

股票代码: 300594



山东朗进科技股份有限公司

SHANDONG LONGERTEK TECHNOLOGY CO., LTD.

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**新一代舒适节能、轻量智能型车辆
变频热泵空调系统及延伸技术**

longertek 朗进科技

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成立于2000年，于2019年在深交所创业板上市（股票代码300594），注册资本8998.17万元，是一家拥有国际先进变频节能核心技术、空调系统与控制技术的国家级高新技术企业，总部设于济南、青岛，下辖北京、广州、深圳、沈阳、成都、西安、郑州、佛山、苏州和武汉等多家子公司。

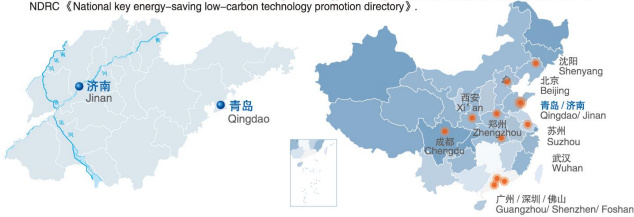
公司围绕高效、节约、环保、智慧的理念，坚持自主创新，致力于智能节能型空调与控制系统研究，产品具有节能、舒适、轻量化、智能化等特点，控制精确、可靠性高、全寿命周期运维成本低。

轨道交通直供电变频空调节能技术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》。

Shandong Longtertek Technology Co., Ltd. was established in 2000 and listed on the growth enterprise market of Shenzhen Stock Exchange in 2019 (Stock Code: 300594), with a registered capital of 89,981.7 million yuan. It is a state-level high-tech enterprise with the international advanced core technology of frequency conversion energy-saving and air conditioning system and control technology. Its headquarters are in Jinan and Qingdao, and it also has many subsidiaries in Beijing, Guangzhou, Shenzhen, Shenyang, Chengdu, Xi'an, Zhengzhou, Foshan, Suzhou and Wuhan.

Our company adheres to independent innovation based on the concept of high efficiency, saving, environmental protection and wisdom. It devotes to the research of intelligent energy-saving air conditioning and control system. The product has the characteristics of energy saving, comfort, light weight, intelligence, etc. It also has the advantages of precise control, high reliability, whole life cycle service and low operation and maintenance costs.

The DC powered air conditioner inverter energy saving technology of railway vehicle air conditioner were included in the NDRC (National key energy-saving low-carbon technology promotion directory).



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"
- 坚持 “朗进造=用心造” 质量理念
Adhere to the quality concept "Create by Longtertek = Create by heart"
- 聚焦 高端智造及核心控制技术
Focus Advanced intelligent manufacture and core control technology
- 创领 综合环控系统智能解决方案
Lead Intelligent solution for integrated environmental control system





DARES TO 大事记

>>> CHALLENGE

- 2020年 获得铁路客车空调机组资质，并成功装车。
Qualified HVAC system supplier of Main Line Coaches in China with installation on fleet
- 2019年 朗进科技在深交所创业板上市，证券代码：300594。
Longtertek 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市列车空调成功装车。
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成功装车。
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诊断系统成功装车。
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ATF 16949认证。
IATF 16949 Certification
- 2016年 公司第一台电动客车空调成功装车。
2016 First electric bus air conditioner of Longtertek was successfully installed
- 2015年 公司技术入选国家发改委《国家重点节能低碳技术推广目录(2015年本、节能部分)》。
Longtertek 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 国内第一台普通客车变频空调在济南铁路局成功装车。
First inverter air conditioner 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。
EN15085 Certification
- 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。
Passenger vehicle inverter air conditioner was installed on Chang'an EV taxi
- 2009年 国内轨道交通行业首次完成车载空调技术节能技术对比测试，测试表明：相比传统定速空调，变频空调平均制冷节电率>30%，平均制热节电率>40%，整车能耗降低12%。
First comparison test between inverter system and fixed speed system was finished in China, compared with fixed speed system, inverter system has more than 30% energy saving in cooling mode, 40% in heating mode. Totally 12% energy saving for whole vehicle.
- 2008年 国内轨道交通行业首次以能源合同管理形式完成上海地铁5号线项目。
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：“德益中庸”
Longtertek 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 Longtertek 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，并成功装车。
First locomotive inverter air conditioner developed with production license
- 1989年 国内第一套空调变频路由朗进董事长李敬茂先生开发完成。
First inverter controller in China was developed by Longtertek Chairman, Mr. Lijingmao

