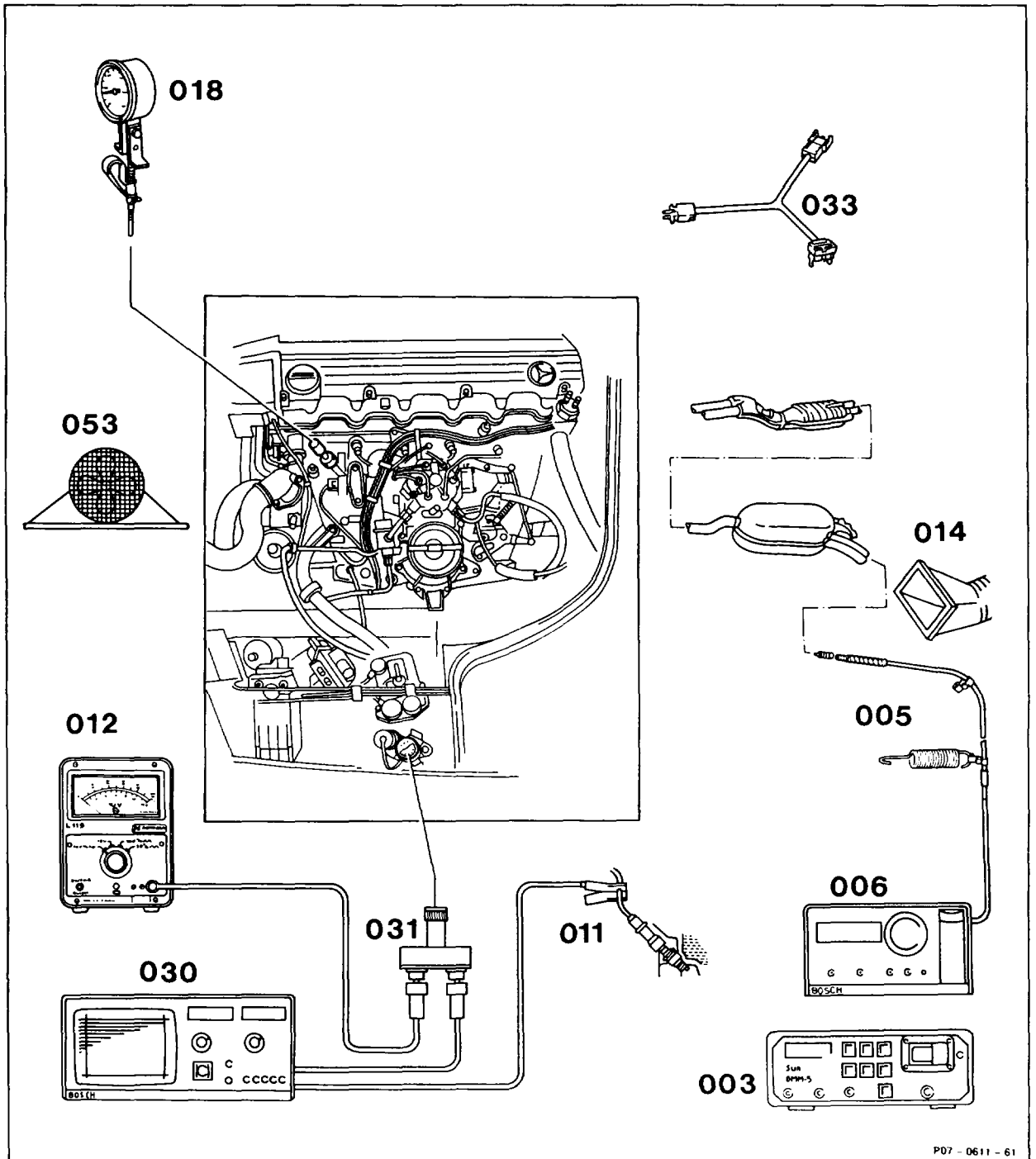


# 07.3-1203 Testing engine output and exhaust emission on the roller dynamometer

Preceding work:  
Testing, adjusting engine (07.3-1100).

