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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 31498-2021

Post-crash safety requirements for electric vehicles

电动汽车碰撞后安全要求

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Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2020 "Directives for standardization - Part

1. Rules for the structure and drafting of standardizing documents". This Standard replaces GB/T 31498-2015 "The safety requirement of electric vehicle post crash". Compared with GB/T 31498-2015, in addition to structural adjustment and editorial modifications, the main technical changes in this Standard are as follows: - modified the application scope of this Standard (see Chapter 1 of this Edition, Chapter 1 of Edition 2015); - deleted the definitions of level-B voltage, high-voltage system, rechargeable energy storage system, conductive part, and high-voltage bus (see 3.2, 3.3, 3.4, 3.8,

3.12 of Edition 2015); - modified the technical requirements for insulation resistance (see 4.2.5 of this Edition,

4.2.5 of Edition 2015); - added the special safety requirements and test methods for post crash for electric vehicle (see Chapter 5 of this Edition); - modified the calculation formulas for low energy [see formula (A.2), formula (A.3), formula (A.4) of this Edition, formula (A.2), formula (A.3), formula (A.4) of Edition 2015)]. Attention is drawn to the possibility that some of the elements of this Standard may be the subject of patent rights. The issuing authority shall not be held responsible for identifying any or all such patent rights. This Standard was proposed by Ministry of Industry and Information Technology of the People's Republic of China. This Standard shall be under the jurisdiction of National Technical Committee on Automobiles of Standardization Administration of China (SAC/TC 114). The drafting organizations of this Standard. China Automotive Technology Research Center Co., Ltd., BYD Automobile Industry Co., Ltd., Chongqing Changan Automobile Co., Ltd., FAW Toyota

Technology Development Co., Ltd., Shanghai Weilai Automobile Co., Ltd., FAW-Volkswagen Co., Ltd., Volvo Cars (Asia Pacific) Investment Holdings Co., Ltd. Company, Jaguar Land Rover (China) Investment Co., Ltd., Dongfeng Motor Co., Ltd., Dongfeng Nissan Passenger Vehicle Co., Ltd., Qoros Motor Co., Ltd. Main drafters of this Standard. Liu Guibin, Lan Hao, Ling Heping, Liu Zhixin, Zeng Dong, Wei Bo, Zhang Aiteng, Jin Xiulian, Li Baoyu, Xu Ai, Qin Hongwei, Liu Jianjian, Shan Jingwei, Li Chun, Wang Jingya, Wang Wei, Sun Zhendong, Yu Yang, Nong Fan Zhen, Pang Chengzhe, Wang Xiaohang, Chen Lei, Ji Mengxue. Versions of standard substituted by this Standard are. - GB/T 31498-2015 issued in 2015 for the first time; - this is the first revision. Post crash safety requirement for electric vehicle

1 Scope

China's national standard for the post-crash safety of electric vehicles, and the current edition of GB/T 31498, replacing the 2015 edition. It specifies the technical requirements and the test procedures for the safety of an electric vehicle after a crash, with a normative annex giving the post-crash electrical safety requirements and their test methods. The problem it addresses is specific to electric vehicles and it begins where a conventional crash test ends. In a petrol car the post-crash concerns are fuel leakage, fire and the ability to open the doors and release the occupants. An electric vehicle adds a traction battery holding a large quantity of energy in a chemical form that cannot be switched off, and a high voltage system that remains live after the impact. So the requirements cover four things that a conventional standard does not: that the high voltage system is isolated or its voltage reduced to a safe level after the crash; that insulation resistance is maintained so that the vehicle body does not become live; that no part of the high voltage system becomes accessible to a person approaching the vehicle; and that electrolyte does not leak and the battery pack stays in place rather than intruding into the occupant compartment. The 2021 revision changes the scope, deletes several definitions that had been absorbed into other standards, revises the insulation resistance requirements, revises the calculation formulae for the low energy criterion, and adds a chapter of special post-crash safety requirements and test methods for electric vehicles. Issued on 20 August 2021 and in force since 1 March 2022.