TECHNICAL 技术线路

>>> ROADMAP

国内首套变频空调控制系统 The first frequency conversion air conditioning control system in China	AC380V交流变频控制技术 AC380V AC frequency conversion control technology	AC380V直流变频控制技术 AC380V DC frequency conversion control technology	正弦波矢量变频技术 Sine wave vector frequency conversion technology
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1989	1999	2005	2008
智能运维 全寿命维护 Intelligent operation and maintenance, whole life maintenance	DC1500V直供变频技术 DC1500V direct supply frequency conversion technology	5D碳纤维、智能化、洁净环控 5D carbon fiber, intelligent, clean environmental control	变频多联无风道技术 Frequency conversion multi-connection without air duct technology
			DC750V直供变频技术 DC750V direct supply frequency conversion technology

2018	2017	2016	2014	2011
新型制冷剂 R513A New refrigerant R513A	新型制冷剂 CO2 New refrigerant CO2	新型制冷剂 R1234yf New refrigerant R1234yf	智能、舒适、低噪 超轻量、超高能效 Intelligent, comfortable, low noise, ultra-lightweight, ultra-high energy efficiency	

2019	2020	2021	未来
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HONOR AND 荣誉和资质

>>> QUALIFICATION

◎ 企业成就

- 2001年将变频热泵节能空调技术引入轨道交通行业
- 拥有轨道交通车载变频空调核心自主知识产权的上市企业
- 具备轨道交通车载变频空调自主研发和定制生产能力
- 完成10个城市（先后12年）各种轨道空调技术节能对比测试

We took the lead in introducing the inverter heat pump energy-saving air conditioning technology into the rail transit industry. In 2001 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. We have completed technology energy-saving comparison test of a variety of rail transit air conditioners in 10 cities during 12 years.

市场运营

38个运营城市
96条运营线路
21年运营经验

Market operation
38 operating cities
96 operating lines
21 years of operating experience

国家认可

轨道交通直流供电变频空调节能技术
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 DC powered air conditioner inverter energy saving technology of railway vehicle air conditioner were included in the NDRC (National key energy-saving low-carbon technology promotion directory)

行业引领

151项专利
直流直进供电技术
引领行业技术发展

Industry leader
151 patents
Direct DC power supply technology leading the development of industry technology

行业认可

中车合格供应商
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
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
国家级高新技术企业
省工程技术研究中心
省级“一企一技术”研发中心
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
National air conditioning inspection center
National level High-tech Enterprise
Provincial Engineering Technology Research Center
Provincial "One Enterprise One Technology" R&D Center
Provincial Intelligent Power Module Lab
China Railway Corporation Scientific and Technological Progress Third Prize

创领未来

全球首款碳纤维空调、5D全智能变频
热泵空调（减重2.5吨/列）
电池热管理空调系统
超轻量，超静音，超高效，智能化
主动运维空调系统技术（PHM）

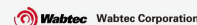
Lead the Future
The first type of carbon fiber air conditioner, 5D all intelligent inverter heat pump air conditioner in the world (weight loss 2.5 tons/vehicle)
Air conditioning system with battery thermal management
Air-conditioning system technologies such as ultra-lightweight, ultra-quiet, ultra-efficient, intelligent and active operation & maintenance (PHM)

MAIN 主要客户

>>> CUSTOMER

车辆厂主要客户

Main Customers (Vehicle Builders)



运营公司主要客户

Main Customers (Operating Company)





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TRACK 应用业绩
>>> RECORD





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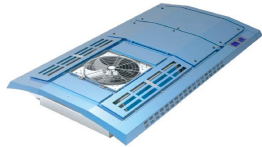
PRODUCT 产品谱系
»» BROCHURE

