上海电气
SHANGHAI ELECTRIC

No. 23

TDBS系列

悬挂式矿井提升机用交流调速同步电动机

TDBS Series AC Cyclo converter Fed Synchronous Motor of Overhanging Type for Mine Hoists

上海电气集团上海电机厂有限公司
Shanghai Electric Machinery Co.,Ltd. (SEC)

TDBS系列悬挂式矿井提升机用交流调速同步电动机

一、概述

上海电气集团上海电机厂有限公司从90年代初成功开发了矿井提升机用同步电动机，同时与国外著名电机制造公司开展合作，生产制造了TDBS系列悬挂式矿井提升机用交流调速同步电动机，积累了先进的设计和制造技术。并在此基础上于20世纪初自主开发了当时国内最大的TDBS 4400千瓦24极交流调速同步电动机，用于安徽铜陵有色金属公司冬瓜山矿。近年来，随着国际变频器厂商推出1140V级、3300V级及6000V级交直交变频装置，我公司相应开发、生产了匹配相应电压等级变频装置的交流调速同步电动机。打破了该领域进口产品的长期垄断，是目前国产化最大的TDBS 5500千瓦16极交直交变频调速电动机，用于淮南矿务局谢桥矿。

本系列同步电动机与传统直流电机相比，具有更优良的调速性能，它不受换向限制，过载能力大，在整个调速过程中，都能输出最大转矩，效率比直流电机提高5%～8%，节能显著。此外，交流调速同步电动机还具有转动惯量小，重量轻，结构简单（定子为整体结构），可突破直流电机结构限制，制作输出更大转矩的单台电机，并且可靠性高，维护量和维护费用低。所以交流调速同步电动机有着良好的技术、经济指标，是理想的提升机驱动设备。

本公司有着数十年生产矿井提升电机的历史，在电机与提升机的衔接配合上，有着成熟的设计技术，积累了丰富的制造经验。本系列同步电动机可全面匹配目前市场上已有的变频装置，为客户提供性能优良、结构合理、质量可靠、效率提高、外形美观动力源。

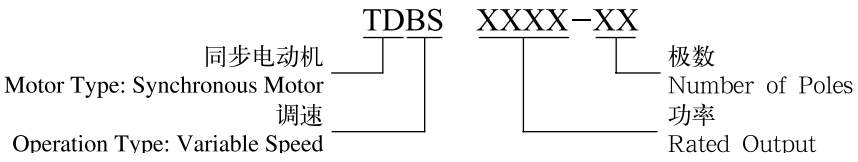
1. General Introduction

Shanghai electrical machinery from starting in the early 1990 of the 20th century, followed by the world-leading, successful development of a mine hoist AC synchronous electric motor, while cooperating with foreign famous motor manufacturing company, produced Ac synchronous motor for Hegang Mining Bureau TDBS 3500-12 1500V 0～82r/min, Huinan Xieqiao Mining TDBS 3200-16 1460V 0～68r/min, accumulation of advanced design and manufacturing technology. And, on that basis, developed in early 2000 and at that time the largest AC speed synchronization of mine hoist TDBS 4400-24 1500V 0～51r/min, used in Anhui Tongling Nonferrous Metals Inc Dongguashan Mining. In recent years, with international and domestic frequency converter manufacturer 1140V level, 3300V 6000V and AC-DC converter, I plant development, production matching the corresponding voltage AC synchronous motor of variable frequency devices.

Compared to DC motors, cycloconverter-fed synchronous motors have good performance in speed regulation and also large capacity of overload without limit in commutation, the largest torque output is always possible within the whole speed range. This type of motors can also save on electricity because the efficiency is 3%-5% higher than that of DC motors. Featuring low moment of inertia, light weight, simple structure, high reliability and good convenience for installation and maintenance, the motor is an ideal driving equipment for mine hoists with good technical and economical specifications.

