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扭矩测量范围: 0-500Nm (可扩展至: 0-1000Nm)

功率测量范围:

功率测量范围:

功率测量范围:

功率测量范围:



CAERI PRODUCT MANUAL

凯瑞装备产品手册



重庆凯瑞测试装备有限公司

CHONGQING CAERI TEST EQUIPMENT CO., LTD



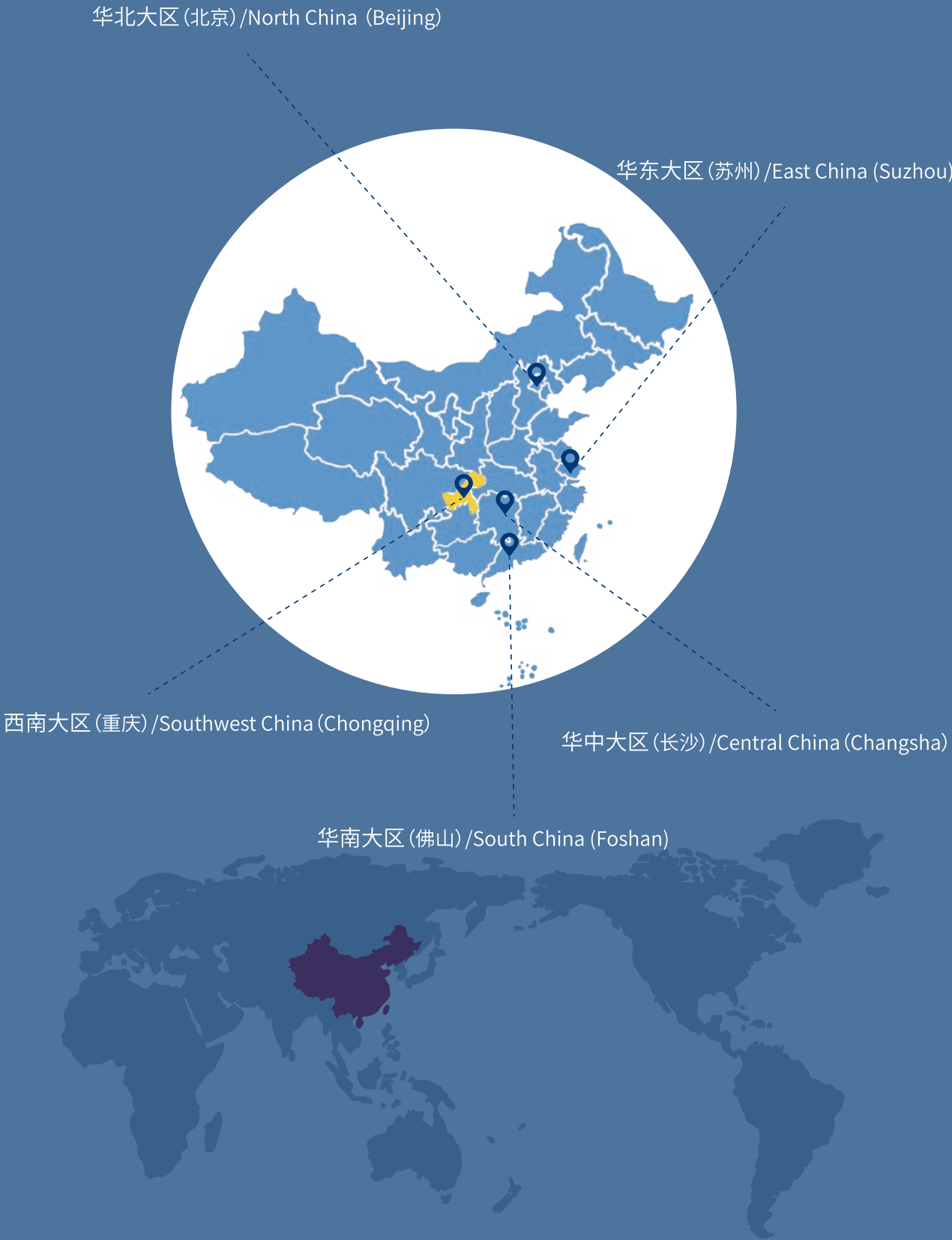
CAERI
凯瑞装备

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业务布局
BUSINESS LAYOUT



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关于凯瑞装备

ABOUT CAERI TEST EQUIPMENT

测试装备研发制造经验 30 年 R&D and manufacturing of test equipment experience 30 years	核心技术人才 50%+ 占比 Core technical talents 50%+	国家专利 100+ 项 National patents 50+	国家级及省部级奖项 40+ 项 National-level and intelligent-level awards 40+	全球客户 300+ 家 Global customers 300+
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企业愿景 VISION



成为测试装备行业领跑者
To be the leader of Test
Equipment Industry

企业使命 MISSION



智慧装备 引领未来
Leading the future with our
intelligent equipment

企业价值观 VALUE



服务客户 成就员工 创新企业
Serving customers Achieving
employees Innovating enterprises

企业精神 SPIRIT



诚信服务 敢于担当 创新协作 勇于奋斗
Serve with integrity, Take responsibility,
Collaborate with innovation, Strive for courage



公司简介

COMPANY PROFILE

◆ 重庆凯瑞测试装备有限公司(简称:凯瑞装备),隶属于中国汽车工程研究院股份有限公司,自1991年成立以来,一直致力于测试装备的研发、制造与销售,是测试装备整体能力建设的系统集成方案解决者。

经过三十余年的发展,秉承创新设计理念,精湛工艺技术,以及专注的工匠精神,成功研发出百余种测试产品,其中多项产品达到国际领先水平。被评定为国家级专精特新“小巨人”企业、国家高新技术企业、工业和信息化部重点实验室、重庆市技术创新示范企业,以及重庆市企业技术中心、是航空工业技术装备工程协会会员单位、中国汽车工程学会会员单位及中国汽车保修设备行业协会会员单位。此外,公司还荣获百余项国家专利,以及国家及省部级奖项,享有极高的行业知名度。近年来,公司成功交付多个国家级“首台套”重点项目,攻克多个“卡脖子”关键核心技术,涉及航空、风电、农机等领域,实现国产替代,持续为高端装备制造产业发展注入强大动力。

