

# Linton

## GRINDER

LT-GMS950



**一、概述**
**I. Overview**

磨倒机 (LT-GMS950) 是一款对开方后的、不同规格的单晶硅方棒进行弧、面一体抛光的设备, 同时具备粗磨、精磨、R 弧及倒角加工控制功能, 既可作为独立的加工设备, 也可同时用于工厂自动化生产线的磨削加工单元。

Grinder (LT-GMS950) is an integrated machine for polishing monocrystalline silicon square rods of different sizes in both arc and surface after square cutting, with the functions of rough grinding, fine grinding, R-arc and chamfering processing control. It can be used both as a stand-alone machine and as a grinding unit in the factory automation line.

**二、主要技术要求**
**II. Main technical requirements**

序号 No	项目 Item	项目内容 Description	检验方法 Inspection method
1	方棒加工长度 Square bar processing length	150-950mm (硅棒长度信息由机外机械手传输, 单机工作人工传输) 150-950mm (Silicon rod length information is transmitted by off-machine robots, manual transmission for single machine work)	游标卡尺 Vernier calipers
2	方棒边宽 Square bar side width	156mm-230mm (换型分段需调整, 156 型增设高度调整垫) 156mm-230mm (Adjustment is required for the segmentation of change type, 156 type with additional height adjustment pad)	游标卡尺 Vernier calipers
3	硅方直径 Silicon Square Diameter	Φ210~330mm	游标卡尺 Vernier calipers
4	设备功能 Device Function	粗、精磨面、弧、倒角 Rough and fine grinding surface, arc, chamfer	
5	方棒垂直度 Square bar verticality	90°±0.05°	万能角度尺 Universal Angle Ruler
6	平面度 Flatness	±0.05mm	刀口平尺 Knife edge flat ruler
7	对角线极限公差 Diagonal Limit Tolerance	±0.05mm	游标卡尺 Vernier calipers
8	玄长极限公差 Limit Tolerance of Genuine Length	≤ 0.3mm	游标卡尺 Vernier calipers
9	装料高度 Loading height	1060mm (机床底面至工件中心线) (machine bottom to workpiece centerline)	
10	砂轮规格 Grinding Wheel Specifications	Φ300×Φ38.1×60mm	
11	主轴转速 Spindle speed	3000r/min (许用磨削转速) (permissible grinding speed)	
12	砂轮线速度 Grinding wheel line speed	30~45m/s	
13	夹具回转速度 Clamp rotation speed	0~30r/min	
14	夹具分度精度 Fixture indexing accuracy	0.01°	
15	夹具夹紧行程 Clamping stroke of fixture	0~840mm	
16	磨削进给滑台速度 Grinding feed slide speed	0~10m/min	
17	立滑台移动行程 Vertical slide travel	140mm	
18	工件输送滑台行程 Workpiece transfer slide stroke	800mm (上料、下料行程同) (the same as the loading and unloading stroke)	

19	上下料方式 Loading and unloading method	上下料口分设机床右、左侧 The loading and unloading ports are located on the right and left side of the machine	
20	自动化接口 Automation Interface	实现与 MES 数据交互、与自动化设备进行对接 Interaction with MES data and interfacing with automation equipment	
21	设备总功率 Total power of equipment	46kw	
22	设备尺寸 Equipment size	5400×2960×2350mm	
23	划痕, 磨痕, 线痕 Scratches, abrasion marks, line marks	无明显划痕、磨痕、线痕、砂轮印 (痕深<0.15um) No obvious scratches, abrasion marks, line marks, grinding wheel marks (trace depth <0.15um)	表面粗糙度测试仪 Surface Roughness Tester
24	圆弧棒 (M10) 加工时间 Arc processing time	700mm<35min/个 (不含辅助时间) (单边余量<0.5mm) 700mm<35min/pc (excluding auxiliary time)(single side margin<0.5mm)	实际统计计算 Actual statistics calculation
25	直角棒(G12)加工时间 Right angle bar processing time	700mm≤25min/个 (不含辅助时间) (单边余量<0.5mm) 700mm ≤ 25min/pc (excluding auxiliary time) (single side margin <0.5mm)	实际统计计算 Actual statistics calculation
26	辅助时间 Auxiliary time	< 5min/方棒 < 5min/square bar	实际统计计算 Actual statistics calculation
27	加工总体磨削量 Total grinding volume for machining	单边磨余量≤0.4mm Single-edge grinding margin ≤ 0.4mm	实际统计计算 Actual statistics calculation
28	硅棒两端面塌边长 Length of collapsed edge on both ends of silicon rod	无 None	菲林尺 film ruler
29	塌边深度 Collapse depth	无 None	菲林尺 film ruler
30	崩边 chipped edge	无 None	菲林尺 film ruler
31	加工良率 Processing Yield	≥99.6%	实际统计计算 Actual statistics calculation
32	噪音 Noise	<75%dB (符合《中华人民共和国国家职业卫生标准 GBZ2.2-2007》中 11.2.1 噪声职业接触限值) < 75%dB (in accordance with the National Occupational Health Standard of the People's Republic of China) (GBZ2.2-2007 11.2.1 Occupational Exposure Limits for Noise)	噪声检测仪 Noise detector
33	设备稼动率 Equipment Crop Rate	≥96%	实际统计计算 Actual statistics calculation

