Electrical Test Program - Test (Engine Runs)

Test step / DTC	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 1.0 2	**Maximum retard setting on at least one cylinder has been reached**	–	–	–	Increased knock tendency, i.e. due to poor fuel quality, carbon build–up, mechanical damage.
⇒ 2.0 3 [1)]	**Engine coolant temperature sensor (B11/2)** Fault circuit	N1/3 13 (B.5) — V — 12 (B.4)	Ignition: **ON**	see table I.	Wires, Engine coolant temperature sensor (B11/2), ⇒ 2.1
⇒ 2.1	Resistance	B11/2 1 — Ω — 3 B11/2 2 — Ω — 4	Ignition: **OFF** Unplug connector on engine coolant temperature sensor (B11/2).	see table I.	Engine coolant temperature sensor (B11/2).
⇒ 3.0 4	**Ignition control module (N1/3)** Load sensor	Connect vacuum gauge.	Engine: **at Idle**	>450 mbar	Vacuum supply to N1/3 interrupted, Ignition control module (N1/3).
⇒ 4.0 5	**Knock sensor (A16)**	–	Ignition: **OFF**	–	Connector (1) for A16 not connected to ignition control module (N1/3), Knock sensor (A16).

1) DTC 3 is implemented in the ignition control modules made by Bosch, part no. 007 545 70 32, only as of production code 946.

Electrical Test Program - Test (Engine Runs)

Test step / DTC	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 5.0 Б	**Camshaft position sensor (L5/1)** Signal	N1/3 [2] 13 (B.5) — 9 (B.1) N1/3 [3] 13 (B.5) — 9 (B.1)	Engine: **Start**	Signal, see Figure 8. >0.25 V	⇒ 5.1
⇒ 5.1	Resistance of camshaft position sensor (L5/1)	N1/3 13 (B.5) — 9 (B.1)	Ignition: **OFF** Unplug test cable with connector B on N1/3.	900 – 1600 Ω	Wiring, Camshaft position sensor (L5/1), ⇒ 5.2
⇒ 5.2	Insulation of camshaft position sensor (L5/1)	N1/3 13 (B.5) — 9 (B.1)	Ignition: **OFF** Unplug test cable with connector B on N1/3.	> 20 kΩ	Wiring, Camshaft position sensor (L5/1).

[2] Test with oscilloscope.

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

Electrical Test Program - Test (Engine Runs)

Test step **DTC**	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 6.0 8,9 **AT only!**	**Transmission overload protection switch (S65)** Fault circuit	S65 1 — (V) — 2	Plug on S65 connected. Unscrew threaded ring, push back rubber boot and measure voltage with points of multimeter leads. Parking brake set. Engine: **at Idle** Selector lever in transmission range: **P/N** **D**	 > 4.7 – 5.3 V < 1 V	Wires, ⇒ 6.1
⇒ 6.1	Transmission overload protection switch (S65) Resistance	S65 2 — (Ω) — 1	Unscrew connector on transmission overload protection switch (S65). Parking brake set. Engine: **at Idle** Selector lever in transmission range: **P/N** **D**	 > 20 kΩ < 1 Ω	S65,

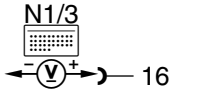
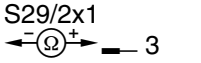
Electrical Test Program - Test (Engine Runs)

Test step / DTC	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 7.0	**Data line** between ignition control module (N1/3) and CFI control module (N3).	–	Visual inspection: Check if N1/3 and N3 are correctly matched.	see Parts Microfiche.	Data line from N1/3 to N3, ⇒ 7.1.
⇒ 7.1	Wire for continuity	N3 — N1/3 26 — Ω — 7 (A.7)	Ignition: **OFF**	< 1 Ω	Data line from N1/3 to N3, ⇒ 7.2
⇒ 7.2	Wire shorted to ground	N1/3 5 — Ω — 7 (A.5) (A.7)	Ignition: **OFF**	200 Ω	Data line from N1/3 to N3.
⇒ 8.0	**Reference resistor (R16/2)**	–	Visual inspection: Check if R16/2 is properly installed and is correctly matched	Part number, 015 545 67 28.	⇒ 8.1

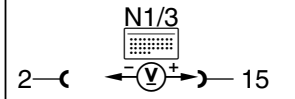
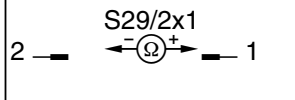
Electrical Test Program - Test (Engine Runs)

Test step **DTC**	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 8.1	Reference resistor (DI) (R16/2)	R16/2 – Ω +	Ignition: **OFF** Unplug R16/2 from ignition control module (N1/3) (see Figure 2).	2.4 kΩ	Reference resistor (R16/2), If nominal value is obtained, replace ignition control module (N1/3).
⇒ 9.0 12	**TN-signal**	N1/3 2 (A.2) – V + 4 (A.4)	Engine: **at Idle**	6 V	⇒ 9.1
⇒ 9.1	Wire, TN-signal for continuity	N16 16 – Ω + N1/3 4 (A.4)	Ignition: **OFF**	< 1 Ω	Wire from N1/3 to N16, ⇒ 9.2
⇒ 9.2	Wire, TN-signal shorted to ground	N1/3 2 (A.2) – Ω + 4 (A.4)	Ignition: **OFF**	200 Ω	Wire from N1/3 to N16, Ignition control module (N1/3).