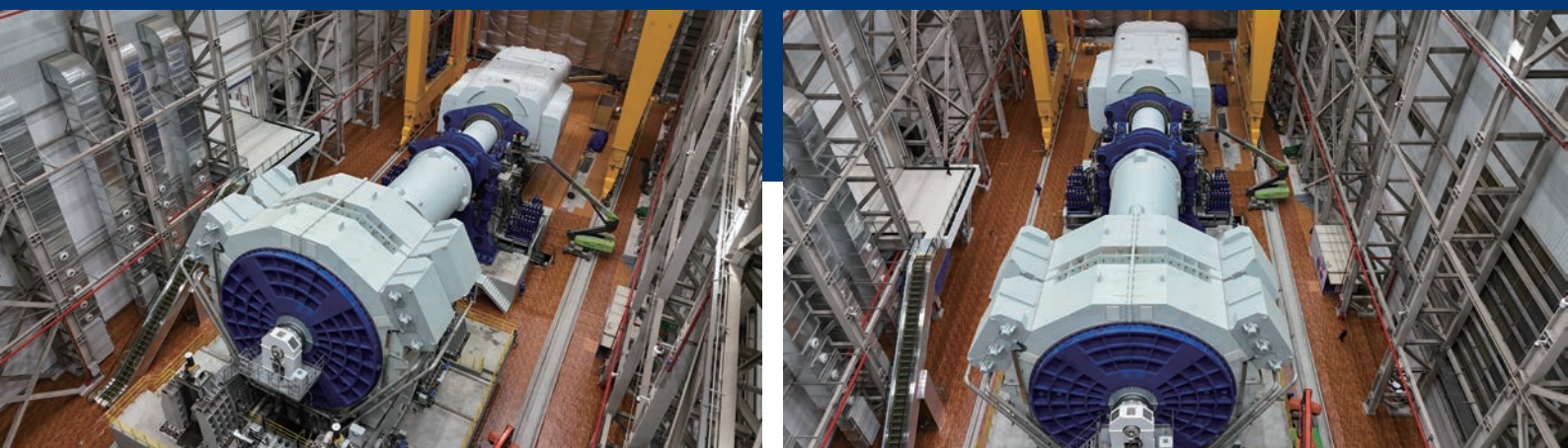
凯瑞装备拥有电驱、电液两大核心技术平台,始终坚持技术同心、产品多元的研发理念,产品谱系齐全,覆盖整车、发动机、传动、制动、转向、新能源、智能网联等领域,广泛应用于汽车及零部件、航空航天、风电、氢能、轨道交通、防务、科研教学、检测机构、在用车后市场等行业,与海内外300余家客户保持着长期稳定的合作关系。

Chongqing CAERI Test Equipment Co., Ltd. (CAERI TEST for short), a subsidiary of China Automotive Engineering Research Institute Co., Ltd., has been committed to the research and development, manufacturing, and sales of testing equipment since its establishment in 1991. It is a system integration solution provider for the overall capability construction of testing equipment.

After more than three decades of development, adhering to innovative design concepts, exquisite craftsmanship, and a dedicated craftsman spirit, CAERI TEST has successfully developed over a hundred types of testing products, with several products reaching an international leading level. The company has been recognized as a national-level specialized, refined, and innovative "New Giant" enterprise, a national high-tech enterprise, a key laboratory of industry and information technology, a Chongqing technological innovation demonstration enterprise, as well as a Chongqing enterprise technology center. It is also a member unit of the Aviation Industry Technical Equipment Engineering Association, a member unit of the China Automotive Engineering Society, and a member unit of the China Automotive Maintenance Equipment Industry Association. In addition, the company has won over a hundred national patents and national and provincial-level awards, enjoying a high reputation in the industry. In recent years, the company has successfully delivered several national "First Set" key projects, overcoming multiple "bottleneck" core technologies in fields such as aviation, wind power, and agricultural machinery, achieving domestic substitution and continuously injecting strong momentum into the development of the high-end equipment manufacturing industry.

CAERI TEST possesses two core technology platforms: electric drive and electro-hydraulic. It always adheres to the development philosophy of technological concentricity and product diversity. Its product range is comprehensive, covering areas such as whole vehicles, engines, transmissions, braking, steering, new energy, and intelligent networking. The products are widely used in industries including automotive and parts, aerospace, wind power, hydrogen energy, rail transit, defense, scientific research and education, testing institutions, and the post-sales market for in-use vehicles, maintaining long-term and stable cooperative relationships with more than 300 domestic and international customers.

风电机组传动链试验台 Wind Turbine Powertrain Test Bench



风电机组传动链全功率试验台,具备机械性能测试、疲劳测试、电网模拟、高低压穿越模拟、硬件在环仿真等测试功能,被测机组功率最大可到25MW,可满足未来数年大功率风电机组测试需求。

The full-power test platform of wind turbine powertrain test bench is equipped with testing functions such as mechanical performance testing, fatigue testing, power grid simulation, high and low voltage crossing simulation, and hardware-in-the-loop simulation. The maximum power of the tested units can reach 25MW, which can meet the testing needs of high-power wind turbine units in the future years.



