B 3 Testing engine output and exhaust emission

Preceding work: Testing and adjusting engine (07-1100) Operation no. of operation texts and work units or standard texts and flat rates: 07-1203 or 07-1206

1	Front wheels	secure, safety chocks at a distance of 100 mm in front of the front wheels.
2	Tire pressure of rear wheels	check, adjust to specified pressure.
3	Trunk contents	check, remove objects which are sensitive to heat and heavy.
4	Units under part load, selector lever position "S" or 3rd gear, approx. 25 kW	drive vehicle until units are hot, engine oil temperature approx. 80°C. Do not exceed 120°C for oil.
5	Vehicles with ASR/ETS/ABS	a) Operations **without** Hand-Held Tester (HHT) Ignition: **OFF**, connect socket 6 with socket 1 (ground) to test coupling (X11/4). Use adapter. ASR/ETS/ABS malfunction indicator lamp illuminated while driving. With multifunction display the text "slip, ASR, control" appears in the display. Before disconnecting, ensure ignition: **OFF**. b) Operations **with** Hand-Held Tester (HHT): Ignition: **OFF**, disconnect ABS/ASR hydraulic unit coupling in wheel house ASR/ETS/ABS malfunction indicator lamp illuminated. With multifunction display the text "slip, ASR, control" appears in the display. After testing connect connector and erase fault memory.
6	Engine with blower	direct air flow to radiator and underside of vehicle (oil pan, exhaust, three-way catalytic converter, tires). Maintain a distance of approx. 1 m between blower and vehicle.
7	Start of delivery or GI value	test (refer to test and adjustment values, Index A).

B 3 Testing engine output and exhaust emission

Preceding work: Testing and adjusting engine (07-1100) Operation no. of operation texts and work units or standard texts and flat rates: 07-1203 or 07-1206

8	Wide open throttle output	test, only drive at wide open throttle output for as long as is required to read the instruments. Compare output values displayed with Index A, test and adjustment values, taking into consideration barometer reading, engine coolant temperature and intake air temperature.
9	Injected fuel quantity	test, only possible with HHT (refer to Test and adjustment values, Index A).
10	Intake manifold absolute pressure	test, only possible with HHT (refer to Test and adjustment values, Index A).
11	Engine coolant temperature	test, only possible with HHT (refer to Test and adjustment values, Index A).
12	Intake air temperature	test, only possible with HHT (refer to Test and adjustment values, Index A).
13	Fuel rack position (engines 605, 606), start of injection (engine 602.982) or injection timer travel (engine 604)	test, only possible with HHT (refer to Test and adjustment values, Index A).
14	Opacity	test (refer to Test and adjustment values, Index A).

Note
Carry out speedometer comparison with frequency generator, only in the event of a complaint if the final speed is not reached

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 Use of correction table

General
The barometer of the weather station must be set to the atmospheric pressure in accordance with the information of the local meteorological office.

The measured engine output must be corrected with correction factors.
A distinction is made between 2 correction factors:
- Altitude correction factor
- Engine output correction factor

Determining engine output related to normal operating conditions
1. Read off atmospheric pressure, altitude and intake air temperature of the test location on the weather station.
2. Determine engine output on the dynamometer.
3. Read off the altitude correction factor in the altitude correction table with the altitude figure of the test location.
4. The atmospheric pressure figure of the test location minus the altitude correction factor results in the atmospheric pressure (p) in hPa (mbar).
5. Using the calculated atmospheric pressure (p), determine in the engine output correction table the engine output correction factor (K_H) on the basis of the intake air temperature (t).
6. With the engine output correction formula, determine the engine output related to normal operating conditions as follows:
   Engine output correction formula $\mathbf{Ne_o = Ne \times K_H}$
   Ne_o = Engine output related to normal operating conditions in kW.
   Ne = Engine output measured on dynamometer in kW.
   K_H = Correction for intake air temperature, barometer reading and altitude of the respective test location.

B 3 Calculation example for correction table

1. Read off atmospheric pressure, altitude and the intake air temperature of the test location on the 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 dynamometer = 100 kW
3. With the altitude value of the test location= 400 m an altitude correction factor of 46 hPa (mbar) is obtained in the altitude correction table.
4. Atmospheric pressure of the test location minus the altitude correction factor produces the atmospheric pressure value (p):
   955 hPa (mbar) - 46 hPa (mbar) = 909 hPa (mbar)
   The atmospheric pressure (p) must be rounded off in order to use it in the table. In the example to 910 hPa.
5. On the basis of the atmospheric pressure (p) = 910 hPa we read off a correction factor (K_H) of 1.0787 from the engine output correction table for an intake air temperature (t) of 20 °C .
6. Engine output related to normal operating conditions is obtained as follows:
   $Ne_0 = Ne \times K_H$
   Ne_0 = 100 kW × 1.0787 = **108 kW**

Note
The figures for this example are marked in the correction table.

Engine output on dynamometer:	Ne	=	100 kW
Atmospheric pressure value 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

Engine output correction on dynamometer for diesel engines in conformity with 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
990	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	1.0680	1.0709	1.0793
950	0.9974	1.0065	1.0155	1.0245	1.0333	1.0421	1.0508	1.0594	1.0624	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	1.0963	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
[ ] = Calculation example

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
830	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

hPa* = Hecto-Pascal
[ ] = Calculation example

Altitude correction

If the reading of the atmospheric pressure is taken in relation 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
[ ] = Calculation example