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Liquid crystal instrument for automobile

汽车用液晶仪表

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Liquid crystal instrument for automobile

1 Scope

This document specifies the term, definitions, requirements, test methods, inspection rules for liquid crystal instruments for automobiles.

This document is applicable to TFT liquid crystal instruments (including speedometer, odometer, tachometer, fuel gauge, thermometer, oil pressure gauge, voltmeter, ammeter, SOC meter, cruising mileage meter, urea level meter, barometer), which are used for Category M and N automobiles. Other display instruments 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 reference documents, only the version corresponding to the date applies to this document; for undated reference documents, the latest version (including all amendments) applies to this document.

GB/T 2423.17-2008 Environmental testing for electric and electronic products - Part 2: Test method - Test Ka: Salt mist

GB 4094 Motor vehicles - Symbols for controls, indicators and tell-tales

GB/T 4094.2-2017 Electric vehicles - Symbols for controls, indicators and tell-tales

GB/T 6739 Paints and varnishes - Determination of film hardness by pencil test

GB/T 16422.2-2014 Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc sources

GB/T 18910.61-2021 Liquid crystal display devices - Part 6-1: Measuring methods for liquid crystal display devices - Photoelectric parameter

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

GB/T 19951 Road vehicles - Disturbances test methods for electrical/electronic component from electrostatic discharge

GB/T 21437.2-2008 Road vehicles - Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only

GB/T 21437.3-2012 Road vehicles - Electrical disturbances from conduction and coupling - Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines

GB/T 28046.2-2019 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 2: Electrical loads

GB/T 28046.3-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 3: Mechanical loads

GB/T 28046.4-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Mechanical loads

GB/T 28046.5-2013 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 5: Chemical loads

GB/T 30038-2013 Road vehicles - Degrees of protection (IP-code) - Protection of electrical equipment against foreign objects, water and access

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

QC/T 550 Vehicle buzzer

QC/T 727 Instrument for automobile and motorcycle

SJ/T 11394 Measure methods of semiconductor light emitting diodes

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

Liquid crystal instrument for automobile

An instrument assembly consisting of at least one liquid crystal display, that comprehensively reflects vehicle conditions to the driver, through information display and alarms (including full liquid crystal instrument and combined liquid crystal instrument).

3.2

Full liquid crystal instrument

4.1.1 Transparent glass or transparent plastic parts shall not have bubbles, inclusions, ripples, spots, scratches, that affect the reading. The protective layer shall be uniform, without obvious defects such as bubbles, spots, rust, peeling off. The liquid crystal display shall not be cracked or deformed. All components fit together well, without looseness, falling off, visible foreign objects.

4.1.2 Division lines, pointers, numbers, characters, symbols shall be clear and complete, without refraction and reading distortion.

4.1.3 The lighting effect shall ensure that the division lines, pointers, numbers, text symbols of various instruments can be seen clearly; there shall be no glare from strong light.

4.1.4 When the signal indicator light is on, the various indication signals, symbols, patterns, colors on the instrument shall be clear and complete, without flashing. When the signal indicator is off, the signal state shall be clearly different from when it is on.

4.2 General provisions

4.2.1 Important information display

The vehicle speed information and alarm information, which are displayed on the liquid crystal instrument, shall remain clearly visible, while the vehicle is running. The alarm information such as brake system malfunction, direction signal, TPMS should be displayed outside the liquid crystal display.

4.2.2 Unit and division

4.2.2.1 Pointer display

The units and divisions of pointers (including virtual and physical pointers) display comply with the following requirements:

- Units and divisions for speedometer, odometer, engine tachometer, fuel gauge, temperature gauge, oil pressure gauge, voltmeter, ammeter shall meet the requirements of QC/T 727;

- The unit of the urea level gauge is expressed in %, which shall not be less than 3 divisions: 0-25%-50%-100%;

- The unit of the SOC display is expressed in %, which shall not be less than 4 divisions: 0-25%-50%-75%-100%;

- For the unit and division of the barometer (air cylinder pressure), refer to the pressure gauge of QC/T 727;

- For the unit and division of the motor tachometer, refer to the engine tachometer of QC/T 727.

4.2.2.2 Digital display meter

The unit and division of the digital display meter shall meet the following requirements:

- The unit of the cruising mileage meter is expressed in km; the division value is not greater than 10 km;

- The unit of the speedometer is expressed in km/h; the division value is not greater than 1 km/h (except that the speed is lower than 5 km/h);

- The unit of the urea level gauge is expressed in %; the division value is not greater than 5%;

- The unit of the fuel gauge is expressed in %; the division value is not greater than 5%;

- The unit of the engine and motor tachometer is expressed in r/min; the division value is not greater than 200 r/min;

- The unit of the voltmeter is represented by V; the division value of the fuel vehicle voltmeter is not more than 0.5 V; the division value of the electric vehicle voltmeter is not large than 1 V;

- The unit of the ammeter is expressed in A; the division value is not greater than 0.5 A;

- The unit of the SOC meter is expressed in %; the division value is not greater than 5%;

- The unit of the barometer is expressed in MPa; the division value is not greater than 0.1 MPa.

