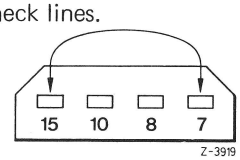
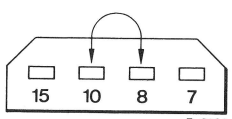
Checkup of Electronically Controlled Gasoline Injection System without Control Unit Not Connected 07.4.1

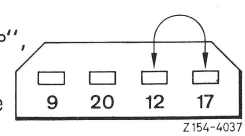
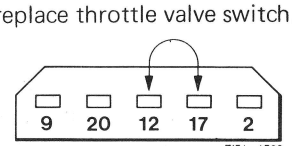
For initial jobs required for testing refer to Job No. 07.4.1–410

M 116, M 117

Turn switch "A" on tester to position "Measuring", switch on ignition and complete all the functions in accordance with the check list below.

Switch "B" in position . . .	Actuate	Measure	Indication (rated value)	Rated value not attained. Possible causes and remedies.
Voltage I	Switch-on ignition and leave switched on throughout entire test sequence described below	Voltage supply for control unit	11 . . . 12.5 (11 . . . 12.5 V)	**Voltmeter shows no voltage:** Break: Plug connection from main relay to control unit (line 16). Main relay does not atract: Check voltage on terminal 86 of main relay, if there is no voltage check fuse No. 14 in fusebox. Measure voltage on terminal 87, if voltage is "0", check connection 30/51 of relay. Check ground connection lines on body. **Voltage below 11 V:** Transfer resistance on line 16, 11 or on relay contacts, replace main relay. Battery discharged.
Voltage II				Similar to voltage I, but check line 24.
Starting Motor Voltage	Actuate starter for a short moment	Voltage on terminal 50 of starting motor	9.0 . . . 12.0 (9.0 . . . 12.0 V)	**Voltmeter shows no voltage, but starting motor rotates:** Line break between starting motor terminal 50 to control unit. Check line to control unit terminal 18. **Voltmeter shows no voltage and starter motor is not rotating:** Ignition starter switch defective, line break. **Voltage below 9.5 V:** Battery discharged, voltage loss too high in line from ignition starter switch to terminal 50 of starter relay. Check line with voltmeter
Adjustment ∞ Pressure Sensor (M 116 and M 117)	Adjust instrument by turning adjusting knob to "∞"			If the instrument shows no full deflection, battery voltage in vehicle is too low. Also refer to test step: voltage I.
	Push button "Ground connection"	Resistance between pressure sensor windings and ground connection (body contact)	Resistance "∞" (∞)	**Resistance "0":** Body contact in supply line or on pressure sensor. Pull plug from pressure sensor, if "∞" is indicated replace pressure sensor; if indication remains "0" lines 7, 8, 10 or 15 may be shorted, replace cable harness. **Resistance below "∞", but not "0":** Insulation damage. Remedy shown above.

Switch "B" in position . . .	Actuate	Measure	Indication (rated value)	Rated value not attained. Possible causes and remedies.
Adjustment ∞, Pressure Sensor	Push "Primary" button	Resistance of primary winding of pressure sensor	0.8 . . . 1.2 on Ω-scale (approx. 90Ω)	**Resistance essentially lower than rated value:** Insulation damage. Pull plug from pressure sensor, if "∞" is indicated, replace pressure sensor. **Resistance "0":** Body contact, short in winding. Pull plug from pressure sensor, if "∞" is indicated, replace pressure sensor. **Resistance considerably higher than rated value:** High transfer resistance. Check plug and line for corrosion or break. **Resistance "∞":** Break. Bridge terminals 7 and 15 on plug. If "0" is indicated, replace pressure sensor. If "∞" is indicated, check lines. Top view of plug  Z-3919
	Push "Secondary" button	Resistance of secondary winding of pressure sensor	3. . . 4 on Ω-scale (approx. 350Ω)	Similar to "Primary". If "∞" resistance, bridge terminals 8 and 10.  Z-3920