1 功能亮点 Feature Highlights

- 机械部件的功能测试
- 变形的设计验证和模型验证
- 传动链单个部件的验证
- 机械效率分析
- 实际载荷条件下的润滑试验
- 机械部件的冷却功能试验
- 机械振动监测
- 实际载荷条件下的高速寿命测试
- 对新供应商部件的验证
- Functional test of mechanical components
- Design verification and modelling of deformations
- Verification of individual components of the powertrain
- Mechanical efficiency analysis
- Lubrication tests under actual load conditions
- Functional test of cooling of mechanical components
- Mechanical vibration monitoring
- High-speed life test under actual load conditions
- Validation of new supplier components

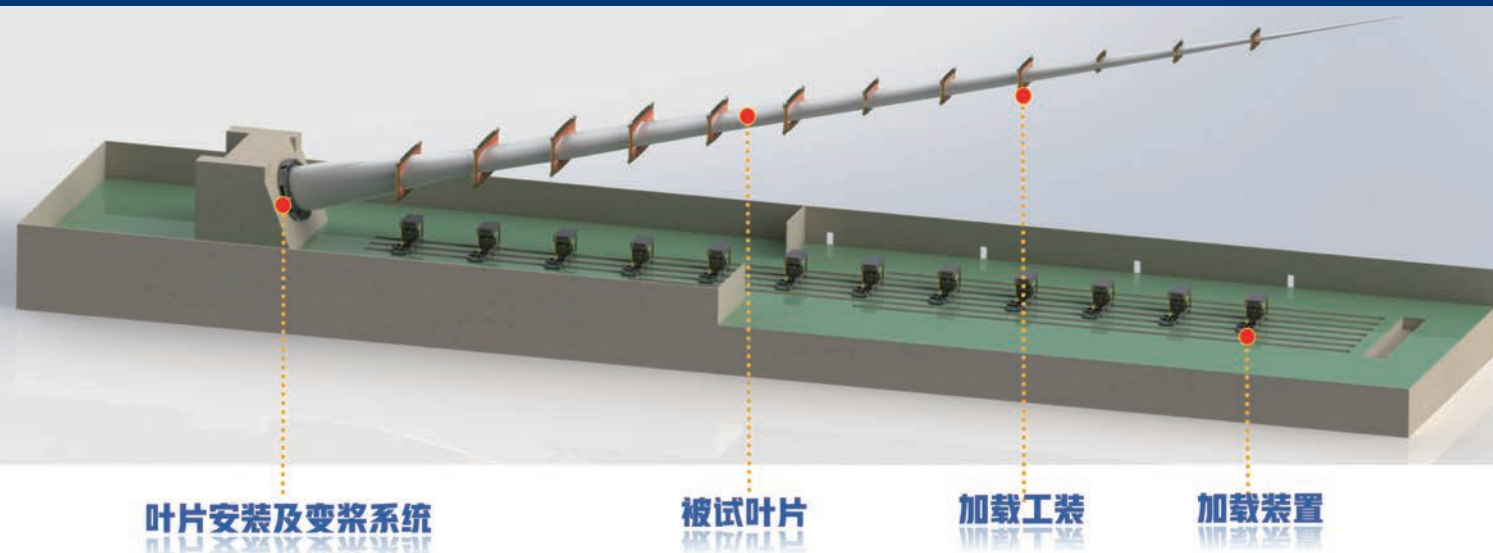
2 扩展功能 Extended Functions

- 载荷谱测试
- 发电系统、电能质量和电网兼容性测试
- 硬件在环仿真测试
- Load spectrum test
- Compatibility test for power generation systems, power quality and grids
- Hardware-in-the-loop simulation test

3 主要技术参考 Main Technical Parameters

- 最大测试产品功率:25MW
- 试验台倾斜角度:6°-10°
- 试验台驱动功率:25MW
- 额定转速:7rpm
- 最高转速:11rpm
- 最大弯矩:90MNm
- 最大径向力:11MN
- 最大轴向力:11MN
- Maximum test product power: 25MW
- Tilt angle of the test bench: 6°-10°
- Test bench drive power: 25MW
- Rated speed: 7rpm
- Maximum speed: 11rpm
- Maximum bending moment: 90MNm
- Maximum radial force: 11MN
- Maximum axial force: 11MN

风电叶片静态加载试验台 Wind Turbine Blade Static Loading Test Bench



风电叶片静态加载试验台用于叶片静态弯矩加载, 包括挥舞方向及摆振方向, 采用竖向加载形式, 占地面积小、结构受力好、操作方便。被测叶片最大长度可到150m, 可满足未来数年大功率风电叶片测试需求。

The static load test platform for wind turbine blades is used for static bending moment loading of the blades, including the swing direction and vibration direction. It adopts a vertical loading form, occupies a small space, has good structural stress, and is easy to operate. The maximum length of the tested blade can reach 150m, which can meet the testing requirements of high-power wind turbine blades in the coming years.



1 功能亮点 Feature Highlights

- ◆ 挥舞静态加载
- ◆ 摆振静态加载
- ◆ 变形三维轨迹测量
- ◆ Waving static loading
- ◆ Pendulum vibration static loading
- ◆ Deformation 3D trajectory measurement

2 主要技术参考 Main Technical Parameters

最大测试产品长度: 150m
Maximum test product length: 150m

最大静态弯矩 (不含叶片自重): 200MNm
Maximum static bending moment (excluding blade weight): 200MNm