Note: Other display methods shall be determined, through negotiation between the supplier and the buyer.

4.2.3 Labels and indicators on the panel

The signal indication symbols, patterns and colors on the instrument panel shall comply with the provisions of GB 4094, GB/T 4094.2-2017. For other display symbols, see Appendix A. The alarm symbols, which are arranged on the LCD panel, should be equipped with text display at the same time.

4.2.4 Screen refresh rate (7-inch and above screens)

The minimum refresh rate of the screen is:

- Screen 25 Hz;

brightness to full black brightness) shall not be lower than 500:1.

4.12 Operating voltage range

The performance of the instrument, in the voltage range of (9 V ~ 16 V) or (16 V ~ 32 V), shall meet the requirements of 4.7, 4.8, 4.9, 4.11.

4.13 Temperature resistance

4.13.1 Resistance to low temperature storage

The meter is kept at -40 °C ambient temperature for 24 hours. After recovering at room temperature for 2 hours, the performance shall meet 4.7, 4.8, 4.9, 4.11.

4.13.2 Resistance to low temperature working

During the -30 °C low-temperature resistance test, the performance of the instrument shall meet the requirements of 4.7, 4.8, 4.9, 4.11.

4.13.3 Resistance to high temperature storage

The meter is kept at an ambient temperature of 85 °C for 48 hours. After recovering at room temperature for 2 hours, the performance shall meet the requirements of 4.8, 4.9, 4.11.

4.13.4 Resistance to high temperature working

During the high temperature resistance test of 80 °C and 96 h, the performance of the instrument shall meet the requirements of 4.8 and 4.9. After 96 hours of high temperature resistance test at 80 °C, recover it at room temperature for 2 hours; the reduction rate of brightness and contrast shall not exceed 25%.

4.13.5 Resistance to rapid temperature changes

The performance of the instrument shall meet the requirements of 4.7, 4.8, 4.9, after the instrument has undergone a rapid temperature change test at a low temperature of -40 °C and a high temperature of 85 °C, AND after recovering at room temperature for 2 hours. The reduction rate of brightness and contrast shall not exceed 25%.

4.14 Resistance to cyclic damp heat

After the instrument has passed the cyclic damp heat test, its performance shall meet the requirements of 4.7, 4.8, 4.9, 4.11.

4.15 Salt spray resistance

After 48 hours of salt spray test, the instrument shall meet the requirements of 4.8 and 4.9, after recovering at room temperature for 2 hours.

4.16 Vibration resistance

After the instrument is subjected to the vibration test, there shall be no damage to the appearance; the performance shall meet the requirements of 4.8 and 4.9.

4.17 Free fall performance

There shall be no hidden damage to the meter after the free fall test. The performance of the meter, which has no damage to the shell, shall meet the requirements of 4.8 and 4.9.

4.18 Protection performance

The front protection level of the instrument shall reach IP5K2.

4.19 Chemical resistance

The performance of the accessible parts on the front of the meter, after the chemical tests of beverages, glass water, cosmetics, alcohol, engine oil, shall meet the requirements of 4.8 and 4.9.

4.20 Electromagnetic compatibility performance

4.20.1 Conduction immunity

The instrument shall comply with the provisions of 4.8 and 4.9, when carrying out the conduction immunity test.

4.20.2 Radiation immunity

The instrument shall comply with the provisions of 4.8 and 4.9, when conducting the electromagnetic radiation immunity test. The severity level of the test shall be determined through negotiation between the supplier and the buyer.

4.20.3 Electrostatic discharge

The instrument shall comply with the provisions of 4.8 and 4.9, after the electrostatic discharge immunity test.

4.20.4 Electromagnetic disturbance

The instrument shall comply with the limit value requirements of the conducted and radiated immunity level 3 of components in GB/T 18655.

4.21 Resistance to abnormal voltage

4.21.1 Resistance to reverse voltage

The meter shall be subject to the reverse voltage test, for a duration of 60 s. After the

5.4 Test of sound alarm volume

Place the sound level meter, at a distance of 1 m from the instrument panel, at the relative height of the analog instrument and the driver's ear, to make measurement according to the provisions of QC/T 550.

5.5 Test of start-up time

Put the instrument into the -30 °C low temperature box for 2 hours. Connect the test voltage. Measure the time, from when the power supply of instrument is turned on to when the information can be displayed normally. If the test is carried out outside the low temperature box, it shall be completed within 5 minutes after the sample is taken out of the low temperature box.

