Original Research Article

# Research on the Verification of Data and Results in the Software Confirmation of Motor Vehicle Inspection and Testing Institutions

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***Abstract:*** How to confirm the applicability of software according to the standard requirements is a technical work that troubles the inspection and testing institutions of motor vehicles. There are many software confirmation contents. In this paper, braking inspection and loading deceleration method are used as examples to verify the results from the process data to ensure that consistency with the requirements of relevant standards plays a crucial role in the accuracy of the inspection results.

***Keywords:*** Vehicle inspection and testing; Software validation; Process data; Verification.

## 1. Introduction

Motor vehicle inspection and testing is an important means to eliminate vehicle safety hazards, urge and strengthen the maintenance of motor vehicles, and reduce traffic accidents and exhaust emissions. Motor vehicle inspection and testing includes two parts: safety technical inspection and exhaust emission inspection.

In addition to the corresponding professional technical and managerial personnel, instruments and equipment, the motor vehicle inspection and testing institutions shall also be equipped with corresponding inspection and testing software. In accordance with the requirements of the General Requirements for the Evaluation of the Qualification Ability of Inspection and Testing Institutions (RB/T214) and the requirements for the Evaluation of the Qualification ability of Inspection and Testing Institutions for Motor Vehicle Inspection Institutions (RB/T218), the software shall confirm its applicability before use and keep confirmation records.

The software of motor vehicle inspection and testing institutions is mainly confirmed from two aspects: first, the form of the confirmation, the confirmation is based on the inspection method and inspection and testing standards, technical specifications, etc.; Second, the verification of data is to verify the results and conclusions formed in the data, curves and inspection reports and records in the process of vehicle detection.

The confirmation is mainly based on the evaluation of the qualification recognition ability of inspection and testing institutions General Requirements for inspection and testing Institutions (RB/T214), Motor Vehicle Safety Technical Inspection Items and Methods (GB38900), Pollutant emission limits and measurement methods for gasoline vehicles (double idle method and simple mode method) (GB18285), Pollutant emission limits and measurement methods for diesel vehicles (free acceleration method and loading deceleration method) (GB3) 847). Clause 4.5.20 of RB/T214 stipulates at least the information contained in the inspection and testing report, and we need to check it one by one in the confirmation to ensure that the inspection and testing report issued by our inspection and testing institution covers the information in clause 4.5.20 of RB/T214; Appendix G and Appendix I of GB38900 stipulate the form filling instructions for the motor vehicle safety technical inspection and testing report, and confirm whether the motor vehicle safety technical inspection report and record issued by the inspection and testing institution fully meet the requirements of the relevant appendix; Appendix G of GB18285 and Appendix F of GB3847 stipulate the relevant requirements of motor vehicle emission inspection, and it is necessary to confirm whether the motor vehicle emission inspection report issued by the inspection and testing institution fully complies with the requirements of the relevant appendix; The following take the braking test project of motor vehicle safety technical inspection and the diesel vehicle loading deceleration method test in emission inspection as examples to focus on how to start from the process data to verify the data and results in the result report.

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## 2. Verification of Brake Test Process Data and Results

The most comprehensive process data involved in the braking inspection is the service braking project, which only verifies the process and results of service braking with examples. The motor vehicle safety technical inspection report only contains the results and evaluation of service braking, and the data comes from the motor vehicle safety technical inspection table (instrument and equipment part), as shown in Table 1.

