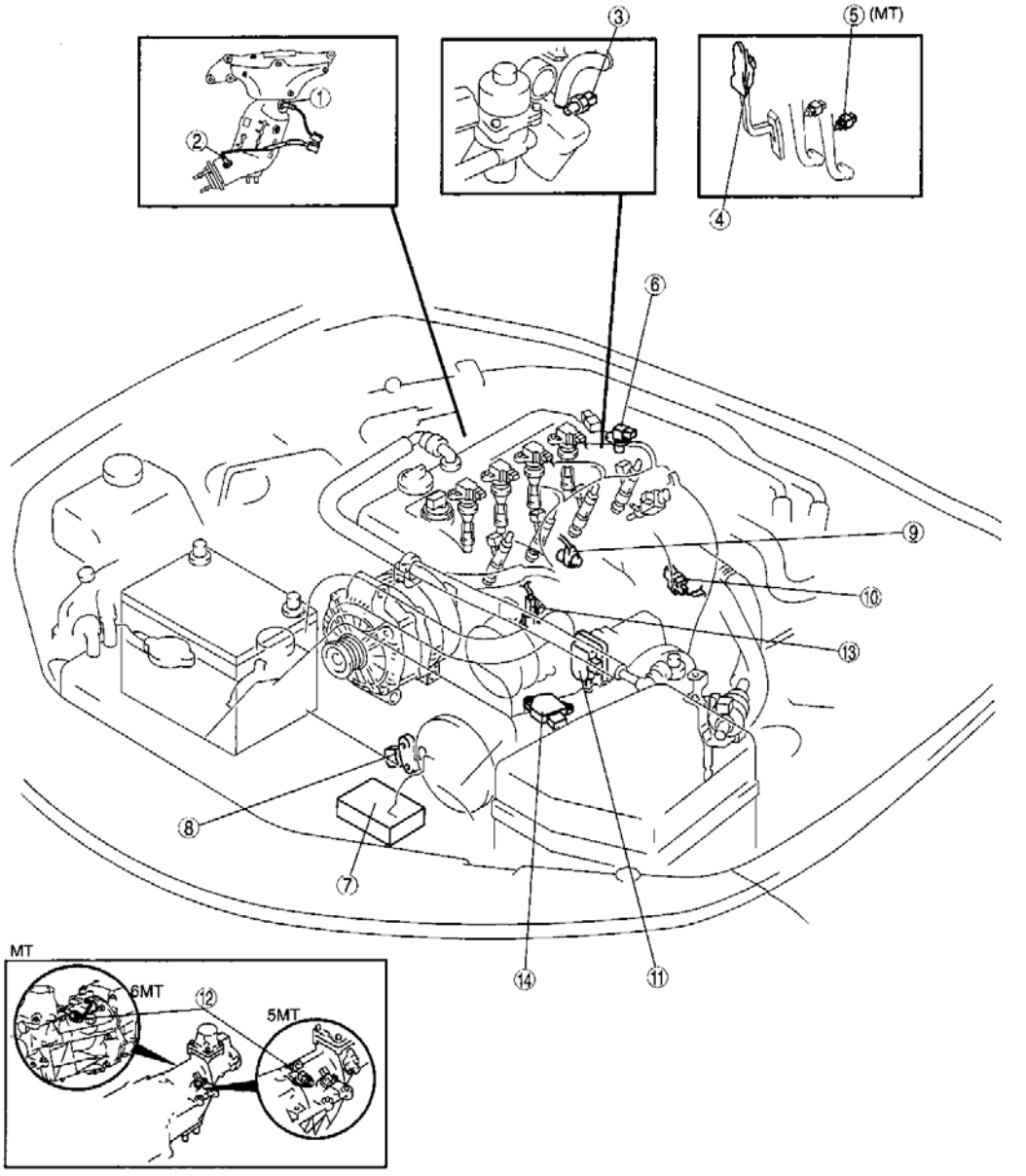
2007 ENGINE PERFORMANCE

Engine Control System - MX-5 Miata

CONTROL SYSTEM LOCATION INDEX [LF]



E5U140ZW4001

1	Front HO2S
2	Rear HO2S
3	ECT sensor
4	APP sensor
5	CPP switch
6	CMP sensor
7	PCM (built into BARO sensor)
8	CKP sensor
9	KS
10	MAP sensor
11	TP sensor
12	Neutral switch
13	PSP switch
14	MAF/IAT sensor

Fig. 1: Identifying Location Of Control System Components
Courtesy of MAZDA MOTORS CORP.

CONTROL SYSTEM DIAGRAM [LF]

