Electrical Test Program – Ignition System Test

⚠ **WARNING!**
Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

⚠ **WARNING!**
Risk of fatal injury from being pulled into rotating vehicle parts.
Do not reach into rotating parts.
Wear closed and tight-fitting work clothes.
Protect vicinity of rotating vehicle components from unauthorized access.

⚠ **WARNING!**
Risk of explosion from fuel igniting, risk of poisoning from inhaling and swallowing fuel as well as risk of injury to eyes and skin from contact with fuel.
No fire, sparks, exposed flames or smoking.
Pour fuels only into suitable and appropriately marked containers.
Wear protective clothing when handling fuel.

Note regarding "Test Connection" column:
The numbers indicated in parentheses, for example, ⇒ 1.0 (2A) signify:
2 = Socket 2 on wiring diagram.
A = Connector A on wiring diagram

Connect interior harness connector to connection 1 on test cable.
Connect engine harness connector to connection 2 on test cable.

Preparation for Test:
1. Review section 0,
2. Review 11, 21, 22,
3. Ignition: **OFF,**
4. Connect test cable with socket box to N3/11 or N3/12, see 22.

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	P0 560 P1 587	**Left engine control module (N3/11) or Right engine control module (N3/12)** Voltage supply circuit 30	N3/11 N3/12 26 (1.26) — V — 35 (1.35)	Ignition: **ON**	11 – 14 V	⇒ 1.1

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⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.1		Ground wire	N3/11 N3/12 26 — (1.26) 39 — (1.39) X11/4 2 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 129** Ground (W27), module box bracket. **Model 140** Harness ground (W15), right footwell. ⇒ 1.2
1.2		Voltage supply circuit 30	N3/11 N3/12 X11/4 1 35 (1.35)	Ignition: **ON**	11 – 14 V	Wiring, Base module (BM) (N16/1) or fuse on N16/1
2.0	P0 560 P1 587	**Left engine control module (N3/11) or Right engine control module (N3/12)** Voltage supply circuit 87L	N3/11 N3/12 38 (1.38) 24 (1.24)	Ignition: **ON**	11 – 14 V	⇒ 2.1

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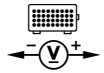
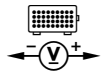
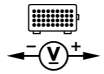
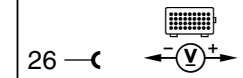
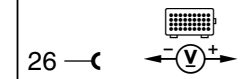
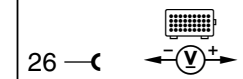
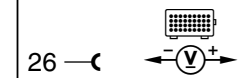
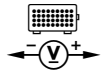
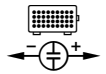
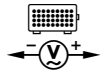
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
2.1		Electronics ground	N3/11 N3/12 38 — (1.38)  X11/4 — 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 129 and 140** Electronics ground (W15/1), right footwell ⇒ 2.2
2.2		Voltage supply Circuit 87L	N3/11 N3/12 X11/4 1 —  — 24 (1.24)	Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Base module (N16/1) or fuse on base module, Ignition/starter switch (S2/1)
3.0	P0 560 P1 587	**Left engine control module (N3/11) or Right engine control module (N3/12)** Voltage supply circuit 87M1e	N3/11 N3/12 39 — (1.39)  — 36 (1.36)	Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Wiring.
4.0		**Ignition coil (T1/1 or T1/7)** Voltage supply	N3/11 N3/12 26 — (1.26)  — 83 (2.83)	Ignition: **ON** Starter: **Crank**	11 – 14 V > 10 V	Wiring. Model 129 as of 09/95 and Model 140 as of 06/96 fused as follows: Model 129: fuse 34 Model 140: fuse 22

