Presentation of GUCHEN

All-Electric Bus Air Conditioning System

Zhengzhou Guchen Industry Co., Ltd.
- DC Variable Frequency All-electric Bus Air Conditioner
- AC Variable Frequency All-electric Bus Air Conditioner
GUCHEN's DC Variable Frequency All-electric Bus Air Conditioners can be applied for electric buses with 6~18 meter length, includes EZDD-03, EZDS-04, EZDS-05 and EZDS-06.

**Wight of 12M Electric Bus:** 400KG → **Decreased to** 245KG

**Length of 12M Electric Bus** is controlled to: < 3M

Zhengzhou Guchen Industry Co., Ltd.
Model: EZDS-06
Application for: 10~13.7m Electric Bus
Weight: ≤ 245KG
Rated Consumption: 8.8KW
Rated Evap. Air Vol.: 4,800M³/h
Energy Adjustment Range: 30%~100%
Dimension: 3,000 × 1,920 × 285 mm

Appearance subject to material object

Zhengzhou Guchen Industry Co., Ltd.
Model: EZDS-05
Application for: 9~10m Electric Bus
Weight: ≤ 170KG
Rated Consumption: 7.0KW
Rated Evap. Air Vol.: 3,200M³/h
Energy Adjustment Range: 30%~100%
Dimension: 2,360×1,920×285 mm

Appearance subject to material object
Model: EZDS-04
Application for: 8~9m Electric Bus
Weight: ≤ 150KG
Rated Consumption: 6.0KW
Rated Evap. Air Vol.: 3,200M³/h
Energy Adjustment Range: 30%~100%
Dimension: 1,960×1,920×285 mm
Model: EZDS-03
Application for: 6~7m Electric Bus
Weight: ≤ 115KG
Rated Consumption: 4.0KW
Rated Evap. Air Vol.: 3,000M³/h
Energy Adjustment Range: 30%~100%
Dimension: 2,399×1,620×245 mm

Appearance subject to material object
DC Variable Frequency All-electric Bus Air Conditioner

DC Variable Frequency All-electric Bus A/C, What GUCHEN did for it?
Load calculation and system simulation in software
Testing the temperature field distribution of each components in order to precision matching
Precise control the flow of refrigerant, test in all kinds of environment conditions to get the best flow data, the data were fitted to determine the best control mode to ensure a precise control.
DC Variable Frequency All-electric Bus Air Conditioner - Energy Saving, Comfort

GUCHEN A/C TESTING CENTER
Vehicle load calculation simulation

Vehicle Cooling Test
### Parameter tuning calculation in control model

<table>
<thead>
<tr>
<th>时间 t</th>
<th>比例</th>
<th>积分</th>
<th>(车内和设置差值)E&lt;sub&gt;x&lt;/sub&gt;</th>
<th>E&lt;sub&gt;x-1&lt;/sub&gt;</th>
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Guchen has developed intelligent inverter control model PI with independent intellectual property through extensive bench testing, theoretical calculations and actual vehicle validation, which has become the core competitiveness of Guchen. The techs in Guchen’s Pure electric bus air conditioners are far more better than domestic rivals in this field, for its all DC products can save more than 15% energy which has been verified in vehicle test.
Intelligent pure electric heating system is R&D based on the rooftop heating pump technology, has developed a electric heater located in driver seat and wall-mounted electric heater. Temperature can be adjusted according to the climate in different regions, so as to improve heating performance in cold areas and comfort compartments.
Patent of Heat pump heating system in intelligent pure electric roof-top bus air conditioner system.
DC Variable Frequency All-electric Bus Air Conditioner - Energy Saving, Comfort
DC Variable Frequency All-electric Bus Air Conditioner - Lightweight

**Weight of 12M Electric Bus:** 400KG
- Decreased to 245KG

**Length of 12M Electric Bus** is controlled to: < 3M

**Weight of 9M Electric Bus:** 300KG
- Decreased to 170KG

**Weight of 8M Electric Bus:** 260KG
- Decreased to 150KG

**Weight of 7M Electric Bus:** 200KG
- Decreased to 115KG
DC Variable Frequency All-electric Bus Air Conditioner - Lightweight

Weight of compressor assy. reduced from 59kg (compressory body 44kg + converter 15kg) to 7.5kg and components have reached automobile grade.

