股票代码: 300594 longertek Mill

# longertek 朗世科技

以 科 技 和 创 新 提 升 人 类 生 活 品 质 Improving the quality of human life with technology and innovation



# COMPANY 企业简介 >> INTRODUCTION

山东朗进科技股份有限公司是一家拥有国际先进变频节能核心技术、空调暖通系统控制技术的高科技股份制企业,注册资本8890.67万元,研发基地设在山东,拥有北京、成都、广州、佛山、苏州、沈阳、南宁、西安、郑州等多家子公司。主要设计生产轨道车辆智能化变频热泵(冷暖)空调、机车变频空调、传统大巴及新能源电动汽车变频空调、电源和变频控制器等系列产品。朗进轨道车辆空调变频节能技术在2015~2017连续三年入选国家发改委《国家重点节能低碳技术推广目录(2018年本、节能部分)》。

Shandong Longertek Technology Co., Ltd. is a high-tech joint-stock enterprise having core energy-saving technology and inverter cooling system control technology, with registered capital of RMB 88,906,700.00. The company is headquartered in Shandong, with its branch companies in Beijing, Chengdu, Guangzhou, Foshan, Suzhou, Shenyang, Nanning, Xi' an, Zhengzhou, Shenzhen, etc. Main products are: rail vehicle intelligent inverter heat pump air conditioning system, railway locomotive inverter air conditioning system, bus vehicle inverter air conditioning system, new energy vehicle inverter air conditioning system, frequency controller and other series products. The inverter energy saving technology of Longertek railway vehicle air conditioning system was included in NDRC "National Key Energy-saving Low-carbon technology promotion Directory" in 2015–2017 (the energy-saving part in 2018 rev.)





# CORE 核心价值观

# >> VALUES

- 秉承 "德 益 中 慧"企业文化 Persist in the corporate culture "Integrity, Benefit, Tradition and Intelligence"
- "朗进造=用心造"质量理念
  - Adhere to the quality concept "Create by Longertek = Create by heart"
- 高端智造及核心控制技术 Focus Advanced intelligent manufacture and core control technology
- 交通车辆系统解决方案 Leading Transportation vehicle system solution

## 安全性、可靠性 舒适性

Safety, Reliability and Comfort

## 为上游客户降低 制造成本

Reduce manufacturing costs for car builders

## 低碳环保是我们 的社会责任

Low carbon environmental protection is our social responsibility

## 精准、诚实 敬业

Accurate, Honest and Dedicated

## 以技术为先导 引领市场

Lead the market with technology guidance

### 为运营商降低 运营成本

Reduce operating costs for operators

## 为子孙后代创造 美好生活环境

Create a better living environment for the

## 感恩回报客户 员工、股东、社会

Thanksgiving return to customers, employees, shareholders and society 安全可靠 节能舒适 轻量智能

