

Linton

SQUARER

QSFA2395



一、概述

I. Overview

双根立式开方机(QSFA2395)是使用金刚线对硅棒进行开方加工的设备，通过机器人及视觉定位上下硅棒，其通过一根高速往复运转的金刚线，对双根硅棒进行开方。

DW squarer (QSFA2395) is a machine that uses diamond wire to square silicon rods. By positioning the upper and lower silicon rods by robot and vision, it squares double silicon rods by a diamond wire that runs reciprocally at high speed.

二、主要技术指标

II. Main technical specifications

序号 No	项目 Item	项目内容 Description
1	加工根数 Number of processed roots	2 根/刀 2 sticks/knife
2	加工直径 Machining diameter	∅ 210~∅ 330mm
3	加工长度 Processing length	150-950mm
4	钢线速度 Steel wire speed	≤ 35m/s
5	钢线直径/规格 Steel wire diameter/size	0.25~0.42mm/442D、BS60
6	切割线耗 Cutting line consumption	0.06m/mm(按 8.4 吋 650mm 长硅棒测算); 回线率设置及控制精度 0.01% 0.06m/mm (measured by 8.4" 650mm long silicon rod); return rate setting and control accuracy 0.01%
7	方棒极差 Square bar extreme difference	≤ 0.3mm
8	方棒平面度 Square bar flatness	≤ 0.2mm
9	垂直度 Perpendicularity	90° ± 0.1
10	剖面粗糙度 Profile roughness	线痕 ≤ 0.2mm Line mark ≤ 0.2mm
11	滑台工作行程范围 Sliding table working stroke range	100mm-1000mm
12	加工边距范围: Machining margin range:	156~230mm((通过换型实现全尺寸加工), 达到在该范围内任意可调) 156 to 230mm ((Full-size processing by change-over) to achieve arbitrary adjustment in this range)
13	断线率 Disconnection rate	≤ 1% (排除人为、硅料、线等因素) ≤ 1% (excluding artificial, silicon, line and other factors)
14	储线长度 Length of storage line	≥ 20KM
15	切割头空载移动速度: No-load travel speed of cutting head:-	0~1500m/min; ≥ 40 mm/min
16	断线处理时间 Disconnection processing time	<20min
17	线网张力范围 Wire mesh tension range	0~120N
18	噪音 Noise	< 80dB (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) < 80dB (in accordance with the National Occupational Health Standard GBZ2.2-2007, 11.2.1)(Occupational exposure limits for noise)

三、外部环境参数表

III.the external environment parameters table Serial number

序号 No	项目 Projects	单位 Unit	内容 Content
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	≤ 59.5KVA
3	压缩空气气压 Compressed air pressure	MPa	0.4mpa-0.6mpa
	气量 Air volume	m ³ /h	≥ 40m ³ /h
	入气管尺寸 (外径) Air inlet pipe size (outside diameter)	mm	φ16mm
	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 Water, tap water
5	用水量 Water consumption	L./min	70
6	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
7	排液口尺寸 Drain port size		2 1/2 寸 2 1/2 inch
8	进水供应接口尺寸 Size of inlet water supply interface		DN40
9	地基 (参考值) Foundation (reference value)		≤ 5T/ m ²
10	环境 Environment	温度 temperature	10° -35°
		湿度 temperature	60° ± 30%

四、设备主要部件的颜色和标牌以及设备的触摸屏显示规范

IV.Color and labeling of the main parts of the equipment and the touch screen display specification

序号 No	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

1. 空载噪音: $\leq 80\text{dB(A)}$ (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: $\leq 80\text{dB(A)}$ (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).

2. 安全: 封闭式钢板防护罩, 保证设备工作时的人机安全。

2. 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 设备是由 2 台上下料台, 1 台机器人, 1 套视觉晶线检测系统, 2 台台双工位数控单晶硅棒立式开方机组成的制造岛, 系统为汇川系统。

The equipment is composed of 2 loading and unloading tables, 1 robot, 1 set of visual line inspection system, 2 duplex CNC single crystal rod vertical squaring machines into a manufacturing island, the system is Huichuan system.