◎地铁车辆空调

适用车型: A/B/C/L 型地铁车辆
供电方式: AC380V/DC750V
额定制冷量: 25-44kW
额定制热量: 15-35kW
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。

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。



◎ Metro Vehicle Air conditioning system

Applicable to: A/B/C/L metro vehicle
Power supply: DC750V/AC380V
Rated cooling capacity: 25-44kW
Rated heating capacity: 15-35kW
Height: 280-480mm

Application: Beijing, Shanghai, Guangzhou, Shenzhen, Shenyang, Changchun, Urumqi, Chengdu, Zhengzhou, Guiyang, Fuzhou and Izmir etc.

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%有轨电车
供电方式: AC380V/DC600V/DC750V/受电弓/超级电容/氢燃料
额定制冷量: 25-50kW
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、佛山等。

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

◎ Tram Vehicle

Applicable to: 70%, 100% tram vehicle
Power supply: AC380V/DC600V/DC750V/pantograph /super capacitor/hydrogen fuel
Rated cooling capacity: 25-50kW
Rated heating capacity: 12-32kW
Height: 350-750mm

Application: Beijing, Guangzhou, Qingdao, Suzhou, Changchun, Chengdu, Huai'an, Zhuhai and Samsun etc.

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



◎无轨电车空调

适用车型: 虚拟轨道导向列车、无轨电车、智轨等
供电方式: AC380V/DC600V
额定制冷量: 24kW/26kW
额定制热量: 10-28kW

产品特点: 变频、热泵制热、机电一体化、直流供电、超低温制热 (补气增焓)、轻量化、低噪声。

◎ Trolley vehicles

Applicable to: Applicable models: the product is suitable for virtual rail guided train, trolley bus, smart rail, etc.

Power supply mode: AC380V / DC600V
Rated cooling capacity: 24kW/26kW
Rated heating capacity: 10-28 kW

Features: frequency conversion, heat pump heating, mechatronics, DC power supply, ultra-low temperature heating (increase enthalpy by replenishing gas), light weight and low noise.





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朗进造 = 用心造



◎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/DC440V/DC750V
额定制冷量：18-40kW
额定制热量：10-28kW
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。

◎Monorail Vehicle

Applicable to: straddled-type monorail vehicle, suspended monorail vehicle and others
Power supply: AC380V/DC440V/DC750V
Rated cooling capacity: 18-40kW
Rated heating capacity: 10-28kW
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：高 / 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：直流供电、变频、热泵制热、超轻量、超高效、无冲击、低噪声。

◎Maglev Vehicle

Applicable to: high/medium/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: DC power supply, inverter control, heat pump heating, light weight, high efficiency, shock free, low noise

◎新一代车辆空调

适用车辆：下一代地铁车辆
供电方式：DC600V-DC750V/DC1500V
额定制冷量：29-44kW
额定制热量：10-28kW

产品应用：各主机厂新开发的下一代地铁车辆平台。

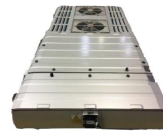
产品特点：变频热泵、全直流供电、智能预诊断、轻量化、更高能效、低噪声、净化杀菌、碳纤维壳体。

◎New Generation Vehicle

Applicable to: New generation vehicle
Power Supply: DC600V-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, carbon fiber casing



◎新型环保冷媒空调

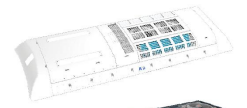
适用车辆：轨道各种车辆
供电方式：AC380V/DC600V/DC750V/DC1500V
额定制冷量：22kW/29kW/35kW/44kW
额定制热量：2-30 kW
冷媒：R513A/R744/R1234yf 等新型环保冷媒

产品特点：变频、热泵制热，环保，缓解全球温室效应。

◎New refrigerant air conditioner

Applicable to: all kinds of rail vehicles
Power supply: AC380V / DC600V / DC750V / DC1500V
Rated cooling capacity: 22kW/29 kW/35 kW/44 kW (can be customized according to customer requirements)
Rated heating capacity: 2-30 kW
Refrigerant: New refrigerants such as R513A/R744/R1234yf