Electrical Test Program - Test (Engine Runs)

Test step DTC	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 10.0	**Wide open throttle/closed throttle position switch (S29/2)** Wide open throttle contact		Ignition: **ON** Accelerator pedal position: **Closed throttle** **Wide open throttle**	 11 – 14 V < 1 V	⇒ 10.1
⇒ 10.1	Wide open throttle/closed throttle position switch (S29/2)		Ignition: **OFF** Unplug connector (S29/2x1) on S29/2. Accelerator pedal position: **Closed throttle** **Wide open throttle**	 > 20 kΩ < 1 Ω	Wiring, Wide open throttle/closed throttle position switch (S29/2).

Electrical Test Program - Test (Engine Runs)

Test step **DTC**	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 11.0 IЧ [4]	**Wide open throttle/closed throttle position switch (S29/2)** Closed throttle position contact		Vacuum line remains connected to N1/3. Ignition: **ON** Accelerator pedal position: **Closed throttle** **Partial load**	 < 1 V 11 – 14 V	⇒ 11.1
⇒ 11.1	Wide open throttle/closed throttle position switch (S29/2) Resistance		Ignition: **OFF** Unplug connector (S29/2x1) on S29/2. Accelerator pedal position: **Wide open throttle** **Closed throttle**	 > 20 kΩ < 1 Ω	Wiring, Wide open throttle/closed throttle position switch (S29/2).

[4] DTC IЧ may be displayed even though there is no malfunction in the system. Control modules made by Bosch, part no. 007 545 70 32, as of production code 946 and those made by Siemens, part no. 007 545 71 32, as of production code 27/89, have had this problem corrected.

Electrical Test Program - Test (Engine Runs)

Test step / DTC	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 12.0 15	**Output in ignition control module (N1/3)** **Engine 104:**	T1 — N1/3 Cir. 1 — Ω — 1 (A.1)	Ignition: **OFF** Disconnect terminal 1 on ignition coil (T1) .	< 1 Ω	Wiring, Ignition coil (T1), Ignition control module (N1/3).
		N1/3 2 (A.2) — Ω — 1 (A.1)		> 20 kΩ	
		T1 Cir. 1 — Ω — Cir. 15	Ignition: **OFF** Disconnect ignition coil (T1).	0.3 – 0.6 Ω	
	Output 1 in ignition control module (N1/3) **Engine 119:**	T1/1 — N1/3 Cir. 1 — Ω — 1 (A.1)	Ignition: **OFF** Disconnect terminal 1 on ignition coil 1 (right cylinder bank) (T1/1) .	< 1 Ω	Wiring, Ignition coil (T1/1), Ignition control module (N1/3).
		N1/3 2 (A.2) — Ω — 1 (A.1)		> 20 kΩ	
		T1 Cir. 1 — Ω — Cir. 15	Ignition: **OFF** Disconnect ignition coil (T1/1).	0.3 – 0.6 Ω	

Electrical Test Program - Test (Engine Runs)

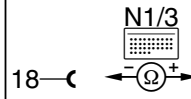
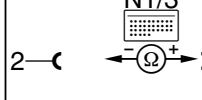
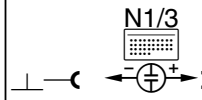
Test step **DTC**	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 13.0 16 **Engine 119 only!**	**Output 2 in ignition control module (N1/3)**	T1/2 — N1/3 (Ω) — 6 (A.6) Cir. 1	Ignition: **OFF** Disconnect terminal 1 on ignition coil 2 (left cylinder bank) (T1/2).	< 1 Ω	Wiring, Ignition coil (T1/2), Ignition control module (N1/3).
		2 (A.2) — N1/3 (Ω) — 6 (A.6)		> 20 kΩ	
		T1/2 Cir. 1 — (Ω) — T1/1 Cir. 15	Ignition: **OFF** Disconnect ignition coil (T1/2).	0.3 – 0.6 Ω	
⇒ 14.0 17 5)	**Crankshaft position sensor (L5)**	18 — N1/3 2) (±) — 17	Starter: **Crank**	Signal, see Figures 6 and 7.	⇒ 14.1
		18 — N1/3 3) (V~) — 17	Starter: **Crank**	> 0.4 V	

2) Test with oscilloscope.

3) Test with multimeter only if oscilloscope not available.

5) DTC 17 is implemented in ignition control modules made by Bosch, part no. 007 545 70 32, only as of production code 946, and in control modules made by Siemens, only as of production code 27/89.

Electrical Test Program - Test (Engine Runs)

Test step **DTC**	Scope of test	Test connection	Test condition	Nominal value	Possible cause/remedy
⇒ 14.1	Resistance from crankshaft position sensor (L5)		Ignition: **OFF** Unplug connector (2) for L5 at ignition control module (N1/3) (see Figure 1).	680 – 1200 Ω	Wiring, Crankshaft position sensor (L5), ⇒ 14.2
⇒ 14.2	Insulation of crankshaft position sensor (L5)		Ignition: **OFF** Unplug connector (2) for L5 at ignition control module (N1/3) (see Figure 1).	> 20 kΩ	Crankshaft position sensor (L5), check flexplate segments.
⇒ 15.0 **Engine 104 only!**	**Load signal for 5-speed automatic transmission to transmission control module (N15/1)**	 Engine analyzer: Primary pattern, measurement range 40 V, duration 100%, auxiliary signal input.	Engine: **at Idle** Electrical consumers shut off. Vacuum connection on ignition control module (N1/3) connected. Vacuum connection on ignition control module (N1/3) disconnected.	2 – 4 % (Table II) see Figure 25. 5 – 10 % (Table II) see Figure 26.	Ignition control module (N1/3), Vacuum line, Wiring.