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
5.0		**Ignition coil (T1/2 or T1/8)** Voltage supply	N3/11 N3/12  26 (1.26) — 94 (2.94)	Ignition: **ON** Starter: **Crank**	11 – 14 V > 10 V	Wiring. Model 129 as of 09/95 and Model 140 as of 06/96 fused as follows: Model 129: fuse 34 Model 140: fuse 22
6.0		**Ignition coil (T1/3 or T1/9)** Voltage supply	N3/11 N3/12  26 (1.26) — 85 (2.85)	Ignition: **ON** Starter: **Crank**	11 – 14 V > 10 V	Wiring. Model 129 as of 09/95 and Model 140 as of 06/96 fused as follows: Model 129: fuse 34 Model 140: fuse 22
7.0		**Ignition coil (T1/4 or T1/10)** Voltage supply	N3/11 N3/12  26 (1.26) — 115 (2.115)	Ignition: **ON** Starter: **Crank**	11 – 14 V > 10 V	Wiring. Model 129 as of 09/95 and Model 140 as of 06/96 fused as follows: Model 129: fuse 34 Model 140: fuse 22
8.0		**Ignition coil (T1/5 or T1/11)** Voltage supply	N3/11 N3/12  26 (1.26) — 84 (2.84)	Ignition: **ON** Starter: **Crank**	11 – 14 V > 10 V	Wiring. Model 129 as of 09/95 and Model 140 as of 06/96 fused as follows: Model 129: fuse 34 Model 140: fuse 22

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
9.0		**Ignition coil (T1/6 or T1/12)** Voltage supply	N3/11 N3/12  26 (1.26) — 95 (2.95)	Ignition: **ON** Starter: **Crank**	11 – 14 V > 10 V	Wiring. Model 129 as of 09/95 and Model 140 as of 06/96 fused as follows: Model 129: fuse 34 Model 140: fuse 22
10.0	P0 335 P1 300	**Left CKP sensor (L5/4)** **Right CKP sensor (L5/5)**	N3/11 [2] N3/12 [2]  78 (2.78) — 89 (2.89)	Starter: **Crank** Engine: **at Idle**	Signal, see Figure 1.	⇒ 10.1, Teeth on starter ring gear.
			N3/11 [3] N3/12 [3]  78 (2.78) — 89 (2.89)	Starter: **Crank** Engine: **at Idle**	> 0.5 V > 7 V Increase in rpm = increase in voltage.	

[2] Test with oscilloscope.

[3] Test with multimeter only if oscilloscope is unavailable.

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
10.1		Resistance of CKP sensor (L5/4 or L5/5)	N3/11 N3/12 78 (2.78) — Ω — 89 (2.89)	Ignition: **OFF** Unplug connector 2 on engine control module (N3/11) or (N3/12).	(at 20°C): 600 – 1200 Ω	L5/4 or L5/5
11.0	P0 341 P1 397	**Left camshaft Hall-effect sensor (B6/2) or Right camshaft Hall-effect sensor (B6/3)** Hall-effect signal	N3/11 2) N3/12 2) 87 (2.87) — ⏚ — 66 (2.66)	Engine: **at Idle**	Signal, see Figure 2.	⇒ 11.1, B6/2 or B6/3
			N3/11 3) N3/12 3) 66 (2.66) — V — 25 (1.25)	Engine: **at Idle**	1.3 – 1.7 V Value changes	

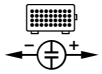
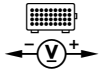
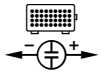
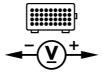
2) Test with oscilloscope.

3) Test with multimeter only if oscilloscope is unavailable.

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
11.1		Voltage supply to camshaft Hall-effect sensor (B6/2 or B6/3)	B6/2 B6/3 1 — (V) — 3	Ignition: **ON** Disconnect connector from Hall-effect sensor (B6/2 or B6/3) and test directly on sockets 1 and 3 of connector.	11 – 14 V	Wiring.
12.0		**Closing duration for ignition coil (T1/1 or T1/7)**	N3/11 N3/12 83 (2.83) — 25 (1.25)	Starter: **Crank** Engine: **at Idle**	20 – 100 ms 2 – 4 ms	⇒ 10.0, ⇒ 12.1, N3/11 or N3/12
12.1		Rest current shut-off: T1/1 or T1/7	N3/11 N3/12 83 (2.83) — 25 (1.25)	Ignition: **ON** Starter: **Crank**	0 V 0.3 – 0.5 V	T1/1 or T1/7, N3/11 or N3/12, < 0.3 V: wire from T1/1 to N3/12 or T1/7 to N3/11 open circuit, > 0.5 V: T1/1 or T1/7