Features: frequency conversion, heat pump heating, environmental protection, alleviate the global greenhouse effect





◎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、西安机场线、时速160公里全自动运行A型市域车、新一代全自动市域车等

产品特点：变频、热泵制热、优化风场、压力波控制。

◎Urban 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：动车高铁车辆
 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、内燃动车组等。

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。

◎High-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



◎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，目前有25G硬座车、卧铺车、软座车等。

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

◎机车空调

适用车辆：干线铁路机车、城轨工程车
 供电方式：DC74V/DC110V/AC220V/AC380V
 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。

产品特点：变频、热泵制热、直流供电、取消空调电源、可靠性高。

◎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.

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





◎配套产品 HVAC Accessories



直流稳压电源
DC Regulated Power Supply



空调控制器
HVAV Controller



废排单元
Exhaust Unit

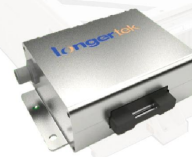


司机室送 / 回风单元
Cab Air Ventilation Unit

◎配套产品 HVAC Accessories



空气检测装置
Air Detection Device



空气净化装置
Air Purification Device



风道
Air Duct



电加热器
Heat Convector

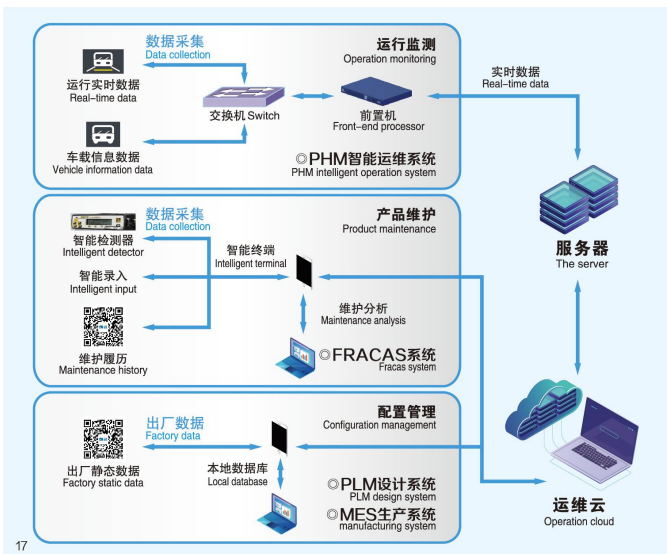


空调控制柜
Control Cabinet

◎ 运维服务体系 OPERATION SERVICE SYSTEM



◎ 质量管理体系 QUALITY MANAGEMENT SYSTEM



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-frequency unit compressor, fan frequency start, start current from zero start, no shock, no interference, reliability improved. Compressor low frequency operation, extend component life.

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



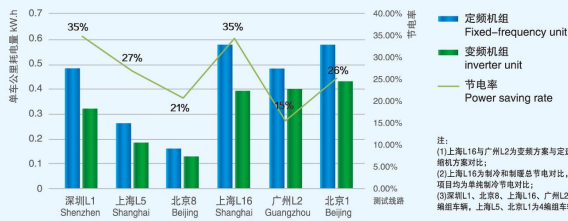
节能环保 ENERGY EFFICIENCY

各城市地铁线路单车公里耗电量及节电率

- 变频方案节电率高于定速四压缩机方案
- 热泵节电率高于电加热方案
- 变频方案节电率高于定速方案

Energy Efficiency

- Inverter unit has better energy efficiency than 4 fixed speed compressor unit
- Heat pump heating has better efficiency than electric heater
- VVVF unit has better energy efficiency than 2 fixed speed compressors unit



注：
(1) 上海L16与广州L2为变频方案与定速四压缩机方案对比；
(2) 上海L16为制冷和制热总节电对比，其他项目均为单纯制冷节电对比；
(3) 深圳L1、北京8、上海L16、广州L2均为6辆编组车辆，上海L5、北京1为4辆编组车辆。