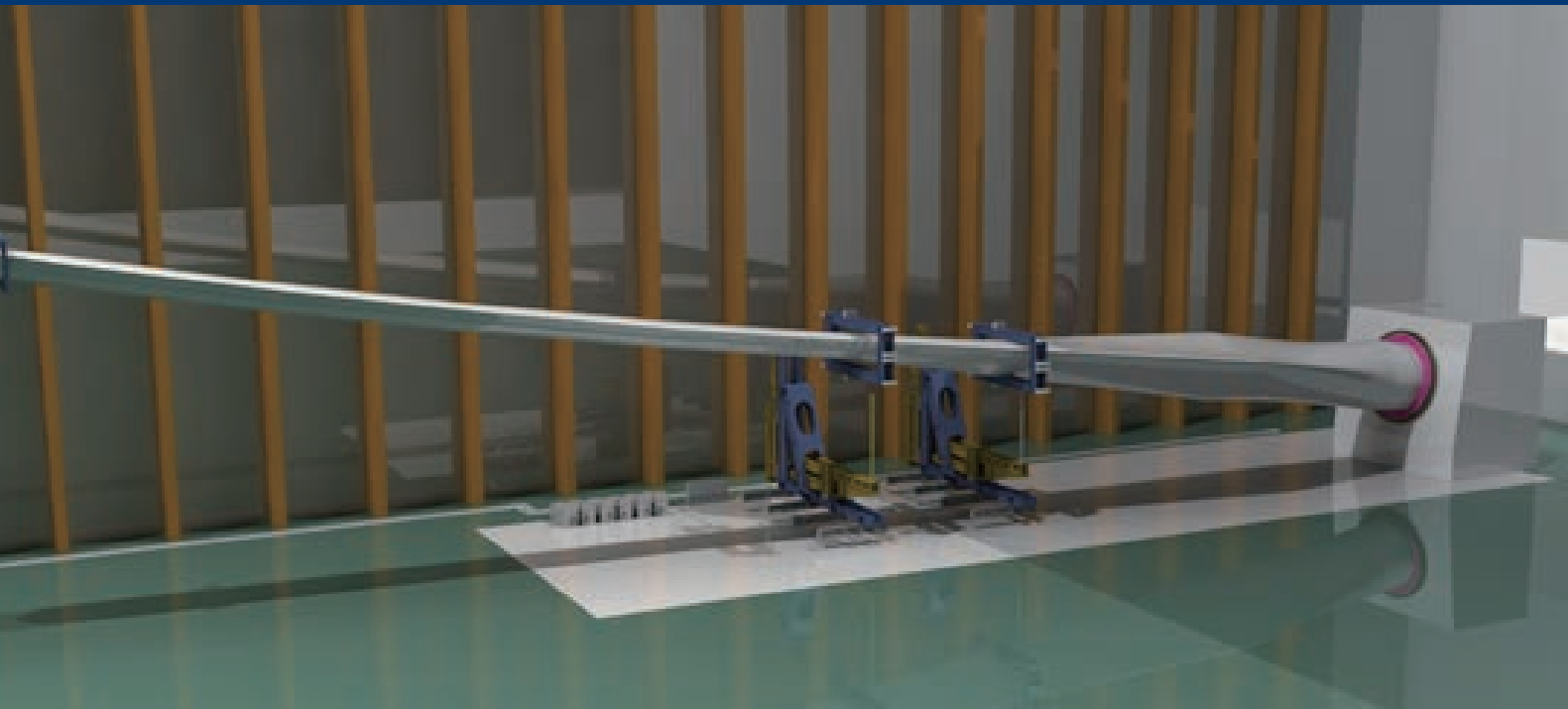
最大测量变形: 50m
Maximum measured deformation: 50m

加载点数量: 12
Number of loading points: 12

加载力大小: 30/40t
Loading force: 30/40t

最大加载速度: 3m/min
Maximum loading speed: 3m/min

风电叶片动态加载试验台 Wind Turbine Blade Dynamic Loading Test Bench



风电叶片动态加载试验台用于叶片动态疲劳测试,包括挥舞方向及摆振方向,采用液压加载形式,可满足双轴同时加载,受力真实、试验周期短。被测叶片最大长度可到150m,可满足未来数年大功率风电叶片测试需求。

The dynamic load test bench for wind turbine blades is used for dynamic fatigue testing of the blades, including swing direction and buffeting direction. It adopts a hydraulic loading mode, which can satisfy simultaneous loading of dual shafts, with realistic stress and short test cycle. The maximum length of the tested blade can reach 150m, which can meet the testing requirements of high-power wind turbine blades in the coming years.

1

功能亮点

Feature Highlights

- ◆ 挥舞静态加载
- ◆ 摆振静态加载
- ◆ 挥舞摆振双轴加载
- ◆ Waving static loading
- ◆ Pendulum vibration static loading
- ◆ Waving and pendulum vibration bi-axial loading

2

主要技术参考

Main Technical Parameters

最大测试产品长度:150m

Maximum test product length: 150m

挥舞最大激振力:±40kN

Maximum excitation force of waving: ±40kN

挥舞激振频率:0.25-0.55Hz

Excitation frequency of waving: 0.25-0.55Hz

摆振最大激振力:±30kN

Maximum excitation force of pendulum vibration: ±30kN

摆振激振频率:0.5-0.8Hz

Pendulum vibration excitation frequency: 0.5-0.8Hz

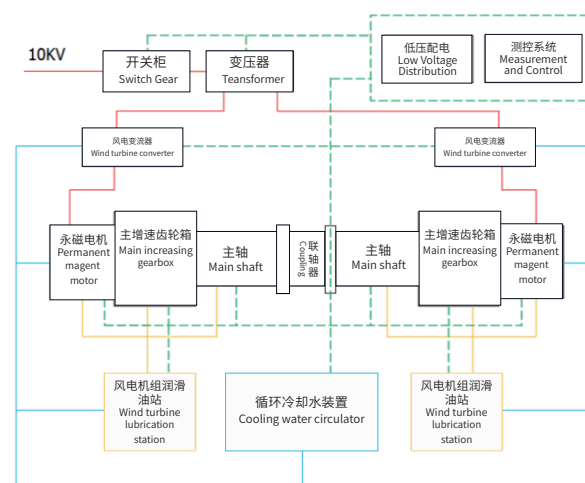
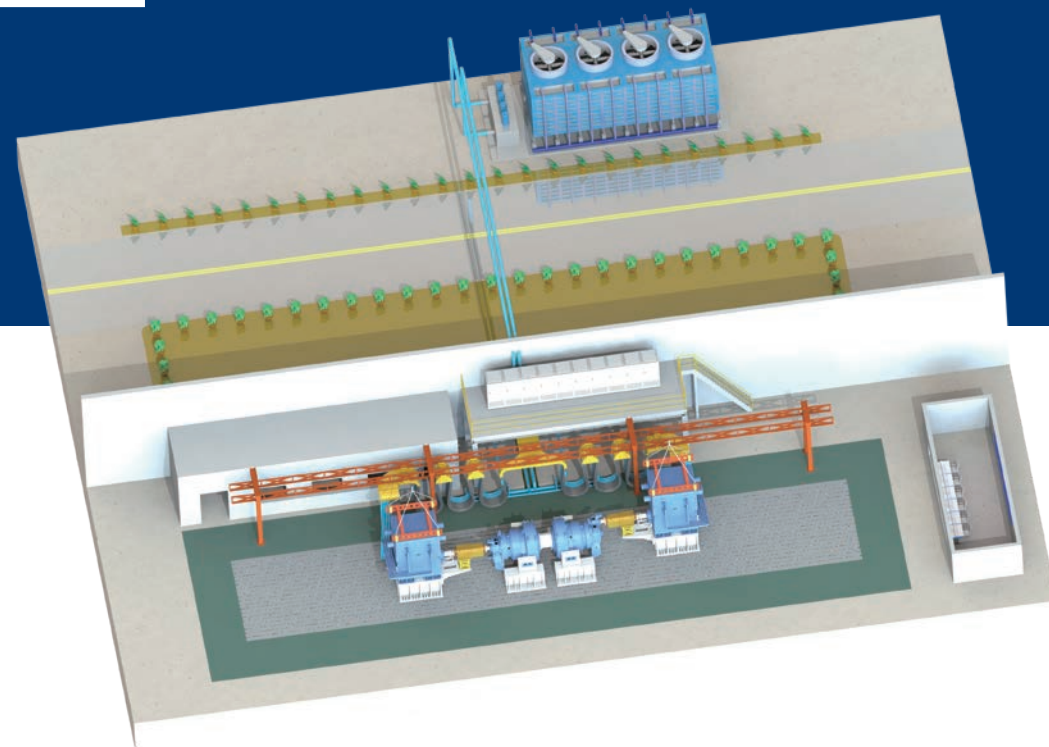
加载轴数量:2