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
13.0		**Closing duration for ignition coil (T1/2 or T1/8)**	N3/11 N3/12  94 (2.94) — 25 (1.25)	Starter: **Crank** Engine: **at Idle**	20 – 100 ms 2 – 4 ms	⇒ 13.1, N3/11 or N3/12
13.1		Rest current shut-off: T1/2 or T1/8	N3/11 N3/12  94 (2.94) — 25 (1.25)	Ignition: **ON** Starter: **Crank**	0 V 0.3 – 0.5 V	T1/2 or T1/8, N3/11 or N3/12, < 0.3 V: wire from T1/2 to N3/12 or T1/8 to N3/11 open circuit, > 0.5 V: T1/2 or T1/8
14.0		**Closing duration for ignition coil (T1/3 or T1/9)**	N3/11 N3/12  85 (2.85) — 25 (1.25)	Starter: **Crank** Engine: **at Idle**	20 – 100 ms 2 – 4 ms	⇒ 14.1, N3/11 or N3/12
14.1		Rest current shut-off: T1/3 or T1/9	N3/11 N3/12  85 (2.85) — 25 (1.25)	Ignition: **ON** Starter: **Crank**	0 V 0.3 – 0.5 V	T1/3 or T1/9, N3/11 or N3/12, < 0.3 V: wire from T1/3 to N3/12 or T1/9 to N3/11 open circuit, > 0.5 V: T1/3 or T1/9

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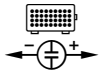
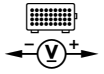
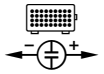
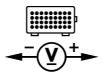
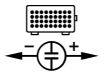
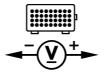
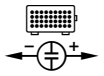
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
15.0		**Closing duration for ignition coil (T1/4 or T1/10)**	N3/11 N3/12  115 (2.115) — 25 (1.25)	Starter: **Crank** Engine: **at Idle**	20 – 100 ms 2 – 4 ms	⇒ 15.1, N3/11 or N3/12
15.1		Rest current shut-off: T1/4 or T1/10	N3/11 N3/12  115 (2.115) — 25 (1.25)	Ignition: **ON** Starter: **Crank**	0 V 0.3 – 0.5 V	T1/4 or T1/10, N3/11 or N3/12, < 0.3 V: wire from T1/4 to N3/12 or T1/10 to N3/11 open circuit, > 0.5 V: T1/4 or T1/10
16.0		**Closing duration for ignition coil (T1/5 or T1/11)**	N3/11 N3/12  84 (2.84) — 25 (1.25)	Starter: **Crank** Engine: **at Idle**	20 – 100 ms 2 – 4 ms	⇒ 16.1, N3/11 or N3/12

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
16.1		Rest current shut-off: T1/5 or T1/11	N3/11 N3/12  84 (2.84) — 25 (1.25)	Ignition: **ON** Starter: **Crank**	0 V 0.3 – 0.5 V	T1/5 or T1/11, N3/11 or N3/12, < 0.3 V: wire from T1/5 to N3/12 or T1/11 to N3/11 open circuit, > 0.5 V: T1/5 or T1/11
17.0		**Closing duration for ignition coil (T1/6 or T1/12)**	N3/11 N3/12  95 (2.95) — 25 (1.25)	Starter: **Crank** Engine: **at Idle**	20 – 100 ms 2 – 4 ms	⇒ 17.1, N3/11 or N3/12
17.1		Rest current shut-off: T1/6 or T1/12	N3/11 N3/12  95 (2.95) — 25 (1.25)	Ignition: **ON** Starter: **Crank**	0 V 0.3 – 0.5 V	T1/6 or T1/12, N3/11 or N3/12, < 0.3 V: wire from T1/6 to N3/12 or T1/12 to N3/11 open circuit, > 0.5 V: T1/6 or T1/12
18.0	P0 300 P0 301 P0 307	**Primary voltage** Ignition coil (T1/1 or T1/7)	N3/11 N3/12  83 (2.83) — 25 (1.25)	**Test connection Note:** Individual primary pattern Range 400 V Duration 100% Starter: **Crank**	200 – 350 V	⇒ 18.1, N3/11 or N3/12