6.2、整机功能介绍 The whole machine function introduction

人工或者桁架机械手将硅棒放置在上下料台上, 机器人从上下料台抓取圆棒, 旋转至视觉检测晶线工位进行晶线检测, 然后将圆棒放置在 1#主机的 1#晶托上。机器人再次从上下料台抓取 1 根圆棒, 视觉晶线检测后上料至 1#主机的 2#晶托上。1#主机防护门关闭, 启动线管理, 切割头向下开始切割, 同时机器人给 2#主机上料。1#主机切割完成后, 防护门打开, 机器人将方棒抓出放置到上下料台上, 人工或者桁架机械手将方棒抓走送至下一工序。

Manually or truss robot will place the silicon bar on the loading and unloading table, robot will grab the bar from the loading and unloading table, rotate to the visual inspection line station for line inspection, and then place the bar on the 1# crystal tray of 1# mainframe. The robot grabs one bar from the loading/unloading table again, and after the visual line inspection, the bar is loaded onto the 2# crystal tray of the 1# mainframe. 1# mainframe gate is closed, the line management is activated, and the cutting head starts cutting downward while the robot loads the 2# mainframe. 1# mainframe gate is opened after the cutting is completed, and the robot grabs the square bar and places it on the loading/unloading table, and the robot or truss robot grabs the square bar and sends it to the next process. The robot will take the bar and place it on the loading and unloading table.

6.3、主要部件功能简介 The main parts of the function profile

6.3.1 硅棒切割头: 竖直切割, 切割头上带 8 个主电机, 分别控制一套切割辊, 切割轮上槽数 ≥ 8 个。切割头主体支架采用高刚性结构。切割头安装在立柱滑台上, 立柱滑台采用伺服驱动, 实现上下运动。导轮支架刚性良好, 牢固可靠。导轮轴承采用气密封, 高级润滑脂润滑。

Silicon rod cutting head: vertical cutting, cutting head with 8 main motors, respectively control a set of cutting rollers, the number of slots on the cutting wheel ≥ 8 . The main support of the cutting head adopts high rigidity structure. The cutting head is mounted on the column sliding table, which adopts servo drive to realize up and down movement. The guide wheel bracket is rigid, solid and reliable. The guide wheel bearings are air sealed and lubricated with high grade grease.

6.3.2 晶托装置: 晶托装置具备晶线检测回转、硅棒竖直装料、边皮支撑功能。晶托装置中心采用浮动支撑结构, 用于适应硅棒端面的倾斜, 浮动支撑到位后锁紧, 保证硅棒中心垂直放置;

Crystal tray device: The crystal tray device has the functions of crystal line detection rotation, silicon rod vertical loading, and edge skin support. The center of the crystal tray device adopts floating support structure, which is used to adapt to the tilt of the end face of the silicon rod, and the floating support is locked in place to ensure that the center of the silicon rod is placed vertically.

6.3.3 边皮抓取装置: 主要由横向移动、竖直 Z 轴及边皮料抓紧结构组成。硅棒切割完成之后, 切割头不退线网, 边皮向上顶起 100~150mm, 边皮抓紧机构将边皮抓紧, 竖直 Z 轴上移, 横向输送移动边皮至边皮下料区。边皮去掉之后, 切割头往上退线网。准备下次切割。

Edge skin gripping device: mainly consists of lateral movement, vertical Z-axis and edge skin material gripping structure. After the silicon rod is cut, the cutting head does not retreat from the wire mesh, the edge skin is lifted upwards by 100~150mm, the edge skin gripping mechanism grips the edge skin, the vertical Z-axis moves upwards, and the lateral conveyor moves the edge skin to the edge skin discharging

area. After the edge skin is removed, the cutting head recedes upward from the wire mesh. Prepare for next cutting.

6.3.4 电气控制系统: 电气控制系统采用汇川数控系统, 汇川数控系统是深圳市汇川技术股份有限公司产品, 主要产品有低中高压变频器、一体化及专机、伺服系统、PLC、HMI、永磁同步电机、新能源汽车电机控制器等产品。深交所上市公司。与台湾运动控制器品牌同等级。

Electrical control system: The electrical control system adopts Huichuan CNC system, which is a product of Shenzhen Huichuan Technology Co., Ltd. The main products are low, medium and high voltage inverter, integrated and special machine, servo system, PLC, HMI, permanent magnet synchronous motor, new energy vehicle motor controller and other products. Listed on Shenzhen Stock Exchange. Same level as Taiwan motion controller brand.

6.4 视觉晶线检测系统 Visual crystal line inspection system

6.4.1 检测方法 Testing Method

选用环形光源+镜头+高分辨率工业相机各两套, 固定安装在检测位置两侧, 通过拍摄圆棒端面, 分析圆棒端面的位置及图像特征, 得出对应的参数。

Two sets each of ring light source + lens + high resolution industrial camera are selected and fixedly installed on both sides of the inspection position, and the corresponding parameters are derived by photographing the end face of the round bar and analyzing the position and image characteristics of the end face of the round bar.

