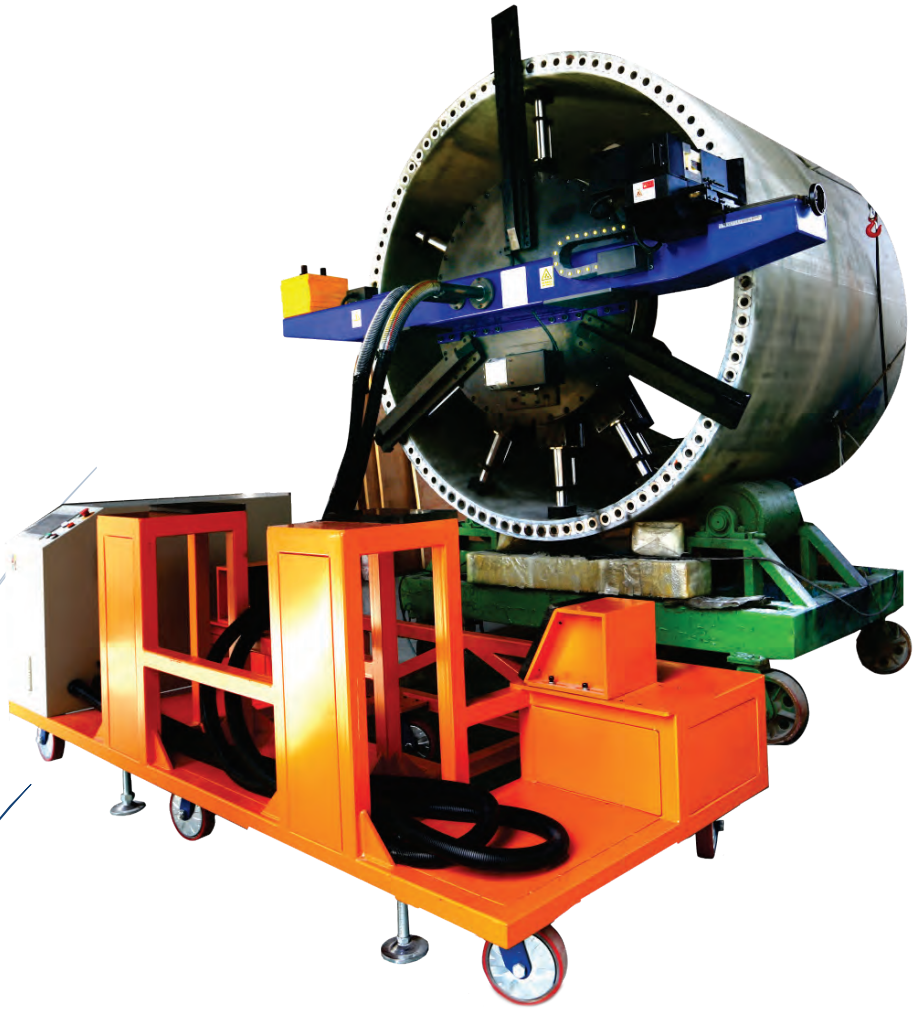
Introduction of the fourth generation of Intelligent End Face Milling Machine



Hunan ThinkWell Intelligent Equipment Co. , Ltd.

1. Introduction of the quipment

The fourth generation of Intelligent End Face Milling Machine is the latest product developed by our company.The product has completely independent intellectual property rights.The productis mainly used for processing the end face of a pre-embedded bolt sleeve at the root part of a wind power blade.By means of milling,The end surface flatness of the blade root can meet the quality standard, Can also be used in other industries flange processing

The equipment has high Processing precision,Quick installation, clamping and positioning,Flexibleadjustment,Good compatibility of products, operating easily,Measurement accuracy,Safe andDependable,Processing data can be saved and output etc. One-stop solution to the root of the wind turbine flange processing procedures and precision requirements.Greatly improved the quality of the product,Increased productivity,Improve the production environment on site,Thus creates the good economic benefit for the customer.

At the same time, the equipment can greatly improve the level of customer intelligent manufacturing,Improve corporate image, step by step for customers to achieve the whole line of intelligent manufacturing.

2. The model specifications and technical parameters of the equipment are as follow

NO	Item	Models and specifications				
		EFMM-IA	EFMM-IIB	EFMM-IIIB	EFMM-IVA	EFMM-VA
1	Pitch Circle size of blade	Φ2100~ Φ2400mm	Φ2300~ Φ2800mm	Φ2800~ Φ3200mm	Φ3200~ Φ3600mm	Φ3600~ Φ5000mm
2	Plane Accuracy	0.15~0.25mm	0.20~0.35mm	0.25~0.40mm	0.30~0.50mm	~0.50mm
3	Spindle radial feed adjustment range	0~300mm	0~400mm	0~300mm	0~300mm	Customizes
4	Spindle axial feed adjustment range	0~50mm				
5	Spindle power	1.5kW（TypeIVA 和 TypeVAOptional Double Head 3kW）				
6	Maximum diameter of milling cutter head	Φ125mm				
7	Maximum speed of rotation	1rpm				

8	Maximum Angle of rotation	≥400°				
9	Surface finish	≤Ra3.2				
10	Power supply	AC 3Φ380V±10%，N PE，50Hz，5KVA				
11	Compressed air	0.6MPa，Flow rate50L/min				
12	Equipment Weight	2400Kg	2800 Kg	3000 Kg	3300 Kg	4000 Kg

3. The schematic diagram of the equipment is as follows

3.1. The equipment consists of three parts: the main equipment, the transfer car and the control cabinet as shown in figure 1.

