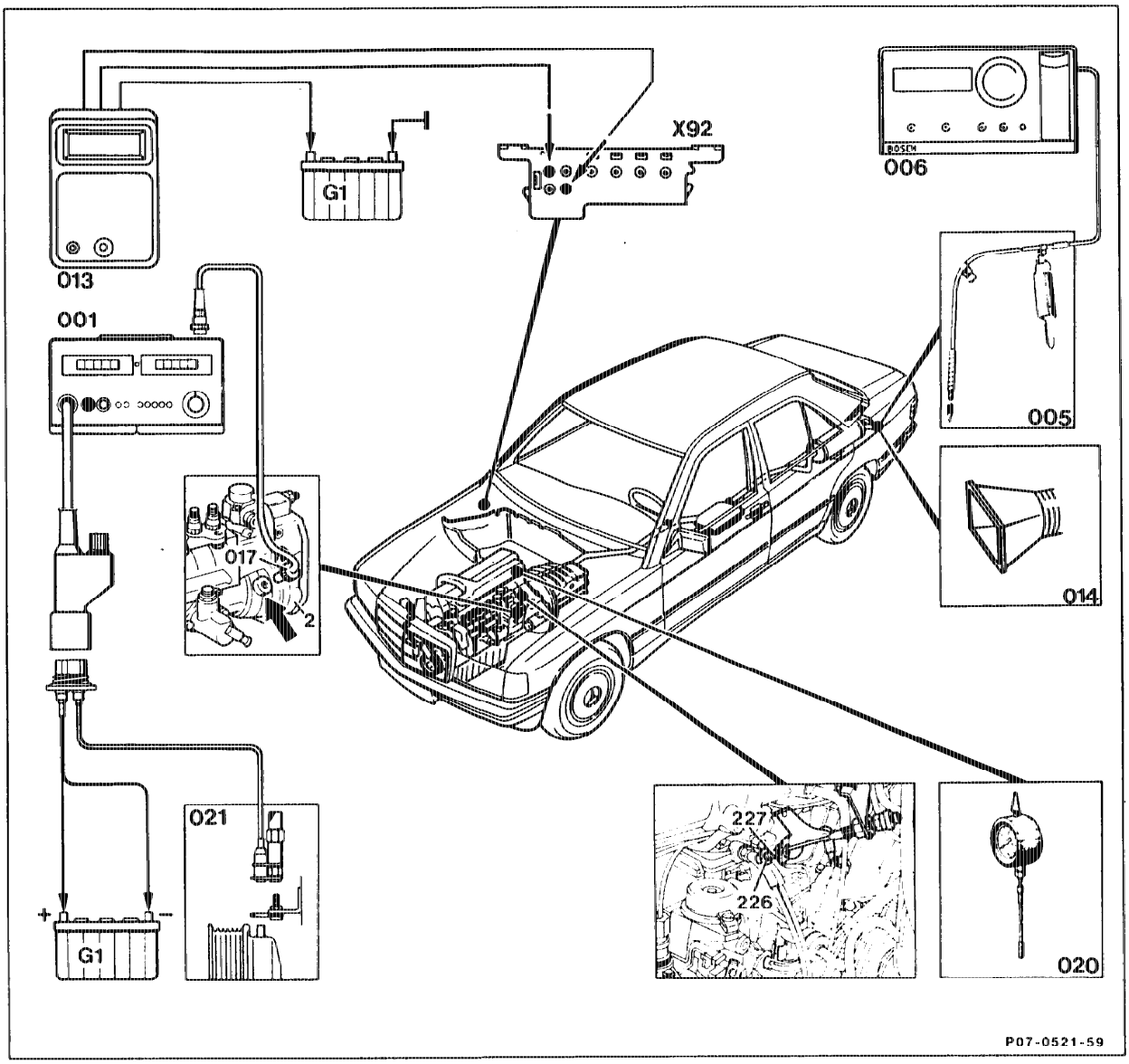
07.1–1203 Testing engine output and exhaust on roller dynamometer

Preceding work:
Testing, adjusting engine (07–1100)

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



Fluid level, automatic transmission fluid	check, correct.
Testers (001, 005, 006, 013, 020)	connect.
Pulse generator (021)	connect.