**Table 1** Motor Vehicle Safety Technical Inspection List (Instrument and Equipment part excerpt).

| 2. Inspection results | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Desktop testing project | | | Empty/ loaded axle load (kg) | Maximum driving braking force under no load/load (10N) | | Maximum difference point between no-load/loading process (10N) | | Empty/ loaded driving brake rate (%) | Unbalance rate of no-load/loading (%) | Empty parking brake force (10N) | Empty parking brake rate (%) | Project determination | Single item count |
| | | | | Left | Right | Left | Right | | | | | | |
| B Braking | Empty braking | 1-axis | 4499 | 1365 | 1288 | 1065 | 1226 | 60.2 | 11.8 | — | | o | 1 |
| | | 2-axis | 3790 | 1495 | 1819 | 1066 | 1184 | 89.2 | 6.5 | — | | o | 1 |
| | | 3-axis | 3793 | 1184 | 1252 | 1184 | 1156 | 65.5 | 2.2 | 2268 | | o | 1 |
| | | 4-axis | 3869 | 930 | 1215 | 915 | 1200 | 56.6 | 8.0 | 2501 | | o | 1 |
| | | 5-axis | — | — | — | — | — | — | — | — | | — | — |
| | Loading brake | 2-axis | 4694 | 1550 | 1943 | 502 | 560 | 75.9 | 3.0 | — | | o | 1 |
| | | 3-axis | 4734 | 1645 | 1567 | 1532 | 1467 | 69.2 | 4.0 | — | | o | 1 |
| | | 4-axis | — | — | — | — | — | — | — | — | | — | — |
| | Whole vehicle | | 14638 | 10548 | | | | 73.5 | | | | o | 1 |
| | Parking | | 14638 | | | | | | | 4769 | 33.2 | o | 1 |
| Static wheel load (left/right) (kg) | | | | 1-axis 2001/2012 | | 2-axis 1789/1805 | | 3-axis 1705/1687 | | 4-axis 1807/1832 | | 5-axis —/— | |

## 2.1 Considering that the value of service brake is the same on all axes, one axle brake is selected for verification. The verification process is as follows:

### 2.1.1 The data in the inspection record table of the instrument and equipment with an intercept axis are shown in Table 2

**Table 2** One axis instrument inspection record sheet.

| 2. Inspection results | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Desktop testing project | | | Empty/ loaded axle load (kg) | Maximum driving braking force under no load/load (10N) | | Maximum difference point between no-load/loading process (10N) | | Empty/ loaded driving brake rate (%) | Unbalance rate of no-load/loading (%) | Empty parking brake force (10N) | Empty parking brake rate (%) | Project determination | Single item count |
| | | | | Left | Right | Left | Right | | | | | | |
| B Braking | Empty braking | 1-axis | 4499 | 1365 | 1288 | 1065 | 1226 | 60.2 | 11.8 | — | | o | 1 |

### 2.1.2 Some effective process data points during the one-axle braking test of the vehicle were intercepted, as shown in Table 3

**Table 3** A partial valid process data sheet for one axle brake inspection.

| Data interception of braking force process Unit: 10N | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1-axis | Left | 963 | 1065 | 1065 | 1210 | 1300 | 1365 | 1310 | 1209 | 1006 | 981 | 780 |
| | Right | 943 | 1010 | 1226 | 1269 | 1288 | 1200 | 1108 | 1029 | 980 | 708 | 560 |

### 2.1.3 Verification procedure

(1) According to the provisions of GB38900 Appendix D.1.5.1b), the value of the left and right wheels participating in the calculation of service braking rate should be the maximum braking force of the left and right wheels of the axle, so the value of the left wheel of "no-load/load maximum braking force" should be the maximum braking force of the left wheel in the process data, and the maximum braking force of the left wheel is 1365 (10N) as shown in Table 1.1.2. It is consistent with the printed data of the left wheel of "no load/load maximum service braking force" in the instrument and equipment inspection table, and the value is correct. Similarly, the verification data of the right wheel of "no-load/load maximum service braking force" is 1288 (10N).

(2) When verifying the "maximum difference point of no-load/loading process difference (10N)", we are based on the terms of GB38900 Appendix D.1.5.1c. Since we can see from the process data that both the left and right wheels of one axis have locked slip, the value end point is when the coaxial left and right wheels have locked slip, according to the provisions of the terms. That is, 1288 (10N) of the right wheel is the first point to produce deadlock slip, which is the fifth point. Then, the value of "maximum difference point of no-load/loading process difference" must be taken from the first point to the fourth point, and the difference of the round around the first point 20 (10N), the second point difference 55 (10N), and the third point difference 161 (10N) are calculated in turn. The fourth point difference 59 (10N), in accordance with the provisions of GB38900 Appendix D.1.5.1c), take the maximum braking force difference of the left and right wheels at the same time measured in the growth process (that is, the first point to the fourth point) as "no load/loading process difference maximum difference point (10N)", then it is the third point, the left wheel 1065 (10N), Right wheel 1226 (10N), consistent with the printed data in the inspection record table of the instrument and equipment part.

