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## 重齿永磁半直驱动力系统

CHONGCHI PERMANENT MAGNET SEMI-DIRECT DRIVE SYSTEM

**CSSC**

重庆齿轮箱有限责任公司  
CHONGQING GEARBOX CO.,LTD

## 概述

### Overview



永磁半直驱动力系统(Permanent Magnet Semi-Direct Drive System)是一种将低速永磁同步电机及减速机集成一体化设计,直接驱动负载的新型动力技术,主要由永磁同步电机(PMSM)、减速机(Reducer)、变频控制(VFD)组成。永磁半直驱动力系统在成本与可靠性等综合优势明显,具有系统效率高、节能高效、噪音振动小、体积小重量轻、可靠性高、智能控制、维护成本低等优点。

传统皮带输送机、斗式提升机、拉链机、选粉机等低压小功率设备以及球磨机、辊压机、立式辊磨机大功率设备,是水泥、矿山、火电、陶瓷等行业中广泛应用的生产设备。目前该类设备动力系统由三相异步电动机、联轴器、制动器以及减速机等组成。存在效率低、能耗高、故障率较高、振动大、维护成本高、结构复杂、体积大等缺点。

随着国家“双碳”目标的日益临近,以及企业降本增效的需求,工业制造领域对生产系统节能减排的要求越来越严苛。永磁半直驱技术通过深度集成永磁同步电机、减速机、变频控制为一体,系统节能优势明显,能为实现“双碳”目标和促进低碳经济发展提供强有力的支持。

重庆齿轮箱有限责任公司(简称“重齿”公司)全新研发永磁半直驱动力技术,充分发挥齿轮传动高扭矩密度、永磁电机高效节能、变频系统控制智能化的优势,将整个驱动系统进行深度集成。研发的永磁半直驱产品广泛适用于建材、煤矿、冶金、电力、化工等高能耗领域。

Permanent Magnet Semi-Direct Drive System is a new power technology that integrates the design of low-speed permanent magnet synchronous motor and reducer to directly drive the load, which is mainly composed of permanent magnet synchronous motor (PMSM), reducer and variable frequency control (VFD). The permanent magnet semi-direct drive system has obvious comprehensive advantages in cost and reliability, and has the advantages of high system efficiency, energy saving and high efficiency, low noise and vibration, small size and light weight, high reliability, intelligent control and low maintenance cost.

Low-pressure and low-power equipment such as traditional belt conveyors, bucket elevators, zipper machines, and powder separators, as well as high-power equipment such as ball mills, roller presses, and vertical roller mills, are widely used production equipment in cement, mining, thermal power, ceramics and other industries. At present, the power system of this kind of equipment is composed of three-phase asynchronous motor, coupling, brake and reducer. There are shortcomings such as low efficiency, high energy consumption, high failure rate, high vibration, high maintenance cost, complex structure and large volume.

With the national "Carbon Peak and Carbon Neutrality" goal approaching and the need of enterprises to reduce costs and increase efficiency, the requirements for energy conservation and emission reduction in production systems in the field of industrial manufacturing are becoming more and more stringent. Through the deep integration of permanent magnet synchronous motor, reducer and frequency conversion control, the permanent magnet semi-direct drive technology has obvious advantages in system energy saving, which can provide strong support for the realization of the "double carbon" goal and the promotion of low-carbon economic development.

The Chongqing gearbox Co., LTD (referred to as "chongchi") has newly developed permanent magnet semi-direct drive technology, giving full play to the advantages of high torque density of gear transmission, high efficiency and energy saving of permanent magnet motors, and intelligent control of frequency conversion system, and deeply integrating the entire drive system. The permanent magnet semi-direct drive products developed are widely used in high energy consumption fields such as building materials, coal mines, metallurgy, electric power, and chemical industry.

# Y LX系列立磨半直驱动力系统

## Y LX SERIES VERTICAL MILL SEMI-DIRECT DRIVE SYSTEM

### 简介 | Brief introduction

立式辊磨机是集中碎、粉磨、烘干、选粉为一体的高效节能粉磨设备，广泛用于水泥生料、水泥熟料、煤渣、矿渣及钢渣粉磨加工，具有结构简单、制造和使用成本低的特点。

Y LX系列立磨半直驱动力系统是重齿研发的第二代半直驱产品，主要用于替代火电厂中煤粉生产线和建材行业水泥生产线等立式辊磨设备的老旧动力系统。

Vertical roller mill is a high-efficiency and energy-saving grinding equipment integrating crushing, grinding, drying and powder separation, which is widely used in cement raw meal, cement clinker, cinder, slag and steel slag grinding and processing, with the characteristics of simple structure, low manufacturing and use cost.

Y LX series vertical mill semi-direct drive system is the second generation of semi-direct drive products developed by chongchi, which is mainly used to replace the old power system of vertical roller mill equipment such as pulverized coal production line in thermal power plant and cement production line in building materials industry.