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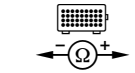
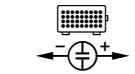
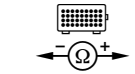
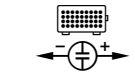
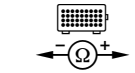
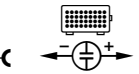
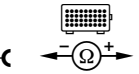
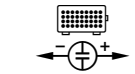
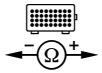
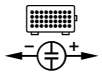
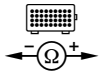
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
18.1		Primary winding of T1/1 and T1/2 or T1/7 and T1/8	N3/11 N3/12  83 (2.83) — 94 (2.94)	Ignition: **OFF**	0.9 – 1.4 Ω The resistance of a single coil is 0.5 – 0.7Ω	T1/1 or T1/2 and/or T1/7 or T1/8
19.0	P0 300 P0 302 P0 308	**Primary voltage** Ignition coil (T1/2 or T1/8)	N3/11 N3/12  94 (2.94) — 25 (1.25)	**Test connection Note:** Individual primary pattern Range 400 V Duration 100% Starter: **Crank**	200 – 350 V	⇒ 19.1, N3/11 or N3/12
19.1		Primary winding of T1/2 and T1/1 or T1/8 and T1/7	N3/11 N3/12  94 (2.94) — 83 (2.83)	Ignition: **OFF**	0.9 – 1.4 Ω The resistance of a single coil is 0.5 – 0.7Ω	T1/2 or T1/1 and/or T1/8 or T1/7
20.0	P0 300 P0 303 P0 309	**Primary voltage** Ignition coil (T1/3 or T1/9)	N3/11 N3/12  85 (2.85) — 25 (1.25)	**Test connection Note:** Individual primary pattern Range 400 V Duration 100% Starter: **Crank**	200 – 350 V	⇒ 20.1, N3/11 or N3/12

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
20.1		Primary winding of T1/3 and T1/4 or T1/9 and T1/10	N3/11 N3/12  85 (2.85) — 115 (2.115)	Ignition: **OFF**	0.9 – 1.4 Ω The resistance of a single coil is 0.5 – 0.7Ω	T1/3 or T1/4 and/or T1/9 or T1/10
21.0	P0 300 P0 304 P0 310	**Primary voltage** Ignition coil (T1/4 or T1/10)	N3/11 N3/12  115 (2.115) — 25 (1.25)	**Test connection Note:** Individual primary pattern Range 400 V Duration 100% Starter: **Crank**	200 – 350 V	⇒ 21.1, N3/11 or N3/12
21.1		Primary winding of T1/4 and T1/3 or T1/10 and T1/9	N3/11 N3/12  115 (2.115) — 85 (2.85)	Ignition: **OFF**	0.9 – 1.4 Ω The resistance of a single coil is 0.5 – 0.7Ω	T1/4 or T1/3 and/or T1/10 or T1/9
22.0	P0 300 P0 305 P0 311	**Primary voltage** Ignition coil (T1/5 or T1/11)	N3/11 N3/12  84 (2.84) — 25 (1.25)	**Test connection Note:** Individual primary pattern Range 400 V Duration 100% Starter: **Crank**	200 – 350 V	⇒ 22.1, N3/11 or N3/12