Electrical Test Program - Test (Engine Runs)

Table I Engine coolant temperature sensor (B11/2) (4-pole)

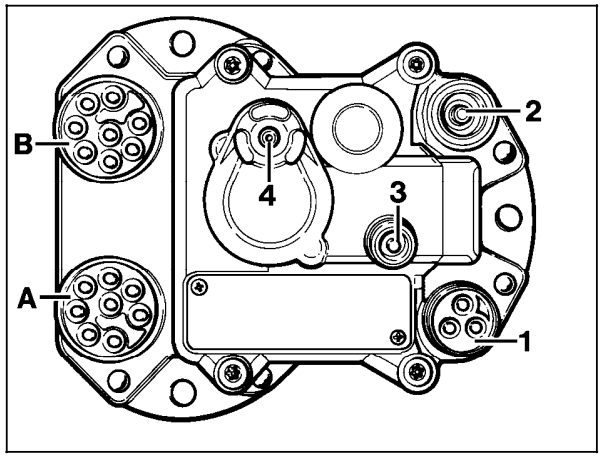
Temperature (°C)	Resistance (Ω) at engine coolant temperature sensor (B11/2)	Voltage (V) at engine coolant temperature sensor (B11/2)
– 20	15700	5.12 – 5.60
– 10	10000	4.49 – 5.11
0	5900	4.12 – 4.48
10	3700	3.77 – 4.11
20	2500	3.36 – 3.76
30	1700	2.92 – 3.35
40	1170	2.51 – 2.91
50	830	2.09 – 2.50
60	600	1.69 – 2.08
70	435	1.36 – 1.68
80	325	1.09 – 1.35
90	245	0.88 – 1.08
100	185	0.75 – 0.87

Electrical Test Program - Test (Engine Runs)

Table II Load signal from ignition control module to transmission control module (N15/1)

Engine speed	Load signal with vacuum (mbar)				Load signal without vacuum (mbar)			
rpm	200	300	400	500	800	900	1000	
600	1.1	1.8	2.5	3.3	5.4	6.1	6.2	On-off ratio %
650	1.2	2.0	2.7	3.6	5.8	6.6	7.4	
700	1.3	2.1	2.9	3.8	6.3	7.1	8.0	
750	1.4	2.3	3.1	4.0	6.8	7.7	8.6	

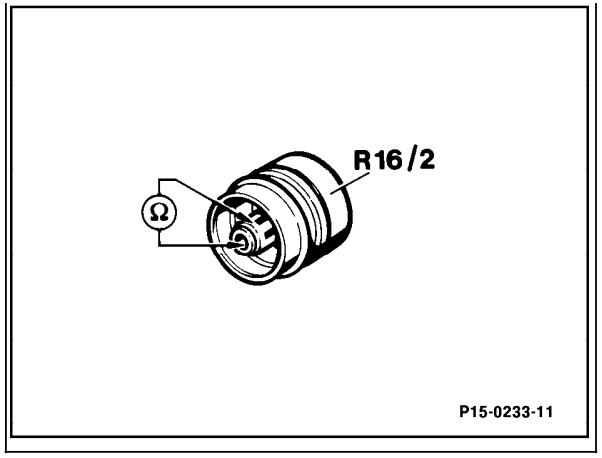
Electrical Test Program - Test (Engine Runs)



P15-2030-13A

Figure 1

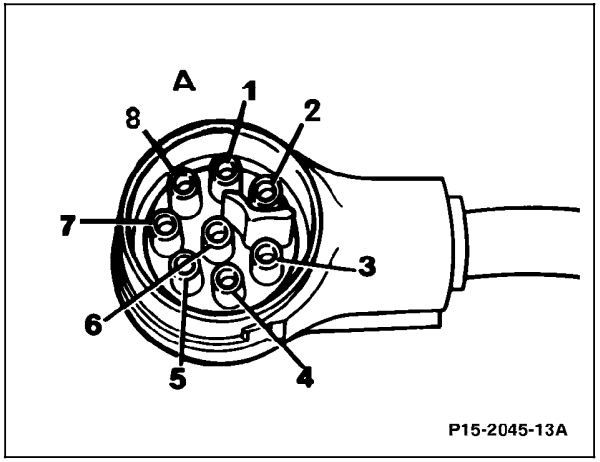
A 8-pole plug connection
B 8-pole plug connection
1 Connection for knock sensors (A16)
2 Connection for crankshaft position sensor (L5)
3 Connection for reference resistor (R16/2)
4 Vacuum connection



P15-0233-11

Figure 2

R16/2 Reference resistor



P15-2045-13A

Figure 3

N1/3 Connector A for ignition control module

Electrical Test Program - Test (Engine Runs)