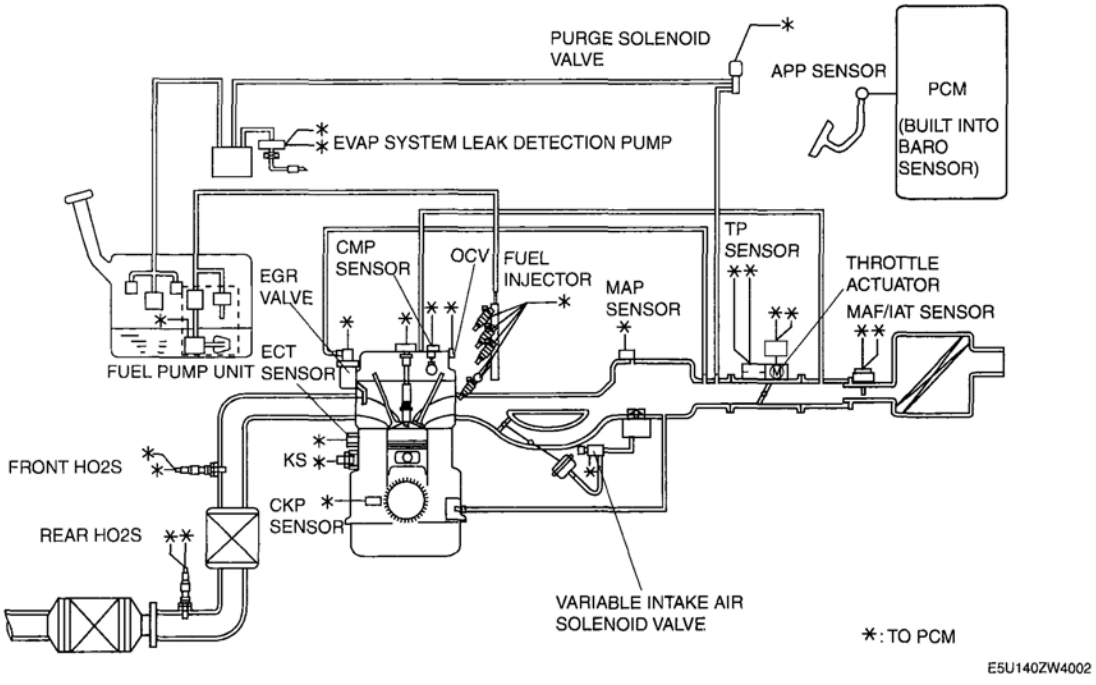


Fig. 2: Engine Control System - System Diagram
Courtesy of MAZDA MOTORS CORP.

CONTROL SYSTEM WIRING DIAGRAM [LF]

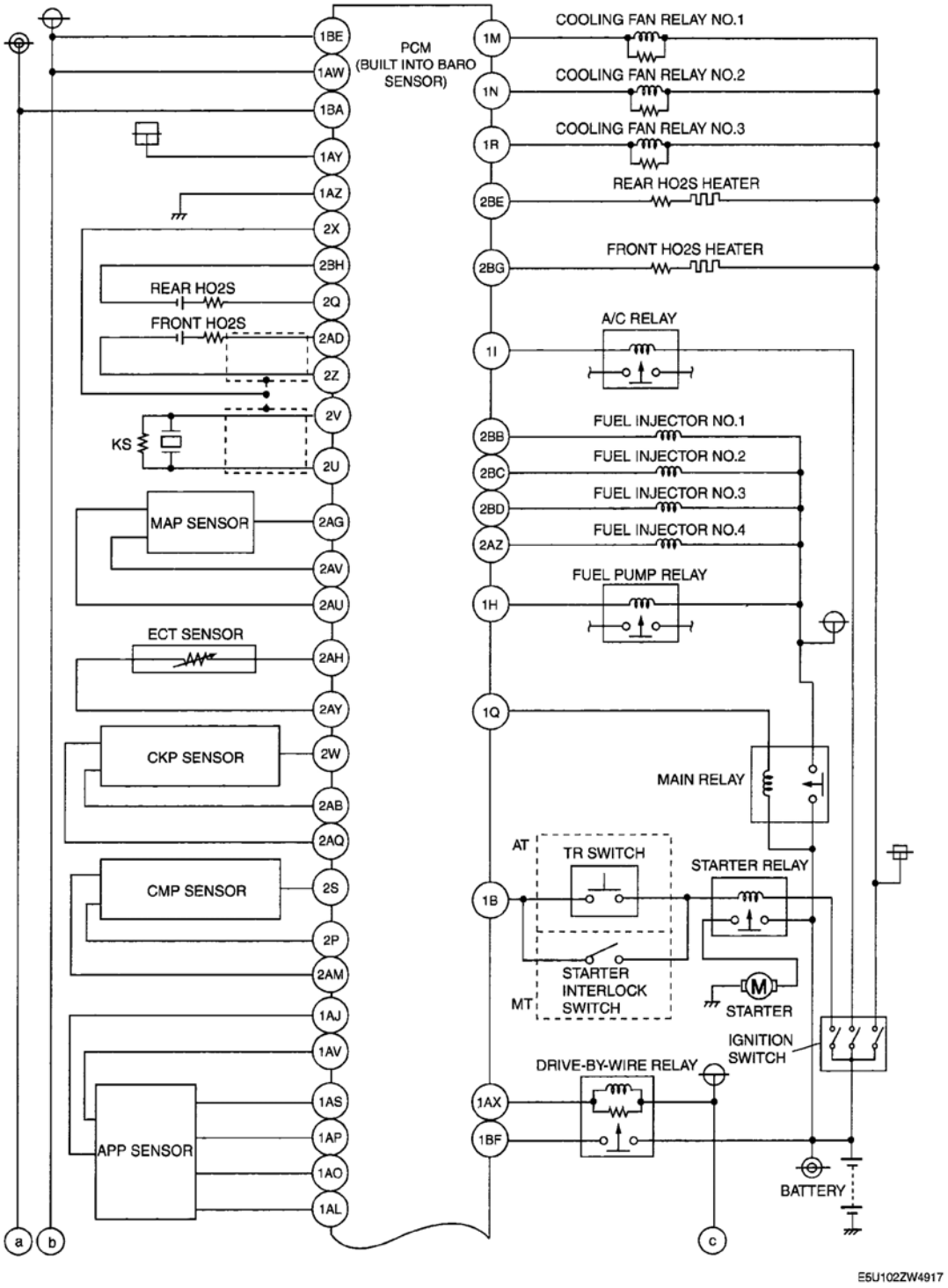


Fig. 3: Engine Control System - Wiring Diagram (1 Of 2)
Courtesy of MAZDA MOTORS CORP.