Trunk contents	check. Remove any heavy or heat-sensitive objects.
Front wheels	secure. Chocks placed approx. 100 mm ahead of front wheels.
Tyre inflation pressure of rear wheels	check, adjust to specified pressure.
Extractor facility (014)	position behind exhaust pipe.
Coolant temperature	raise to approx. 80 °C at part load, keeping a check on speedometer.
Blower	cool engine, do not exceed engine oil temperature of 120 °C.
Air conditioning or automatic climate control	switch off.
Lever of service valve on 4MATIC cars	move from "A" to "B".
Full-load output	check (refer to Table). Pay attention to notes regarding testing output and exhaust. ⚠ Run at full-load output only for as long as necessary to read instruments.
Emissions level under load	test. Specification: max. 0.1 % CO
Charge pressure under load	test. Specification: 0.85–0.95 bar, at 4000 rpm in drive position "3".
Exhaust back pressure (USA) California Model Year 1986/87	test. Specification: < 2.0 bar.

Test and adjustment data

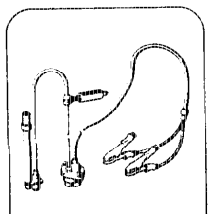
Engine		602.96	603.960/961	603.963	603.971
Version		Std. (A)	Std. (A)	Std. (A)	(USA)
Idle speed	rpm	680 ± 20 [5])	630 ± 20	630 ± 20	610 ± 20
Start of delivery with digital tester	RI specification [1])	15 ± 1° ATDC. As of Model Year 1992: 14 ± 0.5° ATDC	15 ± 1° ATDC. As of Model Year 1992: 14 ± 0.5° ATDC	15 ± 1° ATDC. As of Model Year 1992: 14 ± 0.5° ATDC	15 ± 1° ATDC. As of Model Year 1992: 14 ± 0.5° ATDC
Full-load output [2]) in kW at 4500/min, Drive position "3"	kW	64	77	73	–
Exhaust level [3]) % CO at 4500 rpm	% CO	0.1 [4])	0.1 [4])	0.1 [4])	–

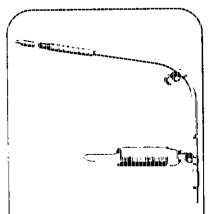
1) RI value – indirect start of delivery.
2) Test data are minimum output figures.
3) Pay attention to drive position and load value.
4) For exhaust measurements on diesel engines, at present used only "DRÄGER Gas Trace Tubes" or CO analysers with a suitably small measuring range.
5) With manual transmission 740 ± 20.

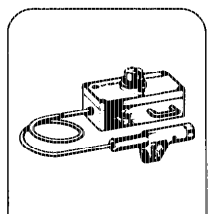
Note

Allowance must be made for the various influencing factors when measuring engine output. Observe references regarding testing output and exhaust on the dynamometer, as well as correcting output, driving instructions and job tips.