SEMC has a history of tens of years in manufacturing motors for mine hoists and have got abundant design experience in linking up motors with hoists, all of this can be applied to cycloconverter-fed induction motors, cyclonconverter-fed synchronous motor of TDBS series is the latest model with good performance and appearance, reasonable structure and reliable quality.

二、型号说明



三、产品性能

1.电机适用海拔高度小于1000米，大于1000米时请事先告知；

2.电机为负载—转速非周期变化工作制S9；

3.变频装置为交直交时，电机功率因数cosφ=1，变频装置为交交时，电机功率因数cosφ≈1；

4.电机正反向双向运行，为连续工作方式；

5.电机定子瞬时过电流为2倍额定电流，时间60秒；

6.电机过载要求不同时，需事先告知；

3. Motor Performance

1.Motor applies for altitudes less than 1000m, more than 1000m prior notice required;

2.The duty type for motor load-speed non-cyclic variation is S9

3.Power factor of the motor:AC-DC-AC cosφ=1、AC-AC cosφ≈1;

4.Motor of bidirection continuous work;

5.Motor stator instaneous over current as twice as rated current can reach 60 sec;

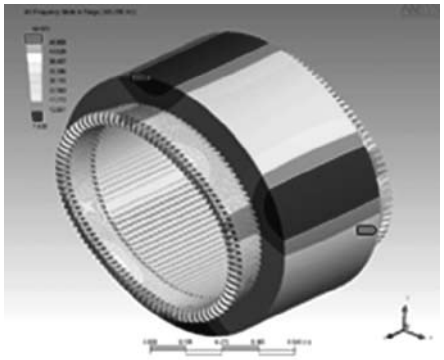
6.If motor over-load requirement is different please in form in advance.

四、设计分析手段

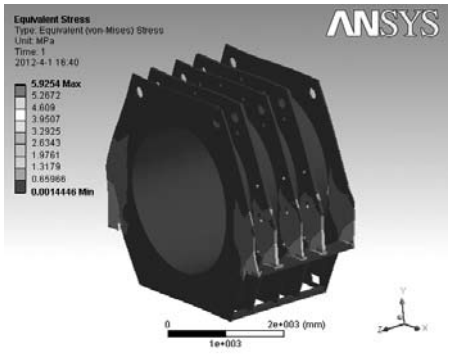
全面采用Solid Edge、Ansys等先进的设计软件，通过模态化，分析电机的电磁、发热、振动等问题，优化电机振动、噪声磁共振，避免了电磁力与结构产生共振的可能。从源头确保电机设计的合理及准确。

4.Design and Analysis methods

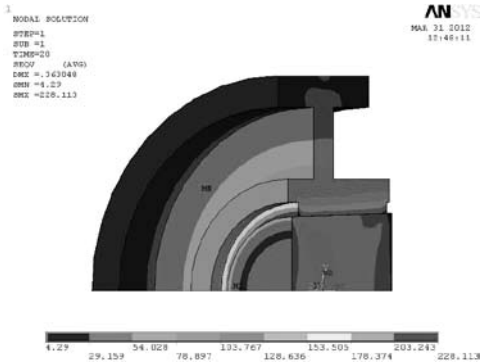
Using Solid Edge, Ansys and other advanced design software, by mode, issues such as electromagnetic, heat, vibration analysis on motor, optimized motor vibration and noise in magnetic resonance imaging, avoid the resonance of electromagnetism and structure. Ensure the motor design a reasonable and accurate from the source.