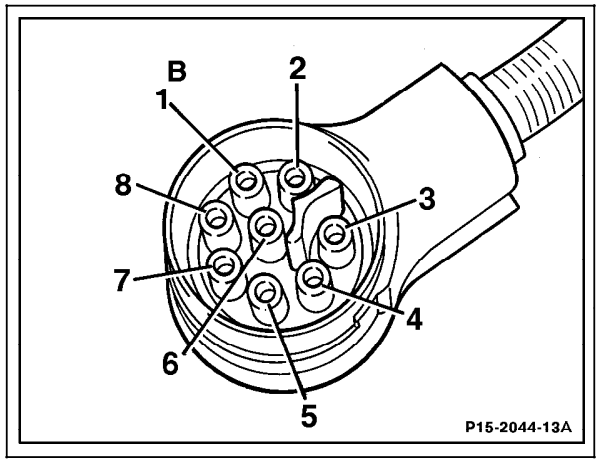


Figure 4 P15-2044-13A

N1/3 Connector B for ignition control module

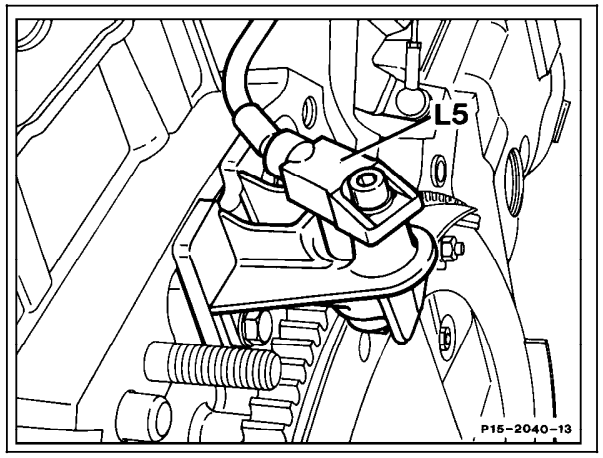
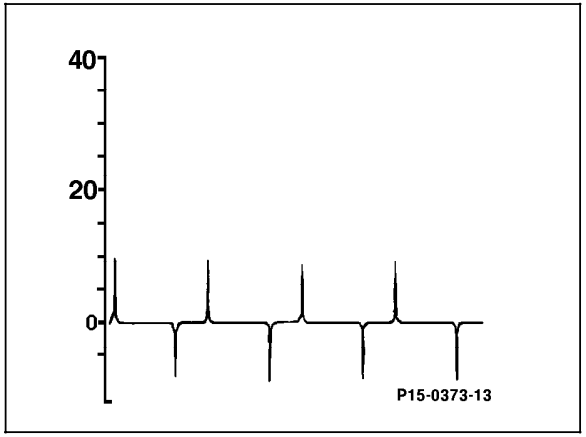


Figure 5 P15-2040-13

Crankshaft position sensor (L5) connector

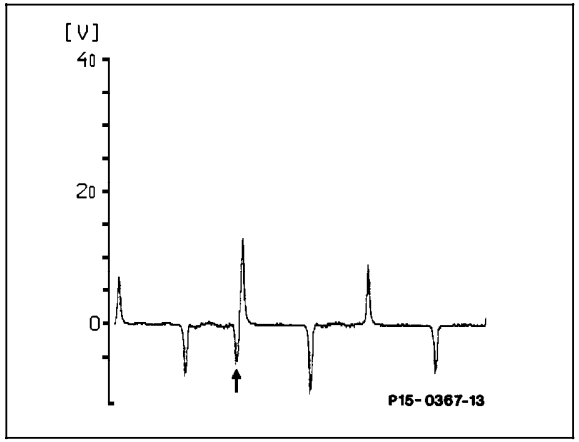


P15-0373-13

Figure 6
Engine 104

L5 Crankshaft position sensor signal

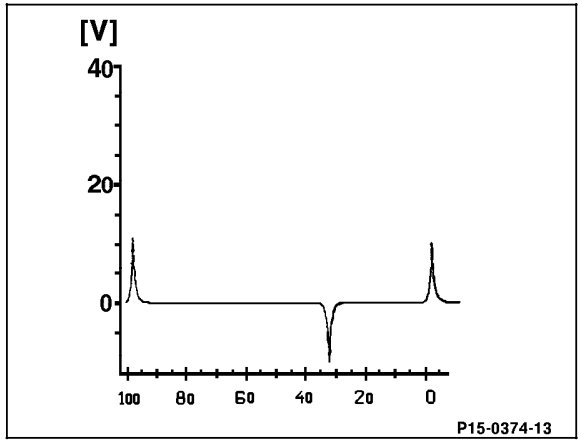
Electrical Test Program - Test (Engine Runs)



P15-0367-13

Figure 7

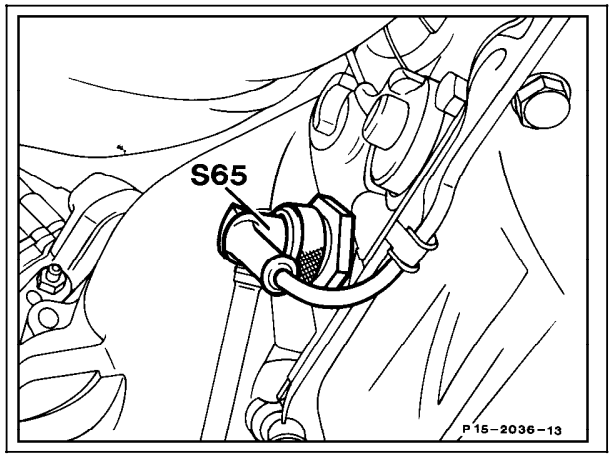
L5 Crankshaft position sensor sensor signal (magnet, arrow)



