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.

Preparation for Test:
1. Review section 0,
2. Review 11, 21, 22 entirely,
3. Readout DTC memory,
4. Ignition: **OFF,**
5. Connect test cable with socket box to N3/10.

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	P0 560	**Engine control module (N3/10)** Voltage supply circuit 30	N3/10 3 (3A) — V — 12 (4B)	Ignition: **ON**	11 – 14 V	⇒ 1.1 – 1.2
1.1		Ground wire	N3/10 3 (3A) — V — X11/4 2 7 (7A) — V — X11/4 2 112 (8F) — V — X11/4 2 119 (15F) — V — X11/4 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 208/210:** (electronics ground - component compartment - right) (W16/6), **Model 163:** (component compartment) (W16), **Model 129:** (control module box/module box) (W27). Model 463: Ground, right A-pillar (w29/2), Ground, bracket control module (W27).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.2		Voltage supply circuit 30	X11/4 1 – V – N3/10 12 (4B)	Ignition: **ON** Model 163: Connect 16-pole test cable to socket 4.	11 – 14 V	Wiring, Passenger-side fuse and relay module box (K40/4). Fuse box (F1), Base module (BM) (N16/1).
2.0	P0 560	**Engine control module (N3/10)** Voltage supply circuit 87	N3/10 8 (8A) – V – 2 (2A)	Ignition: **ON**	11 – 14 V	⇒ 2.1 – 2.2
2.1		Electronics ground	N3/10 8 (8A) – V – X11/4 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 208/210:** (electronics ground - component compartment - right) (W16/6), **Model 163:** (component compartment) (W16), **Model 129:** (control module box/module box) (W27). **Model 463:** Ground, right A-pillar (W29/2)
2.2		Voltage supply circuit 87	X11/4 1 – V – N3/10 2 (2A)	Ignition: **ON** Model 163: Connect 16-pole test Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Passenger-side fuse and relay module box (K40/4). Fuse box (F1), Base module (BM) (N16/1), (F1f22)

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
3.0		**Ignition coil (T1/1)** Cylinder 1 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — 124 (20F) N3/10 3 (3A) — 125 (21F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/1). **Model 463:** Fuse F1f25 Ignition coil (T1/1).
4.0		**Ignition coil (T1/2)** Cylinder 2 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — 123 (19F) N3/10 3 (3A) — 122 (18F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/2), **Model 463:** Fuse F1f25 Ignition coil (T1/2).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
5.0		**Ignition coil (T1/3)** Cylinder 3 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 109 (5F) N3/10 3 (3A) — (V) — 108 (4F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/3), **Model 463:** Fuse F1f25 Ignition coil (T1/3).
6.0		**Ignition coil (T1/4)** Cylinder 4 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 110 (6F) N3/10 3 (3A) — (V) — 111 (7F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/4) **Model 463:** Fuse F1f25 Ignition coil (T1/4).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
7.0		**Ignition coil (T1/5)** Cylinder 5 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 117 (13F) N3/10 3 (3A) — (V) — 118 (14F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/5), **Model 463:** Fuse F1f25 Ignition coil (T1/5).
8.0		**Ignition coil (T1/6)** Cylinder 6 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 121 (17F) N3/10 3 (3A) — (V) — 120 (16F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/6), **Model 463:** Fuse F1f25 Ignition coil (T1/6).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
9.0		**Ignition coil (T1/7)** Cylinder 7 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 116 (12F) N3/10 3 (3A) — (V) — 115 (11F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/7), **Model 463:** Fuse F1f25 Ignition coil (T1/7).
10.0		**Ignition coil (T1/8)** Cylinder 8 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 114 (10F) N3/10 3 (3A) — (V) — 113 (9F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/8), **Model 463:** Fuse F1f25 Ignition coil (T1/8).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
11.0	P0 335	**CKP sensor (L5)**		Test with oscilloscope. Starter: **Crank**	Signal: see Figure 1 and 3.	⇒ 11.1, Teeth on starter ring gear.
		Signal	N3/10 93 (37E) — 94 (38E)	Engine: **at Idle**		
				Test with multimeter only if oscilloscope is unavailable.		
		Voltage	N3/10 93 (37E) — 94 (38E)	Starter: **Crank**	> 2.0 V	
				Engine: **at Idle**	> 5 V Voltage increases with increasing rpm.	
11.1		Resistance of CKP sensor (L5)	N3/10 93 (37E) — 94 (38E)	Ignition: **OFF** Unplug connector **E** on engine control module (N3/10).	(at 20°C): 600 – 1200 Ω	Wiring, L5

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
12.0	P0 341	**Camshaft Hall-effect sensor (B6/1)** Hall-effect signal	N3/10 95 (39E) — 96 (40E)	Test with oscilloscope. Engine: **at Idle**	Signal: see Figure 2 and 3.	⇒ 12.1, Wiring, B6/1
		Voltage	N3/10 96 (40E) — 2 (2A)	Test with multimeter only if oscilloscope is unavailable. Engine: **at Idle**	1.2 – 2.2 V Value changes.	
12.1		Voltage supply to camshaft Hall-effect sensor (B6/1)	B6/1 1 — 3	Ignition: **ON** Disconnect connector from Hall-effect sensor (B6/1) and test directly on sockets 1 (brown/green) and 3 (red/blue) of connector.	11 – 14 V	Wiring.