After the above verification process, the data printed in the inspection record of service brake axle is consistent with the process data in the adoption process, and the verification result is consistent.

## 2.2 Verify whether the printed data of service brake rate, service brake unbalance rate, parking brake rate and vehicle brake rate in the inspection record of the instrument and equipment are consistent with the results calculated by the calculation process specified in GB38900 standard.

(1) According to the provisions of GB38900 Appendix D.1.5.1b), the braking rate of the service brake shaft is the percentage of the sum of the maximum braking force of the left and right wheels of "no-load/loading maximum braking force (10N)" and the static axle load of the shaft (according to GB38900 Appendix D.1.5.1 Note 1, the vehicle is a four-axle truck, and the static axle load is taken of the no-load axle load). Service braking rates of no-load one axis, two axes, three axes, four axes and load two axes and three axes are calculated in sequence as follows:

No-load axis: $\left\{(1365+1288)/[4499\times 0.98]\right\}\times 100\%\approx 60.2\%$ (where 0.98 is the conversion factor of 1kg=9.8N, the following formulas for calculating braking rate all use the same algorithm)

No-load two-axis: $\left\{(1495+1819)/[3790\times 0.98]\right\}\times 100\%\approx 89.2\%$

No-load three-axis: $\left\{(1184+1252)/[3793\times 0.98]\right\}\times 100\%\approx 65.5\%$

No-load four-axis: $\left\{(930+1215)/[3869\times 0.98]\right\}\times 100\%\approx 56.6\%$

Load two axes: $\left\{(1550+1943)/[4694\times 0.98]\right\}\times 100\%\approx 75.9\%$

Load three axes: $\left\{(1645+1567)/[4734\times 0.98]\right\}\times 100\%\approx 69.2\%$

The data calculated by the above service brake rate is consistent with the data printed in the inspection table of the instrument and equipment.

(2) According to the provisions of GB38900 Appendix D.1.5.1c, the braking unbalance rate of the axle is

the maximum difference between the left and right wheel braking force at the same time divided by the maximum value of the left and right wheel braking force (considering that there are special circumstances when calculating the unbalance rate of the rear axle of the vehicle, when the service braking rate of the rear axle is less than 60.0%, The maximum braking force difference of the left and right wheels divided by the static axle load of the axle, the vehicle is a four-axle truck, and the static axle load is taken as the no-load axle load).

The service brake unbalance rates of no-load one axis, two axes, three axes, four axes and loaded two axes and three axes are calculated in sequence as (unit: 10N) :

No-load axis: $\left[(1226-1065)/1365\right]\times 100\% \approx 11.8\%$

No-load two-axis: $\left[(1184-1066)/1819\right]\times 100\% \approx 6.5\%$

No-load three-axis: $\left[(1184-1156)/1252\right]\times 100\% \approx 2.2\%$

No-load four-axis: $\left[(1215-930)/(3869\times 0.98)\right]\times 100\% \approx 7.5\%$

(The axle is the rear axle, and the service braking rate is less than 60%, so the denominator should be the no-load axle load of the axle). The braking unbalance rate calculated by the axle is 7.5%, which is inconsistent with the braking unbalance rate of 8.0% printed out in the inspection table of the instrument and equipment. We will verify again whether the denominator is mistaken as the static axle load of the axle in the software. $\left\{(1215-930)/\left[(1807+1832)\times 0.98\right]\right\}\times 100\% \approx 8.0\%$, after verification, the software did not take the static axle load of the vehicle as the no-load axle load in accordance with the GB38900 Appendix D.1.5.1c) clause note 1, resulting in a deviation between the calculated data and the calculation formula specified in the standard.

Load two axes: $\left[(560-502)/1943\right]\times 100\% \approx 3.0\%$

Load three axes: $\left[(1532-1467)/1645\right]\times 100\% \approx 4.0\%$

To sum up, the checking calculation of the braking unbalance rate of the vehicle is consistent except that the four-axle no-load is inconsistent. Then, let's analyze again the reasons for the non-conformity of the four-axle no-load verification problem, which is mainly caused by the wrong denominator selection in the calculation of the rear axle of the vehicle, which can only occur under specific circumstances (when the rear axle braking rate is less than 60%). Therefore, we should try our best to cover all cases stipulated in the standard when making software confirmation. Otherwise, some special cases may cause software calculation errors that cannot be discovered.

