

B 3 Testing engine output and exhaust emissions

Preceding work:testing, adjusting engine (07-1100)

Operation no. of operation texts or standard units and flat rates:_07-1203 or 07-1206

- 1 Automatic transmission fluid level
- 2 Front wheels
- 3 Pressure of rear tires
- 4 Contents of trunk
- 5 Vehicles with ESP/ASR/ETS/ABS


check; pay attention to condition of fluid (visual inspection).
 secure; place wheel chocks 100 mm ahead of front wheels.
 check; adjust to specified pressure.
 check; remove heavy objects or objects sensitive to heat.
 A. Vehicles with CFI injection system (8- or 16-pin data link connector):
 Unplug connector at ABS/ASR control module and connector at pressurizing pump. Models with 4MATIC: switch over service valve.
 B. Vehicles with LH-SFI/HFM-SFI/PEC injection system (16- or 38-pin data link connector):
 Ignition: **OFF**, connect contact 5 or 6 (see table diagnostic socket, chapter C21/l..) to contact 1 (GND) at data link connector (X11/4). Use adapter. ABS/ASR light comes on when driving. Ignition must be **OFF** before disconnecting.
 C. Vehicles with ME injection system
 a) Working **without** Hand-Held Tester (HHT):
 Ignition **Off**, connect contact 6 to contact 1 (GND) at data link connector (X11/4). Use adapter. ESP/ASR/ETS/ABS warning lamp comes on when driving. On the multifunction display the text "slip, ASR, control" appears in the display. Before disconnecting, it is absolutely essential to switch the ignition: **OFF**.
 b) Working **with** Hand-Held Tester (HHT):
 Ignition: **OFF**, disconnect ABS/ASR hydraulic unit coupling in wheel house. ESP/ASR/ETS/ABS malfunction indicator lamp illuminated. On the multifunction display the text "slip, ASR, control" appears in the display.
 After testing, connect the connector and erase fault memory.

1) CFI, LH-SFI injection system only
 80°C = 325 Ω (fixed resistors as special tool in preparation).
 20°C = 2:5 kΩ.

B 3 Testing engine output and exhaust emissions

- 6 Engine coolant temperature
- 6.1 Engine oil temperature
- 7 Components
- 8 Engine
- 9 Inertia fuel shut-off
- 10 Secondary ignition system (except HFM-SFI/MFI/PEC/ME-SFI)
- 10.1 Ignition angle under load (except HFM-SFI/MFI/PEC/ME-SFI)
- 10.2 Oscilloscope image under load (except HFM-SFI/MFI/PEC/ME-SFI)
- 11 Full load output
- 12 Emissions levels/lambda control

simulate 80 °C coolant or 20 °C intake air¹⁾ with ohms decade or temperature simulator (boiling protection deactivated) (except HFM-SFI/PEC).
 warm up to about 80 °C.
 warm up at part load, drive position "S" or 3rd gear about 25 kW; engine oil temperature about 80 °C. Do not exceed temperature of 120 °C.
 cool with fan.
 Direct air flow to radiator and underside of vehicle (oil pan, exhaust, catalytic converter, tires). Keep a distance of about 1 meter between fan and vehicle.
 test (see Test and adjustment data).
 test (see Test and Adjustment Data Index A, except HFM-SFI/PEC).¹⁾
 test (see Test and Adjustment Data Index A).
 analyze (see Test and Adjustment Data and Oscilloscope Images Index C).
 test. Run at full load output only as long as is necessary to read instruments.
 Compare indicated output levels with Index A, Test and Adjustment Data. Take into account barometer level, coolant temperature and intake air temperature.
 test under **load**. Air cleaner fitted. Engine oil approx. 80°C, cool if necessary.
 Full load CO
 upper part load CO (detach purge line), readout fluctuates.
 lower part load CO (detach purge line), readout fluctuates.

 If catalytic converter is hot (engine oil >100°C) a high conversion rate (or self-regulation) is achieved. This results in a full load CO value of <1% by vol. It is important to ensure that full throttle is recognized.

¹⁾ As of 03/94, use HHT to measure HFM-SFI/PEC.