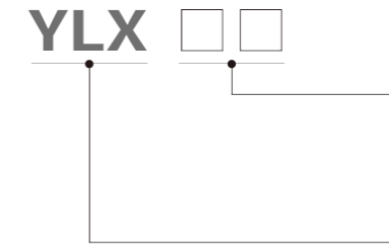
Y LX立磨半直驱动力单元  
Y LX series vertical mill semi-direct drive power unit

### 性能特点 | Performance characteristics

- 该动力系统机电一体化深度集成，可实现老旧动力系统的原基础替换，特别适合于占地有限的生产线。
- 系统运行节能，新型动力系统比旧系统综合节电率提升8%~15%。
- 配置的油站规格比传统结构减少30%~50%，油站采购成本降低，后期换油成本降低。
- 运行平稳，可根据用户生产需求，调节转速，达到调产和优化物料粉磨工艺的目的。
- 无需预埋主电机基础，安装过程中找正环节的步骤减少，简化安装规程。
- 可配置380V低压变频控制代替传统机械辅传，实现磨盘在线堆焊和日常检修。
- 可配置CG-master远程健康管理系統，对系统运行进行实时监测及故障预警。

- The power system is deeply integrated with mechatronics, which can replace the original foundation of the old power system, and is especially suitable for production lines with limited land area.
- The operation of the system is energy-saving, and the comprehensive power-saving rate of the new power system is increased by 8%~15% compared with the old system.
- The specifications of the configured oil station are reduced by 30%~50% compared with the traditional structure, the procurement cost of the gas station is reduced, and the cost of oil change in the later stage is reduced.
- The operation is stable, and the speed can be adjusted according to the user's production needs, so as to achieve the purpose of adjusting production and optimizing the material grinding process.
- There is no need to pre-embed the main motor foundation, and the steps of the alignment link in the installation process are reduced, simplifying the installation procedures.
- It can be configured with 380V low-voltage frequency conversion control instead of traditional mechanical auxiliary transmission to realize online surfacing welding and daily maintenance of grinding discs.
- The CG-master remote health management system can be configured to monitor the system operation in real time and give early warning of faults.

### 命名方式 | Nomenclature



产品型号 /Product model

P/n<sub>2</sub>X9550/1000≈P/n<sub>2</sub>X10kN

P 磨机所需(轴)功率 /The (shaft) power required by the mill  
n<sub>2</sub> 磨机所需转速 /The speed required for the mill

Y: 永磁驱动 /Permanent magnet drive

L: 立式传动 /Vertical drive

X: 行星齿轮 /Planetary gears

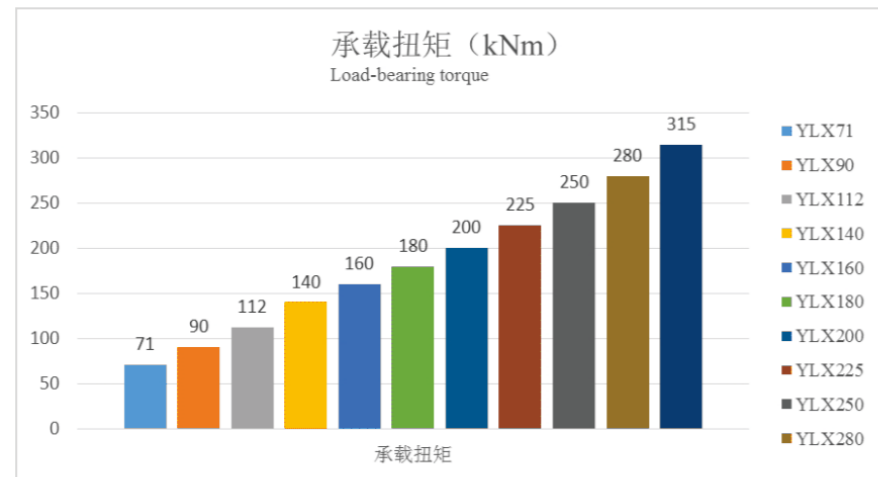
### 主要技术参数 | Main technical parameters:

功率范围: 200kW~900kW	Power range: 200kW~900kW
电压等级: 6/10kV	Voltage level: 6/10kV
输出转速: 24rpm~40rpm	Output speed: 24rpm~40rpm
额定扭矩: 70kNm~315kNm	Rated torque: 70kNm~315kNm

Y LX系列范围 Y LX series range: :Y LX71~Y LX315

未列参数请咨询我公司

Please consult our company for unlisted parameters

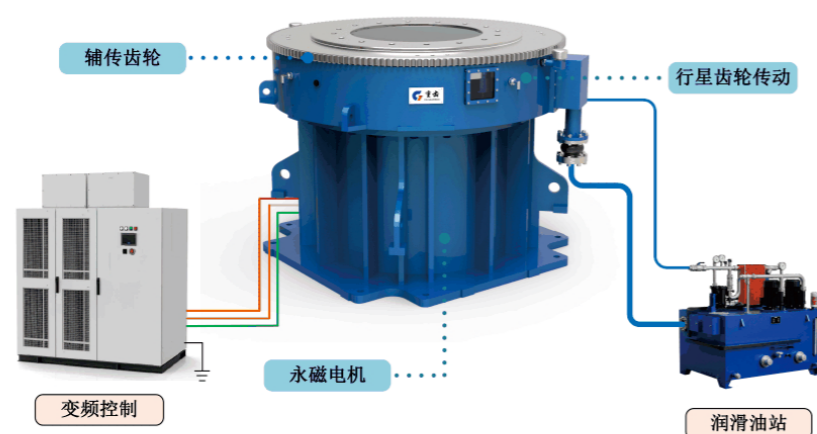


系统承载扭矩分布图  
Diagram of the load-bearing torque distribution of the system

## 系统组成 | System composition:

YLX立磨半直驱动力单元+变频控制+润滑油站+慢驱装置(机械辅传或380V低压变频控制)