Number of loading axes: 2

加载点数量:挥舞与摆振可分体加载

Number of loading points: waving and pendulum vibration can be split loaded

风电齿轮箱疲劳试验台 Wind Turbine Gearbox Fatigue Test Bench



风电齿轮箱试验台,采用电封闭结构,适用于齿轮箱全功率驱动试验,包括风电齿轮箱的型式试验和出厂验证试验。

The wind turbine gearbox test bench adopts an electrically enclosed structure and is suitable for full-power driving tests of the gearbox, including type tests and factory verification tests of the wind turbine gearbox.

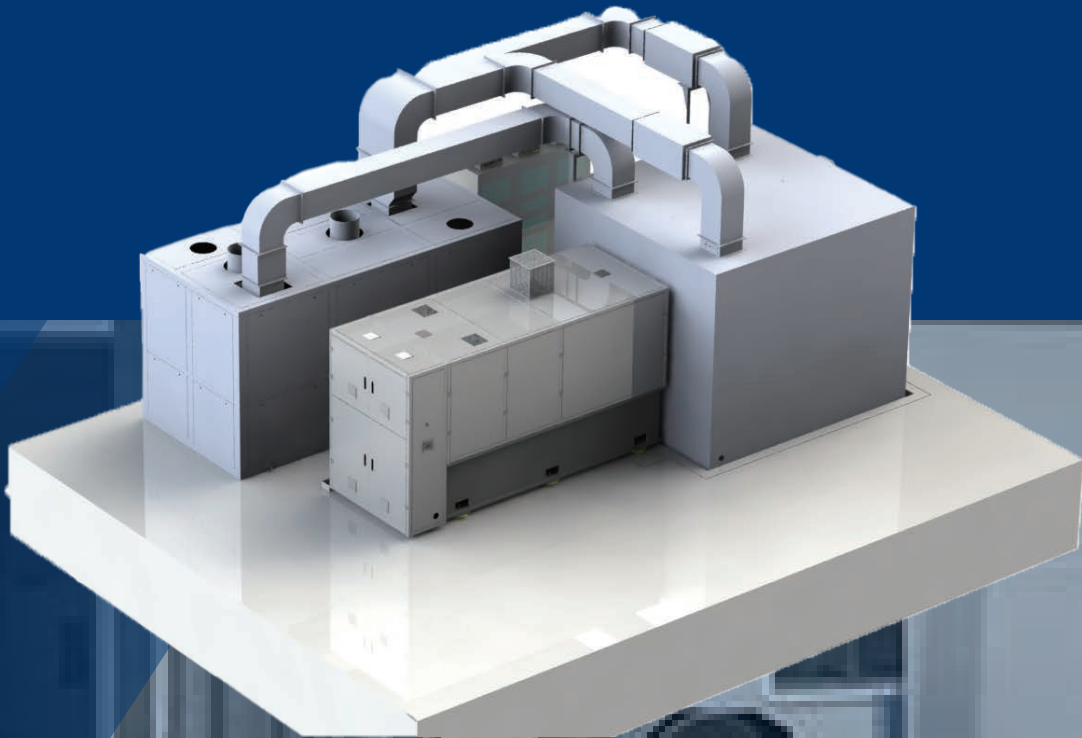
1 功能亮点 Feature Highlights

- ◇ 空载试验 No-load test
- ◇ 性能试验 Performance test
- ◇ 功率损耗试验 Power loss test
- ◇ 超载试验 Overload test
- ◇ 齿面接触疲劳寿命试验 Gear contact fatigue life test
- ◇ 自定义稳态试验 Customised steady state test
- ◇ 载荷谱模拟试验 Load spectrum simulation test

2 主要技术参考 Main Technical Parameters

- 测功电机最大额定功率:20MW Maximum rated power of dynamometer motor: 20MW
- 测功电机最大额定扭矩:200kNm Maximum rated torque of dynamometer motor: 200kNm
- 测功电机额定转速:1200rpm Rated speed of dynamometer motor: 1200rpm
- 测功电机最大转速:2200rpm Maximum speed of dynamometer motor: 2200rpm
- 编码器分辨率:1024ppr Encoder resolution: 1024ppr
- 扭矩传感器:200KNm Torque sensor: 200KNm

风电制动器惯性试验台 Wind Turbine Brake Inertia Test Bench



试验台主要用于风电制动器综合性能试验,可模拟风电制动器在实际工况条件下的动态综合制动性能、摩擦材料性能、制动力或制动力矩检测、温度检测等,为产品设计开发、出厂检验、产品升级等提供可靠的试验数据。

The test bench is mainly used for comprehensive performance tests of wind turbine brakes, which can simulate the dynamic comprehensive braking performance, friction material performance, braking force or braking torque detection, temperature detection and other performance under actual working conditions of the wind turbine brakes. It provides reliable test data for product design and development, factory inspection, product upgrading, etc.