6.4.2 立体倾斜角度的检测:Detection of stereo tilt angle:

通过图像分析, 可得到相机 1 拍摄端面中心位置为 (x_1, y_1) , 相机 2 拍摄端面中心位置为 (x_2, y_2) , 当圆棒横向位置在两相机横向位置中心时, 利用 (x_2-x_1, y_2-y_1) 结合圆棒长度, 可以计算出圆棒相对于 Z 轴的倾斜角度, 其方向为 (x_2-x_1, y_2-y_1) 。Through image analysis, we can get the center position of camera 1 shooting end face as (x_1, y_1) and the center position of camera 2 shooting end face as (x_2, y_2) . When the lateral position of the round bar is in the center of the lateral position of the two cameras, the tilt angle of the round bar relative to the Z-axis can be calculated by using (x_2-x_1, y_2-y_1) combined with the length of the round bar, and its direction is (x_2-x_1, y_2-y_1) .

6.4.3 中心位置的识别: Identification of the center position.

在角度倾斜调整完成后, 配合机器人进行中心位置的识别与校正, 采用图像直接分析中心位置, 左右相机取均值即可实现。After the angle tilt adjustment is completed, the identification and correction of the center position is carried out with the robot, which can be achieved by using the image to analyze the center position directly and the left and right cameras to take the average value.

6.4.4 晶线角度识别: Crystal line angle identification.

由于采用高像素工业相机拍摄的端面, 理论上可以拍摄出晶线的位置, 通过图像处理直接得出晶线的角度。Due to the use of high pixel industrial camera to shoot the end face, theoretically the position of the crystal line can be photographed, and the angle of the crystal line can be directly derived through image processing Degree.

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 方棒边距尺寸精度: $\leq \pm 0.2\text{mm}$; Accuracy of square bar edge distance dimension: $\leq \pm 0.2\text{mm}$.

7.1.2 单根方棒边距极差: $\leq 0.3\text{mm}$; extreme difference of edge distance of single square bar: $\leq 0.3\text{mm}$.

7.1.3 方棒四面夹角 $\leq 90^\circ \pm 0.1^\circ$; Square bar four-sided angle $\leq 90^\circ \pm 0.1^\circ$.

7.1.4 方棒四表面线痕轻微, 线痕分布均匀, 方棒四面平面度 $\leq 0.2\text{mm}$;

Slight line marks on the four surfaces of the square bar, uniform distribution of linemarks, flatness of the four surfaces of the square bar $\leq 0.2\text{mm}$.

7.1.5 良品率 $\geq 99.5\%$; Yield rate $\geq 99.5\%$.

7.1.6 开方机不允许有漏水等现象, 重要部件及零件做好防腐、防锈措施。

The open square machine does not allow water leakage and other phenomena, important parts and components to do anti-corrosion, rust prevention measures.

7.1.7 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, 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。Equipment safety protection continued to meet national standards.

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;

Providing 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	名称 Name	型号或规格 Model or specification	数量 Quantity	制造厂家 Manufacturer	备注 Remarks
1	主机 Mainframe	QSFA2395	2 台 2 units		
2	上下料台 Loading and unloading table		1 套 1 set		
3	机器人 Robotics		1 套 1 set	日本那智不二越/日本发那 科等品牌 Japan Nachi- Fujikoshi / Japan Fanuc and other brands	
4	视觉晶线检测 Visual crystal line inspection		1 套 1 set		
5	机床垫铁 Machine tool pads	0303-0910	12 组 12 groups		
6	上下料台垫铁 Loading and unloading table mats	0303-0920	8 组 8 groups		
7	标准检棒 Standard check stick	Φ250 和 Φ330	1 套 1 set		1 套 1 set

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	控制系统 Control System	汇川 Huichuan
2	PLC	汇川 Huichuan
3	电气元件 Electrical components	良信及其它 Good faith and others
4	主轴轴承 Spindle bearings	NSK 及其它 NSK and others
5	导轨丝杠 Guide Screws	TBI、上银及其它 TBI, SCB and others

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	切割轮 Cutting Wheel	QSFA2395- 21301	8	个 individual	大连连城 Dalian Liancheng	单台配置 Singleunit configuration

2	胶圈 Gasket	QDFA2185-217501	100	个 individual	大连连城 Dalian Liancheng	单台配置 Singleunit configuration
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十一、随机技术资料、工具
X I . 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 th 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