道 锐意创新 善为善成



Type Test for the MTR project (14 items)



4. Test verification and application performance

源于清华 精研轨道 锐意创新 善为善成



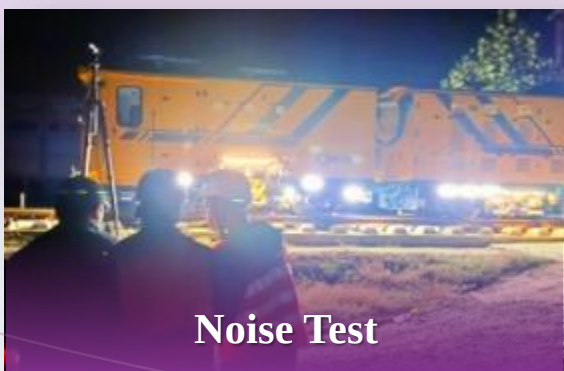
Milling Test



Turnout Milling Test



80% Slope Milling Test



Noise Test



Rail Inspection System Test



Water prove test

Factory Acceptance Test for the MTR project (48 items)



4. Test verification and application performance

源于清华 精研轨道 锐意创新 善为善成



Milling Function Test



Compatibility Test



Emergency Rescue Test



Brake System Dynamic Test



Coupling on Curve Test



65% Slope Pass Test

On-site Acceptance Test for the MTR project (28 items)



5. Company History

源于清华 精研轨道 锐意创新 善为善成



October 2018

The first generation of milling train was successfully handed over and a product launch conference was held.



January 2019

Award the title of "Top Ten Iconic High-end Equipment in Henan Province's Equipment Manufacturing Industry"



June 2019

The second generation milling train was successfully launched and participated in the International Rail Transit Exhibition.



July 2019

Rail milling service for Beijing Metro Line 16.



November 2019

Rail milling service for Beijing Metro Line 14.



5. Company History

源于清华 精研轨道 锐意创新 善为善成



**September
2020**

Won the bid for Nanjing Metro rail milling and grinding services.



May 2021

Won the bid for the procurement of one rail repair equipment (milling type) for the MTR, HongKong.



July 2021

National Engineering Laboratory for Metro Development of a new generation of rail milling equipment Memorandum of Cooperation.



August 2021

Won the bid for Nanjing Rail Milling and Grinding Service.



June 2022

Won the bid for purchasing a Rail Milling Train for Zhengzhou Metro.



**December
2023**

Delivery the FGM500A Rail Milling train to MTR.



5. Company Qualification

源于清华 精研轨道 锐意创新 善为善成

Certification



ISO9001:2015
Quality Management
System Certification



ISO14001:2015
Environmental
Management System
Certification



ISO45001:2018
Occupational Health and
Safety Management System
Certification



5. Company Products

源于清华 精研轨道 锐意创新 善为善成

FGM Milling Train V1.0



FGM01 Rail Milling Train



FGM500 Rail Milling Train

FGM Milling Train V2.0



FGM500A Rail Milling Train



FGM500B Rail Milling Train



FGM500C Rail Milling Train

New generation FGM Milling Train



Contact wire / Battery dual power
mode Rail Milling Train



Hydrogen Energy Rail Milling train



High-speed rail milling machine



5. Company Sales Reference

源于清华 精研轨道 锐意创新 善为善成

MTR

FGM500A Rail Milling Train



Guangzhou Metro

FGM500B Dual Power
Rail Milling Train



Zhengzhou Metro

FGM500C Rail Milling Train



Market sales
performance



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