Switch "B in position . . .	Actuate	Measure	Indication (rated value)	Rated value not attained. Possible causes and remedies.
ZV Contact I **ZV Contact II** **ZV Contact III** **ZV Contact IV**	Rotate ignition distributor by short actuation of starting motor	Function of release contacts in ignition distributor	Alternately resistance "0" and "∞" (0/∞ohm)	If the needle of the instrument is not oscillating while starting or does not stop in position ∞ or 0 check connections 12, 13, 14, 21 and 22 on contact slide-in. If connections and cable harness for control unit are in order, replace releasing contacts, adjustment impossible.
Throttle Valve Switch I then **Throttle Valve Switch II**	Step slowly on accelerator pedal	Function of transition enrichment	Needle of instrument oscillates approx. 10 times between "0" and "∞". (alternately 0/∞ ohm)	When the stepped down accelerator pedal is released the instrument needle should remain in position "∞" **Indication "0":** Throttle valve switch defective, replace.
Throttle Valve Switch III (M 116)	a) Throttle valve in idling speed position (closed)	Function of contacts in throttle valve switch	a) 0 (0 Ω)	a) **Resistance "∞":** Throttle valve switch wrongly adjusted or break in supply line. Check adjustment, pull off plug, bridge terminals 12 and 17. If then still "∞", replace cable assembly, if not, replace throttle valve switch.  Z154-4037
	b) Throttle valve slightly opened (approx. 1°)		b) ∞ (∞ Ω)	b) **Resistance "0":** Throttle valve switch wrongly adjusted or short in supply line. Pull plug, if indication is then still "0", adjust or replace cable assembly, if not, adjust or replace throttle valve switch.
Throttle Valve Switch III (M 117)	a) Throttle valve in idling speed position (closed)	Function of contacts in throttle valve switch	a) 0 (0 Ω)	a) **Resistance "∞":** Throttle valve switch wrongly adjusted or break in supply line. Check adjustment, pull plug, bridge terminals 12 and 17. If then still "∞", replace cable assembly, if not, replace throttle valve switch.  Z154-4523
	b) Throttle valve slightly opened (approx. 1°)		b) ∞ (∞ Ω)	b) **Resistance "0":** Throttle valve switch wrongly adjusted or short in supply line. Pull plug, if indication is then still "0", adjust or replace cable assembly, if not, adjust or replace throttle valve switch.

Switch "B" in position . . .	Actuate	Measure	Indication (rated value)	Rated value not attained. Possible causes and remedies.
Temperature Sensor I (induction air)		Resistance of temperature sensor	2 . . . 5 at 20° C (heavily dependent on temperature) 640 Ω at 0° C 400 Ω at 10° C 300 Ω at 20° C 210 Ω at 30° C 150 Ω at 40° C	Rated value applies to 20°C. Resistance will be lower with increasing temperature. If no 0 or ∞ are measured, the sensor is in order. **Indication "∞":** Break. Pull plug and bridge. If indication is "0", replace temperature sensor, if not, replace cable assembly. **Indication "0":** Short circuit. Pull plug. If indication is unchanged, cable is defective. If indication is "∞", replace temperature sensor.
Temperature Sensor II (cooling water)		Resistance of temperature sensor	0.2 . . . 0.4 at 80° C (heavily dependent on temperature 5.9 kΩ at 0° C 2.5 kΩ at 20° C 1.2 kΩ at 40° C 600 Ω at 60° C 325 Ω at 80° C 190 Ω at 100° C	Refer to temperature sensor I, rated value applies to 80° C cooling water temperature.
Valves Adjust instrument again, if required, to "∞" (in switch position "valves").	Button 1 = valves cyl. 1 and 5 Button 2 = valves cyl. 3 and 6 Button 3 = valves cyl. 2 and 7 Button 4 = valves cyl. 4 and 8 **Caution!** Prior to actuating buttons, always pull off one valve plug on one of the two injection valves, so that always only one valve, e. g. cyl. 1 or 5, or 2 or 7 is measured.	Resistance of valve winding in relation to supply line	2 . . . 3 (2.4 Ω at 20° C)	**Resistance "0":** Short circuit in supply line or on valve. Pull plug on respective valve, if indication is then "∞", replace valve, if not, replace cable assembly. **Resistance "∞":** Break in supply line or in valve coil. Bridge contacts in valve plug, if indication is then "∞", cable assembly is defective. If indication is "0", valve is defective. **Resistance via "3":** Ground connection line of valves has had connection on engine.