B 3 Testing engine output and exhaust emissions

Preceding work:Testing engine output and exhaust (07-1203 and 07-1206)

- 13 Exhaust back pressure
- (only perform if required)
- 14 Boost pressure
- (only carry out if necessary, if the engine output does not correspond to the specified value)

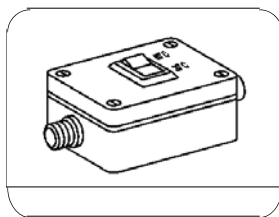
test under **load** (see Test and Adjustment Data Index A).
 remove lambda sensor and install test connector 103 589 00 91 00. Fit on pressure connection of tester.

 Coat test connector with hot lubricating paste, part no. 000 989 76 51.

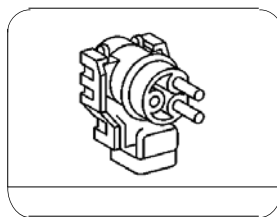
Note
 Perform speedometer comparison with frequency generator.

Remove purge line on idle speed control actuator and connect pressure tester (for specified values, refer to Test and adjustment values Index A).

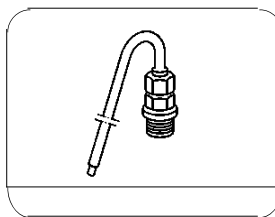
Special tools



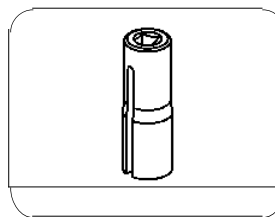
140 589 09 21 00



140 589 10 21 00



103 589 00 91 00



111 589 03 09 00

B 3 Driving specifications/test conditions

Restrict driving to the time absolutely necessary for reading out the instruments (approx. 5 seconds for output dynamometer; approx. 20 seconds for exhaust emission testing)

B 3 Driving instructions/test conditions

Note

If no express engine output fault exists, a maximum speed of 100 km/h or 120 km/h, respectively, is sufficient for the test.

Observe the test instructions and the following sequence:

Warming-up - output test - exhaust emissions test at full load, upper part load, lower part load - idling - exhaust emissions test at idling.

The full load tests (output, exhaust) should be performed directly after warming-up so long as the tyre temperature is still low as the temperature rises most sharply during these measurements. Two repeat measurements after adjustment work are permissible. Always wait approx. 45 minutes before conducting further measurements to allow all the components to cool down.

B 3 Use of correction table

General

The barometer of the weather station must be set to the air pressure according to the information supplied by the local meteorological office.

The output level measured must be corrected with correction factors.

A distinction is made between two types of correction factors:

- Altitude correction factor
- Output correction factor

Calculating output related to normal operating conditions

1. Take reading of atmospheric pressure, altitude and intake air temperature of test location at the weather station.
2. Determine output on the dynamometer.
3. Read off the altitude correction factor with the altitude of the test location in the altitude correction table.
4. The atmospheric pressure level of the test location minus the altitude correction factor produces the atmospheric pressure (p) in hPa (mbar).

B 3 Re calculation example

1. Take reading of atmospheric pressure, altitude and intake air temperature of test location at weather station.
In the example:
Atmospheric pressure of test location = 955 hPa (mbar)
Altitude of test location = 400 m
Intake air temperature of test location = +20°C
2. Determine engine output on the dynamometer = 100 kW
3. Using the altitude of the test location = 400 m, an altitude correction factor of 46 hPa (mbar) is obtained in the altitude correction table.



On vehicles fitted with catalytic converter the operation must be immediately interrupted if combustion faults occur otherwise damage to the catalyst cannot be ruled out.

Cool vehicle with a blower (minimum capacity 15,000 m³/h). Direct air flow onto radiator and underside of vehicle (oil sump, exhaust, catalytic converter, tyres). Position blower approx. 1 m away from vehicle.

Note

The minimum air throughput of 15,000 m³/h is also adequate for cooling vehicles fitted with a catalytic converter.

5. Taking the calculated atmospheric pressure (p), determine in the output correction table the output correction factor (K_H) on the basis of the intake air temperature (t).

6. Using the output correction formula, calculate the output related to normal operating conditions as follows:

Output correction formula

$$N_{e0} = N_e \times K_H$$

N_{e0} = Output related to normal operating conditions in kW.

N_e = Measured output on dynamometer in kW.

K_H = Correction for intake air temperature, barometer level and altitude of the respective test location.