(3) For the checking and calculation of vehicle braking rate and parking braking rate, first of all, we must make it clear that the formula for calculating vehicle braking rate is the sum of braking force of each wheel and the sum of static axle load of each axle of the vehicle as stipulated in GB38900 Appendix D.1.5.1d). According to Appendix D.1.5.1e), the formula for calculating the parking brake rate is the percentage of the sum of braking force of all wheels and the sum of static axle load of all axles of the vehicle. Then our verification process is divided into the following two steps:

Step 1: The sum of braking force of all wheels of the vehicle is calculated as (1365+1288) + (1184+1252) + (930+1215) + (930+1215) =10548 (10N), which is consistent with the no-load braking force of the vehicle printed in the inspection table, and the sum of braking force of all wheels of the parking is 2268+2501=4769 (10N). Consistent with the parking no-load braking force printed in the inspection list; The sum of the static axle load of each axle of the vehicle is calculated as (2001+2012) + (1789+1805) + (1705+1687) + (1807+1832) =14638 (kg), which is consistent with the printed data at the unloaded axle load of the vehicle and parking in the inspection table.

**Step 2:** Train calculation vehicle braking rate $\left[15048/(14638\times 0.98)\right]\times 100\% \approx 73.5\%$

Calculated parking brake rate of train $\left[4769/(14638\times 0.98)\right]\times 100\% \approx 33.2\%$

It is consistent with the printed data of the vehicle brake rate and the printed data of the parking brake rate in the inspection table.

# 3. Test Procedure of Loading Deceleration Method and Verification of Process Data and Results

## 3.1 First, after the vehicle is tested by the loading deceleration method, the detection data and results will be printed out in the form of a report template, and the printed report is shown in Table 4

**Table 4** Test report of loading deceleration method (Excerpt).

<table>
<tr><th colspan="9">Content of inspection results</th></tr>
<tr><td rowspan="13">Exhaust pollutant testing</td><th colspan="8">Free acceleration</th></tr>
<tr><td rowspan="2">Rated speed (r/min)</td><td rowspan="2" colspan="2">Actual measured speed (r/min)</td><td colspan="3">The last three smoke measurement values</td><td>Average value (m-1)</td><td>Limit value (m-1)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="2"></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="8">Loading speed</td></tr>
<tr><td colspan="3">speed</td><td colspan="5">Maximum wheel edge power</td></tr>
<tr><td>Rated speed</td><td colspan="2">Actual measurement (correction) VelMaxHP</td><td colspan="3">Actual measured kW</td><td colspan="2">Limit kW</td></tr>
<tr><td>2200</td><td colspan="2">67.7</td><td colspan="3">94.5</td><td colspan="2">80</td></tr>
<tr><td colspan="3">Smoke intensity</td><td colspan="5">Nitrogen oxide $NO_X$</td></tr>
<tr><td></td><td>100%</td><td>80%</td><td colspan="3"></td><td colspan="2">80%</td></tr>
<tr><td>Actual measured value</td><td>0.82</td><td>0.84</td><td colspan="3">Actual measured value</td><td colspan="2">653</td></tr>
<tr><td>Limit value</td><td><1.2</td><td><1.2</td><td colspan="3">Limit value</td><td colspan="2"><1500</td></tr>
</table>

## 3.2 The data interception points of vehicle loading deceleration process corresponding to the above inspection reports are shown in Table 5

## 3.3 Process verification

### 3.3.1 The power scan phase (point 1 to point 13 of the process data) verifies the following

(1) According to GB3847 B.4.2.16, in the power scanning stage, the $CO_2$ concentration in the exhaust gas is higher than 2% (including the subsequent test process), the test result is valid.

(2) According to GB3847 B.4.3.1, the real VelMaxHP corresponds to the third point at the power scanning point, the maximum power scanned is 98.4kW, and the corresponding drum line speed VelMaxHP=67.7km/h. Consistent with report print data.

(3) According to GB3847 B.4.3.2, after obtaining the real VelMaxHP, the power scanning shall continue until the drum line speed (vehicle speed) is more than 20% lower than the real VelMaxHP. We observe the process data, and at the 13th point of the end of the power scanning, the corresponding drum line speed (vehicle speed) is 53.1km/h. It is 21.6% lower than the real VelMaxHP 67.7km/h, which meets the requirements of the national standard.