New compressor can be Dustproof, waterproof, shockproof, and protection performance has met the IP67 standard.
Company has contacted an alliance with Hitachi Compressor and signed a strategic cooperation agreement. R&D focus on new energy electric vehicle air-conditioner compressor. Three advanced core technologies, such as scroll fluid compressor, permanent magnet synchronous motors, and 360° inverter control, have reached the international advanced level in reliability, energy conservation and environmental protection.
DC Variable Frequency All-electric Bus Air Conditioner - Lightweight
Frequency Changer 7.5kg + Condenser Fan 25kg + Evaporator Blower 25kg

DC Brushless Evaporator Blower 3kg + DC Brushless Condenser Fan 3kg

The DC brushless Blower or Fan with external rotor contains the characteristics of high efficiency, large air volume, long service life, low noise, stable performance and stepless speed regulation, which have reached the automotive-grade. The external rotor brushless DC motor is more stable and reliable than regular fans when working around the clock, neither AC interference, nor endanger personal safety.
Combined the drive model with compressor together as a whole part, the protection class has reached IP67 standard. The characteristics of dustproofing, waterproofing and anti-vibration make it reach the automotive-grade.

The external drive inverter is not dustproof and waterproof. It can hardly reach the automotive-grade by air-cooling. Meanwhile the inner control box will be dusty after a period of working.
1. All components meet the automotive-grade standard. Power module and compressor have reached the IP67 standard.

2. Various protection functions: high-voltage alarm and cut-off function, low-voltage alarm and cut-off function, high-current protection, compressor over-heat discharge protection, high and low voltage protection of air conditioner systems, and temperature controlling, etc.

3. Passed a rigorous bench testing: rated capacity test (cold / hot), high-temperature cooling / heating, defrosting, intelligent temperature adjustment, inverter compressor oil and refrigerant volume confirmation test, vibration test, over-high temperature refrigeration start test, long operation room.

4. Vehicle test verification: the cooling, heating and other testing operating on different road conditions, like general highway, elevated road have reached 60,000km in total.

5. Both compressors and power module are waterproof, dustproof, shockproof, which have fully met the automotive grade. Fan with safe voltage level is more secure, and the protection level is more higher.

6. Air conditioner weight directly reduces by more than 40%, which lowers the center of gravity of vehicle and improves vehicle safety. Light-weight air conditioner also benefits to reduce vehicle weight indirectly, which enhances the passenger capacity and mileage.
Vehicle test verification
◆ Housing and cover are made of SMC and LFT material, meanwhile made by mould pressing technology, ensure that the emissions of harmful substances are below the national standard. It is unique in the industry.

◆ All components are passed the rigorous environmental testing.
SMC Housing
(Mould Pressing)

SMC Cover
(Mould Pressing)
DC Variable Frequency All-electric Bus Air Conditioner - Environmental Protection

Housing Moulds
Atomizing Experiments

<table>
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<th>测试条件</th>
<th>测试开始日期</th>
<th>测试结束日期</th>
<th>粒子尺寸及重量</th>
<th>粒子干燥时间</th>
<th>加热温度</th>
<th>加热时间</th>
<th>冷凝温度</th>
<th>冷凝时间</th>
<th>测试结果</th>
<th>DIDP 值</th>
<th>客户要求限值</th>
<th>判定</th>
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<tr>
<td></td>
<td>2013.11.13</td>
<td>2013.11.15</td>
<td>80mm 圆/28.246g</td>
<td>24h</td>
<td>100℃</td>
<td>16h</td>
<td>21℃</td>
<td>/</td>
<td>DIP 值</td>
<td>0.66mg</td>
<td>0.84mg</td>
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Formaldehyde Test

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<th>测试条件</th>
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<th>测试结束日期</th>
<th>样品尺寸/质量</th>
<th>样品含水率</th>
<th>测试结果</th>
<th>样品一</th>
<th>样品二</th>
<th>样品三</th>
<th>样品四</th>
<th>样品五</th>
<th>报告值</th>
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<tr>
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<td>2013.11.14</td>
<td>2013.11.18</td>
<td>40mm*100mm/26.363g</td>
<td>0.56%</td>
<td>N.D.</td>
<td>N.D.</td>
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<td>N.D.</td>
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| 客户要求限值 | <10mg/kg |
| 判定          | PASS     |