Calculation example

The figures which you require for this example are indicated in the table.

| | |
|--|--------------------------|
| Output measured on dynamometer: | N_e = 100 kW |
| Atmospheric pressure of test location: | P = 955 hPa (955 mbar) |
| Intake air temperature of test location: | t = +20°C |
| Altitude of test location: | 400 m above MSL |

| | |
|--------|--------------------|
| Units: | hPa = Hecto-Pascal |
| | 1 hPa = 1 mbar |
| | 1 Pa = 0.01 mbar |

B 3 Correction table

Output correction on the dynamometer for spark-ignition engines conforming to 80/1269 EEC

hPa* (mbar) correction factor

| | | | | | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1040 | 0.9111 | 0.9194 | 0.9277 | 0.9358 | 0.9439 | 0.9519 | 0.9599 | 0.9678 | 0.9756 | 0.9833 | 0.9910 |
| 35 | 0.9155 | 0.9239 | 0.9321 | 0.9403 | 0.9485 | 0.9565 | 0.9645 | 0.9724 | 0.9803 | 0.9881 | 0.9958 |
| 1030 | 0.9200 | 0.9284 | 0.9367 | 0.9449 | 0.9531 | 0.9612 | 0.9692 | 0.9772 | 0.9851 | 0.9929 | 1.0007 |
| 25 | 0.9245 | 0.9329 | 0.9412 | 0.9495 | 0.9577 | 0.9659 | 0.9739 | 0.9819 | 0.9899 | 0.9977 | 1.0056 |
| 1020 | 0.9290 | 0.9375 | 0.9458 | 0.9542 | 0.9624 | 0.9706 | 0.9787 | 0.9867 | 0.9947 | 1.0026 | 1.0105 |
| 15 | 0.9336 | 0.9421 | 0.9505 | 0.9589 | 0.9672 | 0.9754 | 0.9835 | 0.9916 | 0.9996 | 1.0076 | 1.0155 |
| 1010 | 0.9382 | 0.9467 | 0.9552 | 0.9636 | 0.9719 | 0.9802 | 0.9884 | 0.9965 | 1.0046 | 1.0126 | 1.0205 |
| 05 | 0.9428 | 0.9514 | 0.9600 | 0.9684 | 0.9768 | 0.9851 | 0.9933 | 1.0015 | 1.0096 | 1.0176 | 1.0256 |
| 1000 | 0.9476 | 0.9562 | 0.9648 | 0.9732 | 0.9817 | 0.9900 | 0.9983 | 1.0065 | 1.0146 | 1.0227 | 1.0307 |
| 95 | 0.9523 | 0.9610 | 0.9696 | 0.9781 | 0.9866 | 0.9950 | 1.0033 | 1.0115 | 1.0197 | 1.0278 | 1.0359 |
| 90 | 0.9571 | 0.9659 | 0.9745 | 0.9831 | 0.9916 | 1.0000 | 1.0084 | 1.0166 | 1.0249 | 1.0330 | 1.0411 |
| 85 | 0.9620 | 0.9708 | 0.9795 | 0.9881 | 0.9966 | 1.0051 | 1.0135 | 1.0218 | 1.0301 | 1.0383 | 1.0464 |
| 900 | 0.9669 | 0.9757 | 0.9845 | 0.9931 | 1.0017 | 1.0102 | 1.0186 | 1.0270 | 1.0353 | 1.0436 | 1.0517 |
| 75 | 0.9719 | 0.9807 | 0.9895 | 0.9982 | 1.0068 | 1.0154 | 1.0239 | 1.0323 | 1.0406 | 1.0489 | 1.0571 |
| 970 | 0.9769 | 0.9858 | 0.9946 | 1.0033 | 1.0120 | 1.0206 | 1.0291 | 1.0376 | 1.0460 | 1.0543 | 1.0626 |
| 65 | 0.9819 | 0.9909 | 0.9998 | 1.0085 | 1.0173 | 1.0259 | 1.0345 | 1.0430 | 1.0514 | 1.0598 | 1.0681 |
| 960 | 0.9870 | 0.9960 | 1.0050 | 1.0138 | 1.0226 | 1.0313 | 1.0399 | 1.0484 | 1.0569 | 1.0653 | 1.0736 |
| 55 | 0.9922 | 1.0013 | 1.0102 | 1.0191 | 1.0279 | 1.0366 | 1.0453 | 1.0539 | 1.0624 | 1.0709 | 1.0793 |
| 950 | 0.9974 | 1.0065 | 1.0155 | 1.0245 | 1.0333 | 1.0421 | 1.0508 | 1.0594 | 1.0679 | 1.0765 | 1.0849 |
| 45 | 1.0027 | 1.0119 | 1.0209 | 1.0299 | 1.0388 | 1.0476 | 1.0564 | 1.0651 | 1.0737 | 1.0822 | 1.0907 |
| 940 | 1.0080 | 1.0172 | 1.0263 | 1.0354 | 1.0443 | 1.0532 | 1.0620 | 1.0707 | 1.0794 | 1.0880 | 1.0965 |
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |

Intake air temperature t °C

hPa = Hecto-Pascal

B 3 Correction table

hPa* (mbar) correction factor

| | | | | | | | | | | | |
|--------------|--------|--------|--------|--------|-----------------|--------|--------|--------|--------|--------|--------|
| 35 | 1.0134 | 1.0227 | 1.0318 | 1.0409 | 1.0499 | 1.0588 | 1.0677 | 1.0764 | 1.0851 | 1.0938 | 1.1023 |
| 930 | 1.0189 | 1.0282 | 1.0374 | 1.0465 | 1.0555 | 1.0645 | 1.0734 | 1.0822 | 1.0910 | 1.0997 | 1.1083 |
| 25 | 1.0244 | 1.0337 | 1.0430 | 1.0522 | 1.0613 | 1.0703 | 1.0792 | 1.0881 | 1.0969 | 1.1056 | 1.1143 |
| 920 | 1.0300 | 1.0393 | 1.0487 | 1.0579 | 1.0670 | 1.0761 | 1.0851 | 1.0940 | 1.1028 | 1.1116 | 1.1203 |
| 15 | 1.0356 | 1.0450 | 1.0544 | 1.0637 | 1.0729 | 1.0820 | 1.0910 | 1.1000 | 1.1089 | 1.1177 | 1.1264 |
| [910] | 1.0413 | 1.0508 | 1.0602 | 1.0695 | [1.0787] | 1.0879 | 1.0970 | 1.1060 | 1.1150 | 1.1238 | 1.1326 |
| 05 | 1.0470 | 1.0566 | 1.0660 | 1.0754 | 1.0847 | 1.0939 | 1.1031 | 1.1121 | 1.1211 | 1.1300 | 1.1389 |
| 900 | 1.0528 | 1.0624 | 1.0720 | 1.0814 | 1.0907 | 1.1000 | 1.1092 | 1.1183 | 1.1273 | 1.1363 | 1.1452 |
| 95 | 1.0587 | 1.0684 | 1.0779 | 1.0874 | 1.0968 | 1.1061 | 1.1154 | 1.1246 | 1.1336 | 1.1427 | 1.1516 |
| 890 | 1.0647 | 1.0744 | 1.0840 | 1.0935 | 1.1030 | 1.1124 | 1.1217 | 1.1309 | 1.1400 | 1.1491 | 1.1581 |
| 85 | 1.0707 | 1.0805 | 1.0901 | 1.0997 | 1.1092 | 1.1186 | 1.1280 | 1.1373 | 1.1465 | 1.1556 | 1.1646 |
| 880 | 1.0768 | 1.0855 | 1.0953 | 1.1060 | 1.1155 | 1.1250 | 1.1344 | 1.1437 | 1.1530 | 1.1621 | 1.1712 |
| 75 | 1.0829 | 1.0928 | 1.1026 | 1.1123 | 1.1219 | 1.1314 | 1.1409 | 1.1503 | 1.1596 | 1.1688 | 1.1779 |
| 870 | 1.0892 | 1.0991 | 1.1089 | 1.1187 | 1.1283 | 1.1379 | 1.1474 | 1.1569 | 1.1662 | 1.1755 | 1.1847 |
| 65 | 1.0954 | 1.1054 | 1.1153 | 1.1251 | 1.1349 | 1.1445 | 1.1541 | 1.1636 | 1.1730 | 1.1823 | 1.1915 |
| 860 | 1.1018 | 1.1119 | 1.1218 | 1.1317 | 1.1415 | 1.1512 | 1.1608 | 1.1703 | 1.1798 | 1.1892 | 1.1985 |
| 55 | 1.1083 | 1.1184 | 1.1284 | 1.1383 | 1.1481 | 1.1579 | 1.1676 | 1.1772 | 1.1867 | 1.1961 | 1.2055 |
| 850 | 1.1148 | 1.1249 | 1.1350 | 1.1450 | 1.1549 | 1.1647 | 1.1744 | 1.1841 | 1.1937 | 1.2032 | 1.2126 |
| 45 | 1.1214 | 1.1316 | 1.1417 | 1.1518 | 1.1617 | 1.1716 | 1.1814 | 1.1811 | 1.2007 | 1.2103 | 1.2198 |
| 840 | 1.1281 | 1.1383 | 1.1485 | 1.1586 | 1.1686 | 1.1786 | 1.1884 | 1.1982 | 1.2079 | 1.2175 | 1.2270 |
| | 0 | 5 | 10 | 15 | [20] | 25 | 30 | 35 | 40 | 45 | 50 |