This Standard specifies special safety requirements and test methods for pure electric vehicles and hybrid electric vehicles with level-B voltage circuits after frontal, side, and rear crashes. This Standard is applicable to frontal crashes of M1 and N1 vehicles with a maximum design total mass of not more than 2500kg, as well as pure electric vehicles and hybrid vehicles with level-B voltage circuits in multi-purpose trucks. This Standard is applicable to side crashes and rear crashes of pure electric vehicles and hybrid vehicles with level-B voltage circuits in M1 and N1 vehicles. This Standard does not apply to fuel cell electric vehicles.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

GB 11551, The protection of the occupants in the event of a frontal crash for motor vehicle

GB 18384-2020, Electric vehicles safety requirements

GB/T 18385-2005, Electric vehicles - Power performance - Test method

GB/T 19596, Terminology of electric vehicles

GB 20071, The protection of the occupants in the event of a lateral crash

GB 20072, The requirements of fuel system safety in the event of rear-end crash for passenger car

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 19596 as well as the followings apply.

3.1 working voltage according to the manufacturer's instructions, in any normal working state, the effective value (rms) of the AC voltage or the maximum value of the DC voltage that may occur in the power system (not considering transient peaks)

3.2 passenger compartment the occupant's space enclosed by the roof, floor, side walls, doors, glass windows and front wall, rear wall or back seat back support plate, as well as electrical protection fences and shells that prevent occupants from contacting live parts [Source: GB/T 19596-2017, 3.1.2.2.5]

3.3 direct contact human or animal contact with live parts [Source: GB/T 19596-2017, 3.1.3.2.3]

3.4 indirect contact human or animal contact with exposed conductive parts that become live in the event of basic insulation failure [Source: GB/T 19596-2017, 3.1.3.2.4]

3.5 exposed conductive part the conductive part that can be touched by the joint test finger (IPXXB) NOTE. This concept is for a specific circuit. The live part in one circuit may be an exposed conductor in another circuit. For example, the body of a passenger car may be the live part in the auxiliary circuit, but it is an exposed conductor in the power circuit. [Source: GB/T 19596-2017, 3.1.2.3.4, with modification]

3.6 live part conductors or conductive parts that are energized during normal use [Source:

GB/T 19596-2017, 3.1.2.3.4]

3.7 electrical chassis a group of electrically connected conductive parts whose potential is used as the reference potential [Source: GB/T 19596-2017, 3.1.2.2.2]

3.8 fire the phenomenon of flame can continue to occur NOTE. A momentary spark or arc is not a fire.

3.9 explosion a phenomenon in which instantaneous pressure waves are generated due to the release of energy and can structurally or physically destroy surrounding objects

3.10 balance of electric power system disconnect all rechargeable energy storage systems (REESS) and the remaining B-level voltage circuits [Source: GB/T 19596-2017, 3.1.2.3.9, with modification]

4 Technical requirements

4.1 Basic requirements After completing the vehicle preparation and crash tests according to

5.1 and 5.2, the vehicle including REESS's power high-voltage system and the high-voltage components conductively connected to the power high-voltage system shall meet the requirements of 4.2~

4.4 at the same time.

4.2 Requirements for protection against electric shock

4.2.1 General requirements Each high-voltage bus bar shall meet at least one of the four clauses specified in 4.2.2~4.2.5. If the crash test is carried out with the REESS of the vehicle being artificially disconnected from the electrical system load, the electrical system load of the vehicle shall meet one of the two provisions specified in

4.2.4 or 4.2.5. REESS and the high-voltage bus for charging shall meet one of the four clauses specified in 4.2.2~4.2.5.

4.2.2 Voltage requirements According to the test method specified in A.1 of Annex A, the voltage U_b , U_1 and U_2 of the high-voltage bus shall not be greater than 30V AC or 60V DC.

4.2.3 Electricity requirements The total electric energy TE on the high-voltage bus should be less than 0.2J. TE can be obtained in one of two ways. One is to measure the total electric energy TE when the electric energy is measured according to the test procedure specified in formula (A.1). The other is to calculate the total energy TE according to the formula (A.2) through the voltage U_b of the high-voltage bus and the capacitance (C_x) of the X-capacitor specified by the manufacturer. The energy stored in the Y-capacitor (TE_{y1} , TE_{y2}) shall also be less than 0.2J. The value shall be calculated according to formula (A.3) and formula (A.4) by the voltages U_1 and U_2 of the high-voltage bus and the electric