YLX series vertical mill semi-direct drive power unit + Variable frequency drive + Lubricating-oil station + Slow drive device (mechanical auxiliary transmission or 380V low voltage frequency conversion control)



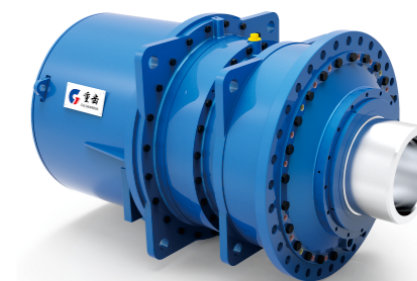
YLX立磨半直驱动力系统组成  
YLX series vertical mill semi-direct drive system

## YGW系列辊压机半直驱动力系统 YGW SERIES ROLLER PRESS SEMI-DIRECT DRIVE SYSTEM

### 简介 | Brief introduction

辊压机是一种新型的水泥节能粉磨设备,可用于替代能耗高、效率低的老旧粉磨系统。具有粉磨质量好、效率高、工作噪音低等特点,广泛应用于水泥、建材行业。

YGW系列辊压机半直驱动力系统是传统辊压机动力系统的升级迭代产品,解决了原系统效率低、占地面积大、安装基础要求较高、维护频次高等问题。该系统主要由行星减速齿轮、高效永磁同步电机和变频控制深度集成,基于一体化设计,具有体积小、效率高、可靠性高、适用范围更广等特点。



YGW辊压机半直驱一体式动力单元  
YGW series roller press semi-direct drive integrated power unit

Roller press is a new type of cement energy-saving grinding equipment, which can be used to replace the old grinding system with high energy consumption and low efficiency. It has the characteristics of good grinding quality, high efficiency and low working noise, and is widely used in cement and building materials industries.

YGW series roller press semi-direct drive system is an upgraded and iterative product of the traditional roller press power system, which solves the problems of low efficiency, large floor area, high installation foundation requirements and high maintenance frequency of the original system. The system is mainly deeply integrated by planetary reduction gears, high-efficiency permanent magnet synchronous motors and variable frequency drive, and is based on the integrated design, which has the characteristics of small size, high efficiency, high reliability and wider application range.

### 性能特点 | Performance characteristics

- 依托重齿标准行星平台研发,模块化设计,提高主要零件的通用性和互换性,减少变换零部件规格数量。
- 一体化设计,深度集成电机、减速齿轮、变频控制,系统体积更小,节省空间。
- 采用高功率因数永磁同步电机,相比原系统综合节电率提升5%~15%。
- 安装简单,空心轴使用锁紧盘安装,无基础建设。
- 运行平稳,可根据用户需求及产线实际运行情况,实时调整转速。
- 左右机采用同一外形设计,可互换,提高动力系统的可利用度,可一备多用。

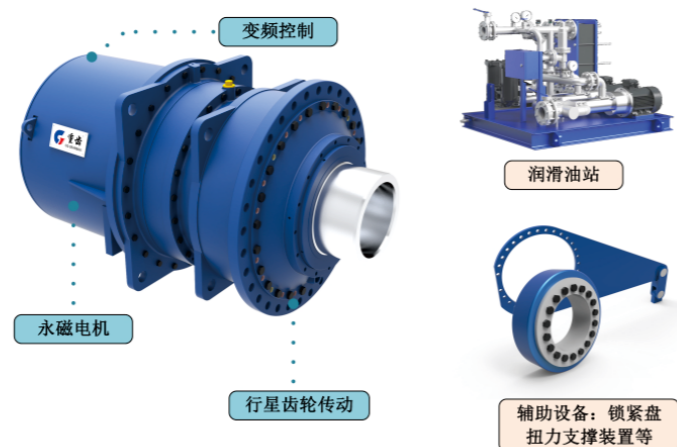
• 可配置CG-master远程健康管理系统, 在线监测实时数据, 对动力系统运行状态进行分析, 提前做好维保安排及备件准备, 有效保证客户生产线的正常运行。

- Relying on the research and development of the Chongchi standard planetary platform and modular design, the versatility and interchangeability of the main parts are improved, and the number of specifications of the converted parts is reduced.
- Integrated design, deep integration of motor, reduction gear, frequency conversion control, the system is smaller and space-saving.
- The high power factor permanent magnet synchronous motor is adopted, and the comprehensive power saving rate is increased by 5%~15% compared with the original system.
- The installation is simple, the hollow shaft is installed with a lock plate, and there is no foundation construction.
- The operation is stable, and the speed can be adjusted in real time according to the user's needs and the actual operation of the production line.
- The left and right machines are designed with the same shape and can be interchanged, which improves the availability of the power system and can be used for multiple purposes.
- It can be configured with CG-master remote health management system, online monitoring of real-time data, analysis of the operation status of the power system, maintenance arrangements and spare parts preparation in advance, and effectively ensure the normal operation of the customer's production line.

## 系统组成 System composition:

YGW辊压机半直驱动力单元+辅助附件  
(扭力支持装置、锁紧盘及胀套、冷却润滑油站等)

YGW series roller press semi-direct drive integrated power unit + Auxiliary accessories  
(Torque support device, Shrink disc and expansion sleeve, Lubricating-oil station, etc.)