Intake air temperature t °C

hPa = Hecto-Pascal

[] = Example, see "Use of correction table"

B 3 Correction table

hPa* (mbar) correction factor

| | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|

| | | | | | | | | | | | |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 35 | 1.1348 | 1.1452 | 1.1554 | 1.1656 | 1.1756 | 1.1856 | 1.1955 | 1.2054 | 1.2151 | 1.2248 | 1.2344 |
| 30 | 1.1416 | 1.1521 | 1.1624 | 1.1726 | 1.1827 | 1.1928 | 1.2027 | 1.2126 | 1.2224 | 1.2321 | 1.2418 |
| 25 | 1.1486 | 1.1590 | 1.1694 | 1.1797 | 1.1899 | 1.2000 | 1.2100 | 1.2200 | 1.2298 | 1.2396 | 1.2493 |
| 820 | 1.1556 | 1.1661 | 1.1765 | 1.1869 | 1.1971 | 1.2073 | 1.2174 | 1.2274 | 1.2373 | 1.2472 | 1.2569 |
| 15 | 1.1627 | 1.1733 | 1.1838 | 1.1942 | 1.2045 | 1.2147 | 1.2249 | 1.2349 | 1.2449 | 1.2548 | 1.2647 |
| 810 | 1.1698 | 1.1805 | 1.1911 | 1.2015 | 1.2119 | 1.2222 | 1.2324 | 1.2426 | 1.2526 | 1.2626 | 1.2725 |
| 05 | 1.1771 | 1.1878 | 1.1985 | 1.2090 | 1.2195 | 1.2298 | 1.2401 | 1.2503 | 1.2604 | 1.2704 | 1.2804 |
| 800 | 1.1845 | 1.1953 | 1.2060 | 1.2166 | 1.2271 | 1.2375 | 1.2478 | 1.2581 | 1.2683 | 1.2784 | 1.2884 |
| 95 | 1.1920 | 1.2028 | 1.2135 | 1.2242 | 1.2348 | 1.2453 | 1.2557 | 1.2660 | 1.2762 | 1.2864 | 1.2956 |
| 790 | 1.1994 | 1.2104 | 1.2212 | 1.2320 | 1.2426 | 1.2532 | 1.2636 | 1.2740 | 1.2843 | 1.2945 | 1.3047 |
| 85 | 1.2071 | 1.2181 | 1.2290 | 1.2398 | 1.2505 | 1.2611 | 1.2717 | 1.2821 | 1.2925 | 1.3028 | 1.3130 |
| 780 | 1.2148 | 1.2259 | 1.2369 | 1.2478 | 1.2585 | 1.2692 | 1.2798 | 1.2904 | 1.3008 | 1.3111 | 1.3214 |
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |

Intake air temperature t °C

1hPa* = Hecto-Pascal

[] = Example, see "Use of correction table"

Altitude correction

If the atmospheric pressure is read of related to MSL (weather station), the following atmospheric pressure should be deducted in the correction table.

| m | hPa | m | hPa | m | hPa | m | hPa | m | hPa |
|-----|-----|--------------|-------------|-----|-----|------|-----|------|-----|
| 0 | 0 | 300 | 36 | 600 | 69 | 900 | 104 | 2000 | 221 |
| 50 | 6 | 350 | 41 | 650 | 75 | 950 | 109 | 2100 | 230 |
| 100 | 12 | [400] | [46] | 700 | 81 | 1000 | 115 | 2200 | 239 |
| 150 | 18 | 450 | 52 | 750 | 86 | 1100 | 126 | 2300 | 250 |
| 200 | 24 | 500 | 58 | 800 | 92 | 1200 | 137 | 2400 | 259 |
| 250 | 30 | 550 | 63 | 850 | 98 | 1300 | 148 | 2500 | 268 |

1hPa = 1 mbar

1Pa = 0.01 mbar

[] = Example, see "Use of correction table"