Switch "A" in position . . . (switch "B" is of no influence)	Actuate	Measure	Indication (rated value)	Rated value not attained. Possible causes and remedies.
Valve Test	Push "pump" button	Pressure in fuel line	Rated value 2.0 + 0.1 atü	**No pressure buildup** (pump not starting), Disconnect cable connections on pump, push button "pump" and measure voltage with voltmeter on cable ends. If indication is 12 Volt, pump is defective and should be replaced. If indication is "0", listen whether pump relay attracts. **If yes,** line break between pump relay terminal 87 and pump connections or from there to ground connection. Fuse No. 14 in fusebox defective. If connection lines are in order, pump relay is defective. **If no,** line break between main relay terminal 87 and pump relay terminal 86 or between pump relay terminal 85 and line 19 to control unit. If lines are in order, replace pump relay. **Pressure not corresponding to rated value** Pressure regulator maladjusted; adjust or replace.
	Briefly push "pump" button	Fuel system (delivery end) for leaks	Pressure may drop to 1.2 atü, then pressure may continue to drop only very slowly	**Pressure drops immediately upon release of "pump" button below 1.2 atü** 1. Leak in delivery line system, sight test for hose connection leaks. 2. Valve of delivery pump, pressure regulator, injection valves or cold starting valve leak. To find out which of the four components leaks: Disconnect pressure hose between fine filter and injection valves with delivery pump running by means of a pinch clip. Switch-off delivery pump. If pressure is no longer dropping, valve in delivery pump is defective, replace delivery pump. But if pressure continues to drop: Check pressure regulator. Pull return hose on pressure regulator immediately after switching off delivery pump. If fuel emerges, replace pressure regulator. If no fuel emerges and if pressure continues to drop: Check spark plug pattern to see whether individaul injection valves or the coldstarting valve are leaking. Deviations among plug patterns indicate leaking injection valves, uniformly dark plug patterns indicate a leaking starting valve. Complete accurate check upon removal of valves connected to delivery system and with delivery pump switched on. Valve opening may become wet, but no more than 2 drops per minute should emerge.

Switch "A" in position . . . (switch "B" is of no influence)	Actuate	Measure	Indication (rated value)	Rated value not attained. Possible causes and remedies.
Note! Complete the following test only when faults on injection valve are suspected. **Valves removed.**	Pressure buildup: Push "pump" button. Push buttons 1 to 4 one after the other, while each time pulling the plug of the valve of a valve group momentarily not tested.	Sight test. Ejection of valves. Catch fuel.		Push "pump" button and determine leaks by sight test. Valve opening may become, wet, but no more than 2 drops per minute should emerge on one valve. If no leaks are found, replace pressure regulator.
Starting Valve Cooling water temperature above + 35° C	a) Push "pump" button, actuate starter for one second.	Function of thermal time switch and starting valve	a) Pressure gauge should not visibly drop	a) **Pressure continuously dropping when actuating starter** Thermal time switch defective, replace. b) **Pressure not dropping when actuating starter** Check lines from starting valve to connection 87 of relay or to ground connection. If connecting lines are in order, check starting valve.
	b) Connect connection "W" of thermal time switch to ground.		b) Starting valve injects, pressure on gauge drops	
Cooling water temperature below + 35° C	Push "pump" button, actuate starter for 1 sec. (thermal time switch again normally connected).		Pressure should drop	If pressure does not drop, replace thermal time switch or check starting valve as described under b). Winding resistance 4.2 Ω at 20° C.

Switch off ignition. Remove pressure gauge.