定子线圈发热及应力分析
Stator coil heating and stress analysis



定子机座应力分析图
Stress analysis of stator base figure



转子磁轭与主轴联接应力分析
Stress analysis of Rotor yoke joined with spindle

五、结构特点

1.电机为卧式结构，安装型式IM 5710，即电机为转子悬挂式，电机无轴、无轴承，带分块底架，与提升机连接方式有：

a.锥套过盈连接，液压装卸；b.夹板式配合螺栓连接；

c.夹板式高强度螺栓连接，目前以锥套过盈连接为主。

2.电机冷却方式IC 37，即电机主体采用管道强制风冷却，轴向通风结构，进出风口在电机下方；

3.电机防护等级IP 44(电机本体)，IP 21(滑环)；

4.电机负载端侧装有接地电刷；

5.电机的定、转子绕组均采用F级绝缘结构。电机定子绕组绝缘采用国内领先的少胶绝缘系列，经过VPI无溶剂漆真空压力浸渍，具有良好电气性能、防潮能力、机械强度和整体散热性；电机转子采用全阻尼结构，使系统具有良好动态响应性能；

6.定子铁心采用高导磁冷轧硅钢板叠压而成，电机的设计能有效地抑制电磁噪音，电机输出转矩平稳；

7.转子为凸极式结构，其机械性能适合提升机负载的要求。磁极铁心由优质冷轧钢板叠压而成，磁极绕组为带散热匝的磁极线圈串联而成，有利于提高绕组的散热效果，降低转子温升。每个磁极通过若干个螺栓将其固定在磁轭上。有利于承受频繁的正反转冲击转矩。

8.定子绕组引出线位于电机底部或后部，引出线可跟据需求为3、6或12根；

9.定子每套绕组埋置6个铂热电阻测温元件Pt100，引出线置于专用出线盒内；

10.电机定子可作轴向移动，使转子外露便于维护和检修。

5.Structure Features

1.This series motor is of horizontal structure with over hanged rotor but without shaft and bearing. The motor has a mounting type of IM5710 and there are three methods of connection between motors and hoists as below:

a.Using conical bushing for interference fit connection, assembled or disassembled by means of pressurized oil.

b.Using clamp plates with fitted bolts connection.

c.Using clamp plates with high-strength bolt friction connection

2.Type of Cooling (IC37):

Forced ventilation along axial direction is adapted to main body of the motor with the inlet and outlet on the lower part of the motor.

3.Protection Degree for Main Body: IP44.

Protection Degree for Slip Ring: IP21

4.Motor load end-to-side with earthing brushes

5.Motor windings are of class F insulation, undergoing vacuum pressure impregnating (VPI) treatment with solvent less varnish, which gives insulation high moisture resistance, high electric capability, high mechanical strength and good heat condctibilitty. Motor rotor damping structure, making the system with excellent dynamic response properties.

6.Stator and rotor cores of this series motor are piled up and pressed by means of laminations made of cool-milled silicon sheet steels of high magnetic conductibility. The motor is designed to be prevented effectively from magnetic noisy and to ensure a smooth and steady output of torque.

7.The rotor saliency type structure, its mechanical properties suitable for hoisting load requirements. Magnetic Pole cores made from high quality cold-rolled steel sheet pile of pressure it, pole windings for the heat-turn pole coils in series and will help improve the cooling of the winding and lower rotor temperature rise. Each magnetic pole through a number of bolts and attach it on the yoke. To withstand frequent reverse impact torque.

8.As required, 3, 6 or 12 leads of the stator come out of the motor bottom or back

9.6 TED`s (Pt100) are embedded in stator windings, outlet lines are in the terminal box.

10.The motor stator can be moved along axial direction so as to make the armature end portion to be accessible for repairing.

六、领先国内同行的专业结构

1.电机在转子滑环侧，装有与绞车主轴同轴度达0.08mm以内的小轴，专门用于安装变频装置所需监测用编码器；此结构已获得国家实用新型专利，专利号：201020527926；

2.电机转子磁轭采用工字型一体合金锻件，满足提升机大转矩、大过盈量需求，确保转子安全可靠运行；

3.电机定子线圈端部采用与端箍加支架绑扎的可靠固定方式，进一步确保电机在频繁正反转运行时，定子线圈端部不会因交变的电磁力产生松动；

4.从日常监控及维护方便出发，设置电机进、出风测温及停机加热器；

5.全系列配套电机定子移动、转子吊用等工具

6.电机全面采用恒压刷握，进一步提高电机维护的简易性；

6.Proprietary structure of leading domestic counterparts:

1.Motor rotor slide ring side, fitted with a winch and small axis of spindle concentricity within 0.08mm, devoted to monitoring required to install converter encoder, this structure has won the national utility model patent, patent number: 201020527926;

2.The rotor yoke using I-one alloy forgings, meet the hoist huge torque, interference requirements to ensure safe and reliable operation of the rotor;

3.the motor stator winding end with the Hoop and assembling of reliable fixed bracket to further ensure that the motor is running in reverse frequently, the stator winding end not affected by alternating electromagnetic force generated is loose.

4.Starting from the daily monitoring and maintenance, motor inlet and outlet air temperature and shut down the heater.

5.The full range of supporting tools such as move the motor stator, rotor crane

6.The motor using constant pressure brush, further improves the simplicity of motor maintenance;

七、选型参考表 The series motors selection reference table

电机功率（kW）	频率 (Hz)	电压 (V)	定子绕组接法
800～11000	5～15	1140、1650、3300、6000	Y 或YY(0°)或YY(30°)

八、规格及效率表 List of Specification and Efficiency for series TDBS:

转速 r/min / 功率kW	效率 % Efficiency						
	30rpm	40rpm	45rpm	50rpm	55rpm	60rpm	70rpm
800	91	91.5	92	92.5	92.8	93	93.3
1000	91.5	92	92.5	92.7	93	93.3	93.6
1250	92	92.3	92.8	93	93.3	93.6	93.8
1500	92.3	92.6	93	93.2	93.5	93.8	94
1750	92.5	92.8	93.3	93.4	93.8	94	94.3
2000	93	93.3	93.8	94	94.2	94.3	94.5
2500	93.3	93.8	94	94.2	94.5	94.8	95
3000	93.8	94	94.2	94.5	94.8	95	95.4
3500	94	94.2	94.5	94.8	95	95.4	95.7
4000	94.2	94.5	94.8	95	95.4	95.7	96
4500	94.5	94.8	95	95.4	95.7	96	96.3
5000	94.8	95.2	95.4	95.7	96	96.3	96.5
5500	95.2	95.4	95.6	95.8	96.1	96.3	96.7
6000		95.6	95.8	96	96.2	96.4	96.6
7000		95.7	95.8	96	96.2	96.4	96.6
8000		95.7	95.9	96	96.2	96.4	96.6
9000		95.8	95.9	96.1	96.3	96.5	96.7
10000		95.8	95.9	96.1	96.3	96.5	96.7
11000		95.8	95.9	96.1	96.3	96.5	96.7

说明：本表中效率为电机不计励磁损耗且定子电阻值为95℃时所得数值

Note: this form and regardless of the excitation efficiency for motor loss in stator resistance value is derived from 95℃ value