Special tools


603 589 00 21 00


126 589 11 63 00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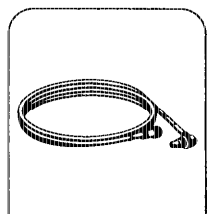
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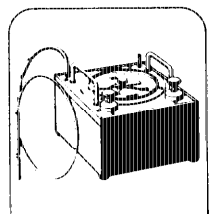
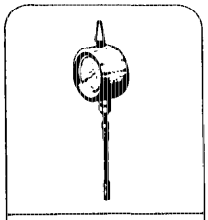
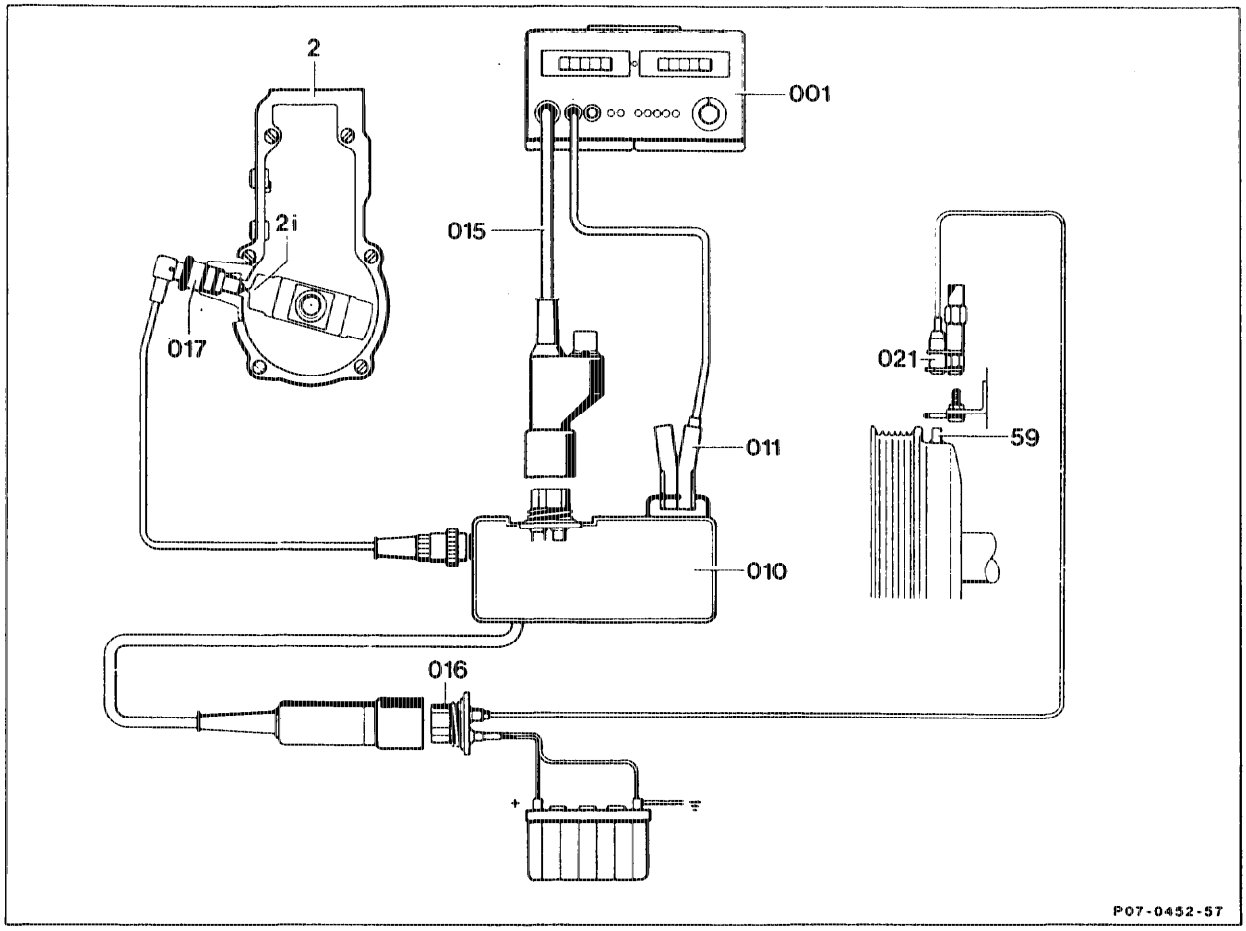

201 589 13 21 00



603 589 03 21 00

Commercially available tools and testers	
Designation	e. g. make, order no.
Used without adapter	
CO analyzer	Bosch, ETT 008.02/04 ETT 008.06
Digital tester	Bosch, ETD 019.02 or MOT 350/500/501 Sun, DIT 9100 AVL, Diesel-Tester 873
Used with adapter	
Digital tester	Bosch, MOT 001.03
Lambda tester (with EDS only)	Bosch, KDJE-P 600 Hermann, L 115



Connection diagram for existing testers with adapter

001	Digital tester	017	RI generator
010	Adapter	021	TDC pulse generator
011	Trigger clamp	2	Governor
015	Test cable with connector	2i	RI generator pin
016	Diagnostic socket	59	TDC generator pin

Testing

1 Check fluid level in automatic transmission.

2 Connect testers (001, 005, 006, 020) according to connection diagram.

3 Connect pulse generator (021).

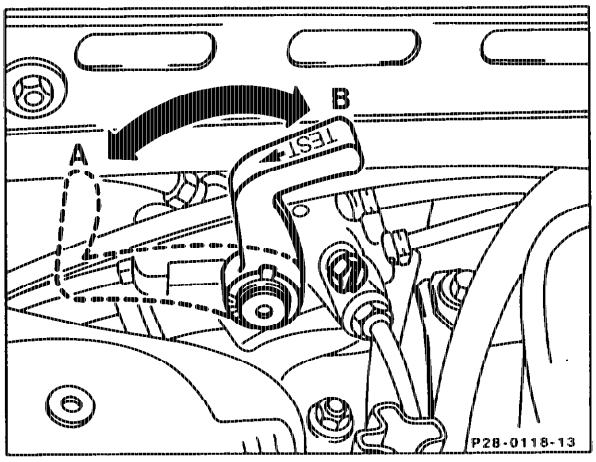
4 Check contents of trunk. Remove any heavy and heat-sensitive objects.