### 三、外部环境参数

#### III.the external environment parameters table

序号 No	项目 Item	单位 Unit	内容 Description
1	使用电源 Using the power supply		380 V±10%AC, 50Hz±1Hz
2	消耗电量: 主机 Power consumption: Mainframe	kVA	≤46KVA (总功率) (total power)
3	压缩空气气压	MPa	0.4mpa-0.6mpa

序号 No	项目 Item	单位 Unit	内容 Description
	Compressed air pressure		
	气量 Air volume	L/min	≥2500L/min
	入气管尺寸 (外径) Air inlet pipe size(outsidediameter)	mm	φ12mm
	接口位置 Interface Location		外置快速活接 External quick connect
4	使用冷却液 Use of coolant		中水、自来水 (30-40L/min) Medium water, tap water (30-40L/min)
5	电源线入口 Power cord entry		三相五线制 有绝缘护套 Three-phase five-wire system with insulation sheath
6	排液口尺寸 Drain port size		Φ75mm (外径) (outside diameter)
7	进水供应接口尺寸 Size of inlet water supply interface		DN25
8	地基 (参考值) Foundation (reference value)		≤5T/㎡
9	环境 Environment	温度 Temperature	20°-30°
		湿度 Humidity	30%-60%

#### 四、设备主要部件颜色、标牌及触摸屏显示要求

#### IV.the main parts of the equipment color, signage and touch screen display requirements

序号 Serial number	设备主要部件 Main components of the equipment	标准产品颜色 Standard product colors
1	外壳 Housing	银白色 Silver White
2	Logo	显著位置印刷供方 logo Prominently printed logo of the supplier
3	触摸屏 Touch Screen	触摸屏显示供方 logo Touch screen display of the supplier's logo
注: Notes:		

#### 五、环保及安全要求

#### V. Environmental protection and safety requirements

- 空载噪音: ≤80dB(A) (测试条件: 操控面板处距离设备 1000mm 和距离地面 1000mm)  
(符合《中华人民共和国国家职业卫生标准 GBZ2.2-2007》中 11.2.1 噪声职业接触限值);  
No-load noise: ≤80dB(A) (test conditions: 1000mm from the equipment at the control panel and 1000mm from the ground)  
(in accordance with the Occupational Health Standard GBZ2.2-2007, 11.2.1 Occupational Exposure Limits for Noise).
- 安全: 封闭式钢板防护罩, 保证设备工作时的人机安全。  
Safety: closed steel plate shield to ensure the safety of man and machine when the equipment is working.

#### 六、设备配置要求

#### VI. Equipment configuration requirements

##### 6.1、主要部件及系统组成 Main components and system composition

本机床是一台双面立卧复合式准方形硅单晶棒数控磨床。整机有自动且相互独立上下料装置、工件定位检测装置、夹具回转驱动装置、磨削主轴进给滑台及驱动装置、磨削进给滑台及螺母旋转驱动装置、工件检测及砂轮磨耗检测装置、整体底座等部件

及系统构成。

This machine is a double-sided vertical and horizontal quasi-square silicon single crystal bar CNC grinding machine. The machine is composed of automatic and independent loading and unloading device, workpiece positioning and inspection device, fixture rotation drive device, grinding spindle feed slide and drive device, grinding feed slide and nut rotation drive device, workpiece inspection and grinding wheel wear inspection device, and overall base.

#### 6.1.1 传动系统 Driveline

机床各运动部件其动作的实现有机械传动、伺服电机、气缸驱动，电气控制相互协调实现。磨削主轴变频调速。

The machine's moving parts are mechanically driven, servo motor and cylinder driven, and electrically controlled in coordination with each other. The grinding spindle is frequency controlled.