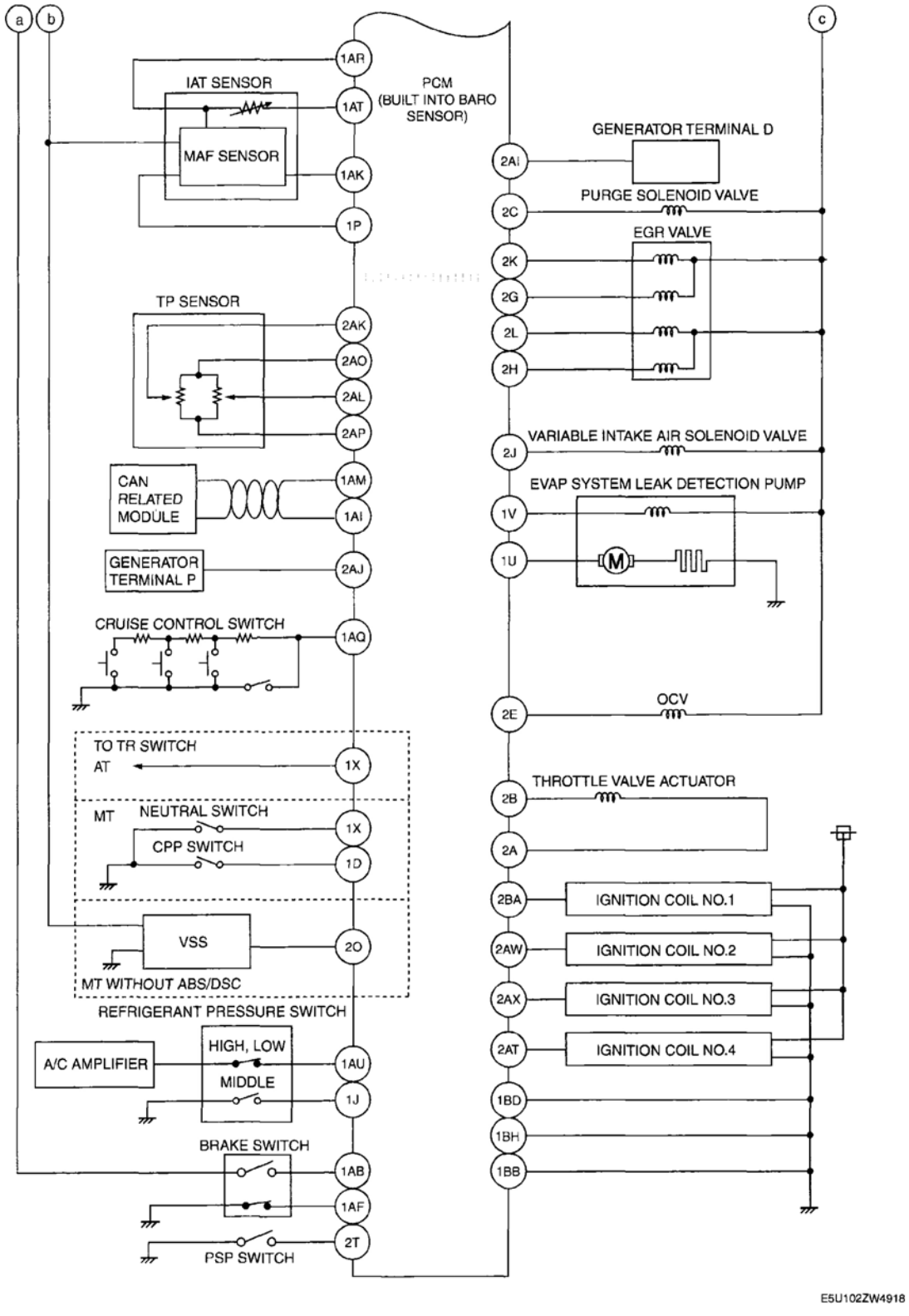
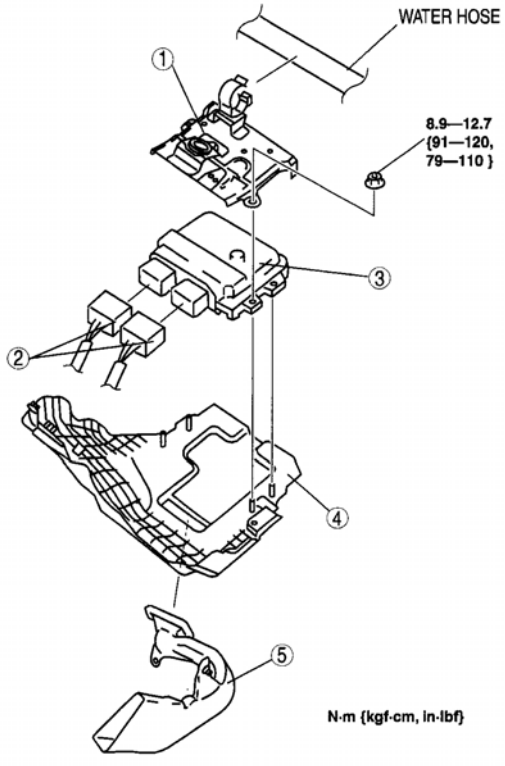


Fig. 4: Engine Control System - Wiring Diagram (2 Of 2)

Courtesy of MAZDA MOTORS CORP.

PCM REMOVAL/INSTALLATION [LF]

1. When replacing the PCM, perform the following:
   - PCM configuration (See **PCM CONFIGURATION [LF]** .)
2. Remove the battery cover.
3. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
4. Remove the air cleaner case. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [LF]** .)
5. Move the water hose from the PCM cover slightly out of the way.
6. Remove in the order indicated in **Fig. 5** .