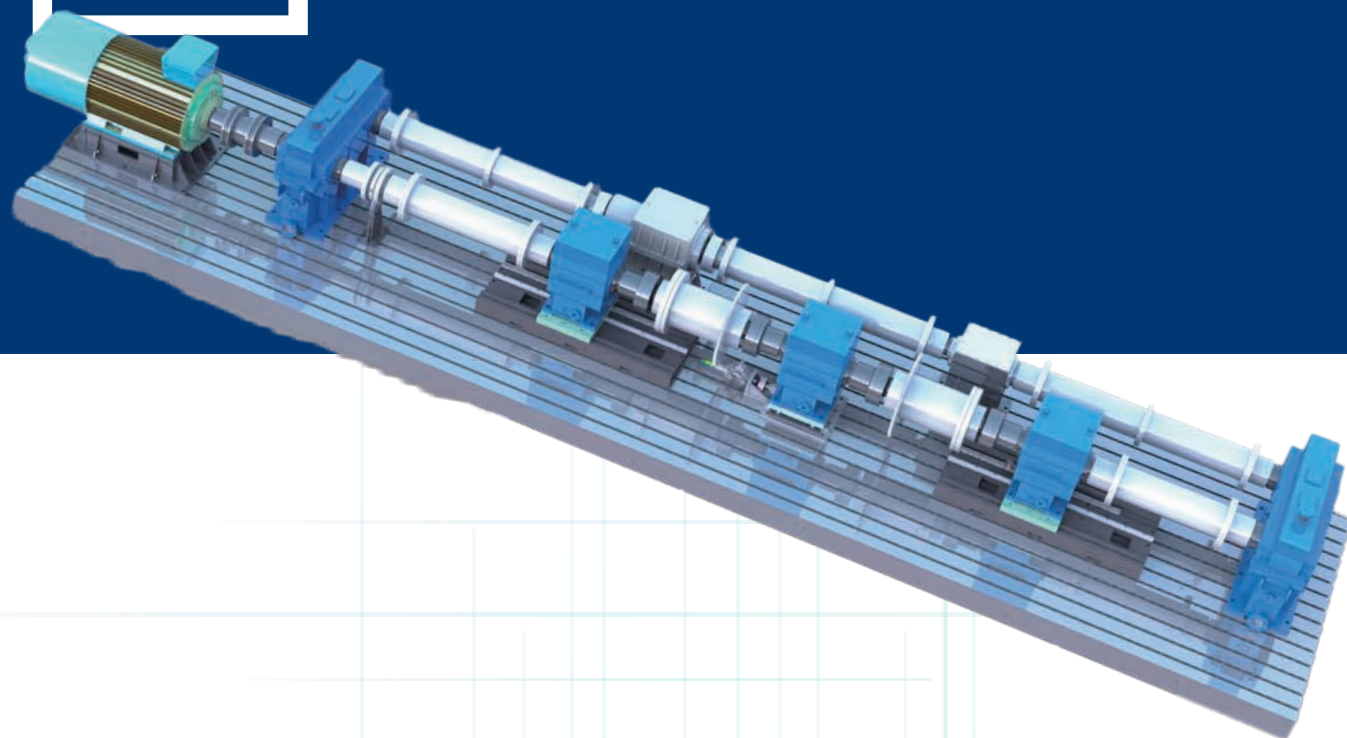
1 功能亮点 Feature Highlights

磨合试验	Break-in test
效能试验	Efficiency test
热衰退恢复试验	Heat fade recovery test
制动衬片/衬块磨损试验	Brake lining/block wear test
静力矩试验	Static torque test

2 主要技术参考 Main Technical Parameters

驱动电机功率:1000kW	Driving motor power: 1000kW
最高转速:3000转/分,无级可调	Maximum speed: 3000 rpm, step-less adjustable
飞轮组惯量:100~10000kg.m2,无级可调	Flywheel set inertia: 100~10000kg.m2, step-less adjustable
惯量模拟精度:≤1%	Electric inertia simulation accuracy: ≤1%
制动压力(液压):0~25Mpa,压力控制精度:≤1%Fs	Brake pressure (hydraulic): 0~25Mpa, Pressure control accuracy: ≤1% Fs
制动力矩范围:0~100000Nm,扭矩控制精度:≤1%Fs	Braking torque range: 0~100000Nm, Torque control accuracy: ≤1% Fs
冷却风速:0~20m/s,可调.冷却风量 >8000m³/h	Cooling and exhaust air velocity: 0~20m/s, adjustable. Cooling and exhaust air volume >8000m³/h
传感器精度:±0.5%	Sensor accuracy: ±0.5%
表具精度:≥1级	Meter accuracy: ≥1grade
系统测试精度:≤1%Fs	System test accuracy: ≤1%Fs
控制方式:专用闭环控制器,可实现恒管压、恒扭矩、恒减速度及电惯量控制	Control mode: special closed-loop controller, which can realise constant pipe pressure, constant torque, constant deceleration and electric inertia control.

风电联轴器耐久试验台 Wind Turbine Coupling Durability Test Bench



风电联轴器耐久试验台, 采用机械封闭结构, 适用于风电联轴器疲劳及性能试验, 可满足2~4件产品同时试验。

Wind turbine coupling durability test bench, with mechanical closed structure, suitable for wind turbine coupling fatigue and performance test, can meet 2~4 pieces of products tested at the same time.

1 功能亮点 Feature Highlights

静态变位试验 Static Displacement Test

联轴器进行旋转疲劳时, 能够同时实现径向和轴向位移加载。包括位移能力试验、位移量试验、启动/制动扭矩试验、额定功率试验、周期运转试验、极限转速试验。

When a coupling is subjected to rotational fatigue, it can simultaneously realize radial and axial displacement loading. It includes tests for displacement capability, displacement amount, start/stop torque, rated power, cycling operation, and extreme rotational speed.