注释: 1) N.D. 表示未检出(小于检出限)。
## Total Carbon Volatilization

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## Benzene, Toluene, Xylene Volatilization

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<td>苯</td>
<td>N.D.</td>
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Efficient Air Purification System

Guchen has air purification devices with intellectual property rights, which contain functions of effective dust collection, sterilization and odor removal action. Patent No.: ZL201220481896.6
Efficient air purification system

This air purification system is specially designed for the city bus with high capacity of passengers and complex internal environment. It enhances degradation of organic volatile gases function, also strengthens the PM2.5, sterilization and deodorization function. Modified air purification system can efficiently make the dust particles, bacteria, viruses and harmful microbes attach the polarization fiber adsorption layer which is located on the upstream. The nanomaterial photocatalysis device and the adsorbed layer are closely linked, to obtain sufficient contact surface and adequate treatment time. And the polarized fiber adsorption layer protects the nano-material from dust covering so as to maintain its stable photocatalytic effects.
DC Variable Frequency All-electric Bus Air Conditioner - Flow Diagram

Cooling Mode

- Inside of Bus
- Evaporator
- Compressor
- Gas separator
- 1 way valve A
- Exp. valve 1
- Exp. valve 2
- 4 way valve
- Condenser
- Heat exchanger

Heating Mode

- Inside of Bus
- Evaporator
- Compressor
- Gas separator
- 1 way valve A
- Exp. valve 1
- Exp. valve 2
- 4 way valve
- Condenser
- Heat exchanger
DC Variable Frequency All-electric Bus Air Conditioner - Internal Structure

- Power Module IP67
- DC Brushless Blower
- DC Compressor IP67
- Condenser
- Evaporator
- Electronic Expansion Valve
- thermostatic expansion valve

EZDS-06 Internal Structure
DC Variable Frequency All-electric Bus Air Conditioner - Flow Diagram

EZDD-03 Internal Structure
Minister of China Science and Technology Visit Us
Except DC air conditioners, GUCHEN also supply the AC (variable frequency all-electric) bus air conditioners:

- EZDD-04 AC Electric Air-conditioner
- EFDD-06 AC Electric Air-conditioner
EFDD-05 Installation Drawing
AC Variable Frequency All-electric Bus Air Conditioner - Products

EFDD-03 Structure
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<td>3380 × 1820 × 227</td>
<td>3600 × 1901 × 227</td>
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<td>−20~50 °C</td>
<td>−20~50 °C</td>
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<td>12~13.7m EV Bus</td>
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Superior Performance

The experimental data comparison between the third-generation variable frequency electric air conditioner EZDD-06G and the well-known foreign brands, at the same testing conditions:

- The COP of EZDD-06G is 1.77 times of the well-known international brand products
- Cooling capacity is 1.16 times of international brands
- Shaft power consumption only is 65% of international brands
Superior Performance

EFDD-06 A/C System testing on the road between city Zhengzhou and Kaifeng, Vehicle: 13.7m Electric Bus:
Date & Time: 2013-07 11:50~16:10
Ambient Climate: Fine, \( T_{\text{emp.}} 30^\circ\text{C} \)
A/C \( T_{\text{emp.}} \) Set: 24°C
Power Consumption:

- **GUCHEN** \( P = 4.3 \text{ KW} \)
- Domestic Brand \( P = 6.3 \text{ KW} \)
- International Brand \( P = 5.3 \text{ KW} \)
1. EZDS-06GA Variable Frequency Electric A/C system (cooling+heating) OEM for Yutong City Bus ZK6100EGAA, ZK6125HG. Thereinto, ZK6125HG - steady operation over 4 years.

2. EZDS-06GAE AC Electric A/C system OEM for ZK6125BEVG1, ZK6122H.

Application for Tourism Coach
Application for 7m Electric Bus
Thanks for your attention!

郑州金相机电科技有限公司

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