1	PCM cover	3	PCM
2	PCM connector	4	Air cleaner insulator
		5	PCM duct

Fig. 5: Removing PCM (With Torque Specifications)
Courtesy of MAZDA MOTORS CORP.

7. Install in the reverse order of removal.
8. When replacing the PCM on the vehicles, perform the following:

- PCM parameter reset (See **IMMOBILIZER SYSTEM COMPONENT REPLACEMENT/KEY ADDITION AND CLEARING[ADVANCED KEYLESS SYSTEM]** .)

PCM CONNECTOR CONNECTED NOTE

1. Connect the PCM connector fully into the PCM and push the lever until a click is heard.

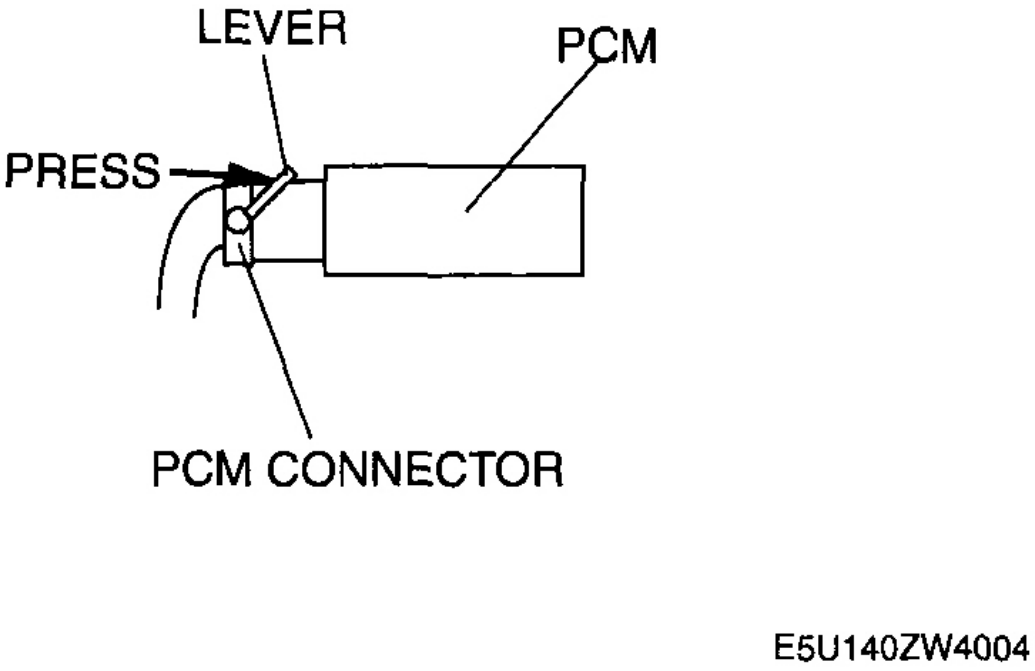


Fig. 6: Connecting PCM Connector Into PCM
Courtesy of MAZDA MOTORS CORP.

PCM INSPECTION [LF]

NOT USING THE M-MDS OR EQUIVALENT

NOTE:

- **The PCM terminal voltage can vary with the conditions when measuring and changes due to aged deterioration on the vehicle, causing false diagnosis. Therefore determine comprehensively where the malfunction occurs among the input systems, output systems, and the PCM.**

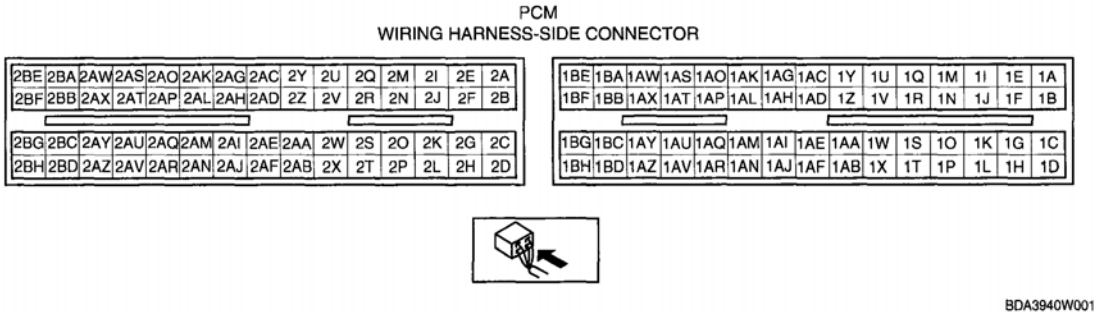


Fig. 7: Identifying PCM Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

PCM TERMINALS VOLTAGE SPECIFICATION TABLE

Terminal	Signal	Connected to	Test condition		Voltage (V)	Inspection item
1A	-	-	-		-	-
1B	Starter relay control	Starter relay	Under any condition		Below 1.0	• Starter relay • Related wiring harness
1C	-	-	-		-	-
1D(2)	Clutch operation	CPP switch	Clutch pedal depressed		Below 1.0	• CPP switch • Related wiring harness
			Clutch pedal released		B+	
1E	-	-	-		-	-
1F	-	-	-		-	-
1G	-	-	-		-	-
1H	Fuel pump control	Fuel pump relay	Ignition switch is turned to the ON position (Engine off) and a certain period has elapsed		B+	• Fuel pump relay • Related wiring harness
			Cranking		Below 1.0	
			Idle		Below 1.0	
11	A/C	A/C relay	Engine running	A/C operating	Below 1.0	• A/C relay • Related wiring harness
				A/C not operating	B+	
			Refrigerant pressure is more than the specification.		Below 1.0	• Refrigerant pressure