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

Basic and national versions, (CH) (S) KAT and without KAT



P07 - 0611 - 61

Test sheet .....	complete.
Fluid levels (engine oil, automatic transmission fluid, coolant) .....	check, adjust to correct level.
Testers .....	connect: oil remote thermometer (018) 124 589 07 21 00, lambda control tester (012), twin socket (031), exhaust probe (005) 126 589 11 63 00, CO analyzer (006), engine tester with oscilloscope (030), trigger clamp (011), multimeter (003), test cable (033) 102 589 04 63 00.
Front wheels .....	secure. Place wheel chocks about 100 mm in front of front wheels.
Tyre pressure of rear wheels .....	check, adjust to specified pressure.
Extraction device (014) .....	fit on to exhaust tailpipe.
Contents of trunk .....	check. Remove any heat-sensitive and heavy objects.
Engine oil temperature .....	warm to about 80°C at part throttle, while checking speedometer.
Engine .....	cool with fan (053). Do not allow engine oil temperature to rise above 120°C.
Oscilloscope image .....	analyze under load (see Diagnosis Manual Engine Volume 1 Register C).
Full load output .....	test (see table). Pay attention to notes regarding output and exhaust test. Coolant temperature: 80 °C = 300 Ω Intake air temperature: 20 °C = 2.5 kΩ



Run engine for testing full load output only as long as is necessary for reading the instrument.

Emission levels . . . . . test under load. If the emission levels are not achieved, then:

1. test lambda control.
2. test throttle valve switch, replace (07.3-1689).
3. check fuel pressures and internal leaktightness (07.3-1603).
4. replace fuel distributor (07.3-1674).

**Notes**

On vehicles fitted with catalytic converter and lambda control, the mixture composition cannot be assessed from measuring the exhaust gases at the tailpipe when the engine is idling and running at part load, but only by measuring the on/off ratio.

The on/off ratio at part load must remain within the lambda control range (pointer fluctuates, not at lean or rich stop). At full load the on/off ratio is constant (open-loop control, the CO emission levels at the exhaust tailpipe correspond to the standard and RÜF versions).

On vehicles fitted with catalytic converter, the operation must be interrupted immediately if combustion faults exist otherwise damage to the catalytic converter cannot be excluded.

## Engine output and emission level

Engine			103.940	103.940	103.940	103.941	103.941
Model			124.007 124.026	124.007 124.026	124.007 124.026	126.020	126.020
Version			NV (RÜF)	RÜF	KAT	NV (RÜF)	RÜF
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100	100
		kW	65	69	66	68	72
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90	90
		kW	63	67	64	66	70
Output test full load <sup>1)</sup>		1/min	5500	5500	5500	5500	5500
	Manual transmission in 3rd gear	kW	85	92	89	85	92
		Automatic transmission in Drive mode "3"	kW	82	89	86	82
Emission test	Idle speed		1/min	650-750	650-750	650-750	650-750
		% CO	1 ± 0.5	1 ± 0.5	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5
		Lambda control %	-	-	<sup>3)</sup>	-	-
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5-5	1.5-5	1.5-5	1.5-5	1.5-5
		1/min	3500	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	0.1-0.8	0.1-0.8	<sup>5)</sup>	0.1-0.8	0.1-0.8
	Upper part load 5th gear 120 km/h, 24 kW	% CO	-	-	-	-	-
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	0.1-0.8	0.1-0.8	<sup>5)</sup>	0.1-0.8	0.1-0.8
	Lower part load 5th gear 50 km/h, 7.0 kW	% CO	-	-	-	-	-

1) The test data are minimum outputs.



Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).

2) When performing special exhaust emission test (ASU).

3) Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

4) During full load test of vehicles with lambda control, lambda control switches to open-loop value.

5) Lambda readout fluctuates.



## Engine output and emission level

Engine			103.941	103.942	103.942	103.942	103.943
Model			126.020	201.029	201.029	201.029	124.226
Version			KAT Ⓢ KAT Ⓢ KAT	NV (RÜF)	RÜF	KAT Ⓢ KAT Ⓢ KAT	NV (RÜF)
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100	100
		kW	69	67	71	68	68
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90	90
		kW	67	60	64	61	59
Output test full load <sup>1)</sup>		1/min	5500	5500	5500	5500	5500
	Manual transmission in 3rd gear	kW	89	85	92	89	82
		Automatic transmission in Drive mode "3"	kW	86	82	89	86
Emission test	Idle speed		1/min	650-750	650-750	650-750	650-750
		% CO	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5	≤ 0.5 <sup>2)</sup>	1 ± 0.5
		Lambda control %	<sup>3)</sup>	-	-	<sup>3)</sup>	-
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5-5	1.5-5	1.5-5	1.5-5	1.5-5
		1/min	3500	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	<sup>5)</sup>	0.1-0.8	0.1-0.8	<sup>5)</sup>	0.1-0.8
	Upper part load 5th gear 120 km/h, 24 kW	% CO	-	-	-	-	-
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	<sup>5)</sup>	0.1-0.8	0.1-0.8	<sup>5)</sup>	0.1-0.8
	Lower part load 5th gear 50 km/h, 7.0 kW	% CO	-	-	-	-	-

<sup>1)</sup> The test data are minimum outputs.

 Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).



<sup>2)</sup> When performing special exhaust emission test (ASU).

<sup>3)</sup> Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

<sup>4)</sup> During full load test of vehicles with lambda control, lambda control switches to open-loop value.

<sup>5)</sup> Lambda readout fluctuates.

## Engine output and emission level

Engine			103.943	103.943	103.980	103.980	103.981
Model			124.226	124.226	124.030	124.030	126.024 126.025
Version			RÜF	KAT  KAT	Std.	Std. KAT	NV (RÜF)
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100	100
		kW	72	69	75	-	80
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90	90
		kW	63	60	70	-	74
Output test full load <sup>1)</sup>		1/min	5500	5500	5500	5500	5500
	 Manual transmission in 3rd gear	kW	89	86	105	-	97
		Automatic transmission in Drive mode "3"	kW	86	83	102	-
Emission test	Idle speed	1/min	650-750	650-750	600-700	600-700	600-700
		% CO	1 ± 0.5	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5 ≤ 1.5 <sup>2)</sup>	1 ± 0.5
		Lambda control %	-	<sup>3)</sup>	-	-	-
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5-5	1.5-5	1.5-5	1.5-5	1.5-5
		1/min	3500	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	0.1-0.8	<sup>5)</sup>	0.1-0.8	-	0.1-0.8
	Upper part load 5th gear 120 km/h, 24 kW	% CO	-	-	-	-	-
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	0.1-0.8	<sup>5)</sup>	0.1-0.8	-	0.1-0.8
	Lower part load 5th gear 50 km/h, 7.0 kW	% CO	-	-	-	-	-

1) The test data are minimum outputs.



Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).

2) When performing special exhaust emission test (ASU).





3) Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

4) During full load test of vehicles with lambda control, lambda control switches to open-loop value.

5) Lambda readout fluctuates.



## Engine output and emission level

Engine			103.981	103.982	103.982	103.982	103.982
Model			126.024 126.025	126.024 126.025	107.041	107.041	107.041
Version			RÜF	KAT  KAT  KAT	NV (RÜF)	RÜF	KAT  KAT
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100	100
		kW	84	82	77	80	78
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90	90
		kW	78	76	72	75	73
Output test full load <sup>1)</sup>		1/min	5500	5500	5200	5200	5200
	 Manual transmission in 3rd gear	kW	104	100	92	100	96
		Automatic transmission in Drive mode "3"	kW	101	97	89	96
Emission test	Idle speed	1/min	600–700	600–700	600–700	600–700	600–700
		% CO	1 ± 0.5	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5	≤ 0.5 <sup>2)</sup>
		Lambda control %	–	<sup>3)</sup>	–	–	<sup>3)</sup>
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5–5	1.5–5	1.5–5	1.5–5	1.5–5
		1/min	3500	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	0.1–0.8	<sup>5)</sup>	0.1–0.8	0.1–0.8	<sup>5)</sup>
	Upper part load 5th gear 120 km/h, 24 kW	% CO	–	–	–	–	–
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	0.1–0.8	<sup>5)</sup>	0.1–0.8	0.1–0.8	<sup>5)</sup>
Lower part load 5th gear 50 km/h, 7.0 kW	% CO	–	–	–	–	–	

<sup>1)</sup> The test data are minimum outputs.

 Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).

<sup>2)</sup> When performing special exhaust emission test (ASU).




<sup>3)</sup> Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

<sup>4)</sup> During full load test of vehicles with lambda control, lambda control switches to open-loop value.

<sup>5)</sup> Lambda readout fluctuates.