九、外形图 Typical shape structure

1.短机座 Short fram

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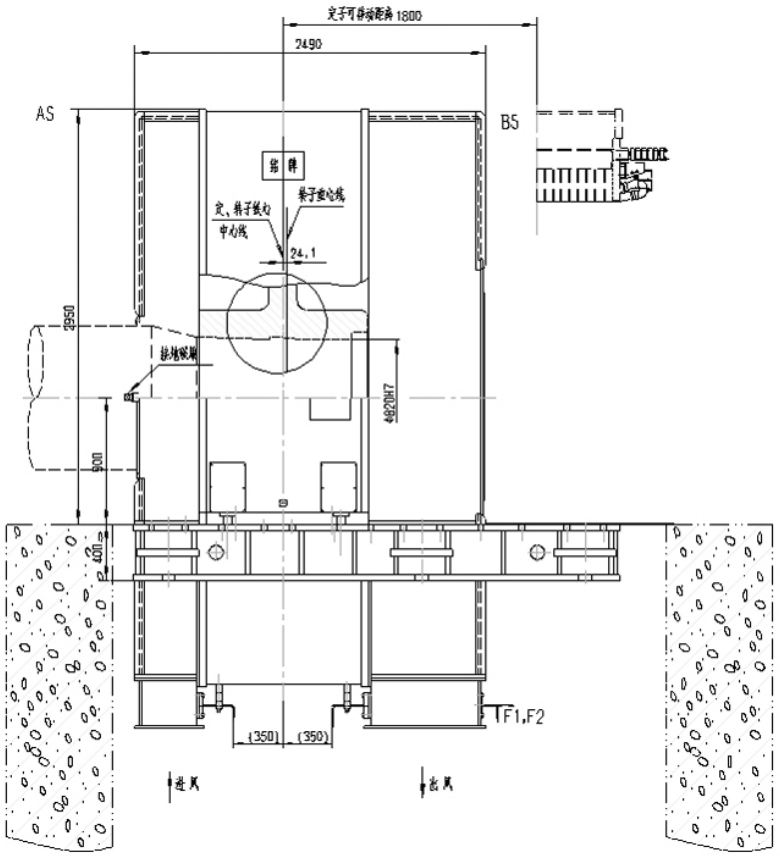
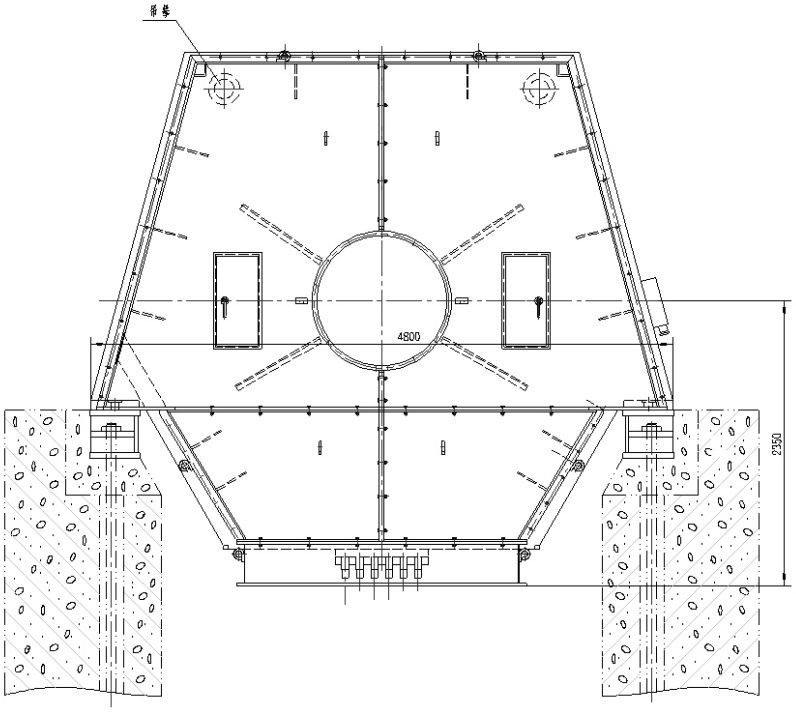