Figure 1 Overall device schematic

3.1.1. The Height of the operation screen is designed according to the Ergonomics, and the operation is convenient.

3.1.2. The equipment control cabinet and the main engine are connected by high flexible cable, the equipment is easy to install and the connection is reliable.

3.2. Storage and transfer trolley

3.2.1. Trolley can be used to store End face millingmachine when the equipment is not working，The main engine and control cabinet are stored in the trolley,We can use a forklift to move the equipment.

3.2.2. The trolley is equipped with a storage box.the box is used to store Installation tools for equipment positioning and processing tools and other accessories.

4.The functional characteristics of the equipment are as follows.

4.1. The equipment has the advantages of stable structure, strong rigidity and long fatigue life.

4.1.1 All the stressed structural elements are analyzed and checked by ANSYS,The rotating mechanism of the equipment core adopts high precision bearing, high precision, large load bearing, strong rigidity, long service life;

4.1.2 The spindle rotating crossbeam is welded by high quality carbon steel, annealed and precision machined, the equipment has good rigidity and the inherent error of the system is small.

4.2. The processing precision of this equipment is high.

4.2.1. The machine adopts large precision bearing to ensure the machining precision of the main machine, and is equipped with high precision rotary servo drive system to ensure the stepless and adjustable feeding speed fz and the fast and accurate positioning of the main shaft.

4.2.2. Using precision machining spindle system, equipped with 125 mm diameter end face disc special customized milling cutter, can meet the bolt sleeve and frp processing, high processing precision, high efficiency, long service life, end face processing one time molding.

4.2.3. The spindle axial feed system is adjusted by Servo Motor, the feed quantity ap can be adjusted accurately, and it is suitable for different processing technology.

4.2.4. Large Intelligent end face milling machine can be equipped with double spindle to further improve the processing efficiency of the blade root.

Fig. 2 the processing effect diagram of Bolt Sleeve

4.3. The equipment can install quickly and Confirm position.

4.3.1 The equipment is equipped with 3-point automatic synchronizing centering mechanism and supporting leg micro-adjustment mechanism. When the equipment is hoisted, the machine center line can be parallel (or coincident) with the Blade Root Center by using 3-point Positioning Reference Board and synchronizing centering mechanism. The synchronizing centering system has self-locking function, which ensures the safety and reliability of the equipment during operation, and solves the problem of irregular inner diameter of the blade root and the difficulty of locating the equipment to the center

4.3.2 After the initial positioning, the equipment is scanned by the flatness of the end plane. If the deviation is too large or the machining allowance is too large, the measuring interface has data instructions. By adjusting the micro-adjustment mechanism of the supporting leg, the equipment can be parallel to the base plane of the bolt sleeve as far as possible, and the machining allowance can be reduced, so that the Flange of the blade root is perpendicular to the axis as far as possible, and the micro-adjustment mechanism of the supporting leg can be selected with automatic or manual micro-adjustment mechanisms;

4.3.3 Several pneumatic tensioning mechanisms automatically push the outrigger of the device against the inner wall of the blade root under the set pressure, ensuring that enough friction is generated at each point to maintain the rigidity of the device during processing, and at the same time, the tensioning force can be controlled in a safe range, so that the rebound of the blade after the device is removed will not affect the plane precision.

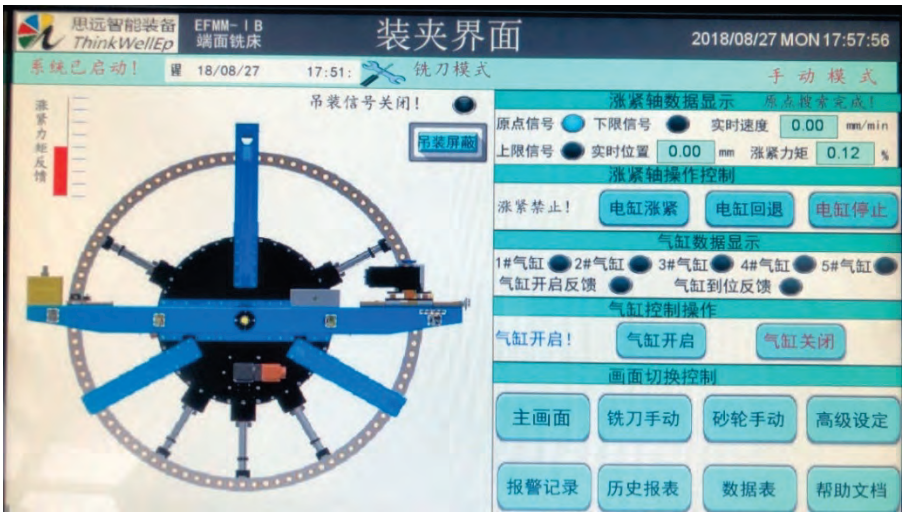


Figure 3 device clamps interface

Fig. 4 schematic diagram of equipment clamps

4.4. The equipment has advanced Laser measuring system and class U measuring accuracy

4.4.1. The equipment is equipped with high precision laser measuring system, which can scan the flatness of flange surface, and fine-tune the equipment according to the peak value of the initial measurement, so that the reference plane of the equipment is parallel to the flange surface of the blade root. The equipment is automatically adjusted to find the highest point of the flange surface, and then start machining. After machining, the equipment self-checks the Flange planeness

to ensure that the product reaches the quality standard.