P15-0374-13

Figure 8

L5/1 Camshaft position sensor sensor signal

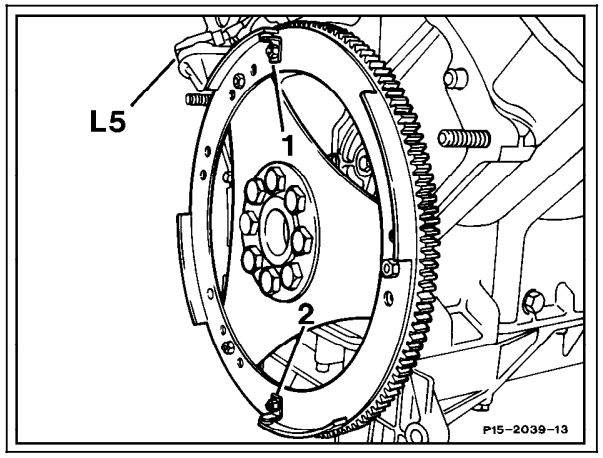


P15-2036-13

Figure 9

S65 Transmission overload protection switch, brake band B1

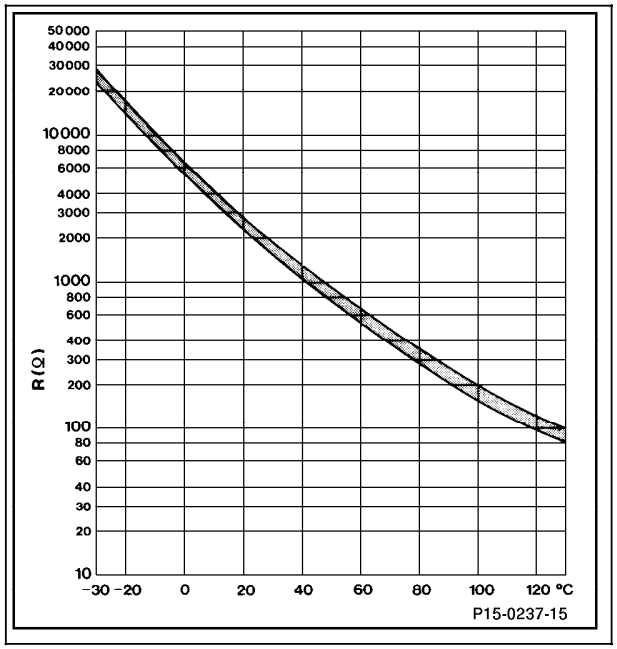
Electrical Test Program - Test (Engine Runs)



P15-2039-13

Figure 10

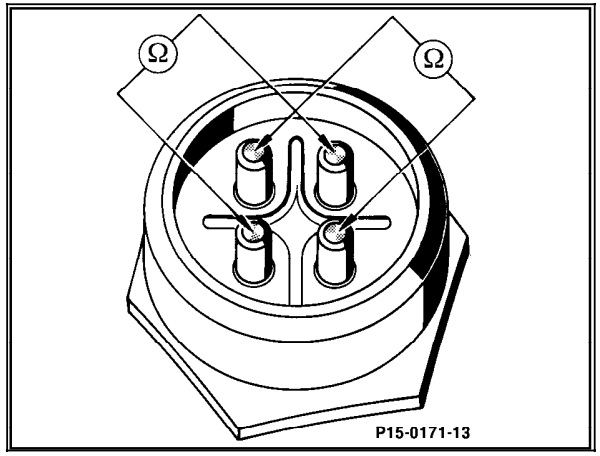
Crankshaft position sensor (L5) segments with magnets 1 and 2



P15-0237-15

Figure 11

B11/2 Diagram, engine coolant temperature sensor (4-pole)



P15-0171-13

Figure 12

B11/2 Engine coolant temperature sensor (4-pole)

Electrical Test Program - Test (Engine Runs)

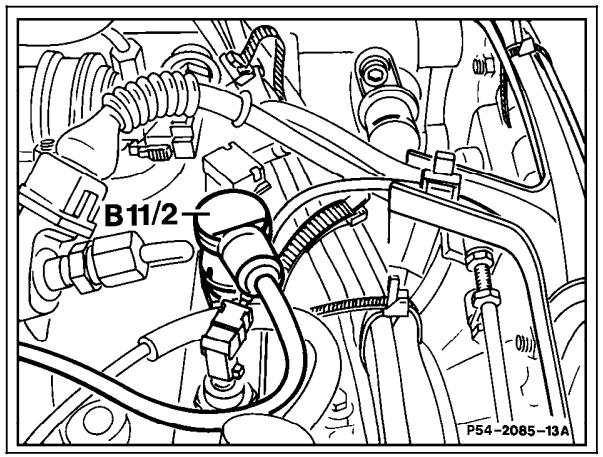


Figure 13 P54-2085-13A

B11/2 Engine coolant temperature sensor (4-pole)