#### 6.1.2 气动系统 Pneumatic system

机床气动系统使用的气源为经处理的干燥、清洁经减压调节为稳定压力的压缩空气。为确保控制系统的稳定性，机床分别设置阀岛控制与主轴气密封、工件加工后吹干两个相对独立的气源供给处理系统。

The pneumatic system of the machine uses a source of dry, clean compressed air that has been treated and regulated to a stable pressure by decompression. To ensure the stability of the control system, the machine is equipped with two relatively independent air supply processing systems for valve island control and spindle air sealing, and for blowing dry the workpiece after machining.

#### 6.1.3 冷却系统 Cooling System

本机床冷却系统有用户采用集中供水，排水方式提供。将满足机床要求的冷却液输入机床冷却系统。

This machine cooling system has a centralized water supply and drainage provided by the user. The coolant that meets the requirements of the machine is fed into the machine cooling system.

#### 6.1.4 润滑系统 Lubrication system

机床润滑采用整机集中（定量）润滑或局部自润滑方式。

The machine tool is lubricated by centralized (quantitative) lubrication or local self lubrication.

#### 6.1.5 电气及操作系统 Electrical and operating systems

机床采用（欧姆龙）可编程控制器、伺服驱动系统、总线驱动系统，基恩士高精度数字检测系统、美德龙高精度传感器，运算速度快、数据传输可靠。提供便利操作平台，图像清晰、操作简便、安全可靠、具有实时记录与数据存储功能，各项参数均可依据用户需求调整。机床操作（动作循环）分自动和调整（手动）两种模式。

The machine adopts (Omron) programmable controller, servo drive system, bus drive system, Keyence high-precision digital inspection system, and Metro high-precision sensor, with fast computing speed and reliable data transmission. It provides a convenient operating platform with clear images, easy operation, safety and reliability, real-time recording and data storage functions, and all parameters can be adjusted according to user requirements. Machine operation (action cycle) is divided into two modes: automatic and adjustment (manual).

### 6.2. 主要特点 Main features

6.2.1 机床智能化程度较高、整机结构紧凑，加工范围大，适用于大、中批量生产要求，能较高且稳定的保证工件的加工精度尺寸之要求。

The machine has a high degree of intelligence, a compact structure, and a large processing range, which is suitable for large and medium volume production requirements, and can ensure high and stable machining accuracy and dimensional requirements of the workpiece.

6.2.2 硅方平面及棱边（R面）磨削加工在一次设定中完成。

Grinding of silicon square planes and edges (R-face) is done in one setting.

6.2.3 效率高（加工过程装卸工件，不占用加工时间）。

High efficiency (processing process loading and unloading work pieces, not taking up processing time)

6.2.4 夹具分度精度高，特殊的浮动夹持装置及失电工件防脱落制动保护。

High accuracy of fixture indexing, special floating clamping device and anti-dislodgement brake protection for workpieces with power loss.

6.2.5 自动化加工单元长度检测信息有（设备外）机械手传输（特殊需求也可单元配置）。

Automated machining cell length detection information is available (outside the machine) for robotic transmission (special requirements can also be cell configured).

6.2.6 高精度数字检测（工件余量检测，磨削循环次数确认）系统。

High-precision digital inspection (workpiece margin inspection, grinding cycle count confirmation) system.

6.2.7 阀岛式集成气动控制系统。

Valve island type integrated pneumatic control system.

6.2.8 数显式流量调节控制及冷却分配系统。

Digital display flow regulation control and cooling distribution system.

6.2.9 螺母旋转式磨削进给控制装置。 Nut rotary grinding feed control device.

6.2.10 砂轮磨耗检测及工件误差自动补偿功能。

Grinding wheel wear detection and automatic workpiece error compensation function.

6.3 设备磨削方式 Equipment grinding method

6.3.1 工件纵向单向进给，磨削砂轮双面横向依据加工余量递进式进给。

The workpiece is fed in one direction in the longitudinal direction, and the grinding wheel is fed in the lateral direction on both sides according to the machining allowance.

6.3.2 分步磨削方法（硅方R面及硅方平面粗、精磨削分步进行）。

Step-by-step grinding method (rough and finish grinding of silicon square R surface and silicon square flat surface are carried out in steps)

## 七、设备验收要求

### VII. Equipment acceptance requirements

7.1 设备验收指标； Equipment acceptance indicators.

7.1.1 加工边距公差： $\leq \pm 0.05\text{mm}$ ； Machining edge distance tolerance:  $\leq \pm 0.05\text{mm}$

7.1.2 加工倒角公差 $\leq \pm 0.05\text{mm}$ ； Machining chamfer tolerance  $\leq \pm 0.05\text{mm}$ .