4.4.2. The laser measuring system is equipped with a sealing protection system, which can prevent iron filings and dust from entering during the processing and ensure the accuracy and reliability of the measurement.

4.4.3. At the same time, the detection function has also been applied to the modification of Drilling machine, and the on-line detection of the planeness of the drilled Blade after plane milling has been carried out, which greatly shortens the detection time of the blade.

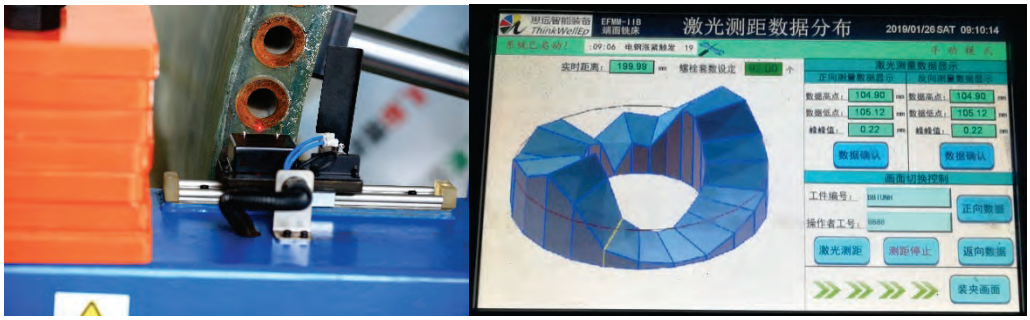


Fig. 5 laser ranging map

4.5. The equipment has automatic cleaning, cooling and splash protection system

The front end of the milling spindle is provided with a protective cover to prevent the iron chips and dust from splashing during cutting. Inside the protective cover is provided with a Compressed air nozzle to blow the iron chips out of the protective cover to prevent the accumulation and scratching of the flange surface The Compressed air also cools the head of the milling cutter, extending the life of the cutter.

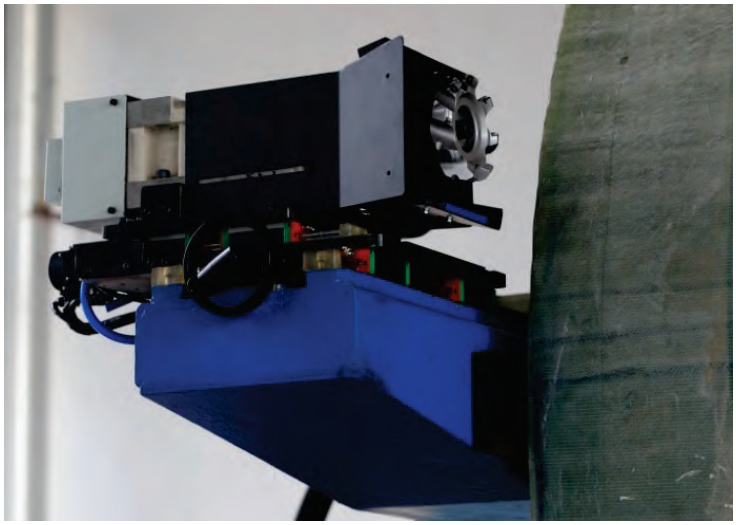


Figure 7.spindle diagram

4.6. The equipmenthas fully automatic operation and monitoring system.

The control system of the equipment adopts high-end PLC + HMI (+PC)for automatic control and data processing,With process settings, process monitoring, automatic manual switching, sound and light alarm, maintenance prompt, data storage and query functions, for customers to achieve intelligent manufacturing; The control system has extended communication function and interface of software and hardware, which is convenient for the customers to use MES management system to schedule The production equipment and transmit the real-time production data synchronously to the monitoring cloud station.

Figure 8 operation and monitoring screenFigure 9 processing history data report

Figure 10 remote monitoring interface

4.7. Theequipment has the advantages of simple structure, simple operation and low

maintenance cost.

The equipment console and the main engine are connected by high flexible cable, the equipment is easy to install, the connection is reliable, the service life is long, the maintenance is simple.3The equipment is equipped with storage and transfer trolley, and is equipped with common installation tools, which is convenient for users to use.