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
13.0	P0 300 P0 301	**Primary voltage** Ignition coil (T1/1), Cylinder 1 Primary circuit a	N3/10 124 (20F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 13.1
		Primary circuit b	N3/10 125 (21F) — 2 (2A)			
13.1		Primary winding of T1/1 Primary circuit a and b	N3/10 124 (20F) — 125 (21F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/1
14.0	P0 300 P0 302	**Primary voltage** Ignition coil (T1/2), Cylinder 2 Primary circuit a	N3/10 123 (17F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 14.1
		Primary circuit b	N3/10 122 (18F) — 2 (2A)			

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
14.1		Primary winding of T1/2 Primary circuit a and b	N3/10 122 (18F) — Ω — 123 (19F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/2
15.0	P0 300 P0 303	**Primary voltage** Ignition coil (T1/3), Cylinder 3 Primary circuit a	N3/10 109 (5F) — ⏚ — 2 (2A)	**Test connection Note:** Individual primary pattern Range 40 V Duration 5 millisec.	200 – 350 V	⇒ 15.1
		Primary circuit b	N3/10 108 (4F) — ⏚ — 2 (2A)	Starter: **Crank**		
15.1		Primary winding of T1/3 Primary circuit a and b	N3/10 108 (4F) — Ω — 109 (5F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/3

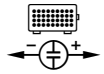
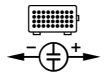
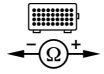
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
16.0	P0 300 P0 304	**Primary voltage** Ignition coil (T1/4), Cylinder 4 Primary circuit a	N3/10 110 (6F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec.	200 – 350 V	⇒ 16.1
		Primary circuit b	N3/10 111 (7F) — 2 (2A)	Starter: **Crank**		
16.1		Primary winding of T1/4 Primary circuit a and b	N3/10 110 (6F) — 111 (7F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/4
17.0	P0 300 P0 305	**Primary voltage** Ignition coil (T1/5), Cylinder 5 Primary circuit a	N3/10 117 (13F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec.	200 – 350 V	⇒ 17.1
		Primary circuit b	N3/10 118 (14F) — 2 (2A)	Starter: **Crank**		

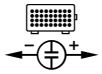
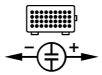
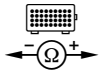
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
17.1		Primary winding of T1/5 Primary circuit a and b	N3/10 117 (13F) — Ω — 118 (14F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/5
18.0	P0 300 P0 306	**Primary voltage** Ignition coil (T1/6), Cylinder 6 Primary circuit a Primary circuit b	N3/10 121 (17F) — 2 (2A) N3/10 120 (16F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 18.1
18.1		Primary winding of T1/6 Primary circuit a and b	N3/10 120 (16F) — Ω — 121 (17F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/6

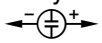
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
19.0	P0 300 P0 307	**Primary voltage** Ignition coil (T1/7), Cylinder 7 Primary circuit a	N3/10  116 (12F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 19.1
		Primary circuit b	N3/10  115 (11F) — 2 (2A)			
19.1		Primary winding of T1/7 Primary circuit a and b	N3/10  115 (11F) — 116 (12F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/7

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
20.0	P0 300 P0 308	**Primary voltage** Ignition coil (T1/8), Cylinder 8 Primary circuit a	N3/10  114 (10F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 20.1
		Primary circuit b	N3/10  113 (9F) — 2 (2A)			
20.1		Primary winding of T1/6 Primary circuit a and b	N3/10  113 (9F) — 114 (10F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/8

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
21.0	P0 300 P0 301 P0 302 P0 303 P0 304 P0 305 P0 306 P0 307 P0 308	**Firing voltage** Ignition coil (T1/1) to (T1/8)	Engine analyzer 	**Test connection Note:** Individual secondary pattern. Range: 20 kV Duration: 100% Connect kV pick-ups successively to T1/1 through T1/8. Starter: **Crank**	8 – 20 kV The resistance of the secondary winding can not be measured due to an installed diode.	Spark plugs, N3/10

