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**Performance requirements and bench test methods for
vehicle electric air compressor**

汽车用电动空气压缩机性能要求及台架试验方法

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Performance requirements and bench test methods for vehicle electric air compressor

1 Scope

This document specifies the terms and definitions, performance requirements, bench test methods of electric air compressors for automobiles.

This document is applicable to electric air compressors, which are used in commercial vehicle pneumatic brake systems. Other electric air compressors for vehicles may make reference to this standard.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated references, only the corresponding version is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB 755-2019 Rotating electrical machines - Rating and performance

GB/T 2408-2021 Plastics - Determination of burning characteristics - Horizontal and vertical test

GB/T 3853-2017 Displacement compressors - Acceptance tests

GB/T 4208-2017 Degrees of protection provided by enclosure (IP code)

GB/T 4975 Displacement compressors vocabulary - General

GB/T 4980 Determination of sound level for noise emitted by displacement compressors

GB/T 7777 Measurement and evaluation of mechanical vibration of displacement compressors

GB/T 10125-2021 Corrosion tests in artificial atmospheres - Salt spray tests

GB/T 18488.2-2015 Drive motor system for electric vehicles - Part 2: Test methods

GB/T 18655-2018 Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection

of on-board receivers

GB 19153-2019 Minimum allowable values of energy efficiency and energy efficiency grades for displacement air compressors

JB/T 7662 Displacement compressor vocabulary - Rotating compressor

JB/T 9107 Reciprocating compressors - Vocabulary

QC/T 413-2002 Basic technical requirements for automotive electric equipment

QC/T 29078-2016 Performance requirements and bench test methods of vehicle air compressor

3 Terms and definitions

The terms and definitions as defined in GB/T 3853-2017, GB/T4975, JB/T 7662, JB/T 9107, as well as the following terms and definitions, apply to this document.

3.1

Electric air compressor

An air compressor powered by a motor.

3.2

Rated speed

The air compressor speed, which is corresponding to the rated speed of the driving motor.

Note: The rated speed is expressed in revolutions per minute.

3.3

Rated discharge pressure

The rated working pressure required by the complete vehicle, to which the electric air compressor is suitable.

Note: Rated exhaust pressure is expressed in MPa.

3.4

Rated condition

The working condition of the electric air compressor, operating at the rated speed,

4.5 Input specific power

The test shall be carried out, in accordance with the provisions of GB/T 19153-2019. The unit input specific power of the electric air compressor, under rated working conditions, shall meet the requirements of level 2 in GB/T 19153-2019.

4.6 Oil content with gas

The test shall be carried out, in accordance with the provisions of Appendix A of QC/T 29078-2016. The oil content in the exhaust of oil-lubricated electric air compressors, under rated working conditions, shall not exceed 10 mg/m³.

4.7 Degree of protection

The overall degree of protection of the electric air compressor shall meet the requirements of IP67 in GB/T 4208-2017.

4.8 Low temperature adaptability

The test shall be carried out, according to the requirements of 5.1. The electric air compressor shall have no leakage of air or oil.

4.9 High temperature adaptability

The test shall be carried out, according to the requirements of 5.2. The electric air compressor shall have no leakage of air or oil.

4.10 Vibration durability

The test shall be carried out, in accordance with the provisions in 3.12 of QC/T 413-2002. The electric air compressor shall be able to work normally without loose fasteners, air leakage or oil leakage.

4.11 Corrosion resistance

The test shall be carried out, according to the requirements of 5.3. The electric air compressor shall be able to work normally, without air leakage or oil leakage. The corrosion rate of its outer surface area shall not exceed 10%. The maximum width of a single rust point shall not exceed 2 mm. There shall be free from cracks, wrinkles, peeling off.

4.12 Damp heat resistance

The test shall be carried out, according to the requirements of 5.4. The electric air compressor shall be able to work normally. Its outer surface shall be free of corrosion. The insulation resistance of the driving motor shall meet the requirements of 4.15.

4.13 Withstand voltage

The test shall be carried out, in accordance with the provisions in 9.2 of GB 755-2019. The leakage current of the drive motor of the electric air compressor shall not exceed 10 mA; there shall be no dielectric breakdown and arc.

4.14 Grounding resistance

The test shall be carried out, according to the requirements of 5.5. The resistance value -- between the grounding point of the electric air compressor and the accessible metal casing of the drive motor -- shall not be greater than 0.1 Ω .

4.15 Insulation resistance

The test shall be carried out, according to the provisions in 5.7 of GB/T 18488.2-2015. The insulation resistance value of the electric air compressor drive motor's stator winding to the casing shall not be less than 20 M Ω .

4.16 Flame retardant properties

The test shall be carried out, according to the provisions of GB/T 2408-2008. The flame retardant performance of the insulating material, which is used for the drive motor of the electric air compressor, shall comply with the HB level for horizontal combustion and the V-0 level for vertical combustion, in GB/T 2408-2008.

4.17 Temperature rise of drive motor

The test shall be carried out in accordance with the requirements of 5.6. The temperature rise limit of the drive motor of the electric air compressor shall comply with the provisions of 8.10 in GB 755-2019.

4.18 Electromagnetic compatibility

The test shall be carried out, according to the requirements of 5.7. The conduction and radiation disturbance limits of the electric air compressor's drive motor shall meet the requirements of level 2 in GB/T 18655-2018.

4.19 Working durability

The test shall be carried out, according to the requirements of 5.8. The electric air compressor shall have no parts damage, air leakage, oil leakage, etc. The volumetric flow rate of the electric air compressor, after the test, shall not be lower than 95% of the volume flow rate, before the test. The oil content in the exhaust gas shall not be greater than 30 mg/m³.

4.20 Overload

The test shall be carried out, according to the requirements of 5.9. The electric air compressor shall have no parts damage, air leakage, oil leakage, etc.

motor, in accordance with the provisions of 5.7 in GB/T 18488.2-2015, under this environmental condition. Check whether the electric air compressor can work normally and whether there is corrosion on its outer surface.

5.5 Ground resistance

Use a ground resistance tester, to measure the resistance -- between the ground point of the electric air compressor and the accessible metal casing of the drive motor.

5.6 Temperature rise of drive motor

Start the electric air compressor. After the drive motor continues to run at the rated power until the heat is stable, measure the temperature rise of the drive motor, according to the provisions of 8.5 in GB 755-2019.

5.7 Electromagnetic compatibility

Start the electric air compressor. Continue to operate at the rated speed. Then carry out the electromagnetic compatibility test, according to the conduction disturbance and radiation disturbance test methods in GB/T 18655-2018.

5.8 Working durability

5.8.1 The volumetric flow test shall be carried out, according to the provisions in 5.6 of GB/T 3853-2017.

5.8.2 See Figure 1, for the schematic diagram of the test device.

5.8.3 Start the electric air compressor. Make it work cyclically -- between 70% of the rated discharge pressure and 110% of the rated discharge pressure (when the electric air compressor has the function of shutdown and unloading, the starting pressure shall not be lower than the maximum pressure in the unloading state) for 1000 h. The working time shall not exceed 1 min each time, meanwhile the downtime shall be consistent with the working time.

5.8.4 The test shall be carried out, according to the requirements of 5.1.3 and 5.1.4.

5.8.5 The volumetric flow test shall be carried out, in accordance with the provisions in 5.6 of GB/T 3853-2017. The gas-entrained oil content test shall be carried out, in accordance with Appendix A of QC/T 29078-2016.

5.8.6 Disassemble and inspect the electric air compressor samples. Record the damage of parts.

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Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

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