YGW辊压机半直驱动力系统组成  
YGW roller press semi-direct drive system

## 主要技术参数 Main technical parameters:

功率范围: 300kW~3000kW	Power range: 300kW~3000kW
电压等级: 380kV、690kV、6/10kV	Voltage level: 380kV、690kV、6/10kV
输出转速: 14rpm~25rpm	Output speed: 14rpm~25rpm
额定扭矩: 115kNm~2045kNm	Rated torque: 115kNm~2045kNm

# YSW系列水泥磨半直驱动力系统

## YSW SERIES CEMENT MILL SEMI-DIRECT DRIVE SYSTEM

### 简介 Brief introduction

随着行星传动技术日趋成熟, 为满足出口和替换产品的需求, 重齿公司开发设计了两级行星中心传动磨机半直驱动力系统, 可用于替代能耗高、传动效率低的老旧粉磨动力系统。具有粉磨质量好、效率高、工作噪音低等特点, 可广泛应用于水泥行业。

YSW系列水泥磨半直驱动力系统是传统水泥磨动力系统的升级迭代产品, 解决了原系统效率低、占地面积大、安装基础要求较高、维护频次高等问题。该系统主要由行星减速齿轮、高效永磁同步电机和变频控制组成, 具有体积小、效率高、可靠性高、适用范围更广等特点。

With the increasing maturity of planetary transmission technology, in order to meet the demand for export and replacement products, the company has developed and designed a two-stage planetary center drive mill semi-direct drive system, which can be used to replace the old grinding power system with high energy consumption and low transmission efficiency. It has the characteristics of good grinding quality, high efficiency and low working noise, and can be widely used in the cement industry.

YSW series cement mill semi-direct drive system is an upgraded and iterative product of the traditional cement mill power system, which solves the problems of low efficiency, large floor space, high installation foundation requirements and high maintenance frequency of the original system. The system is mainly composed of planetary reduction gears, high-efficiency permanent magnet synchronous motors and variable frequency drive, which has the characteristics of small size, high efficiency, high reliability and wider application range.



YSW水泥磨半直驱动力单元  
YSW series cement mill semi-direct drive power unit

### 性能特点 Performance characteristics

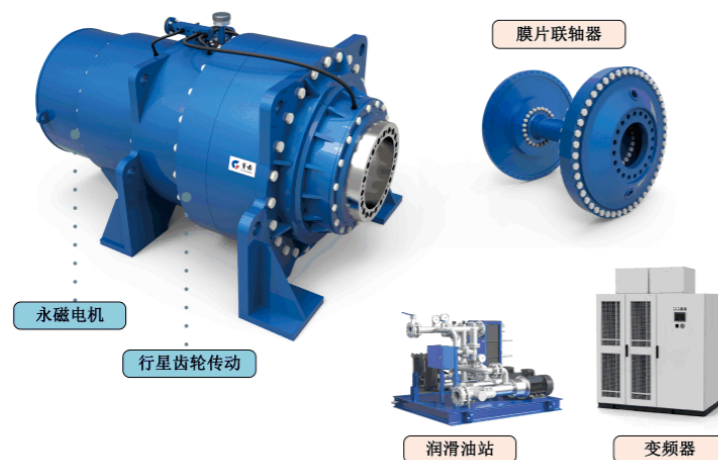
- 一体化设计, 深度集成电机、减速齿轮, 系统体积更小, 节省空间。
- 针对磨机运行工况, 启动转矩 $\geq 2.2$ 倍, 软起软停。
- 采用高功率因数永磁同步电机, 相比原系统综合节电率提升5%~15%。
- 安装简单, 简化安装步骤, 综合性价比高。
- 运行平稳, 可根据用户需求及产线实际运行情况, 实时调整转速。

• 可配置CG-master远程健康管理系统, 在线监测实时数据, 对动力系统运行状态进行分析, 提前做好维保安排及备件准备, 有效保证客户生产线的正常运行。

- Integrated design, deep integration of motors, reduction gears, the system is smaller and space-saving.
- According to the operating conditions of the mill, Starting Torque  $\geq 2.2$  times, and the soft start and soft stop.
- The high power factor permanent magnet synchronous motor is adopted, and the comprehensive power saving rate is increased by 5%~15% compared with the original system.
- The installation is simple, the installation steps are simplified, and high comprehensive cost-effectiveness.
- The operation is stable, and the speed can be adjusted in real time according to the user's needs and the actual operation of the production line.
- It can be configured with CG-master remote health management system, online monitoring of real-time data, analysis of the operation status of the power system, maintenance arrangements and spare parts preparation in advance, and effectively ensure the normal operation of the customer's production line.

## 系统组成 System composition:

YSW水泥磨半直驱动力单元+变频控制+辅助附件(低速膜片联轴器JL系列、冷却润滑油站、慢驱装置等)  
YSW series cement mill semi-direct drive power unit + Variable frequency drive + Auxiliary accessories  
(Low-speed diaphragm coupling JL series, Lubricating-oil station, Slow drive device, etc.)