5.6 Response time test

Put the instrument on the test bench. Connect the test voltage, to make the signal change step by step from the lower limit value to the upper limit value. Measure the time which is required for display changes.

5.7 Basic error test

Basic error test of speedometer, tachometer, fuel gauge, temperature gauge, oil pressure gauge, voltmeter, ammeter is carried out, according to the provisions of QC/T 727. The basic error test of urea level gauge and SOC gauge shall be carried out, in accordance with the provisions of fuel gauge in QC/T 727. The basic error test of the barometer is carried out, in accordance with the provisions of the pressure gauge in QC/T 727.

5.8 Static current test

Put the instrument on the test bench. Connect the test voltage. Make the instrument work normally. Then simulate the shutdown of the whole vehicle. Wait for the instrument to be completely sleep, before measuring the quiescent current of the instrument.

5.9 Optical performance test

5.9.1 Brightness and brightness uniformity

5.9.1.1 Brightness test

Put the meter on the test bench in the dark room. Connect the test voltage. Make the meter work normally. Adjust the brightness to the maximum. Measure the brightness of the central point vertically, by a luminance meter at a distance of 500 mm.

5.9.1.2 Brightness uniformity test

According to the method in 5.9.1.1, use a luminance meter to measure the luminance

The test shall be carried out, in accordance with the provisions in 4.2 of GB/T 28046.2-2019.

5.13 Temperature resistance test

5.13.1 Test of resistance to low temperature storage

The test shall be carried out, according to the provisions in 5.1.1.1.2 of GB/T 28046.4-2011.

5.13.2 Test of resistance to low temperature working

The test shall be carried out, according to the provisions in 5.1.1.2.2 of GB/T 28046.4-2011. If the performance test is carried out outside the low-temperature box, it shall be completed within 5 minutes after the sample is taken out of the low temperature box.

5.13.3 Test of resistance to high temperature storage

The test shall be carried out, according to the provisions in 5.1.2.1.2 of GB/T 28046.4-2011.

5.13.4 Test of resistance to high temperature working

The test shall be carried out, according to the provisions in 5.1.2.2.2 of GB/T 28046.4-2011. If the performance test is carried out outside the high temperature box, it shall be completed within 5 minutes after the sample is taken out of the high temperature box.

5.13.5 Test of resistance to rapid temperature change

100 rapid temperature change cycle tests shall be carried out, according to the provisions in 5.3.2 of GB/T 28046.4-2011. It shall be kept at low temperature and high temperature in each cycle for 30 min.

5.14 Test of resistance to cyclic damp heat

It shall, according to the provisions of 5.6.2.3 in GB/T 28046.4-2011, carry out 10 cycles of temperature/humidity combined cycle test, within -10 °C ~ 65 °C.

5.15 Test of resistance to salt spray performance

The test shall be carried out, according to the method specified in GB/T 2423.17-2008. During the test, the instrument is installed in the text box, according to the normal test position, for a duration of 48 h.

5.16 Vibration resistance test

Fix the instrument to simulate the installation method of the real vehicle. The passenger car shall be subjected to the test, according to the provisions of 4.1.2.4.2 in GB/T

accompanied with the product quality certificate and mark.

6.2 Exit-factory inspection

The exit-factory inspection items include instrument appearance, general requirements, dimensions, basic performance (4.8, 4.9).

6.3 Type inspection

6.3.1 Situations where type inspection shall be carried out

In case of any of the following situations, the type test shall be carried out on the instrument:

a) Type finalization and identification of trial production of new products;

b) After the official production, if the structure, material, process have changed greatly, which affect the performance of the instrument;

c) For instruments produced in batches or in large quantities, not less than once every 2 years;

d) When the production of the instrument is restored after suspension for more than 1 year;

e) When the exit-factory inspection results are significantly different from the last type inspection results;

f) When the national quality supervision agency proposes to carry out type inspection.

Note: The electromagnetic immunity test is only applicable to a) and b) (when the circuit is changed).

6.3.2 Sampling and grouping

The samples for type inspection shall be taken from the same batch of samples, that passed the exit-factory inspection; the number shall not be less than 15. The samples shall be re-inspected according to the exit-factory inspection items. After passing the re-inspection, divide the samples into 6 groups for test. The quantity of each group of samples and the corresponding test items are as follows:

- Group 1 (3 pieces): Start-up time test, protection test, temperature resistance test, cyclic damp heat test, salt spray test;

- Group 2 (3 pieces): Static current test, working voltage range test, abnormal voltage resistance test, insulation withstanding voltage test, chemical resistance test, vibration test;

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