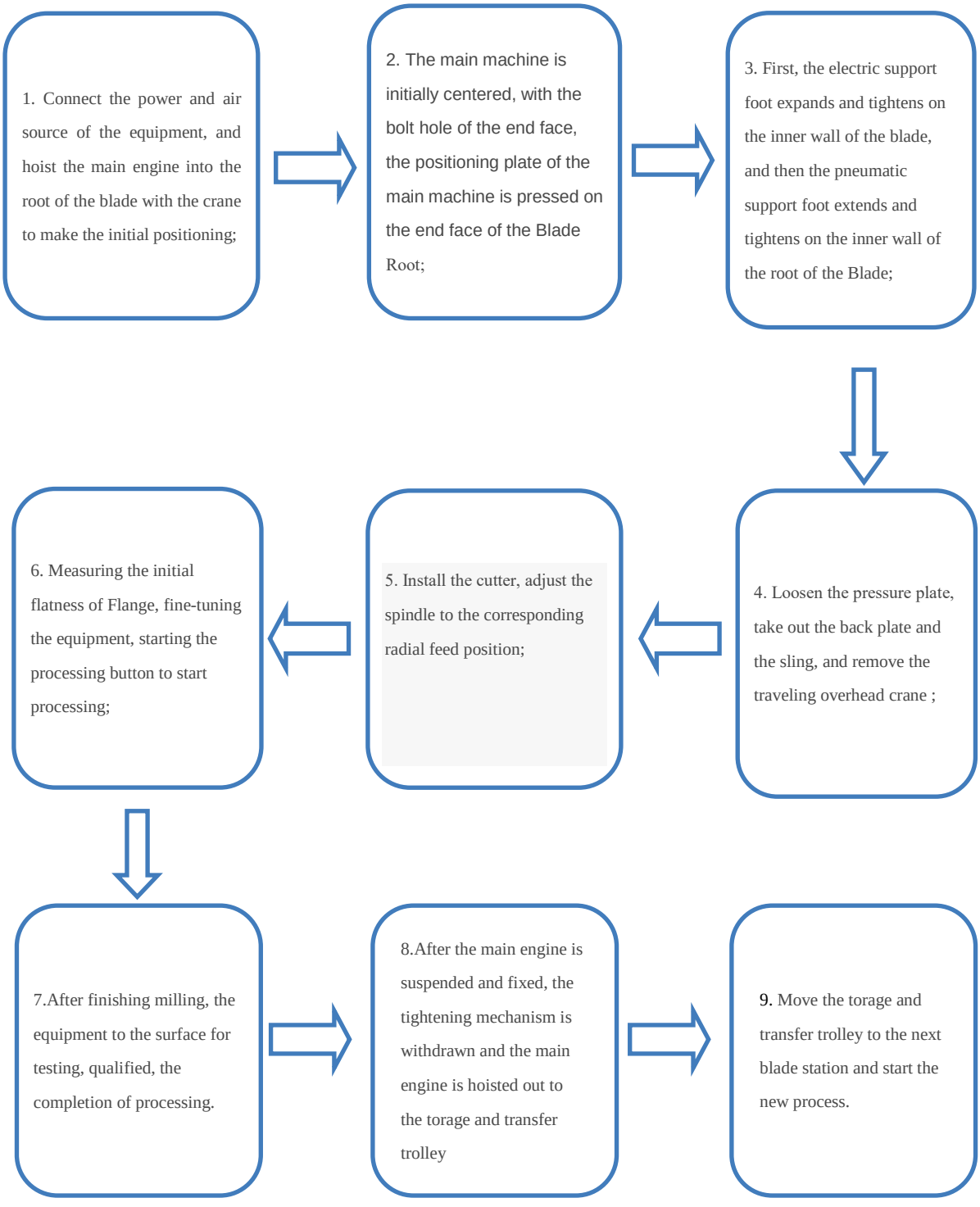
4.8. The equipment has high reliability and stability

The key components are all imported famous brands to ensure the reliability and stability of the equipment.

5. The working conditions required for the equipment are as follows.

5.1 Working Environment: Ambient Temperature 0 ~ 45 °C, relative humidity 20 ~ 90% , no dew;
5.2 power supply voltage: AC 3Φ380V (10%) , 5KVA, frequency 50Hz three-phase five-wire
5.3 Compressed air: 0.6 MPA, Flow Rate ~ 50L / Min;
5.4 Customers need to be equipped with more than 5 tons of crane for lifting positioning;
5.5 occupation of equipment working area: a 5m * 5m area is reserved for the front end of the blade root.

6. The workflows of the equipment are as follows.



7. The Standard to which the equipment is capable of meeting.

1. Technology: The equipment lays a solid foundation for the client's Industry 4.0.
2. Service: We can respond to customer feedback within two hours and our service staff will be on site within 24 hours in the Chinese market. We will guarantee the main parts of the equipment for one year, and the equipment for life-long maintenance.
3. Interface: According to the standard of automation equipment, the hardware and software of the control system have ethernet interface, which is convenient for customers to upgrade the information management system in the future
4. Standard: It is produced in strict accordance with CE certification standard and ISO9001 quality certification standard

8. Quality Management System

Since its establishment, Hunan Siyuan Intelligent Equipment Co. , Ltd. has always regarded product quality as the core of the company's participation in market competition. It is precisely this successful positioning and the strong product quality awareness of all Siyuan employees Make the company continue to grow and provide more perfect products for users.