YSW水泥磨半直驱动力系统组成  
YSW cement mill semi-direct drive system

## 主要技术参数 Main technical parameters:

功率范围: 1000kW~6000kW	Power range: 1000kW~6000kW
电压等级: 6/10kV	Voltage level: 6/10kV
输出转速: 14rpm~17rpm	Output speed: 14rpm~17rpm
额定扭矩: 560kNm~4092kNm	Rated torque: 560kNm~4092kNm

## YBM系列球磨机永磁半直驱动力系统

YBM SERIES BALL MILL PERMANENT MAGNET SEMI-DIRECT DRIVE SYSTEM

## 简介 Brief introduction

边缘传动球磨机结构简单, 是冶金、化工、水泥、陶瓷、建筑、电力等领域的重要粉末设备。但是球磨机的缺点也很明显, 高耗能、传动效率较低。近年来随着国家绿色环保节能的要求不断提高, 节能降耗成为球磨机研究的热点。

YBM系列球磨机永磁半直驱动力系统, 是根据边缘型传动球磨机运行特点设计的新型动力系统。该系统采用高效永磁电机, 并将永磁电机、减速机、慢驱装置集成一体化设计, 最后通过变频控制磨机转速, 使磨机达到最佳工作状态。

通过采用高效永磁同步电机、高功率密度的行星传动, 在相同工况条件下, 相比传统动力系统体积、重量大大减小, 效率明显提高; 同时变频控制转速磨机始终工作在最佳状态, 提高磨粉效率; 从而达到高效节能、减少碳排放、绿色生产的目的。



YBM球磨机半直驱动力单元

YBM series ball mill semi-direct drive power Unit

The edge drive ball mill has a simple structure and is an important powder equipment in metallurgy, chemical industry, cement, ceramics, construction, electric power and other fields. However, the disadvantages of the ball mill are also obvious, such as high energy consumption and low transmission efficiency. In recent years, with the continuous improvement of national requirements for green environmental protection and energy saving, energy saving and consumption reduction have become a hot spot in the research of ball mills.

YBM series ball mill permanent magnet semi-direct drive system is a new type of power system designed according to the operation characteristics of edge drive ball mill. The system adopts a high-efficiency permanent magnet motor, and integrates the design of the permanent magnet motor, reducer, and slow drive device, and finally controls the speed of the mill through frequency conversion to make the mill reach the best working condition.

Through the use of high-efficiency permanent magnet synchronous motor and high-power density planetary transmission, the volume and weight are greatly reduced compared with the traditional power system under the same working conditions, and the efficiency is significantly improved. At the same time, the frequency conversion control speed mill always works in the best state to improve the powder efficiency; So as to achieve the purpose of high efficiency and energy saving, carbon emission reduction and green production.

## 性能特点 Performance characteristics

- 高效节能, 整机系统效率  $\geq 93\%$ , 相比原系统综合节电率提升  $8\% \sim 15\%$ 。
- 动力单元深度集成减速齿轮、永磁同步电机、冷却系统、慢驱制动装置。
- 永磁同步电机, 超高性能钕铁硼永磁材料, 最高连续工作温度可达  $180^\circ\text{C}$ 。

- 变频调速, 最佳转速, 最佳粉碎状态。
- 高可靠性, 低维护性, 损耗低。
- 体积小, 重量轻, 易于安装, 综合性价比高。
- 可配置CG-master远程健康管理系统, 在线监测实时数据, 对动力系统运行状态进行分析, 提前做好维保安排及备件准备, 有效保证客户生产线的正常运行

- High efficiency and energy saving, Overall System Efficiency  $\geq 93\%$ , and the comprehensive power saving rate is increased by 8%~15% compared with the original system.
- The power unit deeply integrates reduction gears, permanent magnet synchronous motors, cooling systems, and slow-drive braking devices.
- Permanent magnet synchronous motor, ultra-high performance NdFeB permanent magnet material, the maximum continuous working temperature can reach 180°C.
- Frequency conversion speed regulation, the best speed, the best crushing state.
- High reliability, low maintenance, low wear and tear.
- Small size, light weight, easy to install, comprehensive cost-effective.
- It can be configured with CG-master remote health management system, online monitoring of real-time data, analysis of the operation status of the power system, maintenance arrangements and spare parts preparation in advance, and effectively ensure the normal operation of the customer's production line

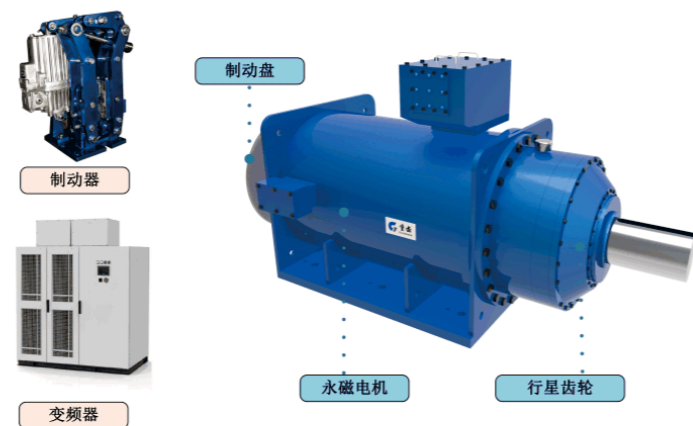
### 主要技术参数 Main technical parameters:

功率范围: 250kW~1250kW	Power range: 250kW~1250kW
电压等级: 380V, 690V, 6/10kV	Voltage level: 380V, 690V, 6/10kV
输出转速: 80rpm~110rpm	Output speed: 80rpm~110rpm
额定扭矩: 21kNm~149kNm	Rated torque: 21kNm~149kNm

### 系统组成 System composition:

YBM球磨机半直驱动力单元+变频控制+辅助附件  
(盘式制动器、慢驱装置等)

YBM ball mill semi-direct drive power unit + Variable frequency drive + Auxiliary accessories  
(disc brake, Slow drive device, etc.)