1J	Refrigerant pressure switch (middle)	Refrigerant pressure switch (middle)	(Refrigerant pressure switch (middle) is on.)			switch (middle) • Related wiring harness
			Refrigerant pressure is less than the specification. (Refrigerant pressure switch (middle) is off.)		B+	
1K	-	-	-		-	-
1L	-	-	-		-	-
1M	Cooling fan control	Cooling fan relay No.1	During test mode(3)	Accelerator pedal released	B+	• Cooling fan relay No.1 • Related wiring harness
				Accelerator pedal depressed	Below 1.0	
1N	Cooling fan control	Cooling fan relay No.2	During test mode(3)	Accelerator pedal released	B+	• Cooling fan relay No.2 • Related wiring harness
				Accelerator pedal depressed	Below 1.0	
1O	-	-	-		-	-
1P	MAF sensor ground	MAF sensor	Under any condition		Below 1.0	• Related wiring harness
1Q	Main relay control	Main relay	Ignition switch is turned to the ON position		Below 1.0	• Main relay • Related wiring harness
			Ignition switch off and a certain period has elapsed		B+	
1R	Cooling fan control	Cooling fan relay No.3	During test mode(3)	Accelerator pedal released	B+	• Cooling fan relay No.3 • Related wiring harness
				Accelerator pedal depressed	Below 1.0	
1S	-	-	-		-	-
1T	-	-	-		-	-
1U	EVAP system leak detection pump (pump)	EVAP system leak detection pump	Ignition switch is turned to the ON position		B+	• EVAP system leak detection pump • Related
			Idle.		B+	

					wiring harness
1V	EVAP system leak detection pump (solenoid)	EVAP system leak detection pump	Ignition switch is turned to the ON position	B+	• EVAP system leak detection pump • Related wiring harness
			Idle	B+	
1W	-	-	-	-	-
1X	(2)Neutral position	Neutral switch	Shift lever is at neutral position	Below 1.0	• Neutral switch • Related wiring harness
			Shift lever is not at neutral position	B+	
	(1)Selector lever position	TR switch	Ignition switch is turned to the ON position: P, N position	Below 1.0	• TR switch • Related wiring harness
			Ignition switch is turned to the ON position: Except above	B+	
1Y	-	-	-	-	-
1Z	-	-	-	-	-
1AA	-	-	-	-	-
1AB	Brake switch No.1	Brake switch	Brake pedal depressed	B+	• Brake switch • Related wiring harness
			Brake pedal released	Below 1.0	
1AC	-	-	-	-	-
1AD	-	-	-	-	-
1AE	-	-	-	-	-
1AF	Brake switch No.2	Brake switch	Brake pedal depressed	B+	• Brake switch • Related wiring harness
			Brake pedal released	Below 1.0	
1AG	-	-	-	-	-
1AH	-	-	-	-	-
1AI	CAN_J.	CAN related module	Because this terminal is for CAN, no valid determination of terminal voltage is possible		• Related wiring harness
1AJ	APP sensor	APP sensor	Ignition switch is turned to	Approx. 5.0	

	No.2 power supply		the ON position			• Related wiring harness
1AK	MAF	MAF sensor	Ignition switch is turned to the ON position		Approx. 0.7	• MAF sensor • Related wiring harness
			Idle		Approx. 1.4	
1AL	APP sensor No.1 power supply	APP sensor	Ignition switch is turned to the ON position.		Approx. 5.0	• Related wiring harness
1AM	CAN_H	CAN related module	Because this terminal is for CAN, no valid determination of terminal voltage is possible			• Related wiring harness
1AN	-	-	-		-	-
1AO	APP sensor No.1	APP sensor	Ignition switch is turned to the ON position	Accelerator pedal depressed	Approx. 3.9	• APP sensor • Related wiring harness
				Accelerator pedal released	Approx. 1.6	
1AP	APP sensor No.2	APP sensor	Ignition switch is turned to the ON position	Accelerator pedal depressed	Approx. 3.4	• APP sensor • Related wiring harness
				Accelerator pedal released	Approx. 1.0	
1AQ	Cruise control switch	Cruise control switch	Ignition switch is turned to the ON position	ON OFF switch pressed in	Approx. 0	• Cruise control switch • Related wiring harness
				CANCEL switch pressed in	Approx. 1.1	
				SET/- switch pressed in	Approx. 3.1	
				RES/+ switch pressed in	Approx. 4.2	
				Except above	Approx. 5.0	
1AR	Sensor ground	MAF/IAT sensor	Under any condition		Below 1.0	• Related wiring harness
1AS	APP sensor No.1 ground	APP sensor	Under any condition		Below 1.0	• Related wiring

						harness
1AT	IAT	MAF/IAT sensor	Ignition switch is turned to the ON position	IAT is 20°C {68°F}	Approx. 2.4	• IAT sensor • Related wiring harness
				IAT is 60°C {140°F}	Approx. 0.9	
1AU	Refrigerant pressure switch (high, low)	Refrigerant pressure switch (high, low)	Ignition switch is turned to the ON position	A/C operating	Below 1.0	• Refrigerant pressure switch (high, low) • Related wiring harness
				A/C not operating	B+	
1AV	APP sensor No.2 ground	APP sensor	Under any condition		Below 1.0	• Related wiring harness
1AW	B+	Main relay	Ignition switch off		Below 1.0	• Main relay • Battery • Related wiring harness
			Ignition switch is turned to the ON position		B+	
1AX	Drive-by-wire relay control	Drive-by-wire relay	Under any condition		Below 1.0	• Drive-by-wire relay • Related wiring harness
1AY	Ignition switch on	Ignition switch	Ignition switch off		Below 1.0	• Ignition switch • Related wiring harness
			Ignition switch is turned to the ON position		B+	
1AZ	Ground	Ground	Under any condition		Below 1.0	• Related wiring harness
1BA	Back-up power supply	Battery (positive terminal)	Under any condition		B+	• Battery • Related wiring harness
1BB	Ground	Ground	Under any condition		Below 1.0	• Related wiring harness
1BC	-	-	-		-	-