## Engine output and emission level

Engine			103.983	103.983	103.983	103.983	103.983
Model			124.030 124.050	124.030 124.050	124.030 124.050	124.090	124.090
Version			NV (RÜF)	RÜF	KAT  KAT  KAT	NV (RÜF)	RÜF
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100	100
		kW	71	75	73	77	80
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90	90
		kW	66	70	68	72	75
Output test full load <sup>1)</sup>		1/min	5500	5500	5500	5500	5500
	 Manual transmission in 3rd gear	kW	97	104	100	97	104
		Automatic transmission in Drive mode "3"	kW	94	101	97	94
Emission test	Idle speed	1/min	600-700	600-700	600-700 <sup>6)</sup>	600-700	600-700
		% CO	1 ± 0.5	1 ± 0.5	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5
		Lambda control %	-	-	<sup>3)</sup>	-	-
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5-5	1.5-5	1.5-5	1.5-5	1.5-5
		1/min	3500	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	0.1-0.8	0.1-0.8	<sup>5)</sup>	0.1-0.8	0.1-0.8
	Upper part load 5th gear 120 km/h, 24 kW	% CO	-	-	-	-	-
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	0.1-0.8	0.1-0.8	<sup>5)</sup>	0.1-0.8	0.1-0.8
	Lower part load 5th gear 50 km/h, 7.0 kW	% CO	-	-	-	-	-

<sup>1)</sup> The test data are minimum outputs.

 Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).

<sup>2)</sup> When performing special exhaust emission test (ASU).

<sup>3)</sup> Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

<sup>4)</sup> During full load test of vehicles with lambda control, lambda control switches to open-loop value.

<sup>5)</sup> Lambda readout fluctuates.

<sup>6)</sup> As of 06/90: 650-750.



## Engine output and emission level

Engine			103.983	103.984	103.984	103.985	103.985
Model			124.090	129.060	129.060	124.230	124.230
Version			KAT ⓐ KAT ⓑ KAT	RÜF	KAT	NV (RÜF)	RÜF
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100	100
		kW	78	94	94	75	79
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90	90
		kW	73	69	69	65	69
Output test full load <sup>1)</sup>		1/min	5500	5500	5500	5500	5500
	Manual transmission in 3rd gear	kW	100	105	105	94	101
		Automatic transmission in Drive mode "3"	kW	97	101	101	91
Emission test	Idle speed		1/min	600–700 <sup>6)</sup>	650–750	650–750	600–700
		% CO	≤ 0.5 <sup>2)</sup>	1 ± 0.5	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5
		Lambda control %	3)	–	3)	–	–
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5–5	1.5–5	1.5–5	1.5–5	1.5–5
		1/min	3500	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	<sup>5)</sup>	0.1–0.8	<sup>5)</sup>	0.1–0.8	0.1–0.8
	Upper part load 5th gear 120 km/h, 24 kW	% CO	–	–	–	–	–
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	<sup>5)</sup>	0.1–0.8	<sup>5)</sup>	0.1–0.8	0.1–0.8
	Lower part load 5th gear 50 km/h, 7.0 kW	% CO	–	–	–	–	–

<sup>1)</sup> The test data are minimum outputs.



Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).

<sup>2)</sup> When performing special exhaust emission test (ASU).

<sup>3)</sup> Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

<sup>4)</sup> During full load test of vehicles with lambda control, lambda control switches to open-loop value.

<sup>5)</sup> Lambda readout fluctuates.

<sup>6)</sup> As of 06/90: 650–750.



## Engine output and emission level

Engine			103.985	103.985	103.985	103.985
Model			124.230	124.290	124.290	124.290
Version			KAT Ⓞ <sup>CH</sup> KAT Ⓞ <sup>S</sup> KAT	NV (RÜF)	RÜF	KAT Ⓞ <sup>CH</sup> KAT Ⓞ <sup>S</sup> KAT
Function test <sup>1)</sup>	Manual transmission in 3rd gear	km/h	100	100	100	100
		kW	77	80	84	82
	Automatic transmission in Drive mode "3"	km/h	90	90	90	90
		kW	67	70	74	72
Output test full load <sup>1)</sup>		1/min	5500	5500	5500	5500
	Manual transmission in 3rd gear	kW	97	95	102	98
		Automatic transmission in Drive mode "3"	kW	94	92	99
Emission test	Idle speed		1/min	600–700 <sup>6)</sup>	600–700	600–700
		% CO	≤ 0.5 <sup>2)</sup>	1 ± 0.5	1 ± 0.5	≤ 0.5 <sup>2)</sup>
		Lambda control %	<sup>3)</sup>	–	–	<sup>3)</sup>
	Full load 3rd gear Drive mode "3"	% CO <sup>4)</sup>	1.5–5	1.5–5	1.5–5	1.5–5
		1/min	3500	3500	3500	3500
	Upper part load 4th gear Drive mode "D" 120 km/h, 24 kW	% CO	<sup>5)</sup>	0.1–0.8	0.1–0.8	<sup>5)</sup>
	Upper part load 5th gear 120 km/h, 24 kW	% CO	–	–	–	–
	Lower part load 4th gear Drive mode "D" 50 km/h, 7.0 kW	% CO	<sup>5)</sup>	0.1–0.8	0.1–0.8	<sup>5)</sup>
	Lower part load 5th gear 50 km/h, 7.0 kW	% CO	–	–	–	–

1) The test data are minimum outputs.