YBM球磨机半直驱动力系统组成  
YBM ball mill semi-direct drive system

## BZML系列密炼机永磁半直驱动力系统

BZML SERIES INTERNAL MIXER PERMANENT MAGNET SEMI-DIRECT DRIVE SYSTEM

### 简介 Brief introduction

密炼机系统用于橡胶、塑料及其混合物的塑炼、混炼和终炼, 具有高效、节能、排胶温度低等优点, 配置智能化点检系统, 可实现无人操作, 在轮胎和橡胶制品行业有广泛的应用。

BZML系列密炼机半直驱动力系统采用低转速永磁同步电动机配合单级行星加单级平行减速机, 实现超低速大扭矩输出, 具有体积小、重量轻、效率高、运行可靠、性价比高、维护简单便捷等优点, 适应于对设备重量和尺寸敏感的场所。

The internal mixer system is used for the plastic refining, mixing and final refining of rubber, plastics and their mixtures, It has the advantages of high efficiency, energy conservation and low discharging temperature, etc., The intelligent point inspection system is configured to realize unmanned operation, which is widely used in the tire and rubber products industry.

The semi-direct drive system of BZML series internal mixer adopts low-speed permanent magnet synchronous motor with single-stage planetary and single-stage parallel reducer to achieve ultra-low-speed and high-torque output, which has the advantages of small size, light weight, high efficiency, reliable operation, high cost performance, simple and convenient maintenance, etc., and is suitable for places sensitive to the weight and size of equipment.



BZML密炼机半直驱动力单元  
BZML internal mixer semi-direct drive unit

### 性能特点 Performance characteristics

- 集成化设计, 系统结构紧凑, 体积小, 重量轻, 功率密度比高, 安装方便。
- 经过实测使用半直驱永磁动力后, 相比传统动力系统, 新系统综合节电率  $\geq 10\%$ 。
- 永磁电机配合变频器做闭环控制, 控制精度高, 启动力矩大, 可以实现密炼机堵料带载启动;
- 依托重齿标准行星平台研发, 使用优质合金钢, 使用先进的修形修向方法, 实现了高可靠、高扭矩输出。
- 可配置CG-master远程健康管理系统, 对系统运行进行实时监测及故障预警。

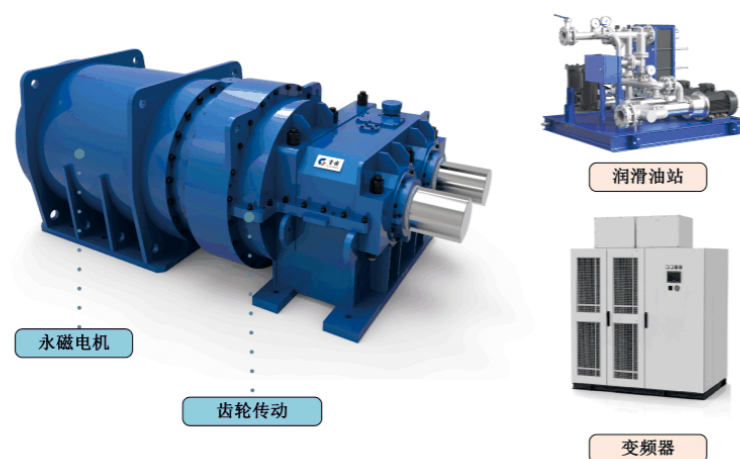
- Integrated design, compact system structure, small size, light weight, high power density ratio, easy installation.
- After the actual test of using semi-direct drive permanent magnet power, the comprehensive power saving rate of the new system is compared with the traditional power system  $\geq 10\%$ .
- The permanent magnet motor cooperates with the inverter for closed-loop control, with high control accuracy and large starting torque, which can realize the material plugging and load start of the mixer;
- Relying on the research and development of the standard planetary platform for Chongchi, the use of high-quality alloy steel, and the use of advanced modification and direction correction methods have achieved high reliability and high torque output.
- The CG-master remote health management system can be configured to monitor the system operation in real time and give early warning of faults.

### 主要技术参数 Main technical parameters:

动力功率: 800kW~3000kW	Power range: 800kW~3000kW
电压等级: 6/10kV	Voltage level: 6/10kV
输出转速: 40rpm~60rpm	Output speed: 40rpm~60rpm
额定扭矩: 130kNm~480kNm	Rated torque: 130kNm~480kNm

### 系统组成 System composition:

BZML系列密炼机半直驱动力单元+变频控制+润滑冷却油站  
BZML series internal mixer semi-direct device power unit + Variable frequency drive + Lubricating-oil station



BZML密炼机半直驱动力单元  
BZML internal mixer semi-direct drive power unit

## 半直驱动力系统应用方案 SEMI-DIRECT DRIVE SYSTEM APPLICATION SCHEME

### 某水泥厂—辊压机2240kW动力系统技改方案

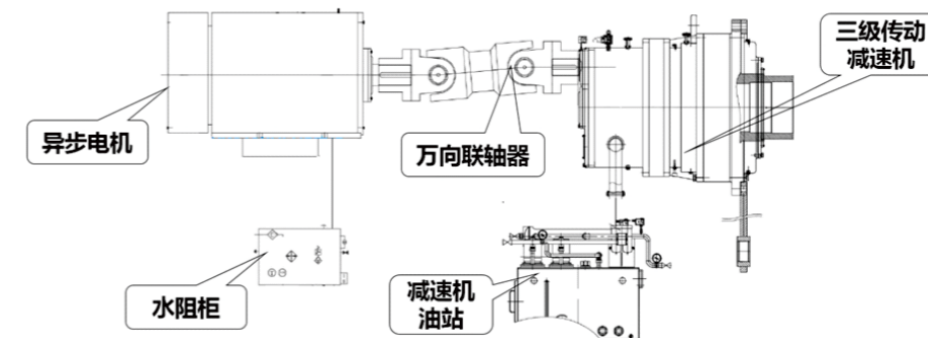
A cement plant - 2240kW power system technical transformation scheme of roller press