自动化智能控制 AUTOMATIC INTELLIGENT CONTROL

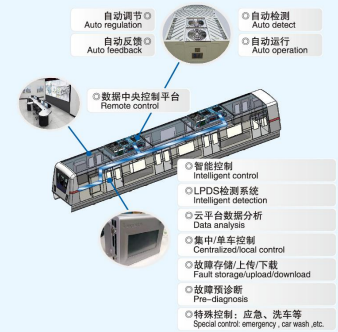


自动化智能控制 GoA4

- 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；
- 保持最佳工作效率。

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



智能运维PHM系统 PRODUCT HEALTH MANAGEMENT



通过大数据分析，智能算法，评判空调系统健康状态，预警故障发生可能性，提示预防性维修，预测部件寿命，形成空调系统运行状态与维护履历，实现全寿命周期健康管理及主动运维服务。

Through big data analysis and intelligent algorithm, we can judge the health status of air conditioning system, warn the possibility of failure, prompt preventive maintenance, predict the service life of components, form the operation status and maintenance resume of air conditioning system, and realize the whole life cycle health management and active operation & maintenance service.

◎技术优势 TECHNICAL ADVANTAGES



舒适度控制

客室升温速率快、稳定性好
客室温度均匀、湿度控制均衡
空气质量检测与控制

Comfort control

High rate temperature rising, good stability
Temperature uniform, the humidity control is balanced
Air quality detection and control

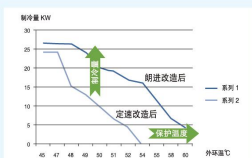


高温制冷

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 $\geq -20^{\circ}\text{C}$ 制热 (常规 $\geq -13^{\circ}\text{C}$)
变频热泵 (取消客室电加热)
变频热泵 + 客室电加热 (超低温热泵)

Heat Pump Heating

Temperature outside $\geq -20^{\circ}\text{C}$ Heating
Normal condition $\geq -13^{\circ}\text{C}$
Inverter heat pump without electric heating devices
Inverter heat pump with electric heating devices (ultra-low temperature heat pump heating)

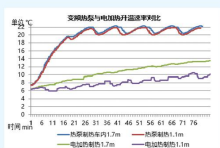


节能环保

变频控制节电
热泵制热节电
轻量减重节电
新型环保冷媒开发

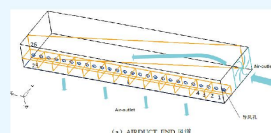
ECO

VVVF control
Heat pump heating
Weight reduction
Green refrigerant



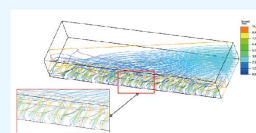
◎风道CFD分析: AIR-DUCT CFD ANALYSIS

建立风道模型, 分析出风均匀性、风速等参数, 为风道结构设计、出风均匀性提供合理化建议。
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.



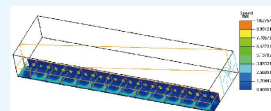
风道模型

Air duct model



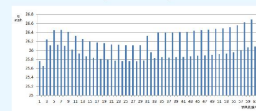
速度流线

Air speed motion pattern



风速截面云图

Air speed cross section cloud picture

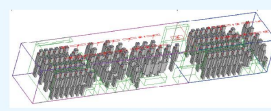


各导风孔风量

Air volume of each air outlet

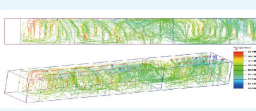
◎客室舒适度仿真分析: SALOON COMFORT SIMULATION ANALYSIS

建立客室模型, 分析客室内速度流线、循环路径、空气温湿度等参数, 为车内风口位置、出风角度、各工况送风风量等提出合理化建议, 从而提高客室舒适度。
Build vehicle body model and analyze the air speed, temperature, etc. Provide rationalized proposal to design and production.



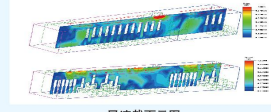
车体模型

Vehicle model



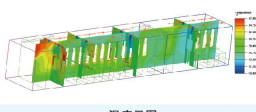
速度流线

Air speed motion pattern



风速截面云图

Air speed cross section cloud picture



温度云图

Temperature