5 Secure front wheels by placing chocks approx. 100 mm ahead of front wheels.

6 Check inflation pressure of the rear wheels; adjust to specified pressure if necessary.

7 Position exhaust extraction device behind exhaust pipe.

8 On 4MATIC vehicles move lever of service valve from "A" to "B".



9 Switch off air conditioner or automatic climate control.

10 Warm up coolant at part load to 60–80 °C coolant temperature; at the same time check speedometer.

11 Cool engine with blower. Do not exceed a coolant temperature of 120 °C.

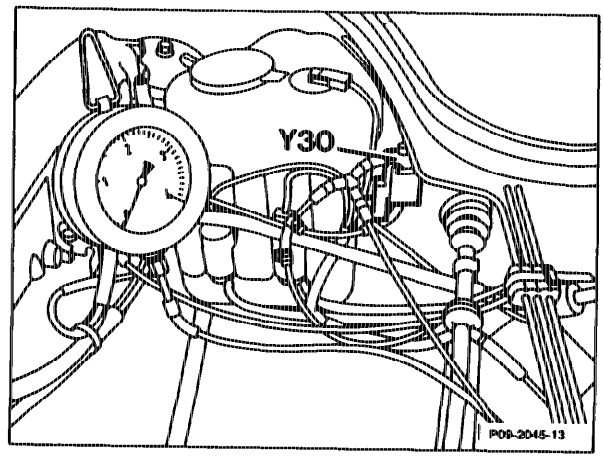
12 Test full load output.

⚠

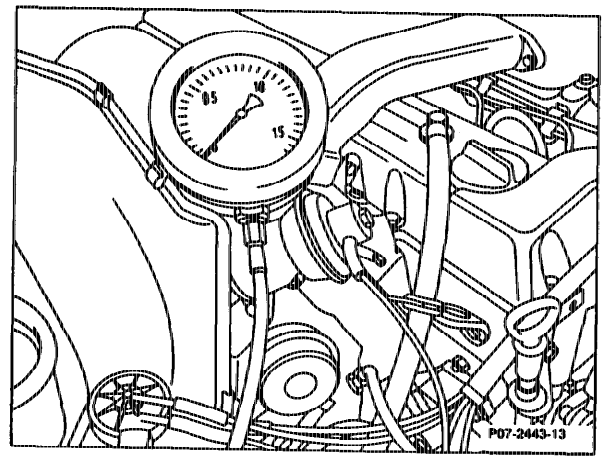
Pay attention to instructions regarding testing engine output and exhaust on dynamometer, as well as correction of output, driving instructions and work instructions.

13 Test exhaust level under load. If the specified exhaust levels under load are not achieved, set injection pump to the upper tolerance limit on the pump test stand.

14 Test charge pressure under load at the electrical switchover valve (Y30). Specification: 0.85–0.95 bar gauge at 4000 rpm in drive position "3".



15 Test exhaust backpressure at exhaust manifold, only (USA) California.
Move selector lever to position "P" and read off test value at 4000 rpm.
Specification: < 2.0 bar
If not, perform regeneration of trap oxidizer as follows: With selector lever in position "2", run car on roller dynamometer or on road for 2 minutes at full load.
Repeat regeneration (max. 1 time). If the specification is not achieved, replace trap oxidizer and perform EDS short test (07–1121, Section "B").



Instructions regarding testing engine output and exhaust on dynamometer as well as correction of output, driving instructions and work instructions.

Testing engine output
This test should only be conducted if a complaint is received regarding engine output. The valid output reference values are minimum outputs and apply to cars with power steering. Allow for barometer level and intake air temperature (refer to use of correction table).

Exhaust tests
The exhaust test at full load is intended to assess fuel consumption and engine output. It is not possible to determine absolute consumption. Instruments operating on the infrared absorption method should be used for the exhaust test.

Correcting engine output on dynamometer
A standard Directive as specified in 80/1269 EEC has been laid down for the European Community for determining engine output. It differs from the hitherto valid DIN 70020 Part 6 method, for example in respect of atmospheric reference conditions (air temperature now 25 °C, previously 20 °C, air pressure 990 hPa (mbar) instead of 1013 hPa (mbar).

Driving instructions, work instructions
It is important to adhere strictly to the following instructions in order to keep tyre wear within permissible limits:

1 The car must not be driven on the dynamometer with winter tyres. The car must be fitted with shop dynamometer test tyres. Only warming-up under part load is permitted.

2 Check inflation pressure of the driven wheels, but do not increase beyond the pressure specified for on-road running.

3 High axle load of the driven wheels is not permitted.

4 Restrict duration of running to the time absolutely necessary for reading the instruments (about 5 seconds for exhaust test).