质量管理体系认证证书

注册号：GCJX18Q30775R0S

兹证明

湖南思远智能装备有限公司

统一社会信用代码：91430103MA4L1WJE1L

注册/经营地址：长沙市雨花区振华路 579 号康庭园一期 7 栋 201 房　　邮编：410000

质量管理体系符合

GB/T19001-2016/ISO9001:2015 标准

质量管理体系适用范围

智能端面铣床的研发、销售

发 证 日 期：2018 年 07 月 27 日

证书有效期至：2021 年 07 月 26 日

注：自发证之日 12 个月起，获证组织必须定期接受监督审核并经审核合格后，本证书与《保持认证注册资格通知书》一并使用方继续有效。本证书信息可在国家认证认可监督管理委员会官方网站（www.cnca.gov.cn）上查询，也可在本公司网站（www.bjgcjx.cn）上查询。

签发人：

北京国诚京信检验认证有限公司

The company has passed ISO9001 quality certification system certification, according to product quality requirements, the establishment of a strict quality

inspection system.The company strictly controls and manages all links related to product quality, sets up scientific inspection standards, and quantifies the inspection indexes, and puts the responsibility to the people to ensure the company to produce qualified products continuously and stably.

The company from the raw materials, select the most influential brands at home and abroad, establish strict product quality inspection standards, and establish a good supply and demand relationship with suppliers.

The company has established a regular quality training system for its employees, explaining new knowledge and new information on quality management, establishing the quality consciousness of every employee and standardizing their own behavior, down to a ball bearing and a signal line So big that a whole machine is meticulous and precise.The Quality Inspection Department has established the standard inspection procedure, has the consummation inspection equipment and the means, and strictly according to the procedure inspection, guarantees the product to be qualified only then can leave the factory.

9. Product Quality Inspection Report

湖南省产商品质量监督检验研究院检验报告

湘检 C2019-W00292　　共2页第1页

样品名称	智能端面铣床	型号规格	EFMM-II
委托单位	湖南思远智能装备有限公司	商　标	/
委托单位地　址	长沙市雨花区振华路579号	检验类别	委托检验
生产单位	湖南思远智能装备有限公司	样品等级	合格品
生产单位地　址	长沙市雨花区振华路579号	到样日期	/
抽样地点	/	送样人	/
经销单位	/	样品数量	1台
经销单位地　址	/	抽样基数	/
检验日期	2019-1-7　至　2019-1-7	生产日期	2018-12
		批　号	/
样品状况	裸样		
检验依据	产品技术要求。		
检验项目	金属螺栓孔端面加工精度、主轴径向进给调节范围、主轴轴向进给调节范围、加工表面粗糙度。		
检验结论	该样品经检验，所检项目符合产品技术要求。 所检项目符合。 签发日期　2019-1-10		
备注	现场测试，测试时间：2019-1-7，测试人：肖庆华 委托代表方签字：王滔润		

编制:　　审核:　　批准:

湖南省产商品质量监督检验研究院

智能端面铣床 检验报告

湘检:C2019-W00292　　共 2 页 第 2 页

序号	检验项目	单位	标准要求	检验结果	单项结论
1	金属螺栓孔端面加工精度	mm	端面平面度：0.2~0.35	0.29	符合
2	主轴径向进给调节范围	mm	不低于0~400。	0~410	符合
3	主轴轴向进给调节范围	mm	不低于0~50。	0~55	符合
4	加工表面粗糙度	μm	≤Ra3.2。	Ra3.2	符合

（以下空白）

10. Delivery and warranty of equipment

1. Delivery time: We will deliver the equipment within 90 days after the signing of the contract.
2. Transport: Within the scope of the Chinese market, we use large trucks for transportation and use cranes or 5-ton forklifts for unloading.
3. Installation: The company will send skilled process engineers to the site for equipment installation and commissioning;
4. Training: Our process engineers will arrive at the scene of the equipment working principle, how to operate, how to carry out maintenance and how to carry out routine maintenance of equipment to do a detailed explanation.
5. Acceptance: Our equipment continuously processed 5 blades, after processing with laser instrument for testing, to meet the requirements of the contract flatness index.
6. Warranty: The main parts of the equipment are guaranteed free of charge within one year, except the fragile parts (cutter head, blade and belt, see the list of fragile parts) , we will undertake to maintain the equipment for life.

11. Comparison between Intelligent End Face Milling Machine and grinding wheel grinding machine

number	Item comparison	Intelligent End Face Milling Machine	Grinding wheel grinder
1	Plane Accuracy	Within 0.5(see technical parameter table)	0.5~1mm(unstable)
2	Processing efficiency	2~3mm/h	0.5mm/h
3	Equipment Card positioning time	20min	30min(Need to adjust halfway)
4	Equipment alignment accuracy	High	Low
5	Feed operation	Fully automatic	Manual regulation
6	Mixed cutting (Metal+FRP)	Easy	Difficult, grinding wheel is easy to jam
7	Automatic feed for high point measurement	Yes (laser measurement)	none
8	Remote monitoring and data transmission	It's got an interface, it's extensible	none
9	Safety of equipment operation	high	low , Abrasive wheels explode easily
10	On-site Working Environment	Clean, no sparks	Dust pollution is serious
11	Device compatibility	Compatible with a variety of blades	Poor compatibility
12	Equipment Energy consumption	Low, about 2.5 kw	High, about 4 kw
13	Equipment maintenance	Simple maintenance, regular lubrication grease	Maintenance is complicated and there is a risk of oil leakage