2012

2013

1989

2005

2009

2010

1990

2008

# DARES TO 大事记

# >> CHALLENGE

- 2020年 获得铁路客车空调机组资质,并装车。 Qualified HVAC system supplier of Main Line Coaches in China with track record. 2019年 朗进科技在深交所创业板上市,证券代码: 300594。 Longertek became a listed company of GEM in Shenzhen Stock Exchange. Stock Code:300594 2018年 国内第一台智能变频热泵城际市域列车空调装车成功。
- First intelligent inverter heat pump air conditioner in China for inter-city train was successfully installed on vehicle
- 2017年 国内第一台DC1500V直供地铁车辆变频空调装车成功。 First DC1500V direct input air conditioner for metro vehicle in China was successfully installed on vehicle
- 2017年 国内第一套列车空调智能预诊断系统装车成功。
- First intelligent pre-diagnosis system for air conditioner was successfully installed on vehicle 2016年 国内第一台"5D"技术,超薄、超静音、全直流技术变频车辆空调研制成功。
- First 5D technology inverter air conditioner in China with ultra-thin, ultra quiet, all direct DC input was successfully developed 2016年 国内第一台DC750V直供地铁车辆变频空调成功装车。
- First DC750V direct input technology inverter air conditioner for metro in China was successfully installed on vehicle 2016年 国内第一台超轻量碳纤维材质变频车辆空调研制成功,引起各方关注。
- First inverter air conditioner with carbon fiber material was developed
- 2016年 公司通过ISO/TS 16949认证。
- ISO/TS 16949 Certification
- 2016年公司第一台电动客车空调成功装车。 2016年张司 (Beltik bus air conditioner of Longertek was successfully installe 2015年公司产品入选国家发改委《国家重点节能低碳技术推广目录(2015年本,节能部分)》。
  - Longertek railway vehicle air conditioner was included in NDRC "National Key Energy-saving Low-carbon technology promotion Directory" (the energy-saving part in 2015 rev.)
- 2015年 国内第一台DC1500V直供地铁车辆变频空调研制成功。
- First DC1500V direct input inverter air conditioner in China was developed 2015年 国内第一台自主设计生产的时速250/350公里动车组节能变频空调机组研制成功。
- First 250/350 high speed train inverter air conditioner with independent research and development production was developed 2013年 朗进公司通过国际铁路行业标准体系IRIS认证。
- IRIS Certification
- 2013年 国内第一台DC750V直供技术有轨电车变频空调成功装车。
- First DC750V direct input technology inverter air conditioner for tram vehicle in China was successfully installed on vehicle 2012年 国内第一台普速客车变频空调在济南铁路局成功装车。
- onditioner for railway coaches in China was installed in Jinan Railways Bureau
- 2012年 朗进公司通过EN15085焊接标准认证。
- 2010年 朗进第一台电动乘用车空调在长安电动出租车成功装车。
- 2009年 国内知道行业首次完成主要的工作。 A CHM I 和 FIRM 3 表 First comparison test between inverter system and fixed speed system was finished in China; compared with fixed speed system, First comparison test between inverter system and fixed speed system was finished in China; compared with fixed speed system, 变频空调平分制冷节电率30%,平均制修节电率>40%,整全能并降低12%。 inverter system has more than 30% energy saving in cooling mode. 40% in heating mode. Totally 12% energy saving for whole vehicle.
- 2008年 国内轨道行业首次以能源合同管理项目形式完成上海地铁5号线。 First Energy Management Contract in China was performed on Shanghai Line 5
- 2008年 朗进文化诞生! 朗进文化的核心哲学思想: "德益中慧"。
  Longertek culture was born: "Integrity, Benefit, Tradition and Intelligence"
- 2008年 山东朗进科技股份有限公司成立、公司股份制改造完成。 Shandong Longertek Technology Co. Ltd. was established, shareholding reform finished
- 2005年 国内第一台变频轨道车辆空调研制成功,并在成功装车。 First railway vehicle inverter air conditioner was developed and installed in China
- 1999年 国内第一台变频机车空调研制成功,并获得生产许可证。 First locomotive inverter air conditioner developed with production license
- 1989年 国内第一套空调变频器由朗进董事长李敬茂先生开发完成。 First inverter controller in China was developed by Longertek Chairman, Mr. Lijingmao





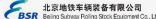
# COOPERATIVE 合作伙伴

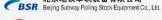
# >> PARTNER

### 车辆厂主要客户

Main Customers(Vehicle Builders)

- 中车青岛四方机车车辆股份有限公司 CRRC QINGDAO SIFANG CO., LTD.
- 中车长春轨道客车股份有限公司 CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.
- 中车株洲电力机车有限公司 CRRC ZHUZHOU LOCOMOTIVE CO., LTD.
- 中车南京浦镇车辆有限公司 CRRC NANJING PUZHEN CO., LTD.
- 中车唐山机车车辆有限公司 CRRC TANGSHAN CO., LTD.
- 中车大连机车车辆有限公司 日 中半人はない。 CRRC DALIAN CO., LTD.
- 中车四方车辆有限公司 CRRC SIFANG CO., LTD.





北京轨道交通技术装备有限公司 Beijing Rail Transit Technology Equipment Group Co., Ltd.

BOMBARDIER 庞巴迪运输集团 Bombardier Transportation

ALSTOM 阿尔斯通 Alstom



CAF公司
CAF-Construcciones y Auxiliar de Ferrocarrilles S.A.