(4) According to GB3847 B.4.2.11, the speed change rate of the relay drum line during the power scanning process shall not exceed $\pm 2km/h$ per second, and the speed value observed from the first to the 13th point of the process data is more than $\pm 2km/h$ per second.

(5) In the process of power scanning, the oil temperature exceeds 80℃ to determine the hot car state, which meets the provisions of GB3847 B.2.3.1.4; During the whole power scanning process, the changes of speed and torque loading were not abnormal.

In summary, the process of the power scanning phase of the vehicle in the loading deceleration detection meets the relevant requirements of the standard GB3847.

**Table 5** Load deceleration process data.

| Number | Vehicle speed (km/h) | speed (r/min) | $CO_2$ Measurement value ($10^{-2}$) | $NO_X$ Measurement values ($10^{-6}$) | Light absorption coefficient ($m^{-1}$) | Indicating power (kW) | Oil temperature (℃) | Torque (N) | Temperature (℃) | Humidity (%) | Atmospheric pressure (Pa) | Detection status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 70.4 | 1980 | 4.95 | 102 | 0.10 | 91.5 | 91.2 | 8120 | 20.1 | 65 | 101.2 | Power scanning |
| 2 | 68.9 | 1943 | 5.00 | 116 | 0.10 | 93.2 | 91.6 | 8189 | 20.1 | 65 | 101.2 | Power scanning |
| 3 | 67.7 | 1900 | 5.30 | 138 | 0.10 | 98.4 | 92.2 | 8210 | 20.1 | 65 | 101.2 | Power scanning |
| 4 | 66.1 | 1843 | 5.18 | 131 | 0.10 | 98.1 | 92.2 | 8213 | 20.1 | 65 | 101.2 | Power scanning |
| 5 | 64.5 | 1820 | 5.13 | 126 | 0.10 | 97.3 | 92.3 | 8220 | 20.1 | 65 | 101.2 | Power scanning |
| 6 | 62.9 | 1801 | 5.10 | 116 | 0.10 | 95.3 | 92.4 | 8220 | 20.1 | 65 | 101.2 | Power scanning |
| 7 | 61.0 | 1759 | 5.15 | 120 | 0.10 | 97.4 | 93.4 | 8245 | 20.1 | 65 | 101.2 | Power scanning |
| 8 | 59.6 | 1724 | 5.08 | 112 | 0.10 | 95.2 | 93.5 | 8256 | 20.1 | 65 | 101.2 | Power scanning |
| 9 | 57.9 | 1702 | 4.98 | 109 | 0.10 | 92.8 | 93.6 | 8278 | 20.1 | 65 | 101.2 | Power scanning |
| 10 | 56.1 | 1654 | 4.95 | 101 | 0.10 | 92.1 | 93.6 | 8290 | 20.1 | 65 | 101.2 | Power scanning |
| 11 | 55.3 | 1639 | 4.89 | 101 | 0.10 | 90.2 | 94.2 | 8300 | 20.1 | 65 | 101.2 | Power scanning |
| 12 | 54.0 | 1598 | 4.90 | 105 | 0.10 | 91.8 | 94.2 | 8320 | 20.1 | 65 | 101.2 | Power scanning |
| 13 | 53.1 | 1550 | 4.92 | 104 | 0.10 | 92.0 | 94.2 | 8333 | 20.1 | 65 | 101.2 | Power scanning |
| 14 | 54.9 | 1589 | 5.00 | 123 | 0.18 | 94.7 | 95.3 | 8320 | 20.1 | 65 | 101.2 | Restore 100% velMaxH |
| 15 | 56.5 | 1603 | 5.04 | 145 | 0.23 | 95.0 | 95.3 | 8310 | 20.1 | 65 | 101.2 | Restore 100% velMaxH |
| 16 | 58.1 | 1680 | 5.10 | 187 | 0.23 | 93.8 | 95.3 | 8289 | 20.2 | 65 | 101.2 | Restore 100% velMaxH |
| 17 | 59.7 | 1720 | 5.06 | 197 | 0.39 | 94.5 | 95.3 | 8280 | 20.2 | 65 | 101.2 | Restore 100% velMaxH |
| 18 | 61.2 | 1750 | 5.08 | 199 | 0.40 | 95.1 | 95.3 | 8276 | 20.2 | 65 | 101.2 | Restore 100% velMaxH |
| 19 | 62.8 | 1798 | 5.02 | 204 | 0.40 | 94.6 | 95.3 | 8265 | 20.2 | 65 | 101.2 | Restore 100% velMaxH |
| 20 | 64.1 | 1842 | 4.95 | 206 | 0.47 | 94.9 | 95.3 | 8255 | 20.2 | 65 | 101.2 | Restore 100% velMaxH |
| 21 | 65.9 | 1858 | 4.89 | 230 | 0.47 | 93.9 | 95.3 | 8243 | 20.2 | 65 | 101.2 | Restore 100% velMaxH |
| 22 | 67.6 | 1895 | 5.01 | 241 | 0.47 | 94.3 | 95.3 | 8235 | 20.1 | 65 | 101.2 | Restore 100% velMaxH |
| 23 | 67.6 | 1890 | 5.05 | 254 | 0.54 | 94.8 | 95.3 | 8236 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 24 | 67.7 | 1892 | 4.98 | 287 | 0.54 | 93.8 | 95.4 | 8234 | 20.2 | 65 | 101.2 | 100% velMaxHP stable |