12. Machining accuracy test of equipment

12.1. The detection report of the processed blade end face with t pitch circle of 2.1 m ~ 2.4 m after processing.

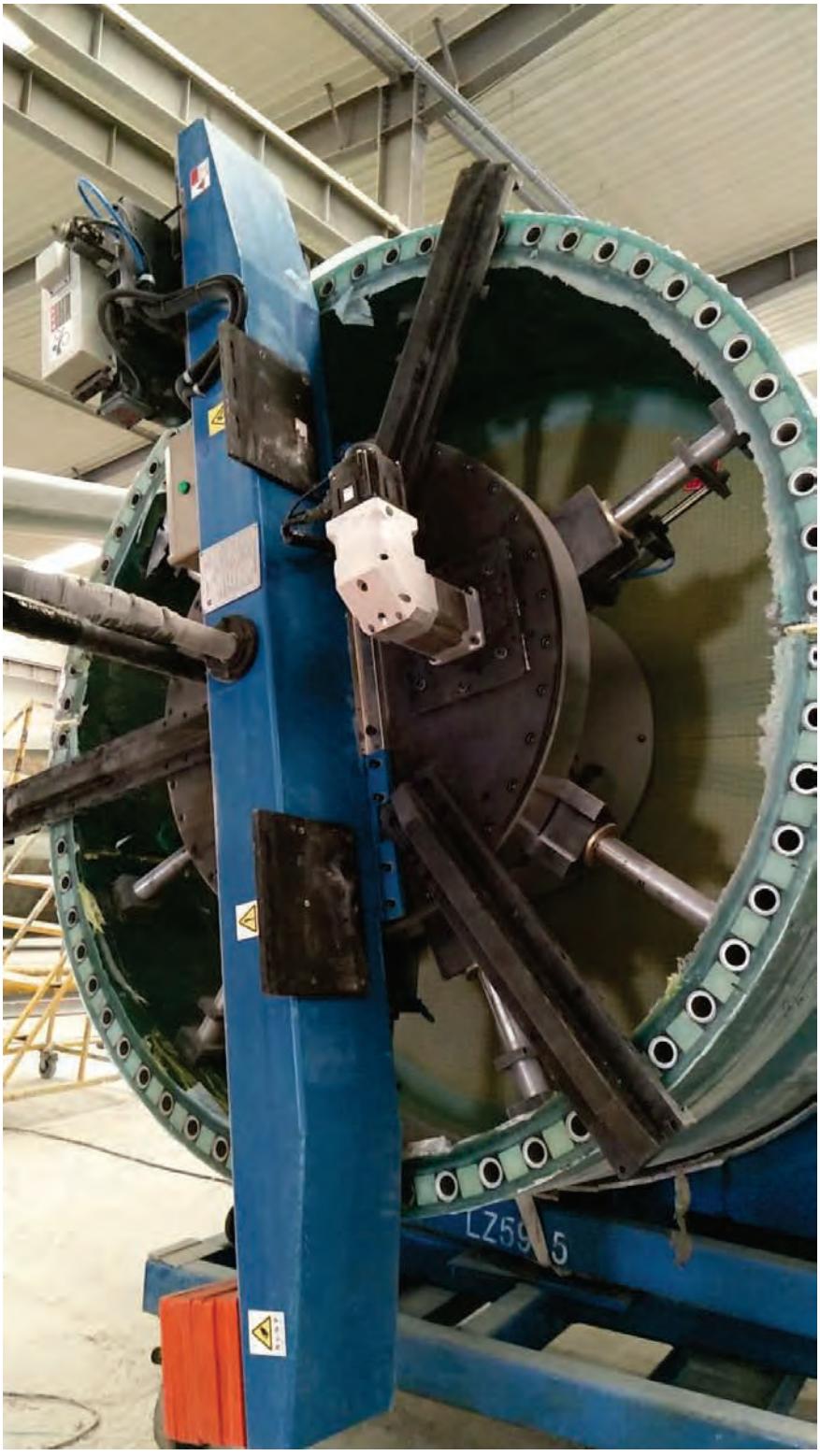


Fig. 10 end face milling machine processing (embedded bolt sleeve blade root processing)

Fig. 11 end face milling machine process (drilling blade root)