1BD	Ground	Ground	Under any condition		Below 1.0	• Related wiring harness
1BE	B+	Main relay	Ignition switch off		Below 1.0	• Main relay • Related wiring harness
			Ignition switch is turned to the ON position		B+	
1BF	Drive-by-wire relay control	Drive-by-wire relay	Ignition switch is turned to the ON position	Drive-by-wire system is malfunction	Below 1.0	• Drive-by-wire relay • Related wiring harness
				Drive-by-wire system is normal	B+	
1BG	-	-	-		-	-
1BH	Ground	Ground	Under any condition		Below 1.0	• Related wiring harness
2A	Throttle control (+)	Throttle body (Throttle valve actuator)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• Throttle valve actuator • Related wiring harness
2B	Throttle control (-)	Throttle body (Throttle valve actuator)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• Throttle valve actuator • Related wiring harness
2C	Purge control	Purge solenoid valve	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• Purge solenoid valve • Related wiring harness
2D	-	-	-		-	-
2E	OCV control	OCV	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• OCV • Related wiring harness

2F	-	-	-	-	-
2G	EGR valve #2 coil control	EGR valve (terminal A)	Idle (EGR control not operating)	B+	• EGR valve • Related wiring harness
2H	EGR valve #4 coil control	EGR valve (terminal F)	Idle (EGR control not operating)	B+	• EGR valve • Related wiring harness
2I	-	-	-	-	-
2J	Variable intake air control	Variable intake air solenoid valve	Ignition switch is turned to the ON position	Below 1.0	• Variable intake air solenoid valve • Related wiring harness
			Engine speed: less than 4,750 rpm	Below 1.0	
			Engine speed: 4,750 rpm or more	B+	
2K	EGR valve #1 coil control	EGR valve (terminal E)	Idle (EGR control not operating)	Below 1.0	• EGR valve • Related wiring harness
2L	EGR valve #3 coil control	EGR valve (terminal B)	Idle (EGR control not operating)	B+	• EGR valve • Related wiring harness
2M	-	-	-	-	-
2N	-	-	-	-	-
2O (4)	Vehicle speed	VSS	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• VSS • Related wiring harness
2P	CMP sensor ground	CMP sensor	Under any condition	Below 1.0	• Related wiring harness
2Q	Rear HO2S	Rear HO2S	Idle after warm-up	Alternates between 0 and 1.0	• Rear HO2S • Related wiring harness
2R	-	-	-	-	-

2S	CMP	CMP sensor	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• CMP sensor • Related wiring harness
2T	Power steering pressure	PSP switch	Idle	Steering wheel at straight ahead position	B+	• PSP switch • Related wiring harness
				While turning steering wheel	Below 1.0	
2U	Knocking (+)	KS	Ignition switch ON (Use digital type voltmeter, because measurement voltage will be detected less than true voltage when using analog type voltmeter)		Approx. 4.3	• KS • Related wiring harness
2V	Knocking (-)	KS	Ignition switch ON (Use digital type voltmeter, because measurement voltage will be detected less than true voltage when using analog type voltmeter)		Below 1.0	• KS • Related wiring harness
2W	CKP	CKP sensor	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• CKP sensor • Related wiring harness
2X	Ground	Shield wire	Under any condition		Below 1.0	• Related wiring harness
2Y	-	-	-		-	-
2Z	Front HO2S	Front HO2S	Idle after warm-up		Approx. 2.4	• Front HO2S • Related wiring harness
2AA	-	-	-		-	-
2AB	CKP sensor ground	CKP sensor	Under any condition		Below 1.0	• Related wiring harness
2AC	-	-	-		-	-

2AD	Front HO2S	Front HO2S	Idle after warm-up		Approx. 2.8	• Front HO2S • Related wiring harness
2AE	-	-	-		-	-
2AF	-	-	-		-	-
2AG	Manifold absolute pressure	MAP sensor	Ignition switch is turned to the ON position (at sea level)		Approx. 4.1	• MAP sensor • Related wiring harness
			Idle		Approx. 1.2	
2AH	ECT	ECT sensor	Ignition switch is turned to the ON position	ECT is 20°C {68°F}	Approx. 3.0	• ECT sensor • Related wiring harness
				ECT is 80°C {176°F)	Approx. 0.9	
2AI	Generator field coil control	Generator (terminal D)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• Generator • Related wiring harness
2AJ	Generator output voltage	Generator (terminal P)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)			• Generator • Related wiring harness
2AK	Throttle valve opening angle No. 1	Throttle body (TP sensor)	Ignition switch is turned to the ON position	Accelerator pedal depressed	Approx. 4.5	• TP sensor • Related wiring harness
				Accelerator pedal released	Approx. 1.0	
2AL	Throttle valve opening angle No. 2	Throttle body (TP sensor)	Ignition switch is turned to the ON position	Accelerator pedal depressed	Approx. 0.5	• TP sensor • Related wiring harness
				Accelerator pedal released	Approx. 4.0	
2AM	Constant voltage	CMP sensor	Ignition switch is turned to the ON position		B+	• Related wiring harness
2AN	-	-	-		-	-