动态变位试验 Dynamic Displacement Test

联轴器进行旋转疲劳时, 能够同时实现径向和轴向动态位移加载。包括动态变位能力试验、动态变位疲劳试验。

When a coupling undergoes rotational fatigue, it can simultaneously achieve radial and axial dynamic displacement loading. This includes dynamic displacement capacity tests and dynamic displacement fatigue tests.

扭矩变化试验 Torque Variation Test

联轴器进行旋转疲劳时, 能够实现扭矩变化加载。包括启停疲劳测试。

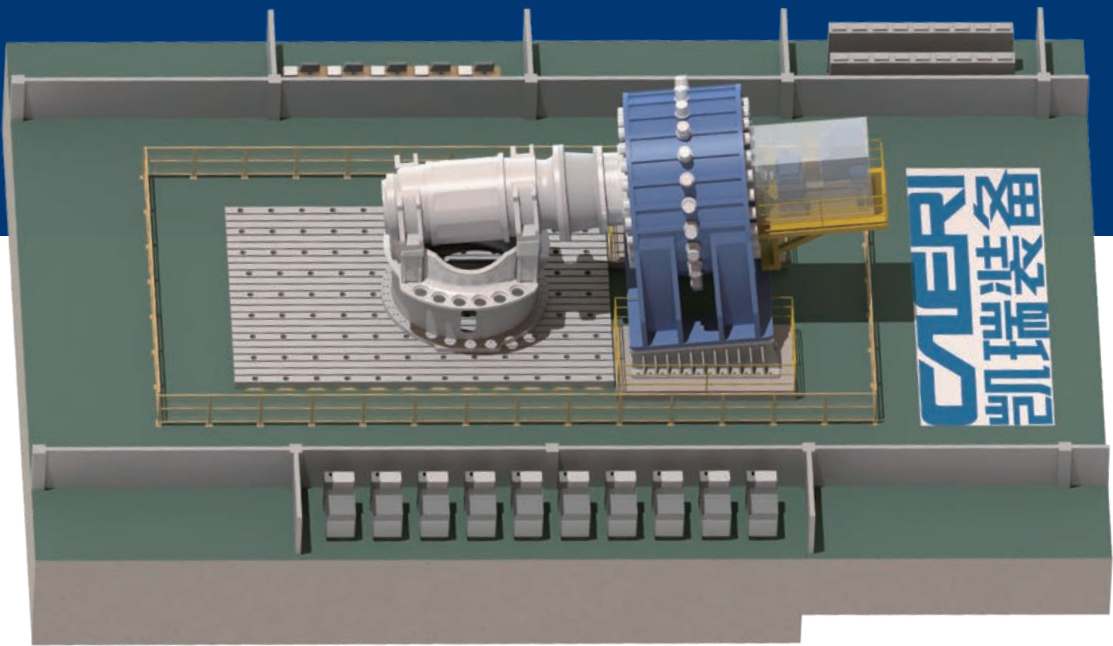
When a coupling undergoes rotational fatigue, it can be subjected to torque variation loading. This includes start-stop fatigue tests.

2 主要技术参考 Main Technical Parameters

驱动电机额定功率: 350Kw Rated power of drive motor: 350Kw	◇	驱动电机额定扭矩: 4800Nm Rated torque of drive motor: 4800Nm
驱动电机额定转速: 700rpm Rated speed of drive motor: 700rpm	◇	试验台最高转速: 1500rpm Maximum speed of test bench: 1500rpm
最大封闭扭矩: 60KN.m (有更大的扭矩加载器可选择) Maximum enclosed torque: 60KN.m (larger torque loaders are available)	◇	最大封闭功率: 1675Kw Maximum enclosed power: 1675Kw
扭矩测量范围: 0~60kNm (可扩展至: 0~100kNm) Torque measurement range: 0~60kNm (extendable to: 0~100kNm)	◇	系统测试精度: $\leq 1\%F_s$ System test accuracy: $\leq 1\%F_s$

传动链系统主轴轴承试验台

Drive Train Main Shaft Bearing Test Rig



传动链系统主轴轴承试验台测试对象主要包括主轴承、轴承座和机座。传动链系统通过偏航连接工装安装到专用底座上，从而固定在试验平台上，对传动链系统施加弯矩、扭矩、轴向力，模拟主轴轴承现场受到的载荷。在另外一端通过电气驱动方式，可施加空转的旋转扭矩，模拟主轴轴承运行工况，驱动电机与中间加载机构通过可变角度的联轴器进行连接。

The main test subjects of the drive chain system main shaft bearing test rig include the main bearing, bearing housing, and base frame. The drive chain system is installed onto a dedicated base via a yaw connection tooling, thereby securing it to the test platform. Bending moments, torque, and axial forces are applied to the drive chain system to simulate the loads experienced by the main shaft bearing in field conditions. At the other end, an electrical drive method can apply a no-load rotational torque to simulate the operating conditions of the main shaft bearing. The drive motor is connected to the intermediate loading mechanism through a flexible coupling with variable angles.