 Test output only with simulated coolant temperature of 80 °C (use 2 Ω decades).

2) When performing special exhaust emission test (ASU).

3) Test lambda control at 2500/min and read off average value; detach regeneration line at regeneration valve for this purpose and seal. Compare this reading with idle speed reading. The average value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

4) During full load test of vehicles with lambda control, lambda control switches to open-loop value.

5) Lambda readout fluctuates.

6) As of 06/90: 650–750.

## Note

These tests must not be performed with the vehicles' own tyres as the test speed is in excess of 130 km/h.

At high speeds, initial invisible damage may occur to the tyres which results in subsequent consequential damage.

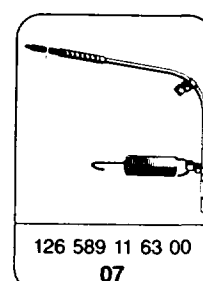
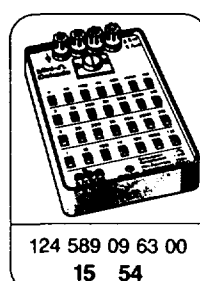
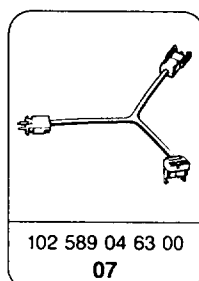
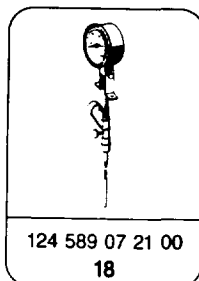
The engine output test should therefore only be employed if there is an expressed complaint regarding engine performance.

The function test at which the driving speed is below 130 km/h is sufficient for a general assessment of engine output.

When measuring engine output it is essential to take into account the various influencing factors.

**Correction of engine output, see correction table.**

## Special tools



## Commercially available tools and testers (see Workshop Equipment Manual)

Designation	e.g., Make, order no.
CO analyzer	
Engine tester (engine speed, dwell angle, ignition angle, oscilloscope, voltmeter)	Bosch, MOT 002.02 Sun, 1019
Lambda control tester	Hermann, L115
Twin socket	Hermann, ECD 53

**Notes regarding engine output and emission test on the roller dynamometer, and also engine output correction, driving instructions and notes regarding procedure.**

### **Engine output test**

This test should only be performed if a complaint exists regarding engine performance.

The valid engine output reference values are minimum outputs and apply to vehicles with power assisted steering. Take into account barometer reading and intake air temperature (see correction table).

The stated engine output reference values are only achieved with the specified fuel, the indicated ignition setting and the indicated valve timing.

The engine output figures may be slightly reduced on vehicles on which ignition timing has been altered because of conversion from leaded to unleaded fuel.

#### **Note**

On such vehicles, the ignition timing is retarded if a coolant temperature of about 95 °C is exceeded. This results in a reduced engine output of about 2 – 5 %.

Test engine output only with a simulated coolant temperature of 80 °C.

The coolant temperature can be simulated with the  $\Omega$  decade (special tool 124 589 09 63 00), 80 °C = 300  $\Omega$ .

To do this, unplug connector at the coolant temperature sensor and connect to ground via  $\Omega$  decade.

2  $\Omega$  decades are required for this test in the case of the 4-pin temperature sensor.

On vehicles fitted with fault memory, the simulated fault in the fault memory must be erased.

On 4MATIC vehicles, ensure that a total test time of 15 minutes is not exceeded on the roller dynamometer.

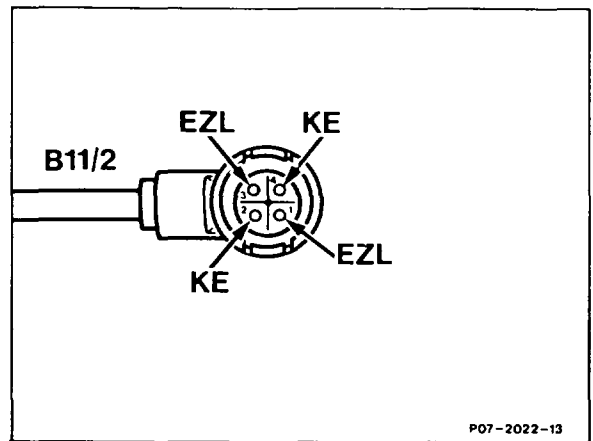
The service valve must be moved into position "Test."