2AO	Constant voltage (Vref)	Throttle body (TP sensor)	Ignition switch is turned to the ON position	Approx. 5.0	• Related wiring harness
2AP	Sensor ground	Throttle body (TP sensor)	Under any condition	Below 1.0	• Related wiring harness
2AQ	Constant voltage	CKP sensor	Ignition switch is turned to the ON position	B+	• Related wiring harness
2AR	-	-	-	-	-
2AS	-	-	-	-	-
2AT	IGT4	Ignition coil (No.4 cylinders)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Ignition coil No.4 • Related wiring harness
2AU	Constant voltage (Vref)	MAP sensor	Ignition switch is turned to the ON position	Approx. 5.0	• Related wiring harness
2AV	MAP sensor ground	MAP sensor	Under any condition	Below 1.0	• Related wiring harness
2AW	IGT2	Ignition coil (No.2 cylinders)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Ignition coil No.2 • Related wiring harness
2AX	IGT3	Ignition coil (No.3 cylinders)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Ignition coil No.3 • Related wiring harness
2AY	ECT sensor ground	ECT sensor	Under any condition	Below 1.0	• Related wiring harness
2AZ	Fuel injection (#4)	Fuel injector No.4	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Fuel injector No.4 • Related wiring harness

2BA	IGT1	Ignition coil (No.1 cylinders)	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Ignition coil No.1 • Related wiring harness
2BB	Fuel injection (#1)	Fuel injector No.1	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Fuel injector No.1 • Related wiring harness
2BC	Fuel injection (#2)	Fuel injector No.2	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Fuel injector No.2 • Related wiring harness
2BD	Fuel injection (#3)	Fuel injector No.3	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Fuel injector No.3 • Related wiring harness
2BE	Rear HO2S heater control	Rear HO2S heater	Heavy load (Heater control not operating)	B+	• Rear HO2S heater • Related wiring harness
2BF	-	-	-	-	-
2BG	Front HO2S heater control	Front HO2S heater	• Inspect using the wave profile. (See **INSPECTION USING AN OSCILLOSCOPE (REFERENCE)** .)		• Front HO2S heater • Related wiring harness
2BH	Rear HO2S ground	Rear HO2S	Under any condition	Below 1.0	• Related wiring harness

(1) AT

(2) MT

(3) Turn the test mode on using the M-MDS simulation function.

(4) MT without ABS/DSC

INSPECTION USING AN OSCILLOSCOPE (REFERENCE)

Throttle Control (+) Signal

PCM Terminals

- 2A (+)-Negative battery terminal (-)

Oscilloscope Setting

- 5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle Condition

- Idle (Accelerator pedal released)

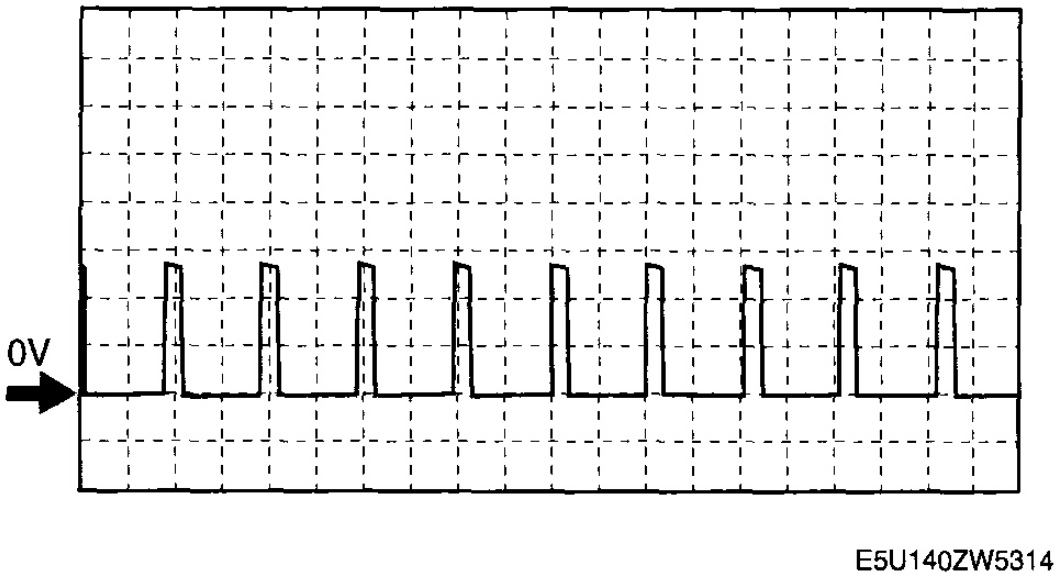


Fig. 8: Waveform Graph (Throttle Control (+) Signal))
Courtesy of MAZDA MOTORS CORP.

Throttle Control (-) Signal

PCM Terminals

- 2B (+) - Negative battery terminal (-)

Oscilloscope Setting

- 5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle Condition

- Idle (Accelerator pedal released)

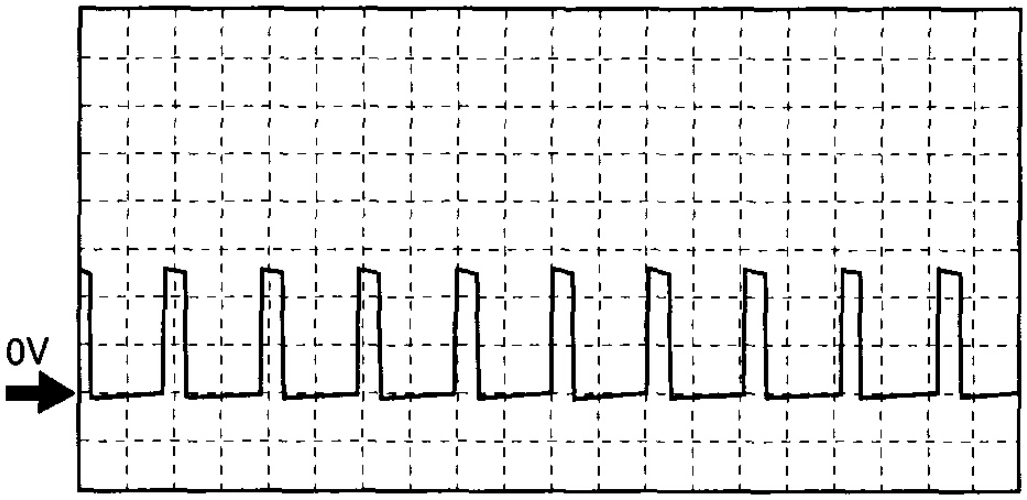


Fig. 9: Waveform Graph (Throttle Control (-) Signal))
Courtesy of MAZDA MOTORS CORP.