Electrical Test Program – Ignition System Test

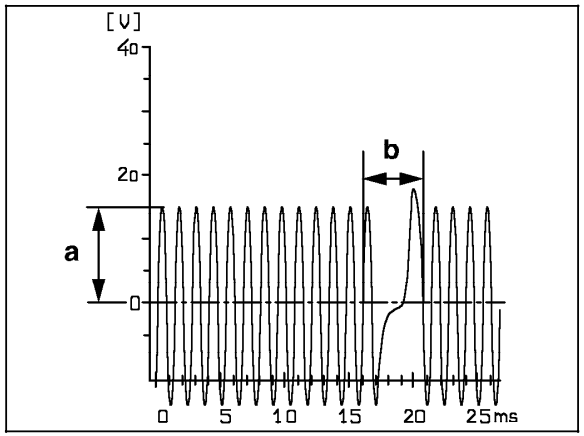


Figure 1

CKP sensor (L5) signal, shown at idle

b=2 missing teeth for cylinder 1 recognition

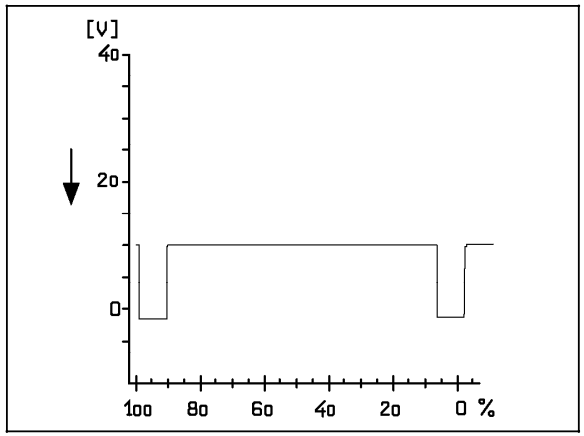


Figure 2

Camshaft Hall-effect sensor (B6/1) signal

Electrical Test Program – Ignition System Test

Signal survey

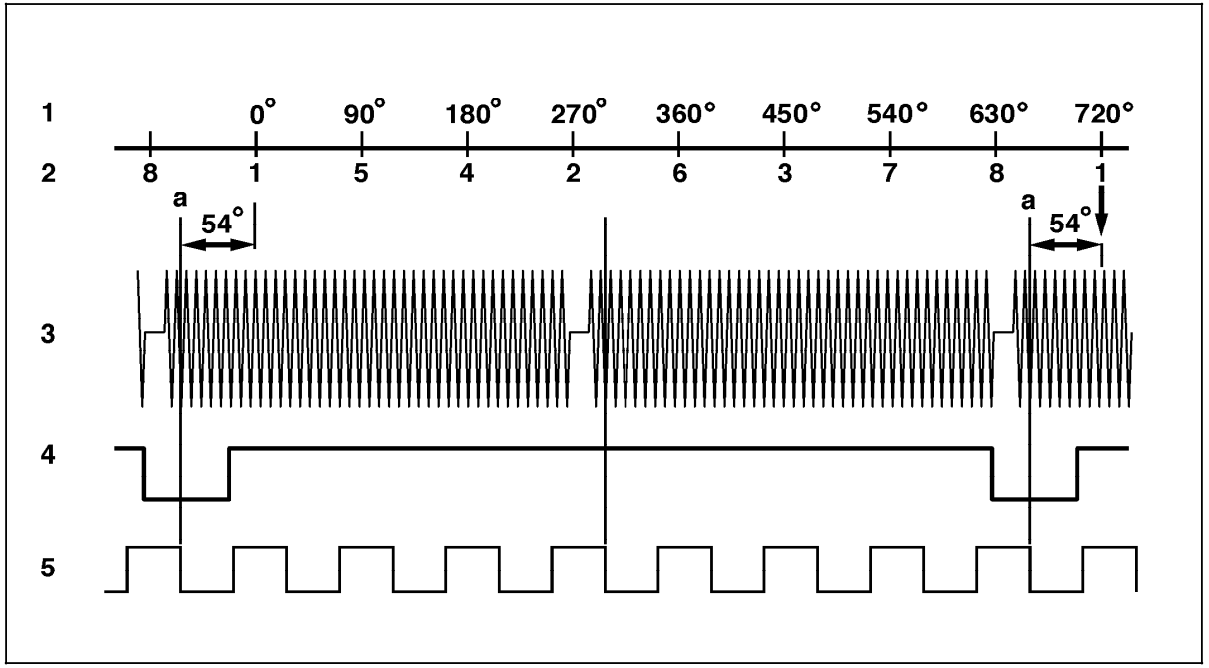


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Figure 3

1 Crank angle (CKA)
2 Cylinder
3 CKP sensor (L5) signal
4 Camshaft Hall-effect sensor (B6/1) signal
5 Engine rpm signal TNA