Fig. 12 Rework the blades in the wind farm

Fig. 13 plane peak value detected after machining 0.2

Fig. 14 peak plane value of 0.17 after machining

Fig. 15 plane peak value detected after machining 0.24

Fig. 16 peak plane value of 0.23 after machining

Fig. 17 plane peak value detected after machining 0.18

Fig. 18 peak plane value of 0.16 after machining

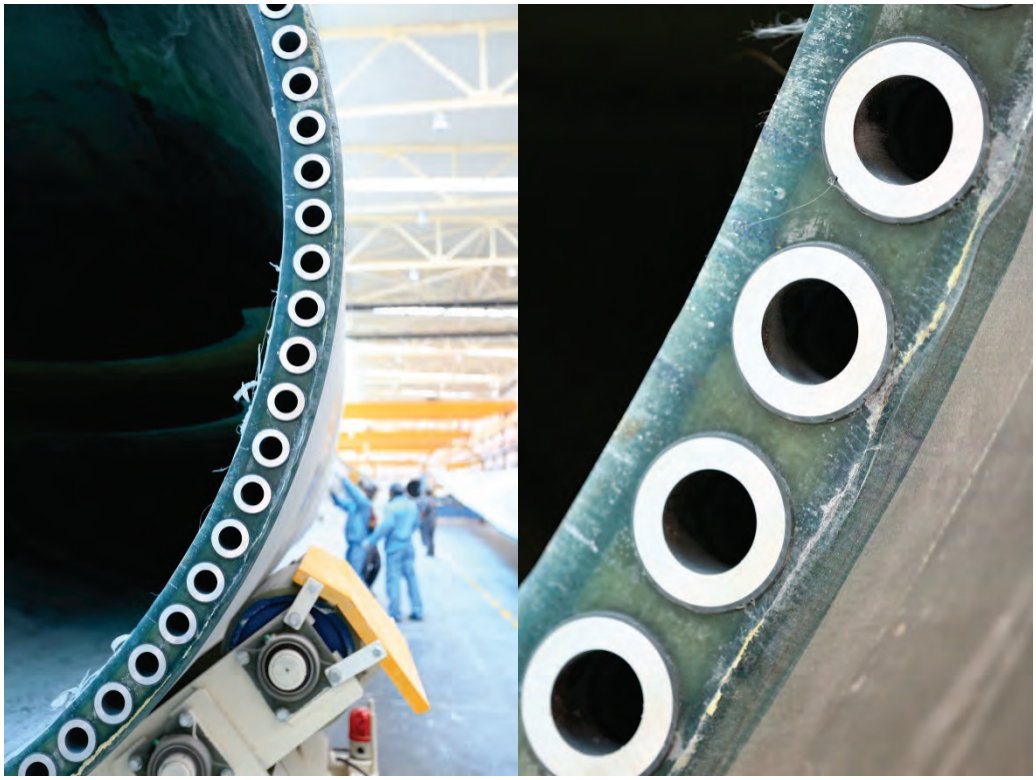


Fig. 19 blade root processing effect diagram

Fig. 20 section circle 2800 blade root processing effect diagram

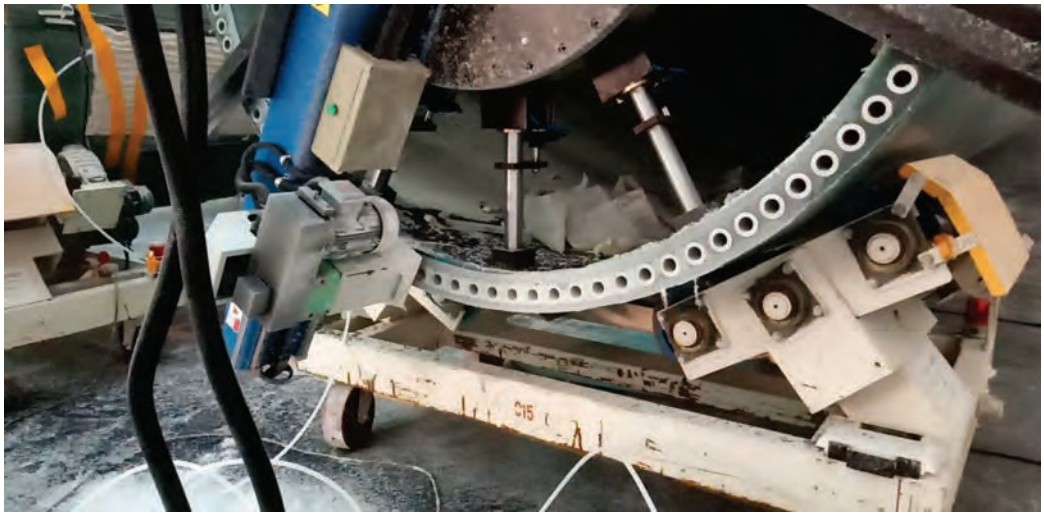


Fig. 21 processing effect diagram of blade root end face

Fig. 22 the processing effect diagram of the end face of the blade root

Figure 23 3.2m section round flange processing effect diagram

12.2. The detection report of the processed blade end face with t pitch circle of 3.2 m after processing.

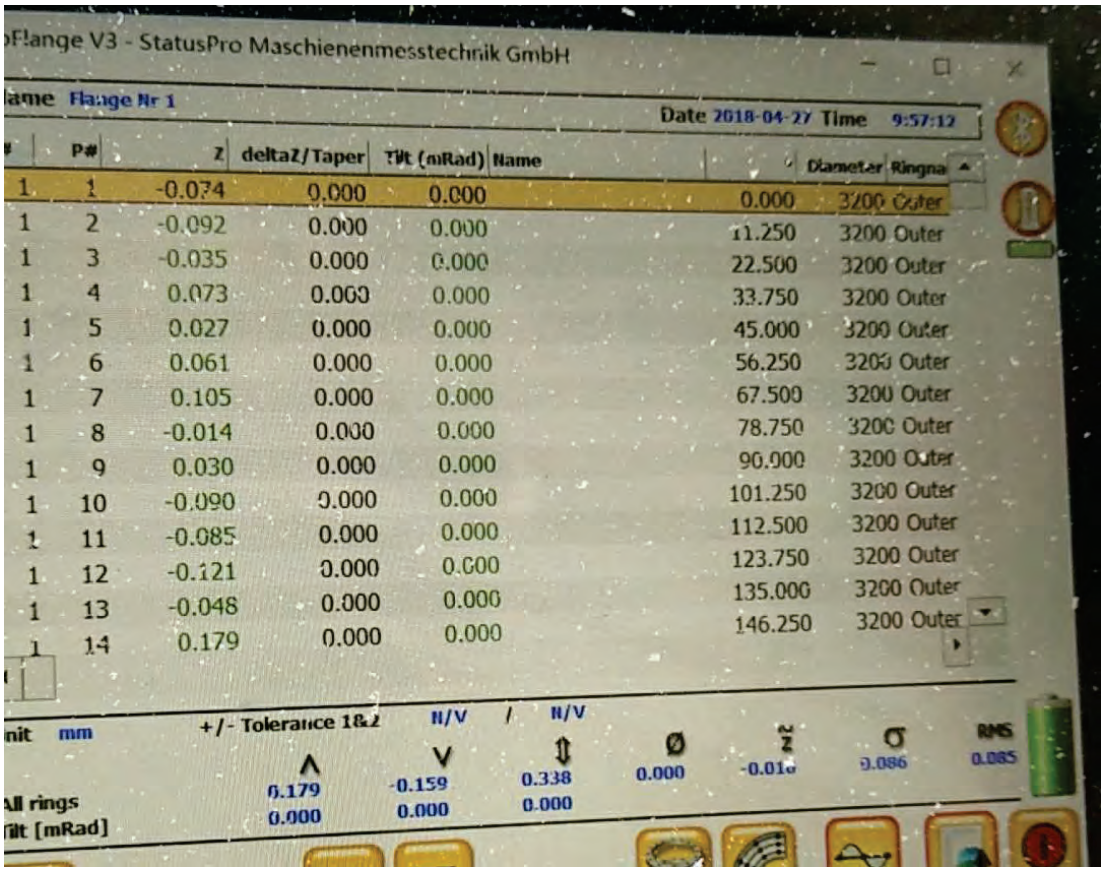


Fig. 24 peak plane value of 0.338 after machining

所有矢量摘要: 矢量组合
A::铣削机端面平面度偏差-2018.12.15

统计	dX (mm)	dY (mm)	dZ (mm)	长度Mag (mm)
Min	-0.01	-0.02	-0.00	-0.02
Max	0.01	0.02	0.00	0.02
Average	0.00	0.00	-0.00	-0.00
StdDev from Avg	0.00	0.01	0.00	0.01