7.1.3 四平面相邻面夹角 $\leq 90^\circ \pm 0.05^\circ$ ； The angle between adjacent surfaces of the four planes  $\leq 90^\circ \pm 0.05^\circ$ .

7.1.4 四平面相对平行度 $\leq 0.05\text{mm}$ ； Relative parallelism of four planes  $\leq 0.05\text{mm}$ .

7.1.5 四平面平面度 $\leq 0.02\text{mm}$ ； Four plane flatness  $\leq 0.02\text{mm}$ .

7.1.6 弦长极差 $\leq 0.30\text{mm}$ ； Chord length polarization  $\leq 0.30\text{mm}$ .

7.1.7 磨面外观质量：无砂轮印、色差、崩边、硅落等异常；

Grinding surface appearance quality: no grinding wheel marks, color difference, chipping, silicon fall and other abnormalities.

7.1.8 弦长极差 $\leq \text{Ra}0.15\mu\text{m}$ （面）， $\leq \text{Ra}0.25\mu\text{m}$ （弧面）；

Chord length polarization  $\leq \text{Ra}0.15\mu\text{m}$  (face),  $\leq \text{Ra}0.25\mu\text{m}$  (curved face).

7.1.9 符合技术方案、技术协议、其它补充技术（如有）、招标技术评标质询承诺等的要求以及甲方对乙方提出的配置及品牌等的要求。

Comply with the requirements of the technical plan, technical agreement, other supplementary technologies (if any), bidding technical evaluation commitment, etc., and the requirements of Party A for Party B's configuration and brand, etc.

7.2 验收期： Acceptance period.:

生产 1 个月后将开始调试验收程序，以买方主流产品硅棒规格进行验收，以量产一个月数据作为依据。

After 1 month of production, we will start the commissioning and acceptance procedure, and the acceptance will be based on the buyer's mainstream product specifications for silicon rods, with one month of mass production data as the basis.

## 八、设备包装及交货要求

### VIII. equipment packaging and delivery requirements

8.1 设备包装要求 Equipment packaging requirements

8.1.1 设备应分类装箱，并遵循适于运输，便于现场卸货，安装和查找的原则；

The equipment should be sorted into boxes and follow the principles of being suitable for transport, easy to unload, install and find on site.

8.1.2 包装箱外外壁应有明显的文字说明，如设备名称及运输存储安全注意事项等；

There should be obvious text descriptions on the outside of the box, such as the name of the equipment and safety precautions for transportation and storage.

8.1.3 所提供的设备及部件应按照国家标准有关包装的技术条件可靠包装，以满足长途运输，吊装和装卸的需要，包装中应采取防止雨淋、腐蚀、振动及碰撞的措施，保证设备在运输过程中不会损坏、变形、受潮及部件丢失。

The provided equipment and components should be reliably packed in accordance with the technical conditions of the national standards on packaging to meet the needs of long distance transportation, lifting and loading and unloading, and the packaging should take measures to prevent rain forest, corrosion, vibration and collision to ensure that the equipment will not be damaged, deformed, damp and lost in the process of transportation.

### 8.2 设备交货要求 Equipment delivery requirements

8.2.1 供方应将设备送至买方指定收货地址；

The supplier shall deliver the equipment to the buyer's designated delivery address.

8.2.2 供方交货时应提供设备出厂检验报告、合格证明或文件；

The supplier shall provide factory inspection reports, certificates of conformity or documents for the equipment upon delivery.

8.2.3 供方需提供设备使用说明书，设备说明书包括：设备基本参数，设备操作说明，设备操作方法，维修保养部位及保养方法，主要异常及处理方法等。

The supplier needs to provide the equipment instruction manual, which includes: basic parameters of the equipment, equipment operation instructions, equipment operation methods, maintenance parts and maintenance methods, major abnormalities and handling methods, etc.

### 8.3 设备安全要求 Equipment safety requirements

设备安全防护符合国家标准，当人体进入防护区时，运动机构停止动作并报警，通过工程师及以上权限可手动关闭防护功能，以满足观察或实验需求；

Equipment safety protection continued to meet national standards, when the human body enters the protection area, the movement mechanism stops and alarm, through the engineer and above authority can manually close the protection function to meet the observation or experimental needs.

## 九、技术支持和服务要求

### IX. Technical support and service requirements

#### 9.1 质保期 Warranty Period

9.1.1 设备整机质保期 1 年，从验收之日起计算；

1 year warranty for the entire equipment, calculated from the date of acceptance.