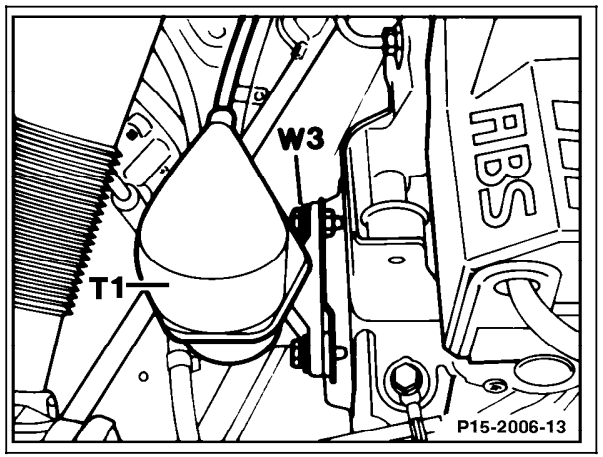


Figure 14 P15-2006-13
Engine 104

T1 Ignition coil

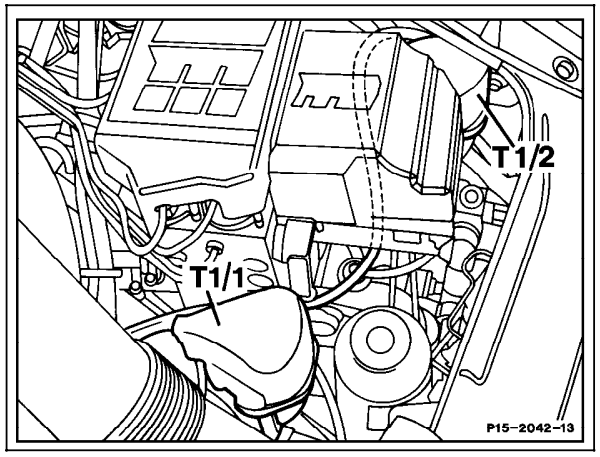
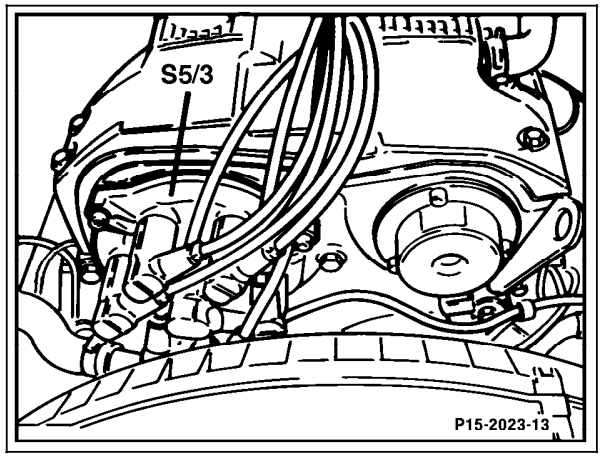


Figure 15 P15-2042-13
Engine 119

T1/1, T1/2 Ignition coil 1 and ignition coil 2

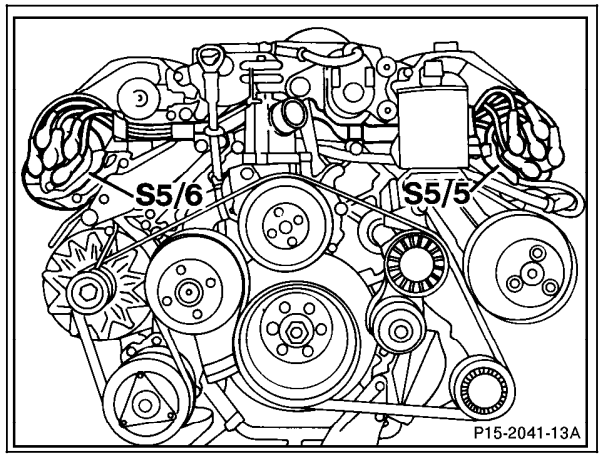
Electrical Test Program - Test (Engine Runs)



P15-2023-13

Figure 16
Engine 104

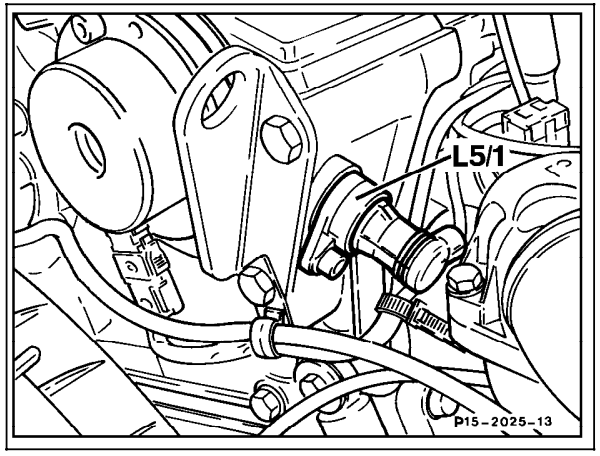
S5/3 High-voltage distributor



P15-2041-13A

Figure 17
Engine 119

S5/5, S5/6 High-voltage distributor (left, right)



P15-2025-13

Figure 18
Engine 104

L5/1 Camshaft position sensor

Electrical Test Program - Test (Engine Runs)