Wabtec Wabtec公司 Wabtec Corporation

### 运营公司主要客户

Main Customers(Operating Company)































































# HONOR AND 荣誉和资质 >> OUALIFICATION

## ◎企业成就

- 率先 2001年将变频热泵节能空调技术引入轨道交通行业
- 唯一 拥有轨道交通变频车载空调核心自主知识产权的高科技企业
- 唯一 具备轨道交通变频车载空调自主研发和定制生产能力
- 唯一 完成9个城市(先后10年)各种轨道空调技术节能对比测试

In 2001, we took the lead in introducing the inverter heat pump energy-saving air conditioning technology into the rail transit industry We are a high-tech enterprise having core independent intellectual property of rail transit inverter vehicle air conditioner. We have the independent R&D and custom production capacity of rail transit inverter air conditioner.

Unique

We have completed technology energy-saving comparison test of a variety of rail transit air conditioners in nine cities (in ten years).

### 行业引领

34个国内外城市 100条轨道线路 20年运营经验 引领行业技术发展

#### **Industry Leader**

34 domestic and foreign cities 100 rail lines 20 years of operating experience Lead the industry technology development

#### 国家认可

朗进轨道车辆空调变频节能技术 在2015~2017连续三年入选国家 发改委《国家重点节能低碳技术 推广目录》

#### State Recognition

The inverter energy saving technology of Longertek railway vehicle air conditioner were included in the NDRC "National key energy-saving low-carbon technology promotion directory" 2015 ~ 2017

## 高精装备

109项目专利 直流直进供电技术成为行业标准

#### **High Precision Equipment**

109 patents

Direct DC power supply technology has become the industry standard

## 行业认可

中车合格供应商 庞巴迪合格供应商 阿尔斯通合格供应商 CAF合格供应商 产品遍布海内外

#### Industry Recognition

CRRC qualified supplier Bombardier qualified supplier Alstom qualified supplier CAF qualified supplier Products spread all over the world

#### 企业荣誉

国家级空调检测中心 省级高新技术企业 省工程技术研究中心 省级智能功率模块实验室 中国铁路总公司科技进步三等奖

#### Honors

Provincial High-tech Enterprise Provincial Engineering Technology Research Center Provincial Intelligent Power Module Lab China Railway Corporation Scientific and Technological Progress Third Prize

## 创领未来

全球首款碳纤维壳体、5D全智能变 频热泵空调(减重5吨/列) 超薄、超轻、超静音、超高能效、 大数据和主动运维等空调新技术

#### Lead the Future

The first type of carbon fiber shell, 5D all intelligent inverter heat pump air conditioner in the world (weight loss 5 tons/vehicle)

New air-conditioning technologies such as Ultra-thin, ultra-light, ultra-quiet, ultra-high energy efficiency, big data and active operation and maintenance

# ◎管理体系 QUALITY MANAGEMENT SYSTEM



















# TRACK 业绩证明 ≫> RECORD



- 城市轨道交通
  - Urban Rail Transit Project
- 铁路车辆
  - Locomotive Project
- ☑ 城市轨道交通及铁路车辆 Urban Rail Transit And Locomotive Project







# THE PRODUCT 产品谱系

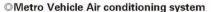
# >> SPECTRUM

# ◎地铁车辆空调

适用车型: A/B/C/ 快轨 供电方式: DC750V/AC380V 额定制冷量: 25~44kW 额定制热量: 9~35kW 高度: 280~480mm

产品应用: 北京、上海、广州、深圳、沈阳、长春、大连、 乌鲁木齐、成都、郑州、贵阳、福州、青岛、济南、哈萨 克、伊兹密尔、马来西亚等 18 余个城市的 39 余条 线路。

产品特点:变频、热泵制热、耐高温高湿、超低温、防 雨雪、防风沙、低噪声、除湿、无人驾驶智能控制。



Applicable to: A/B/C/high-speed railway Power supply: DC750V/AC380V Rated cooling capacity: 25-44kW Rated heating capacity: 9-35kW Height: 280-480mm

Application: 39 lines in more than 18 cities including Beijing, Shanghai, Guangzhou, Shenzhen, Shenyang, Changchun, Urumqi, Chengdu, Zhengzhou, Guiyang, Fuzhou and Izmir.