If a test time of more than 15 minutes is necessary, the vehicle must be driven for about 1 km on the road after a test period of 15 minutes.

Following this, it can be tested for a further 15 minutes on the roller dynamometer.

### Emission test

The emission tests at idle speed, part load and full load are used to assess the mixture composition in the combustion chamber.



### Coolant temperature sensor

Coupling pin assignment:

- 1 EZL/AKR temperature sensor
- 2 KE temperature sensor
- 3 Ground, EZL/AKR ignition control unit
- 4 Ground, KE ignition control unit

The emission test should be performed if complaints exist regarding engine running, fuel consumption and engine output.

It is not possible to obtain a statement regarding absolute fuel consumption.

The stated emission levels at part load apply only to switch position 1 of the resistance trimming plug for the fuel injection system (inscription ECE).

Test equipment operating on the infrared absorption method should be used for the emission tests.

On vehicles fitted with catalytic converter and lambda control, the mixture composition at idle speed and part load cannot be assessed by measuring the exhaust at the exhaust pipe but only by measuring the on/off ratio. On/off ratio at idle speed, see notes in table 1 and 3.

The on/off ratio at part load must remain within the lambda control range (pointer fluctuates, does not deflect to lean or rich).

At full load, the on/off ratio is constant (open-loop control, the CO emission level at the exhaust tailpipe correspond to the Standard and RÜF versions).

### **Engine output correction on the roller dynamometer**

To determine the engine output, a standard directive has been specified for the European Community in conformity with 80/1269 EEC.

It differs from the previously applicable DIN 70020 Part 6, e.g. in respect of the atmospheric reference conditions (air temperature now 25 °C, air pressure 990 hPa (mbar) instead of 1013 hPa (mbar)).

The formula for determining the correction factors have also been modified. The air humidity is not taken into account in this respect.

### **Driving instructions, notes regarding procedure**

It is essential to adhere to the following specifications in order to maintain tyre stress within permissible limits:

- 1 Tests must not be performed on roller dynamometers with winter tyres. Workshop test tyres must be fitted. Only warming-up at part load (see step 8) is permissible.
- 2 Check the inflation pressure of the driving wheels, but to not increase pressure beyond the figure indicated for driving on roads.
- 3 A high axle load of the driving wheels is not permissible.
- 4 Limit the duration of the test to the time absolutely necessary for reading the instrument (about 5 seconds for engine output test, about 5 seconds for exhaust emission test).
- 5 Do not exceed a driven speed of more than 130 km/h (120 km/h with SR tyres). Fit shop test tyres for a test speed in excess of 130 km/h. On models 124, 126, 201 and 107, 6 1/2 J×15 H 2 ET 49 steel disc wheels with 195/65 R 15 tyres may be used; on model 129, 8J×16 H 2 ET 34 light alloy or steel disc wheels with 225/55 ZR 16 tyres.

If the roller diameter is 220–318 mm, shop test tyres must be fitted to vehicles with SR for speeds in excess of 100 km/h. Function and output tests at not more than 100 km/h may also be performed with the original tyres.

6 Observe the test instructions and the following sequence:

Warming up – output test – exhaust emissions test – full load, upper part load, lower part load – idle speed – idle speed exhaust emissions test.

The full load tests (engine output, exhaust emissions) 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 operations are permissible. Before performing further measurements, it is essential to wait (45 minutes) to allow all the components to cool down.

**Note**

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

Vehicles with ASR:

Unplug coupling from ABS/ASR control unit.

Vehicles with 4MATIC:

Move service valve into "Test" position.

Do not exceed a total test time of more than 15 minutes.



7 Cool vehicle with the fan (minimum capacity 15 000 m<sup>3</sup>/h). Direct air flow at radiator and underside of vehicle (oil sump, exhaust, catalytic converter, tyres). Position fan about 1 m away from vehicle.

The minimum air throughput of 15 000 m<sup>3</sup>/h is also adequate for cooling vehicles fitted with a catalytic converter.

8 Warm-up vehicle at part load (drive mode "3" or 3rd gear, approx. 60 km/h, approx. 25 kW) up to an oil temperature of 80 °C.