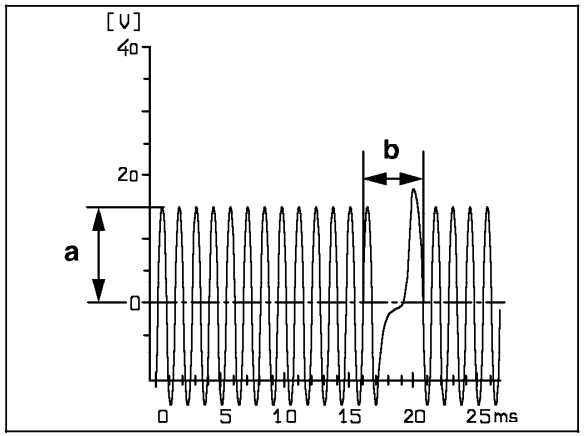
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
22.1		Primary winding of T1/5 and T1/6 or T1/11 and T1/12	N3/11 N3/12  84 (2.84) — 95 (2.95)	Ignition: **OFF**	0.9 – 1.4 Ω The resistance of a single coil is 0.5 – 0.7Ω	T1/5 or T1/6 and/or T1/11 or T1/12
23.0	P0 300 P0 306 P0 312	**Primary voltage** Ignition coil (T1/6 or T1/12)	N3/11 N3/12  95 (2.95) — 25 (1.25)	**Test connection Note:** Individual primary pattern Range 400 V Duration 100% Starter: **Crank**	200 – 350 V	⇒ 23.1, N3/11 or N3/12
23.1		Primary winding of T1/6 and T1/5 or T1/12 and T1/11	N3/11 N3/12  95 (2.95) — 84 (2.84)	Ignition: **OFF**	0.9 – 1.4 Ω The resistance of a single coil is 0.5 – 0.7Ω	T1/6 or T1/5 and/or T1/12 or T1/11

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
24.0	P0 300 P0 301 P0 302 P0 303 P0 304 P0 305 P0 306 P0 307 P0 308 P0 309 P0 310 P0 311 P0 312	**Firing voltage** Ignition coil (T1/1) to (T1/12)	Engine analyzer	**Test connection Note:** Individual secondary pattern Range 20 kV Duration 100% Connect kV pick-ups successively to T1/1 through T1/12. Starter: **Crank**	8 – 20 kV The resistance of the secondary winding can not be measured due to an installed diode.	Spark plugs, T1/1 to T1/12, N3/11 or N3/12

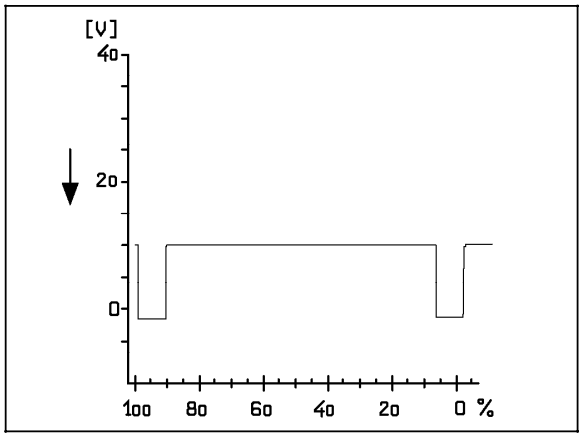
Electrical Test Program – Ignition System Test



P07.61-0215-01

Figure 1

Left CKP sensor (L5/4) and Right CKP sensor (L5/5) signal
a=voltage, b=2 missing teeth for cylinder 1 or cylinder 7 recognition