TDBS4400—24 0—51r/min 1500V

B



TDBS4400—24 0—51r/min 1500V

2.长机座 Long fram

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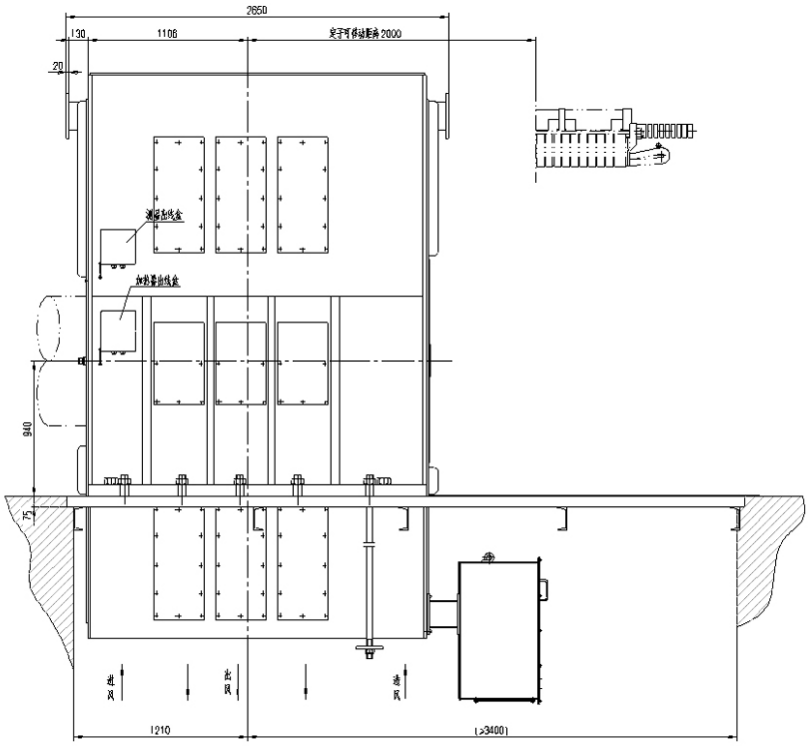

TDBS5500−16　0−52.7r/min　3150V

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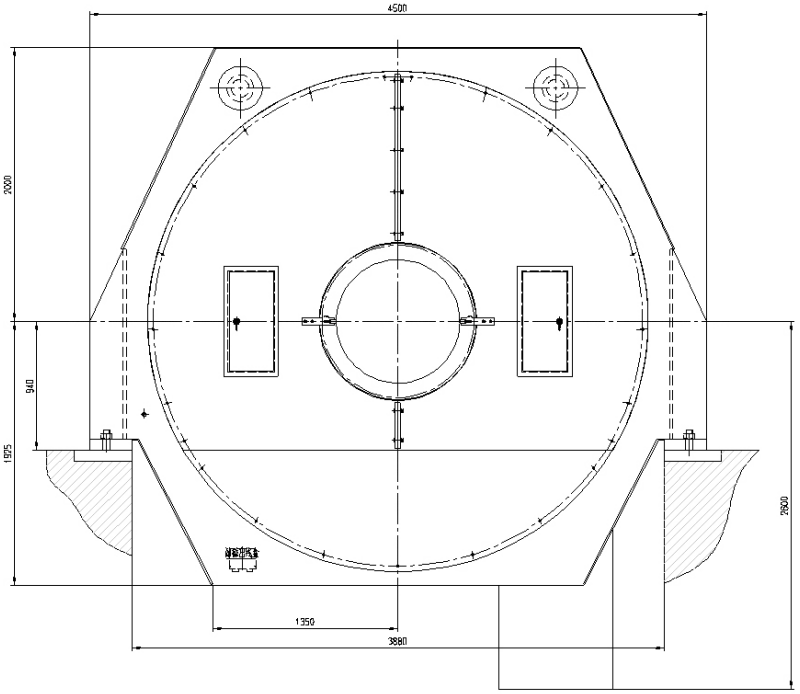

TDBS5500−16　0−52.7r/min　3150V

TDBS 4400—24 0—51r/min 1500V （短机座） 交流调速同步电动机在铜陵有色金属（集团）公司冬瓜山矿运行

AC speed synchronization of mine hoist TDBS 4400-24 1500V 0～51r/min, Anhui Tongling Nonferrous Metals Inc Dongguashan Mining.

TDBS 5500—16 0—52.7r/min 3150V （长机座） 交流调速同步电动机在淮南矿业集团谢桥矿运行

Huinan Xieqiao Mining Ac synchronous motor TDBS 3200-16 1460V 0～68r/min

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