9 Insert exhaust probe (special tool 126 589 11 63 00) at least 300 mm deep into the exhaust pipe.

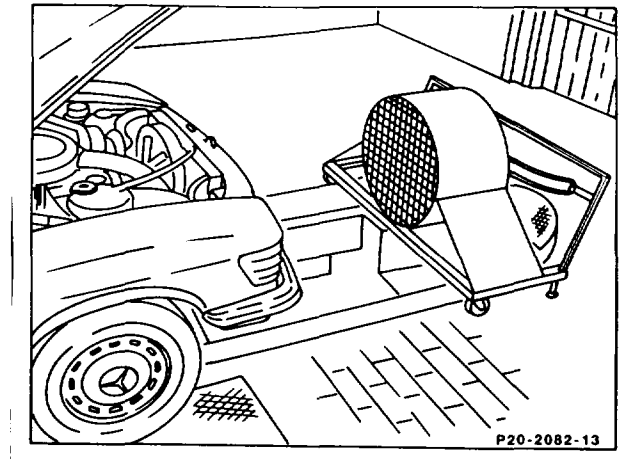
**10 When performing engine output test,** drive in the specified gear at the stated engine speed and run engine at full load.

Read off instruments.

Release accelerator.

Compare indicated engine output with reference value, taking into account vehicle equipment, barometer level, coolant temperature and intake temperature (see correction table for engine output correction).

Test output only at the a simulated coolant temperature of 80 °C.



The coolant temperature can be simulated with the  $\Omega$  decade (special tool 124 589 09 63 00), 80 °C = 300  $\Omega$ .

To do this, unplug connector at the coolant temperature sensor and connect to ground via  $\Omega$  decade.

2  $\Omega$  decades are required for this test in the case of the 4-pin temperature sensor.

On vehicles fitted with fault memory, the simulated fault in the fault memory must be erased.

**11 When performing exhaust emissions test,** drive in the specified gear at the indicated engine speed or road speed and at dynamometer setting of full load or part load.

Do not drive for longer than is necessary for reading the instruments.

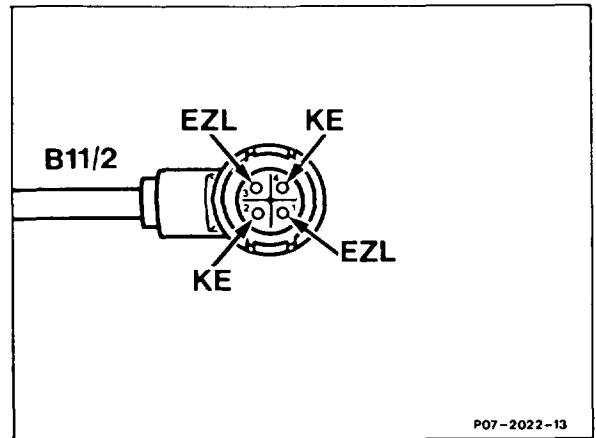
Detach crankcase breather.

The air cleaner must be installed.

The exhaust emissions test at part load should be performed at an oil temperature between 75°C and 85°C.

If necessary, the engine must be allowed to cool down after the full load run.

**12 When performing exhaust emissions test,** at idle speed, an oil temperature of 60–80°C is necessary. The cooling fan must be switched off. Run engine at idle speed for 5 minutes to stabilize it.



#### Coolant temperature sensor

##### Coupling pin assignment

- 1 EZL/AKR temperature sensor
- 2 KE temperature sensor
- 3 Ground, EZL/AKR ignition control unit
- 4 Ground, KE ignition control unit

## Use of correction table

All the engine output figures relate to normal operating conditions:

- a) Reference pressure: 990 hPa = 990 mbar  
b) Reference intake air temperature: + 25 °C

The engine output measured on the dynamometer must be corrected if other test conditions exist to enable it to be compared with the engine output figures in the technical documentation.

## Barometric pressure measuring system of weather station

The barometer of the weather station indicates the air pressure related to mean sea level (MSL). Before using the weather station, the barometer must be set to the air pressure stated by the local meteorological office.

In addition to the barometer, it is necessary to take into account the altitude and intake air temperature.

Engine output correction formula

$$Ne_o = Ne \times K_H$$

$Ne_o$  = output related to normal operating conditions in kW.

$Ne$  = measured engine output on dynamometer in kW.

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

Reference should be made to the correction table for the engine output correction factors.

## Calculation example

(The figures for this example are indicated in the drawing.)