传统辊压机系统如图1所示,采用“三相异步电机+三级传动减速机+万向节联轴器+大容量油站+高压启动水阻柜”的方式进行驱动,存在以下不足:

- 1) 原三相异步电机,其额定转速993r/min属于高速旋转区,结合三级传动减速机,系统输入转速高、振动和损耗较大,故障率高。
- 2) 辊压机运行工况属于冲击波动性负载,使三相异步电机运行时电流波动较大,电机处于非高效区。
- 3) 三相异步电机为恒转速运行,无法根据不同物料工况做出适应的调整,造成辊压机两个辊子的磨损程度不同,影响研磨效果。

As shown in Figure 1, the traditional roller press system is driven by the method of "three-phase asynchronous motor + three-stage transmission reducer + universal joint coupling + large-capacity oil station + high-pressure starting water resistance cabinet", which has the following shortcomings:

- 1) The original three-phase asynchronous motor, its rated speed of 993r/min belongs to the high-speed rotation zone, combined with the three-stage transmission reducer, the system input speed is high, the vibration and loss are large, and the failure rate is high.
- 2) The operating condition of the roller press belongs to the impact fluctuation load, which makes the current fluctuation of the three-phase asynchronous motor during operation, and the motor is in the non-efficient area.
- 3) The three-phase asynchronous motor runs at a constant speed, and it is impossible to make adaptable adjustments according to different material conditions, resulting in different wear degrees of the two rollers of the roller press, which affects the grinding effect.



传统辊压机动力系统简图

Schematic diagram of the power system of a traditional roller press

### 技改后前后参数对比:

Comparison of parameters before and after technical transformation:

#### 240kW异步电机辊压机动力系统主要参数

The main parameters of the power system of the 2240kW asynchronous motor roller press

设备(Equipment)	规格参数 (Specifications)
辊压机 Roller presses	RP2000-100,2×2240kW
三级减速机 Three-stage reducer	JGR4048 ,N2:19 r/min
异步电机 Asynchronous motors	RYKK710-6, P:2240kW,U:10kV,In:158.5A, N1:993r/min

#### 技改后YG2240辊压机永磁驱动系统主要参数

The main parameters of the permanent magnet drive system of YG2240 roller press after technical transformation

设备(Equipment)	规格参数 (Specifications)
辊压机 Roller presses	RP2000-100,2×2240kW
两级减速机 Two-stage reducer	JGW4048B, N2:19 r/min
永磁同步电机 Permanent magnet synchronous motor	TYC710-16, P:2240kW, U:10kV, In:137.5A, N1:375r/min
高压变频器 High-voltage inverters	HD93S-J100/3500-DB, 容量Capacity:3500kVA

### 技改后效果:

Effect after technical modification:

该项目简化了原驱动系统的减速机结构,由三级行星传动简化为两级行星传动,三相异步电机由993 r/min替换为永磁电机375r/min,电机效率≥96%,设计电流下降了13.2%,项目于2023年运行,最终实测综合节电率约15%,整套系统大大节省了电量,减少了维护工作,为客户每年节约了大量电费及日常维护成本。

The project simplifies the reducer structure of the original drive system, simplifies the three-stage planetary transmission to the two-stage planetary transmission, replaces the three-phase asynchronous motor from 993 r/min to the permanent magnet motor 375r/min, the motor efficiency ≥96%, and the design current is reduced by 13.2%, the project will be operated in 2023, and the final measured comprehensive power saving rate is about 15%, the whole system greatly saves electricity, reduces maintenance work, and saves a lot of electricity and daily maintenance costs for customers every year.

### 技改后现场:

After the technical transformation:



### 某发电厂—630kW立磨半直驱动力系统技改方案

A power plant - 630kW vertical mill semi-direct drive system technical transformation scheme

传统立式辊磨机动力系统一般采用“三相异步电机+两级传动减速机+膜片联轴器+油站+慢速驱动装置”存在以下问题:

- 1) 原系统传动链复杂,整体传动效率较低,故障点多。
- 2) 三相异步电机功率因数和效率比永磁电机低,系统耗能大。
- 3) 电厂有调峰生产需求,原异步电机无法调速运行。

The power system of the traditional vertical roller mill generally adopts "three-phase asynchronous motor + two-stage transmission reducer + diaphragm coupling + oil station + slow drive device", which has the following problems:

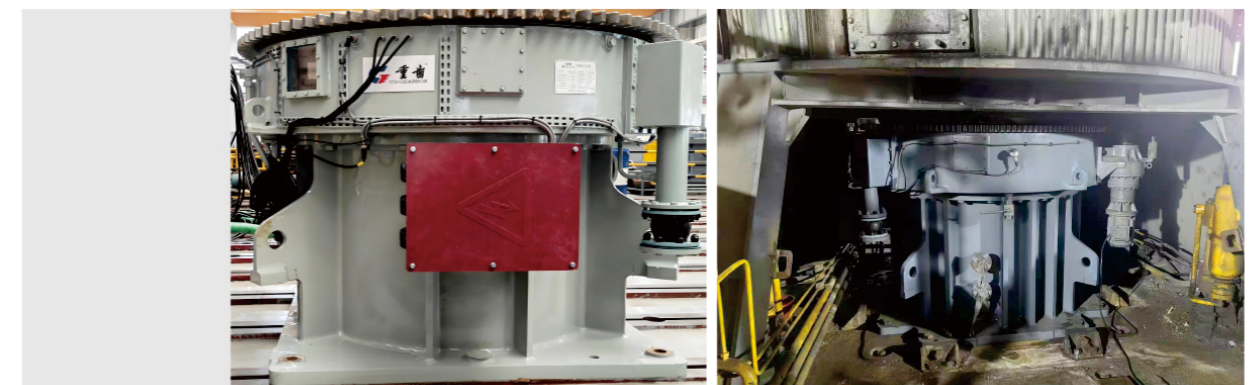
- 1)The transmission chain of the original system is complex, the overall transmission efficiency is low, and there are many fault points.
- 2)The power factor and efficiency of three-phase asynchronous motors are lower than those of permanent magnet motors, and the system consumes more energy.
- 3)The power plant has peak shaving production needs, and the original asynchronous motor cannot operate at a controlled speed.

### 技改后效果:

Effect after technical modification:

该项目技改后,采用了YLX系列立磨半直驱,两级行星传动简化为一级行星传动,省略联轴器、慢速驱动装置、水电阻等附属设备,永磁电机与减速齿轮深度集成,实现了磨机减速机的原基础替换,项目于2024年运行,改造之后,负载率80%,通过现场电表记录,系统综合节电率达10.92%,可满足电厂调峰需求,为电厂碳资产交易提供支持。

After the technical transformation of the project, the YLX series vertical mill semi-direct drive is adopted, the two-stage planetary transmission is simplified to the first-stage planetary transmission, the coupling, slow drive device, water resistance and other auxiliary equipment are omitted, and the permanent magnet motor and reduction gear are deeply integrated, realizing the replacement of the original foundation of the mill reducer, the project will be operated in 2024, after the transformation, the load rate is 80%, and the comprehensive power saving rate of the system is 10.92% through the on-site electricity meter record, which can meet the peak regulation needs of the power plant and provide support for the carbon asset trading of the power plant.



## 半直驱动力系统技改项目业绩表

### SEMI-DIRECT DRIVE SYSTEM TECHNICAL TRANSFORMATION PROJECT PERFORMANCE TABLE

序号 serial numbe	项目 project	功率 power	数量 quantity	备注 remark
1	邹平一电一厂煤立磨半直驱 Zouping one power plant coal vertical mill semi-direct drive system	630kW	1	立磨半直驱项目 Vertical mill semi-direct drive project
2	双鸭山立磨半直驱 Shuangya Mountain vertical mill semi-direct drive system	710kW	1	
3	冀东铜川水泥立磨半直驱 Yidong Tongchuan vertical mill semi-direct drive system	710kW	2	
4	山西立磨半直驱 Shanxi vertical mill semi-direct drive system	230kW	20	
5	大唐乌沙山立磨半直驱 Datang Wusha Mountain vertical mill semi-direct drive system	500kW	2	
6	汇流河立磨半直驱 Hui Liu River vertical mill is semi-direct-drive system	385kW	3	
7	霍林河立磨半直驱 Huolin River vertical mill semi-direct drive system	600kW	2	
8	山能灵台立磨半直驱 Shanneng Lingtai vertical mill semi-direct drive system	800kW	8	
9	国电通辽立磨半直驱 Guodian Tongliao vertical mill semi-direct drive system	400kW	12	
10	合肥粉体立磨半直驱 Hefei powder vertical mill semi-direct drive system	400kW	1	
11	华新水泥球磨机半直驱 Huaxin cement ball mill semi-direct drive system	900kW	1	球磨机半直驱项目 Ball mill semi-direct drive project
12	万泰皮带机半直驱 Wantai belt conveyor semi-direct drive system	200-800 kW	7	皮带机半直驱项目 Belt conveyor semi-direct drive project

序号 serial numbe	项目 project	功率 power	数量 quantity	备注 remark
13	华新水泥辊压机半直驱 Huaxin cement roller press semi-direct drive system	1250kW	2	辊压机半直驱项目 Roll press semi-direct drive project
14	青海祁连山水泥辊压机半直驱 Qinghai Qilian Mountain cement roller press semi-direct drive system	1120kW	2	
15	大连天瑞水泥辊压机半直驱 Dalian Tianrui cement roller press semi-direct drive system	2240kW	2	
16	合肥粉体辊压机半直驱 Hefei powder roller press semi-direct drive system	1600 kW	2	
17	陇南祁连山生料辊压机半直驱 Longnan Qilian Mountain raw material roller press semi-direct drive system	2000 kW	2	
18	陇南祁连山水泥辊压机半直驱 Longnan Qilian Mountain cement roller press semi-direct drive system	1600kW	4	
19	张掖祁连山生料辊压机半直驱 Zhangye Qilian Mountain raw material roller press semi-direct drive system	2000kW	2	
20	张掖祁连山水泥辊压机半直驱 Zhangye Qilian Mountain raw material roller press semi-direct drive system	1600kW	4	