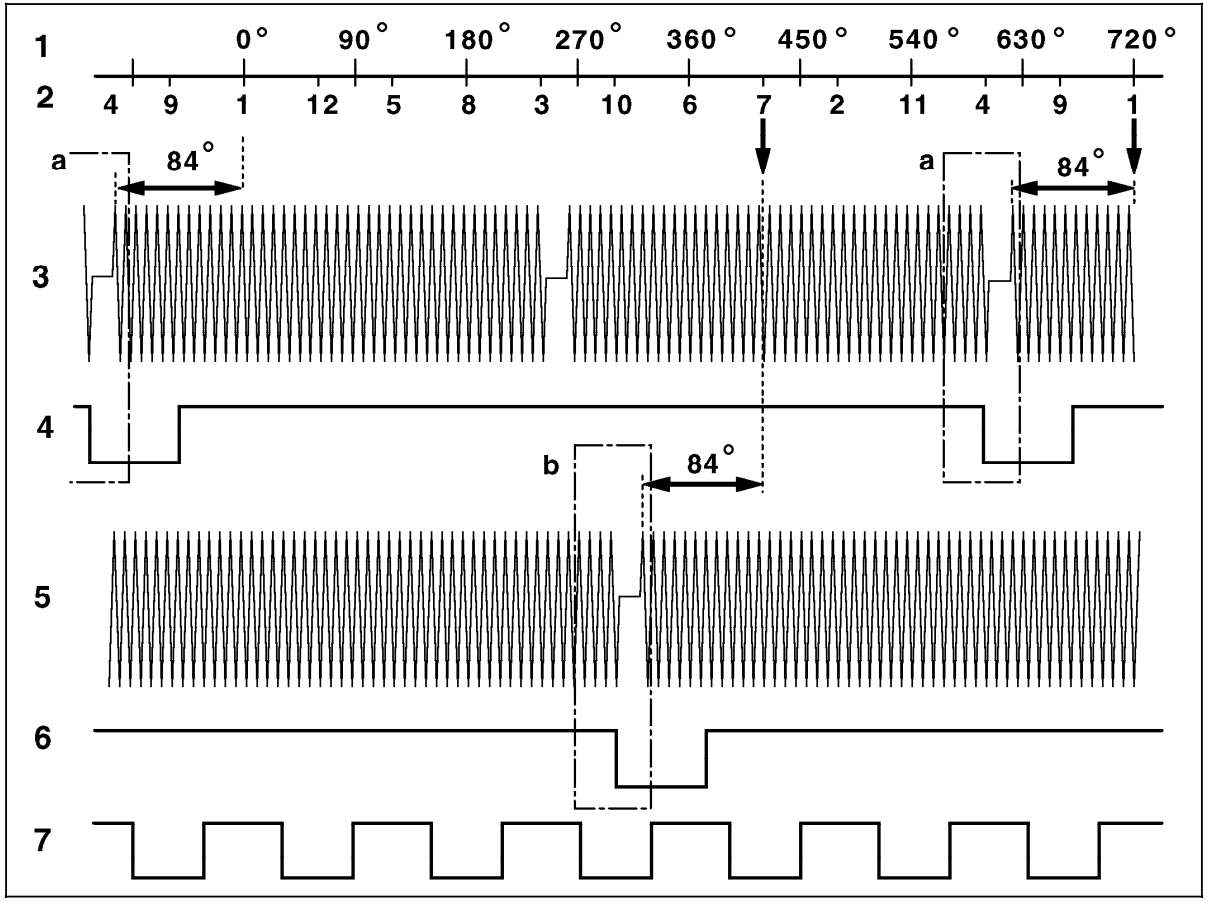
P07.61-0536-01

Figure 2

Left camshaft Hall-effect sensor (B6/2) and Right camshaft Hall-effect sensor (B6/3) signal

Electrical Test Program – Ignition System Test

Signal survey



P07.61-0231-06

Figure 3

1 Crank angle (CKA)
2 Cylinder
3 Right CKP sensor (L5/5) signal
4 Right camshaft Hall-effect sensor (B6/3) signal
5 Left CKP sensor (L5/4) signal
6 Left camshaft Hall-effect sensor (B6/2) signal
7 Engine rpm signal TNA
a Cylinder 1 recognition
b Cylinder 7 recognition