Features: Inverter control, heat pump heating, resistant to high temperature and ultra-low temperature, protective against rain and snow and wind and sand, low noise









# ◎有轨电车空调

适用车型: 70%、100%

供电方式: AC380V、DC750V: 受电弓、超级电容、

氢燃料

额定制冷量: 25~45kW 额定制热量: 12~32kW 高度: 350~750mm

产品应用:北京、广州、大连、青岛、苏州、长春、成都、淮安、珠海、萨姆松、佛山11余个城市的17余条线路。占据市场的80%以上)。

产品特点:变频、直流直进(发明专利)、热泵制热、轻量化、低噪声、高能效(COP: 2.6)。

#### **©Tram Vehicle**

Applicable to: 70%, 100%

Power supply: AC380V, DC750V: pantograph, super

capacitor, hydrogen fuel

Rated cooling capacity: 25~45kW Rated heating capacity: 12~32kW

Height: 350~750mm

Application: more than 17 lines in more than 11 cities including Beijing, Guangzhou, Qingdao, Suzhou, Changchun, Chengdu, Huai'an, Zhuhai and Samsun (accounting for more than 80% of the domestic

Features: Inverter control, DC DF (patent), heat pump heating, light weight, high EER (COP: 2.6) and low noise

# ◎单轨车辆空调

适用车型: 跨坐式单轨车、悬挂式单轨车及其他

小运量车辆

供电方式: AC380V/DC750V 额定制冷量: 18~40kW 额定制热量: 12~35kW 高度: 275~450mm

产品应用: 重庆2号线、重庆3号线、重庆3号线增购、重庆3号线延长、四方股份新一代跨坐式车辆、韩城悬挂以及各主机厂跨坐式单轨研发项目。

产品特点:变频、热泵制热、直流直进、超薄、轻量、高效、消音降噪。

#### 

Applicable to: straddled-type monorail vehicle, suspended monorail vehicle and others

Power supply: AC380V / DC750V Rated cooling capacity: 18~40kW Rated heating capacity: 12~35kW

Height: 275~450mm

Application: Chongqing Line 2 & Line 3, extension of Chongqing 3 line, the new generation of straddled-type vehicles of SIFANG Corporation and the new straddled-type monorail R & D projects of main car builders.

Features: Inverter control, heat pump heating, DC direct input, ultra-thin – minimum height of 275mm (straddled-type monorail), light weight and high efficiency





## ◎磁悬浮车辆空调

适用车型:中低速磁悬浮车辆 供电方式: AC380V/DC440V 额定制冷量: 18~40kW 额定制热量: 10~28kW 高度: 300~345mm

产品应用: 北京 S1 线、唐山中速磁悬浮、 大连中速磁悬浮、西南交大中低速磁悬浮等 主要应用于中小运量城市或区域。

产品特点:变频、热泵制热、超轻量、超高能效、无冲击、低噪音。

#### 

Applicable to: Medium and low speed maglev vehicle

Power supply: AC380V/DC440V Rated Cooling Capacity: 18~40kW Rated Heating Capacity: 10~28kW

Height: 300~345mm

Application: Beijing S1, Tangshan medium speed maglev vehicle, Dalian medium speed maglev vehicle. Southwest Jiaotong University medium speed maglev vehicle.

Features: Inverter control, heat pump heating, light weight, high efficiency, shock free low noise



## ◎普速客车空调

适用车辆:干线铁路普速客车供电方式:AC380V/DC600V

额定制冷量: 9kW/29kW/35kW/40kW

额定制热量: 9~30kW

产品应用: 主要应用于干线铁路, 目前 25G

硬座车、卧铺车、软座车等车型。

产品特点: 变频热泵、优化风场、直流供电。

#### © General-speed Passenger Train

Applicable to: general-speed passenger train Power supply: AC380V/DC600V Rated cooling capacity: 9kW/29kW/35kW/40kW

Rated heating capacity: 9~30kW
Application: mainly used in urban or inter-city

trunk lines, currently 25G train with hard seats, sleeper train, train with soft seats and etc.