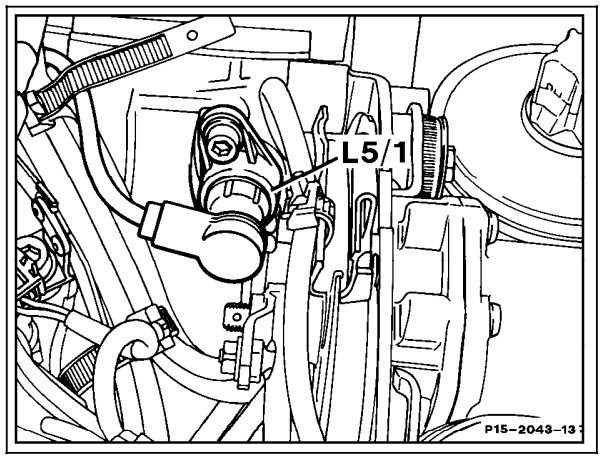


Figure 19
Engine 119

P15-2043-13

L5/1 Camshaft position sensor

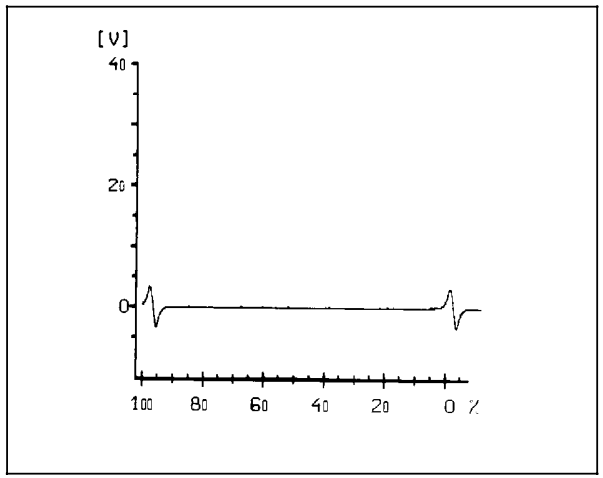


Figure 20

P15-5093-13

Camshaft position sensor (L5/1) signal

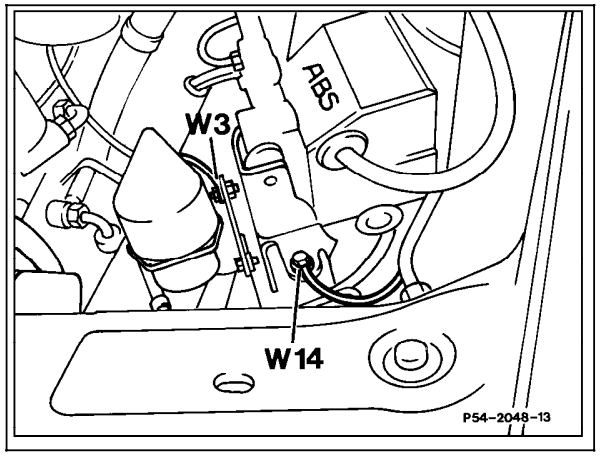


Figure 21

P54-2048-13

W3 Ground (left front wheelhousing at ignition coil)

Electrical Test Program - Test (Engine Runs)

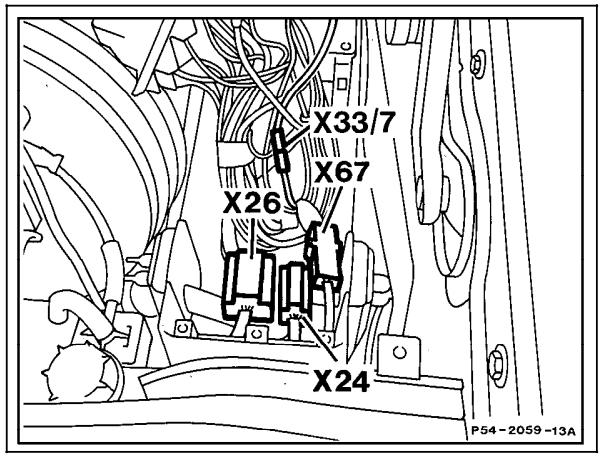


Figure 22 P54-2059-13A

X24 Headlamp harness connector (6-pole)
X26 Interior/engine connector

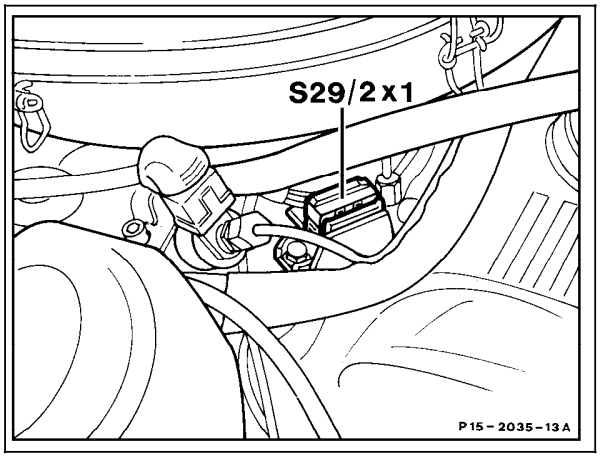


Figure 23 P15-2035-13A

S29/2x1 Wide open throttle/closed throttle position switch connector

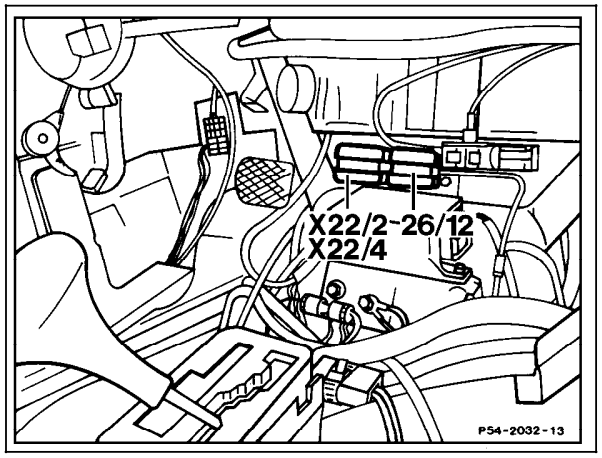
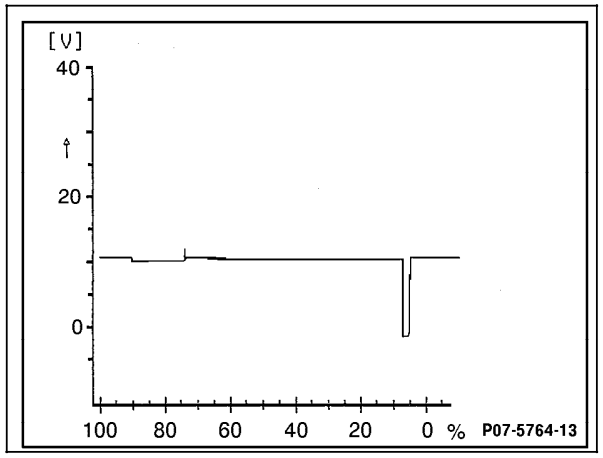