| 25 | 67.5 | 1894 | 5.04 | 280 | 0.68 | 94.3 | 95.4 | 8235 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 26 | 67.5 | 1895 | 5.01 | 298 | 0.78 | 95.0 | 95.4 | 8231 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 27 | 67.4 | 1896 | 5.09 | 316 | 0.81 | 93.9 | 95.4 | 8229 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 28 | 67.5 | 1889 | 5.10 | 353 | 0.80 | 94.0 | 95.4 | 8234 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 29 | 67.3 | 1900 | 5.12 | 387 | 0.80 | 94.3 | 95.4 | 8231 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 30 | 67.4 | 1895 | 5.07 | 398 | 0.83 | 94.2 | 96.0 | 8227 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 31 | 67.2 | 1895 | 5.07 | 429 | 0.82 | 94.7 | 96.0 | 8228 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 32 | 67.2 | 1890 | 5.10 | 476 | 0.85 | 94.8 | 96.0 | 8231 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 33 | 67.1 | 1894 | 4.95 | 480 | 0.85 | 94.8 | 96.0 | 8234 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 34 | 67.3 | 1893 | 4.96 | 498 | 0.85 | 95.0 | 96.0 | 8229 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 35 | 66.5 | 1885 | 5.01 | 530 | 0.86 | 95.3 | 96.0 | 8269 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 36 | 65.2 | 1826 | 5.02 | 569 | 0.83 | 95.2 | 96.0 | 8300 | 20.3 | 65 | 101.2 | 100% velMaxHP stable |
| 37 | 63.8 | 1785 | 5.08 | 598 | 0.84 | 94.2 | 96.0 | 8278 | 20.3 | 65 | 101.2 | 100% velMaxHP stable |
| 38 | 62.1 | 1740 | 5.03 | 609 | 0.88 | 94.1 | 96.0 | 8429 | 20.3 | 65 | 101.2 | 100% velMaxHP stable |
| 39 | 61.0 | 1704 | 5.02 | 649 | 0.85 | 93.7 | 96.0 | 8486 | 20.3 | 65 | 101.2 | 100% velMaxHP stable |
| 40 | 59.8 | 1630 | 5.02 | 659 | 0.84 | 93.8 | 96.0 | 8508 | 20.3 | 65 | 101.2 | 100% velMaxHP stable |
| 41 | 58.5 | 1602 | 5.06 | 657 | 0.84 | 95.1 | 96.0 | 8568 | 20.3 | 65 | 101.2 | 100% velMaxHP stable |
| 42 | 57.3 | 1583 | 5.01 | 654 | 0.87 | 94.6 | 96.3 | 8611 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 43 | 55.9 | 1565 | 5.06 | 659 | 0.89 | 94.7 | 96.3 | 8650 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 44 | 54.1 | 1550 | 5.02 | 651 | 0.83 | 94.5 | 96.3 | 8678 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 45 | 54.0 | 1548 | 5.02 | 654 | 0.82 | 94.3 | 96.3 | 8680 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 46 | 53.8 | 1540 | 5.12 | 658 | 0.85 | 94.6 | 96.3 | 8678 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 47 | 53.9 | 1539 | 5.08 | 659 | 0.86 | 94.2 | 96.3 | 8679 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 48 | 53.6 | 1535 | 5.07 | 649 | 0.83 | 94.6 | 96.3 | 8675 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 49 | 53.7 | 1530 | 5.02 | 654 | 0.82 | 94.8 | 96.3 | 8675 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 50 | 53.5 | 1540 | 5.02 | 658 | 0.82 | 93.9 | 96.3 | 8672 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 51 | 53.5 | 1538 | 5.07 | 653 | 0.85 | 94.2 | 96.3 | 8676 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 52 | 53.2 | 1540 | 5.02 | 658 | 0.83 | 94.6 | 96.3 | 8668 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 53 | 53.2 | 1532 | 5.08 | 651 | 0.85 | 95.0 | 96.3 | 8676 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 54 | 53.6 | 1533 | 5.03 | 658 | 0.86 | 94.6 | 96.3 | 8671 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 55 | 53.5 | 1538 | 5.08 | 645 | 0.86 | 94.7 | 96.3 | 8671 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |
| 56 | 54.5 | 1540 | 5.09 | 650 | 0.87 | 93.9 | 96.3 | 8670 | 20.1 | 65 | 101.2 | 100% velMaxHP stable |