Features: inverter heat pump, optimized wind field and DC power supply



# ◎市域城际空调

适用车辆:市域城际列车 供电方式:AC380V 额定制冷量:29~44kW 额定制热量:9~30kW

产品应用: 主要应用于市域或城际线路,目前有北京新机场线(四方、长客)、西安机场线、长客市域车、台州 S1 线(在研)、四方城际车(在研)等项目。

产品特点:变频、热泵制热、优化风场、压力波 控制。

#### **OUrban and Intercity Train**

Applicable to: Urban and Intercity Train

Power supply: AC380V

Rated cooling capacity: 29~40kW Rated heating capacity: 9~30kW

Application: mainly used in urban or intercity lines, Beijing Airport line (CRRC Sifang, Changchun), Xian Airport line, Urban train of CRRC Changchun and Sifang, Taizhou S1 (under development)

Features: complete independence, inverter heat pump, optimized wind field, pressure wave control and high sealing



# ○动车高铁空调

适用车型: 动高铁车辆 供电方式: AC380V/AC440V 额定制冷量: 29~44kW 额定制热量: 9~30kW

产品应用:主要应用于动车和高速铁路,目前有 CRH380A、混合动力动车组、内燃动车组项目。

产品特点:完全自主化、变频热泵、优化风场、压力波控制、密封性高。

#### OHigh-speed Train

Applicable to: Motor Car & High–speed Rail Vehicle Power supply: AC380V/AC440V Rated cooling capacity: 29–44kW Rated heating capacity: 9~30kW

Application: Mainly used in motor car and high-speed railway vehicle, currently CRH380A, hybrid rail motor set, diesel rail motor set.

Features: complete independence, inverter heat pump, optimized wind field, pressure wave control and high sealing



## ◎机车空调

适用车辆:干线铁路机车、城轨工程车

供电方式: AC380V/AC220V/DC110V/DC74V

额定制冷量: 4~12kW 额定制热量: 2~11kW

产品应用: 主要应用于铁路机车及城轨地铁工程车、检测车等车型,目前应用于 45 个国家和城市,共计 4658 台空调机组。

产品特点:变频、热泵制热、直流供电、取消空调电源、可靠性高。



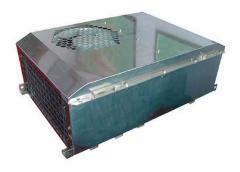
#### Company Locomotive

Applicable to: locomotive and urban rail vehicle Power supply: AC380V/AC220V/DC110V/DC74V

Rated cooling capacity: 4~12kW Rated heating capacity: 2~11kW

Application: mainly used in railway locomotives and urban rail metro engineering vehicles, testing vehicles and etc., currently used in more than 4,658 vehicles in 45 countries and cities.

Features: inverter heat pump, DC power supply, removed unit power source and high reliability





# ◎新一代车辆空调

适用车辆: 下一代地铁车辆

供电方式: DC700V/DC750V/DC1500V

额定制冷量: 29~44kW 额定制热量: 10~28kW

产品应用: 主要应用于中车各主机厂下一代地铁车辆平台。

产品特点: 变频热泵、全直流供电、智能预诊断、轻量化、更高能效、低噪声、净化杀菌。



Applicable to: New generation vehicle Power Supply: DC700V/DC750V/DC1500V Rated Cooling Capacity: 29~44kW Rated Heating Capacity: 10~28kW

Application: New generation vehicles of car builders

Features: Inverter heat pump, DC supply, Intelligent pre-diagnosis system, light weight, high efficiency, low noise, air purification



# ◎核心技术 CORE TECHNOLOGY



## 舒适性控制

恒定客室温度 均衡湿度控制 空气质量检测及控制

### **Comfort control**

Constant temperature Intelligent dehumidification



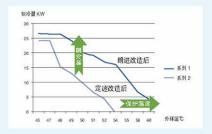


## 高温制冷

部件优化 过热保护温度控制

## High temperature cooling

Optimized components Over temperature protection





## 热泵制热

室外≥-20℃制热(常规≥-13℃)