Figure 24 P54-2032-13

X22/2 Connector, automatic transmission/engine (8-pole)

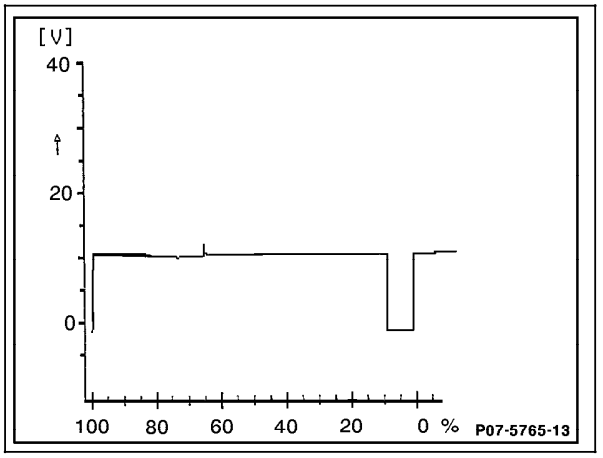
Electrical Test Program - Test (Engine Runs)



P07-5764-13

Figure 25
Engine 104

Load signal to automatic transmission control module (N15/1) with vacuum line connected at ignition control module (N1/3)

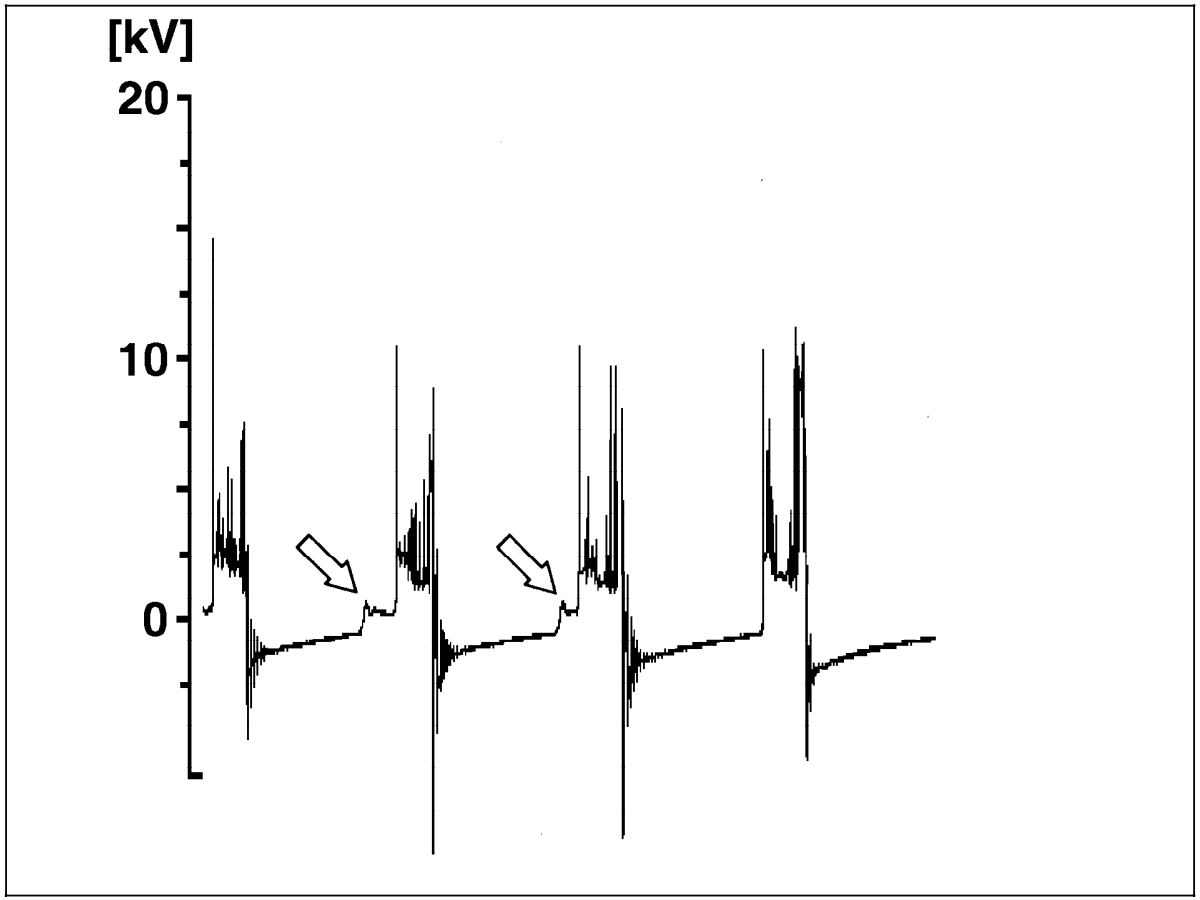


P07-5765-13

Figure 26
Engine 104

Load signal to automatic transmission control module (N15/1) with vacuum line disconnected at ignition control module (N1/3)

Electrical Test Program - Test (Engine Runs)



P15-0012-57

Figure 27

Primary circuit voltage limitation, secondary overload