1 功能亮点

Feature Highlights

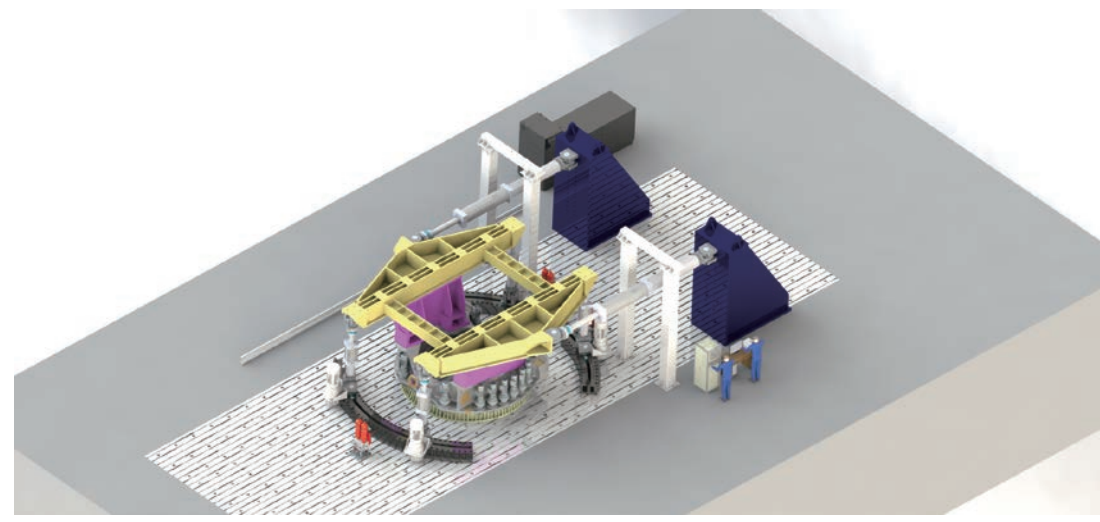
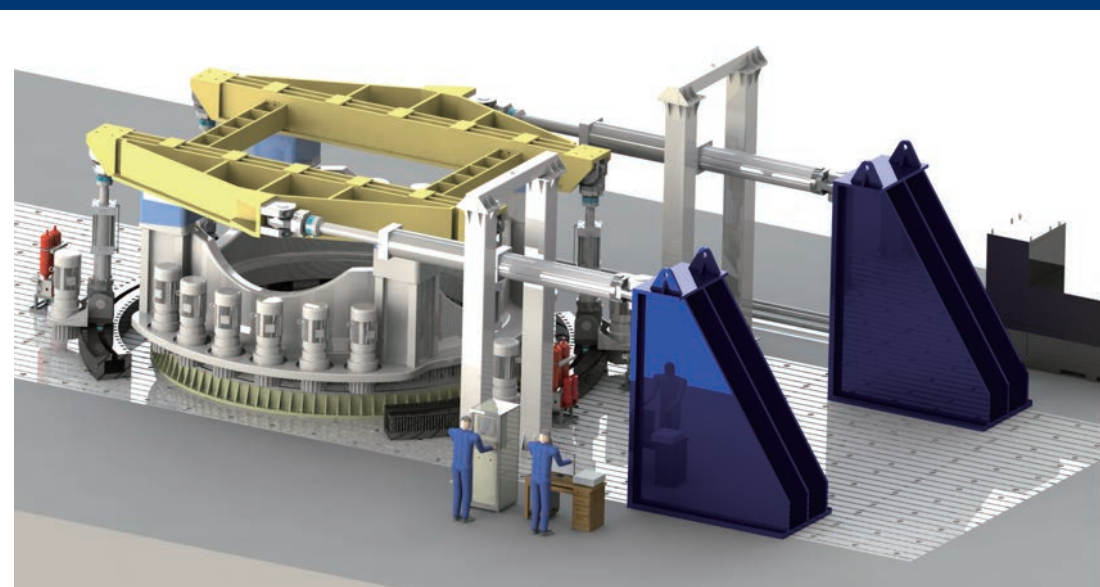
- | | |
|------------|---|
| ◇ 弯矩加载 | ◇ Bending Moment Loading |
| ◇ 轴向力加载 | ◇ Axial Force Loading |
| ◇ 径向力加载 | ◇ Radial Force Loading |
| ◇ 多自由度载荷模拟 | ◇ Multi-degree-of-freedom Load Simulation |
| ◇ 温升测试 | ◇ Temperature Rise Test |
| ◇ 性能测试 | ◇ Performance Test |
| ◇ 耐久测试 | ◇ Endurance Test |
| ◇ 润滑测试 | ◇ Lubrication Test |

2 主要技术参考

Main Technical Parameters

额定输出扭矩:5000 kNm	Rated Output Torque: 5000 kNm
最大旋转速度:10rpm	Maximum Rotation Speed: 10 rpm
最大静态弯矩: $\geq 255\text{MNm}$	Maximum Static Bending Moment: $\geq 255\text{ MNm}$
最大动态弯矩: $\geq 135\text{MNm}$	Maximum Dynamic Bending Moment: $\geq 135\text{ MNm}$
最大静态径向力: $\geq 8\text{MN}$	Maximum Static Radial Force: $\geq 8\text{ MN}$
最大动态径向力: $\geq 6\text{MN}$	Maximum Dynamic Radial Force: $\geq 6\text{ MN}$
最大静态轴向力: $\geq 17\text{MN}$	Maximum Static Axial Force: $\geq 17\text{ MN}$
最大动态轴向力: $\geq 13\text{MN}$	Maximum Dynamic Axial Force: $\geq 13\text{ MN}$

偏航轴承试验台 Yaw Bearing Test Rig



1 试验对象 Test Object

试验对象: 风电偏航轴承
Test Object: Wind Turbine Yaw Bearing

2 基本能力 Basic Capabilities

- | | |
|----------------|---|
| ◇ 模拟迎风载荷 | ◇ Simulate windward load |
| ◇ 模拟侧风载荷 | ◇ Simulate sidewind load |
| ◇ 模拟重力载荷 | ◇ Simulate gravitational load |
| ◇ 测试偏航电机的最大驱动力 | ◇ Test the maximum driving force of the yaw motor |
| ◇ 测试偏航电机最大制动力 | ◇ Test the maximum braking force of the yaw motor |
| ◇ 检查齿轮在载荷下运行情况 | ◇ Inspect gear operation under load |

3 主要技术参考 Main Technical Parameters

测试产品范围: 4.5m~6m

Test product range: 4.5m~6m

绕X轴弯矩: 6MNm

Bending moment around the X-axis: 6 MN·m

绕Y轴弯矩: 6MNm

Bending moment around the Y-axis: 6 MN·m

绕Z轴弯矩: 4MNm

Bending moment around the Z-axis: 4 MN·m

偏航轴承运动角度: $\pm 15^\circ$

Yaw bearing movement angle: $\pm 15^\circ$