5 Road speed max. 130 km/h (120 km/h if SR tyres fitted) on dynamometers with roller diameter of at least 318 mm with original tyres. If roller diameter 220–318 mm, shop test tyres must be fitted to cars with SR tyres for speeds in excess of 100 km/h. Function and engine output tests up to max. 100 km/h may also be conducted with original tyres.

6 Observe the test specifications and the following sequence:
Warming-up – engine output test – exhaust test at full load. The full load tests (output, exhaust) should be conducted immediately after the warming-up run so long as tyre temperature is still low, as the temperature rises most rapidly during these measurements. Two repeat measurements after adjusting work are permitted. It is essential to wait (45 minutes) before conducting further measurements to allow the tyres to cool down.

7 Cool car with blower (minimum capacity 15,000 m^3/h). Direct air flow onto radiator and underside of car (oil sump, exhaust, tyres). Maintain a distance of about 1 meter between blower and car.

8 Warm-up under part load (drive position 3 or 3rd gear, approx. 60 km/h, approx. 25 kW) up to a coolant temperature of 60–80 °C.

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

10 When performing output test, run engine in specified gear at the specified engine speed with engine running at full load. Read off instruments. Release pressure on accelerator pedal. Compare indicated output with reference value. Allow for car equipment, barometer level and intake temperature (refer to use of correction table and specifications for correcting output).

11 When performing exhaust test, run engine at full load in the specified gear at the stated engine speed and dynamometer setting. Do not run for longer than is necessary to read off instruments. The air filter must be fitted. If necessary, the engine must be allowed to cool down after a full load test.

Use of correction table

All engine output data relate to normal operating conditions:

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

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

Air pressure measuring system of meteorological station

The barometer of the meteorological station indicates air pressure related to sea level. The barometer must be set to the air pressure indicated by the local meteorological office before being used.

In addition to the barometer reading, allowance must also be made for altitude and inlet air temperature.

Output correction formula	$Ne_o = Ne \times K_H$

Ne_o = output related to normal operating conditions in kW.

Ne = output measured on dynamometer in kW.

K_H = correction for inlet air temperature, barometer level and altitude of particular test locations.

The output correction factors can be obtained from the correction table.

Calculation example
(The values are entered for this example).

Output determined:	Ne = 100 kW
Barometer level (related to sea level):	p = 955 hPa (955 mbar)
Altitude of test location:	400 m above sea level
Inlet air temperature:	t = +20 °C

Hence:

p test location	= p barometer – p altitude
p test location	= 955 hPa –46 hPa
	= 909 hPa ≈ 910 hPa
K_H	= 1.0787 (from correction table 910 hPa + 20 °C)
Ne_o	= measured output Ne × correction K_H
Ne_o is thus	= 100 kW × 1.0787 = 108 kW

Correction of engine output on dynamometer for diesel engines conforming to 80/1269 EEC

Air press. 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	1.1294	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	1.2117	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

Inlet air temperature t + °C

Altitude correction
If the air pressure reading is related to sea level (meteorological station), deduct the following air pressure as stated 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	145	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

Repair order arrangement
Note for the use of operation numbers in the various workshop areas.

Order processing
The repair order is to be issued by the service receptionist in line with the complaint of the customer, taking into account the mileage of the vehicle and any due or recently carried out service. To inform the workshop personnel, the customer complaint must be written precisely and clearly on the order.
Two examples for specifying operation numbers:

Example 1
Vehicles with engine complaint without a service due.

In this case perform Operation No. 07–1100 "check, adjust engine", incorporating additional related work depending on the complaint.

Example 2
Vehicles with a service due and engine complaint.

In order to avoid overlaps, do not state Operation No. 07–1100 as "Testing, adjusting engine" is already contained in Part II of the service.

In this case, it is advantageous to have Part II performed in the test group in order to carry out any additionally required work as combined work.

Notes on standard texts and flat rates microfilm
The identification "*" in front of the operation text in the work unit documentation means that a detailed included text is listed in connection with the respective operation group.

The flat rates stated are matched to the scopes of work in the corresponding microfilm "Engine Combustion".

Notes for workshop supervisor
The engine test program is structured in such a way that the repair order can be extended as necessary.

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

Diesel engines
07–1203 and 1206
Testing engine output and exhaust on test bench. This operation number provides for the work being conducted on the dynamometer.

If no dynamometer is available, individual items (related to the complaint) should be specified.