Measured engine output:	$Ne = 100 \text{ kW}$
Barometer level (related to MSL):	$p = 955 \text{ hPa (955 mbar)}$
Altitude of test location:	400 m above MSL
Intake air temperature:	$t = +20 \text{ °C}$

Hence:

$p_{\text{test location}}$	= $p_{\text{barometer}} - p_{\text{altitude}}$
$p_{\text{test location}}$	= $955 \text{ hPa} - 46 \text{ hPa}$
	= $909 \text{ hPa} \approx 910 \text{ hPa}$
$K_H$	= 1.0787 (from correction table 910 hPa, + 20 °C)
$Ne_o$	= measured engine output $Ne \times$ correction $K_H$
Hence $Ne_o$	= $100 \text{ kW} \times 1.0787 = 108 \text{ kW}$

## Engine output correction on dynamometer for spark-ignition and car diesel engines

Air pressure p 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
1035	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
1025	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
1015	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
1005	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
995	0.9523	0.9610	0.9696	0.9781	0.9866	0.9950	1.0033	1.0115	1.0197	1.0278	1.0359
990	0.9571	0.9659	0.9745	0.9831	0.9916	1.0000	1.0084	1.0166	1.0249	1.0330	1.0411
985	0.9620	0.9708	0.9795	0.9881	0.9966	1.0051	1.0135	1.0218	1.0301	1.0383	1.0464
980	0.9669	0.9757	0.9845	0.9931	1.0017	1.0102	1.0186	1.0270	1.0353	1.0436	1.0517
975	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
965	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
955	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	1.0680	1.0765	1.0849
945	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
935	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
925	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
915	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
905	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
895	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
885	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	1.0866	1.0963	1.1060	1.1155	1.1250	1.1344	1.1437	1.1530	1.1621	1.1712
875	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
865	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
855	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
845	1.1214	1.1316	1.1417	1.1518	1.1617	1.1716	1.1814	1.1911	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	1.2177	1.2270
835	1.1348	1.1452	1.1554	1.1656	1.1756	1.1856	1.1955	1.2054	1.2151	1.2248	1.2344
830	1.1416	1.1521	1.1624	1.1726	1.1827	1.1928	1.2027	1.2126	1.2224	1.2321	1.2418
825	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
815	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
805	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
795	1.1920	1.2028	1.2135	1.2242	1.2348	1.2453	1.2557	1.2660	1.2762	1.2864	1.2965
790	1.1994	1.2104	1.2212	1.2320	1.2426	1.2532	1.2636	1.2740	1.2843	1.2945	1.3047
785	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  $t + ^\circ\text{C}$ .



### Altitude correction

If the air pressure is read off related to MSL (weather station), deduct the following air pressure in the correction table.

m	hPa (mbar)	m	hPa (mbar)	m	hPa (mbar)	m	hPa (mbar)	m	hPa (mbar)	m	hPa (mbar)
0	0	300	36	600	69	900	104	1400	159	2000	221
50	6	350	41	650	75	950	109	1500	170	2100	230
100	12	400	46	700	81	1000	115	1600	181	2200	239
150	18	450	52	750	86	1100	126	1700	192	2300	250
200	24	500	58	800	92	1200	137	1800	201	2400	259
250	30	550	63	850	98	1300	148	1900	210	2500	268

### Layout of repair order

Notes for the use of operation numbers in the various workshop sectors.

### Repair order procedure

The repair order should be completed by the Service Advisor in response to the customer complaint, taking into account the distance covered by the vehicle and any maintenance service which may be due at that moment or in the near future.

**To provide the workshop personnel with full information, the customer complaint should be described as precisely and comprehensively as possible in the repair order.**

Two examples for specifying the operation numbers:

#### Example 1

Vehicles with complaints regarding engine running where no maintenance service is due.

In this case, carry out operation no. 07-1100 "Testing, adjusting engine." Add in any additional combined work, depending on the customer complaint.

## **Example 2**

Vehicles with engine running complaint and for which a maintenance service is due.

To avoid any overlapping, do not state operation no. 07-1100 as it is already contained in part II of the maintenance service "Testing, adjusting engine."

In this case it is beneficial to have Part II performed in the test group in order to perform any additional operations which may be required as combined work.

### **Notes regarding work units microfilm "standard texts and flat rates"**

In the works units documentation the marking \* before the operation text indicates that a more detailed included text is listed following the respective operation group.

The flat rates stated are matched to the procedures in the corresponding microfilm Combustion.

### **Notes for the workshop foreman**

The engine test program is structured in such a way that the order can be extended as required.

Extensions as a result of additionally necessary combined work must be justified by the test and measurement results.