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**General technical requirements for chassis-by-wire of low
speed automated vehicle**

低速线控底盘通用技术要求

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3 Terms and definitions

3.1 autonomous-service-vehicle: a special-purpose working vehicle fitted with a driving automation system and dedicated automatic control equipment, having no driving cab, used in specific scenarios such as delivery, transport, retail, patrolling and sweeping.

3.2 chassis-by-wire: a chassis with a certain load-carrying capacity, made up of a drive-by-wire system, a brake-by-wire system, a steer-by-wire system and other systems, controlled in the form of electrical signals and driven through a control device or a driving automation system. A note states that control devices include manual control devices and remote driving systems, the manual control device being a remote controller with locking and unlocking functions.

3.3 to 3.5 drive-by-wire system, brake-by-wire system and steer-by-wire system: systems that use by-wire techniques such as electronic circuits and communication transmission to receive commands from the driving automation system or the control device and to control, respectively, the driving, the braking and the steering of the low-speed chassis-by-wire.

3.6 response time: the difference between the moment at which the driving automation system or the control device issues a command and the moment at which the actuator begins to execute the command and the actual value begins to change.

3.7 maximum overshoot: the largest difference between the actual value and the target value while the drive-by-wire, brake-by-wire or steer-by-wire system carries out the corresponding action. 3.8 steady-state error: the difference between the desired target value and the actual steady-state output of those systems.

3.9 emergency stop device: a control device triggered manually or automatically that makes the chassis-by-wire stop immediately and stay at rest until it is reset.

3.10 event data recorder (EDR): a device or system made up of one or more modules that monitors, acquires and records vehicle data before, during and after events of various kinds. The source is given as GB 39732-2020, 3.2, modified.

3.11 to 3.15 the document also defines maximum driving speed, estimated maximum speed, no load, full load and over-the-air (OTA) upgrading. No load is the state in which no added structure is present apart from the equipment that has to be installed; full load is the total mass when other structures are added to the unladen chassis and it is filled with goods, the loaded total mass not exceeding the maximum permissible total mass of the chassis.

4 General requirements

4.1 The design and manufacture of the low-speed chassis-by-wire shall ensure safe operation, with no unreasonable hazard when it is operated and maintained normally according to the product instruction manual. Components shall comply with the corresponding national standards and be manufactured to drawings and technical documents approved through the prescribed procedure. At least one towing device meeting GB 32087 shall be fixed or installed at the front of the chassis.

4.2 The chassis shall have an emergency stop device or a drive interface for one, and the signal triggered by that device shall be storable in the EDR or uploadable to the vehicle platform. The device shall be installed in a conspicuous position that is easy to operate, shall take priority over the other control devices of the chassis, shall be of the ON/OFF type or of the self-resetting type, and shall be reset manually or automatically by remote control. The emergency stop output signal shall remain valid after the power of the chassis has been removed.

4.3 The chassis shall support the installation of a collision protection device; when an obstacle is struck it shall be able to brake in an emergency, with a trigger force of not more than 50 N. After manual confirmation, the emergency stop state shall be released manually or remotely. Throughout the collision, before and after, the related collision information shall be storable in the EDR or uploadable to the vehicle platform.

4.4 When a manual control device is used, the remote control distance shall be not more than 50 m; beyond 50 m the manual control device shall give an alarm signal. The response time from the issuing of a control command to the start of the corresponding operation by the chassis shall not exceed 100 ms; when control commands are lost the chassis shall stop immediately and hold a static park. When the chassis is in drivable mode and the remote controller has not been operated for more than 1 min, the remote controller shall be unlocked before the chassis can be operated normally again. When the chassis leaves the planned control range of the remote driving system, that system shall give an alarm signal and the chassis shall stop immediately and hold a static park.

4.5 Electrical parts that constitute a hazard shall have fixed guards and enclosures which, during normal operation or standstill, can be removed or opened only with a tool. For the class B voltage defined in GB 18384-2020, the waterproof rating required of components depends on the installation zone with the vehicle fully laden, and the protection degrees shall satisfy GB/T 4208: not lower than IPX3 for the battery and electrical compartment, not lower than IPX4 for high-voltage parts under the chassis that are shielded, and not lower than IPX7 for high-voltage parts under the chassis that are not shielded. Simulated washing and simulated wading tests shall be run according to 7.6, and after each test, with the chassis still wet, the insulation resistance shall be measured by the method of GB 18384-2020, 6.2.1 and shall meet 5.1.4.1 of that standard.

4.6 The chassis shall have interfaces for mounting lighting and light-signalling devices; key lamps shall have a self-check function and shall support the uploading of their switching state and command control. A note lists the key lamps as headlamps, direction indicators, stop lamps, reversing lamps and warning lamps. An interface for mounting an audible signalling device shall also be provided.

4.7 The instruction manual shall state the purpose and scope of application of the product and, according to its features and needs, give the main structure, performance, model, specification and the correct methods of lifting and transport, installation, use, operation, repair, maintenance and storage, together with the measures protecting the operator and the product. It shall give safety warnings on matters of safety, and shall cover safety and accident handling (protective devices and precautions, procedures and methods when a fault occurs, emergency measures for sudden events) and maintenance and repair (daily maintenance and calibration, maintenance during operation, inspection intervals, normal repair procedures and maintenance during long periods out of use).

4.8 The chassis shall carry warning texts and safety reminder signs complying with GB 24943. It shall carry a product nameplate reliably fixed in a visible position, whose content includes but is not limited to the identification number, manufacturer, country of manufacture, chassis mass, maximum permissible load, rated capacity of the traction battery and month and year of manufacture; the performance of the nameplate shall meet GB/T 25978. The chassis shall have a unique chassis identification number and unique serial numbers for the drive motor and the traction battery, whose content and composition shall satisfy GB 16735; the chassis identification number shall be stamped on a visible part of the outer side of the frame, and the recorded characteristic information shall not be permitted to be altered or to be read by tools obtainable on the market.

5 General technical requirements

5.1 The chassis shall pass over certain specific terrain as required by its design, such as vertical obstacles, horizontal trenches and wading pools. Under non-accelerating conditions, whether unladen or laden, it shall be tested by the method of 7.4 and shall be able to pass at constant speed over a speed hump 5 cm high and 30 cm wide.

5.2 Tested by the method of 7.2, the lateral deviation of the chassis shall be less than 2 m.

5.3 The chassis shall stay normal when used, transported and stored under the environmental conditions given in table 1; where it has to work in special environments, the environmental conditions are laid down separately by the user. Table 1 fixes ambient temperature, relative humidity and atmospheric pressure for operating and for storage conditions. The operating temperature range runs from minus 20 degrees Celsius to 55 degrees Celsius and the storage range from minus 25 degrees Celsius to 55 degrees Celsius; relative humidity in operation is not more than 50 % at 40 degrees Celsius and not more than 90 % at 20 degrees Celsius, and in storage not more than 95 % at 40 degrees