9.1.2 验收后，供方需提供合理范围的技术支持及服务；

After acceptance, the supplier is required to provide a reasonable range of technical support and services.

#### 9.2 客服及时性 Customer Service Timeliness

质保期内发生故障，供方需在 4 小时内远程指导解决，若无法远程解决，供方需在 48 小时内达到现场解决；

If a failure occurs during the warranty period, the supplier is required to provide remote guidance to solve the problem within 4 hours, and if the problem cannot be solved remotely, the supplier is required to reach the site within 48 hours.

#### 9.3 设备使用维护培训 Equipment use and maintenance training

提供设备操作、故障处理、维护保养等培训；

Provide training on equipment operation, troubleshooting, maintenance, etc.

## 十、供货内容

### X. Supply content

#### 10.1 供货范围 Scope of supply

序号 No	货物或部件名称 Name of goods or parts	型号或规格 Model or specification	数量 Quantity	制造厂家 Manufacturer	备注 Remarks
1	主机	LT-GMS950	1 台	连城数控	

	Mainframe		1 table	Linton	
2	样件 (样盘) Prototype (sample plate)	LT-GMS950-690	1 组 1group	连城数控 Linton	1 组/12 台 1group/12 units
3	砂轮修整装置 Grinding wheel dressing device	LT-GMS950-620	1 组 1group	连城数控 Linton	1 组/5 台 1 group/5 units
4	变压器 Transformer	SSC-15KVA	1 件 1piece		
5	减震垫铁 Vibration damping mounts	MFA1665-910	14 组 14groups	连城数控 Linton	

## 10.2 主要次级供货商 Major sub-suppliers

序号 No	主要元器件 Main components	标准产品品牌 Standard product brands
1	驱动系统、控制系统 Drive system,control system	欧姆龙 Omron
2	直线导轨、滚珠丝杠 Linear guide, ball screw	上银、银泰 (丝杠或 NSK) Shang Yin, Yintai (Screw or NSK)
3	轴承 Bearings	人本、HRB、NSK HUMAN, HRB, NSK
4	气动系统 Pneumatic system	SMC、CKD
5	检测传感器 Detection sensors	基恩士 Keenes

## 10.3、免费备品备件清单: Free spare parts list:

序号 No	名称 Name	规格型号 Specification Model	数量 Quantity	单位 Unit	生产厂家 Manufacturers	备注 Remarks
1	润滑脂 Grease	00	1	罐 Can	永嘉流变 Yongjia Flow	单台配置 Single unit configuration

## 10.4、易损易耗件和特殊要求件 (区分生产耗件外) 清单:

List of consumable parts and special requirement parts (other than production consumable parts):

序号 No	部件名称 Part Name	规格型号 Specification Model	使用部位 Use parts	备注 Remarks
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1	粗磨金刚石砂轮 Rough grinding diamond wheels	LT-GMS950-60001	主轴 Main shaft	安装于设备 Installed in the device
2	精磨金刚石砂轮 Fine grinding diamond wheels	LT-GMS950-60002	主轴 Main shaft	安装于设备 Installed in the device
3	环形尼龙毛刷 Ring-shaped nylon brushes	LT-GMS950-930701	冷却分配器 Cooling distributor	视实际使用情况 Depending on actual usage
4	环形尼龙毛刷 Ring nylon bristle brush	LT-GMS950-930702	冷却分配器	视实际使用情况 Depending on actual usage
5	修刀石 Knife Repair Stone	20×20×100mm	砂轮修正装置 Grinding wheel correction device	

## 10.5 随机技术资料、工具 Random technical information, tools

序号 No	随机技术资料内容 Content of random technical data	数量 Quantity
1	纸板和电子版设备使用说明书 (含气动原理图、电气原理图、电气接线图等、设备操做流程说明书) Paperboard and electronic versions of equipment manuals (including pneumatic schematic diagram, electrical schematic diagram,electrical wiring diagram, etc., equipment operation process instructions)	随设备数量 With the number of equipment
2	电子版易损件图纸 Electronic drawing of wearing parts	1 份 1 copy
3	备品备件清单及易耗品清单 Spare parts list and consumables list	1 份 1 copy
4	装箱说明(对箱内包装内容说明,箱内非连接的零部件要做标示,装箱说明中明细与标示要统一) Packing instructions (description of the contents of the box, the box of non-connected parts to be marked, the details of the packing instructions and labeling to be unified)	1 份 1 copy