StdDev from Zero	0.00	0.01	0.00	0.01
RMS	0.00	0.01	0.00	0.01
Tol Range				-0.05
				0.05
In Tol				206 (100.0%)
Out Tol				0 (0.0%)
Count	206			

Fig. 25 flatness data after machining

GDT Feature Check Summary									
	Check Name:	Tolerance	Special Characters	High Tol	Low Tol	Datums	Results	Measured Deviation	Distance Out of Tolerance
垂直度计算									
⊥	垂直度 1	1.00				AB	PASSED	0.05	0.00
⊥	垂直度 2	1.00				AB	PASSED	0.05	0.00
⊥	垂直度 3	1.00				AB	PASSED	0.10	0.00
⊥	垂直度 4	1.00				AB	PASSED	0.10	0.00
⊥	垂直度 5	1.00				AB	PASSED	0.11	0.00
⊥	垂直度 6	1.00				AB	PASSED	0.12	0.00
⊥	垂直度 7	1.00				AB	PASSED	0.12	0.00
⊥	垂直度 8	1.00				AB	PASSED	0.13	0.00
⊥	垂直度 9	1.00				AB	PASSED	0.14	0.00
⊥	垂直度 10	1.00				AB	PASSED	0.14	0.00
⊥	垂直度 11	1.00				AB	PASSED	0.15	0.00
⊥	垂直度 12	1.00				AB	PASSED	0.15	0.00
⊥	垂直度 13	1.00				AB	PASSED	0.17	0.00
⊥	垂直度 14	1.00				AB	PASSED	0.15	0.00
⊥	垂直度 15	1.00				AB	PASSED	0.17	0.00
⊥	垂直度 16	1.00				AB	PASSED	0.19	0.00
⊥	垂直度 17	1.00				AB	PASSED	0.18	0.00
⊥	垂直度 18	1.00				AB	PASSED	0.16	0.00

Fig. 26 verticality (partial data) after processing

Hunan ThinkWell Intelligent Equipment Co. , Ltd.

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