♀ 変频热泵(取消客室电加热)

## **Heat Pump Heating**

Temperature outside ≥ -20°C Heating Normal condition ≥ -13°C

Inverter heat pump without electric heating devices
 Inverter heat pump with electric heating devices
 (ultra-low temperature heat pump heating)



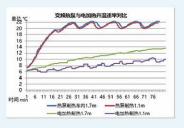


# 更舒适、更节能

客室温升速率快 客室温度均匀性好 客室温度稳定性好

# More comfort, More energy efficiency

High rate temperature rising Good temperature uniformity Good temperature stability



# ◎技术路线 TECHNICAL ROUTE



<b>第1/2代</b> 1st/2nd Generation	第3代 3rd Generation	第4代 4th Generation	<b>第5代</b> 5th Generation	第6代 6th Generation
较传统定频空调 节电30%~55% Save energy 30%~55% compared with traditional fix-frequency air conditioner	较第二代节电约10% Save energy 10% compared with the 2nd generation	较第三代风机 节电约 6% Save energy 6% compared with the 3rd generation	能效比>2.6 EER>2.6	系统能效进一步提升 System EER can be improved further
较传统定频空调系统 减重1吨/列 Reduce weight 1 ton/vehicle compared with traditional fix-frequency air conditioner	较传统定频空调节约 减重2.5吨/列 Reduce weight 2.5 ton/vehicle compared with traditional fix-frequency air conditioner	取消风道再减重约 1吨/列 Reduce weight 1 ton/vehicle after cancellation of air duct	空调机组减重30% Reduce weight of unit 30%	新型材料和部件 系统进一步减重 New type materials and components allow the system to have weight reduced further
变频控制更舒适, 更可 靠机电一体化易维护 Inverter control is more comfortable and reliable, and mechanical–electrical integration is easy to maintain	减小或取消辅助 逆变电源 Reduce or cancel the auxiliary inverter power source	取消传统风道 更舒适卫生 Cancel traditional air duct More comfortable and healthy	洁净客室环境 整机噪音<71dB Clean the passenger compartment environment Overall noise <71dB	智能控制 设备故障预诊断 Intelligent Control Pre-diagnosis of Equipment Fault

## ◎朗讲智造 INTELLIGENTLY MADE IN LONGERTEK

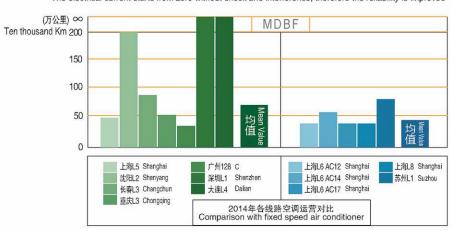
## ◎安全可靠 RELIABILITY

#### 变频空调与定速空调MDBF数据统计

The MDBF data statistics of inverter air conditioning versus that of fixed rotation rate

压缩机、通风机变频启动,启动电流从零开始,无冲击、无干扰,可靠性提高。 压缩机低频运行,延长部件使用寿命。

The electrical current starts from zero without shock and interference, therefore the reliability is improved



#### 变频空调整体可靠性高于定速空调!

The data suggests that the overall reliability of the HVAC with inverter is higher than that of fixed rotation rate.

#### 单车公里耗电量及节电率 Energy Efficiency

- 1. 变频方案节电率高于定速四压缩机方案
- 2. 热泵节电率优于电加热方案
- 3. 变频方案节电率优于定速方案
- 1. Inverter unit has better energy efficiency than 4 fixed speed compressor unit
- 2. Heat pump heating has better efficiency than electric heater