#### 3.3.2 Recovery to 100%VelMaxHP point and validation of the point sampling phase process

(1) Data in each process is normal during restoration.

(2) The second-by-second change rate of the drum linear speed during the sampling stage is in compliance with the requirements of GB3847 B.4.2.10. The linear speed of the strands at 9 points during the entire sampling process is less than VelMaxHP (67.6km/h). The second-by-second change rate is not More than $\pm 1.0 km/h$.

(3) During the process, the oil temperature exceeds 80℃ to determine the hot car state, meeting the provisions of GB3847 B.2.3.1.4, the speed changes and torque loading changes in the whole process are not abnormal, and the $CO_2$ concentration is greater than 2%.

#### 3.3.3 During the transition from 100% VelMaxHP to 80%VelMaxHP, the change rate of the second-to-second conversion line speed (vehicle speed) is less than $\pm 2km/h$, meeting the requirements of GB3847 B.4.3.3; The increase of torque, the change of engine speed and the change rate of vehicle speed during the transition process accord with the characteristics of the vehicle using this test method.

#### 3.3.4 The 80% VelMaxHP sampling process verifies no anomalies in the same way as 100% points.

### 3.4 Validation of process data and result data

The verification of process data and result data is based on GB3847 B.4.3.5. Except for the real VelMaxHP, the data printed in the other report forms are subject to this clause. Considering that the corrected data will be basically given in the process data, we will not verify the data before the correction. The checking process is as follows:

100% VelMaxHP Smoke point value (light absorption coefficient K, unit: $m^{-1}$) :

$$(0.78+0.81+0.80+0.80+0.83+0.82+0.85+0.85+0.85)/9 \approx 0.82$$

100% VelMaxHP point measured maximum wheel power (unit: kW)

$$(95.0+93.9+94.0+94.3+94.2+94.7+94.8+94.8+95.0)/9 \approx 94.5$$

80% VelMaxHP Smoke point value (light absorption coefficient K, unit: $m^{-1}$) :

$$(0.83+0.82+0.82+0.85+0.83+0.85+0.86+0.86+0.87)/9 \approx 0.84$$

80% VelMaxHP point NOx (unit: $10^{-6}$) Value:

$$(649+654+658+653+658+651+658+645+650)/9 \approx 653$$

Based on the inspection report of the vehicle and the verification and calculation of all aspects of the process data, the conformity is verified.

## 4. Conclusion

The above on the confirmation of the software for some simple analysis and verification, because of the differences in the understanding of the standards and technical specifications clauses often cause software development and design units or software installation and debugging process software does not meet the standard technical specifications of the situation, so the motor vehicle inspection and testing agencies to confirm the software is still very necessary.

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