# ◎智能化生产和质量控制 INTELLIGENT PRODUCTION AND QUALITY CONTROL



Management

全员参与, 朗进造=用心造

All Staff Participation

# ◎售后服务体系 AFTER-SALES SERVICE SYSTEM





### 运营维保 Maintenance

- 轨道百年工程
- · 三十年寿命
- ·一百年服务

100 years project 30 years lifetime 100 years service



#### 架大修 Operation

- · 全寿命周期服务
- ·开拓服务后市场
- ·新技术融合

Service in life time Extend service market New technology fusion



质保期外 Beyond Warranty

架大修 Overhaul 技术升级 Upgrade 部件供应 Spares supply



技术升级 Upgrade

- · 落后技术升级
- 性能提升
- 创造价值

Upgrade outdated technology Improve performance Create values

# ◎智能运维PHM系统 INTELLIGENT OPERATION PHM SYSTEM



通过大数据分析手段、AI人工智能诊断算法来预测和评判空调系统的健康程度,实现在空调发生显性故障前的预防性维修,提升轨道交通运营安全可靠性和维保效率;实现空调系统的状态监测、健康诊断、故障预警。

从传统的计划修和故障修等"被动维护",逐渐转变为状态修的"预防性主动维护",实现车辆空调系统部件全寿命周期健康管理及主动运维服务管理。

By means of big data analysis and AI diagnosis algorithm, the health degree of air conditioning system can be predicted and evaluated, preventive maintenance can be realized before the air conditioner has fault, to improve the operation reliability and maintenance efficiency. The condition monitoring, health diagnosis and fault warning of air conditioning system can be also realized.

It is transformed into the "active maintenance" from the traditional "passive maintenance" such as planned maintenance and fault repair, so as to realize the whole life cycle health management and active operation and maintenance service management of air conditioning system.





# ◎自动化智能控制 AUTOMATIC INTELLIGENT CONTROL



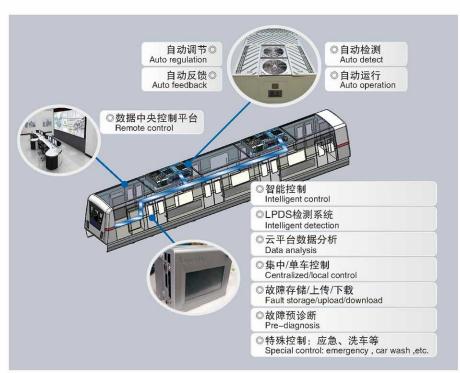
## 自动化智能控制 GoA4

列车空调系统随车自检启动; 自动运行制冷/制热模式; 自动调节系统能力输出; 自动优化舒适性曲线; 保持最佳工作能效。

#### Automatic intelligent control GoA4

Auto start with vehicle operation; Auto operation, cooling/ heating; Auto adjustment on output; Auto optimize comfort curve; Keep high efficiency performance

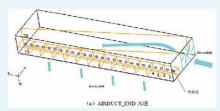




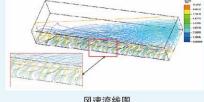
# ◎风道CFD分析: AIR-DUCT CFD ANALYSIS

对空调机组与风道匹配建立模型,对出风均匀性、风速等进行分析。为风道设计、机组与风道匹配试验、产品应用提出合理化建议方案。

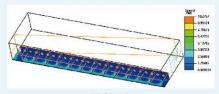
Build model on air conditioning and air duct, simulate and analyze the air outlet uniformity and speed. Provide rationalized proposal to air duct design, test and production.



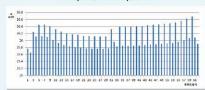
风道CFD模型 Air duct CFD model



风速流线图 Air speed motion pattern



风速云图 Air speed cloud picture

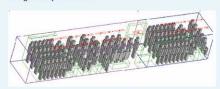


各导风孔风量 Volume of each air outlet

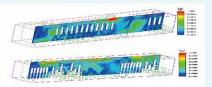
# ◎客室舒适性仿真分析: PASSENGER COMFORT SIMULATION ANALYSIS

对车辆车体建立模型,对客室内风场流线速度、风口流线速度、空气温度等进行分析,为产品优化、 产品应用提出合理化建议。

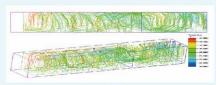
Build vehicle body model and analyze the air speed, temperature, etc. Provide rationalized proposal to design and production.



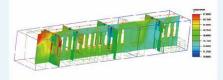
车体计算模型 Vehicle model



空气速度 Air speed



风场流线速度 Wind field streamline speed



车厢空气温度 Temperature



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