Purge Control Signal

PCM Terminals

- 2C (+)-Negative battery terminal (-)

Oscilloscope Setting

- 2 V/DIV (Y), 0.1 s/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

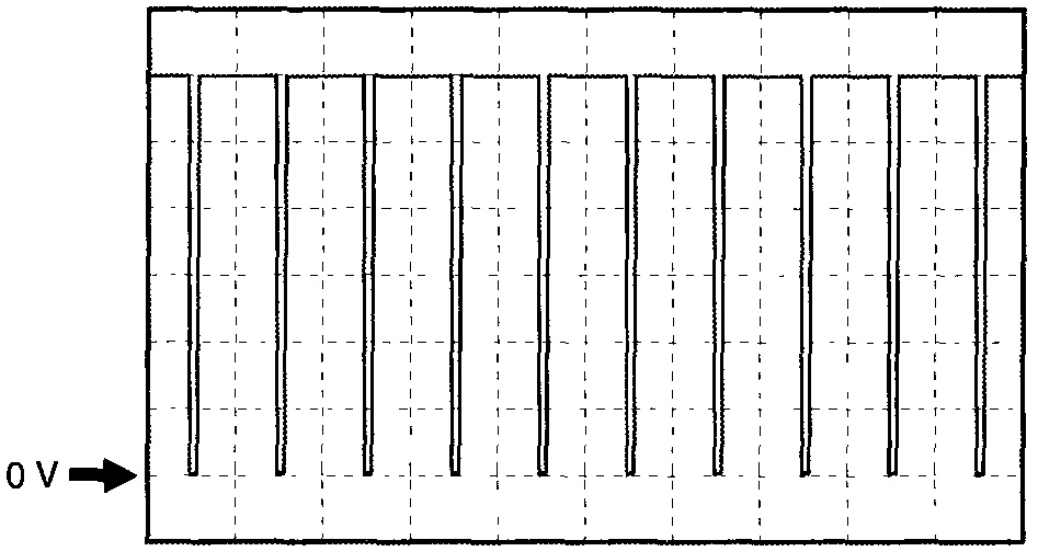


Fig. 10: Waveform Graph (Purge Control Signal)
Courtesy of MAZDA MOTORS CORP.

OCV Control Signal

PCM Terminals

- 2E (+)-Negative battery terminal (-)

Oscilloscope Setting

- 2.5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

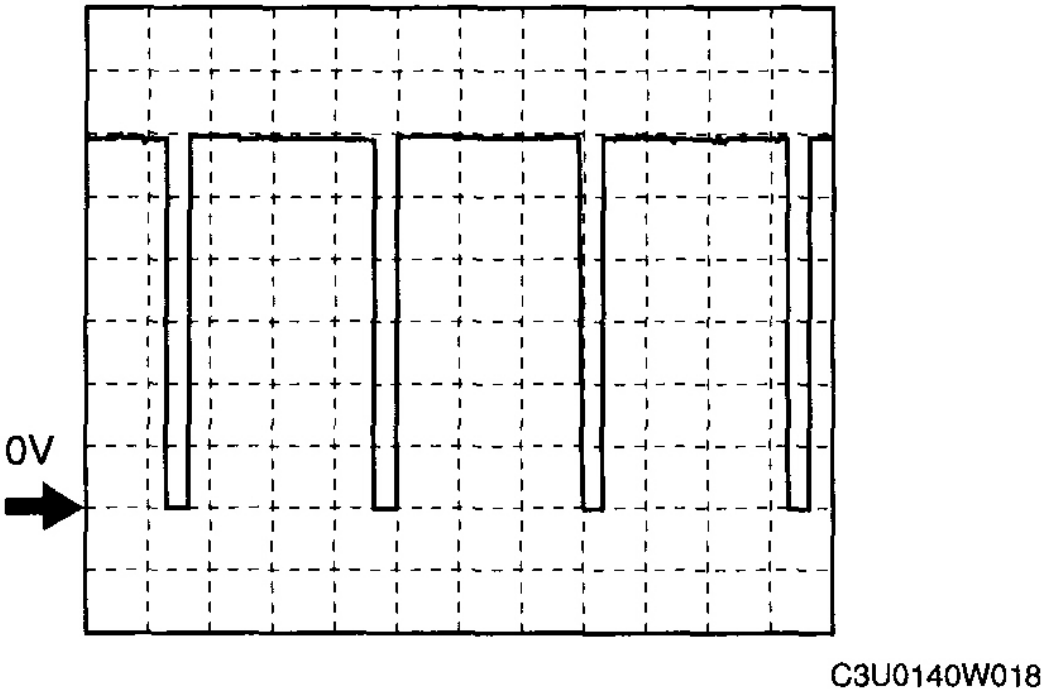


Fig. 11: Waveform Graph (OCV Control Signal)
Courtesy of MAZDA MOTORS CORP.

Vehicle Speed Signal

PCM Terminals

- 2O (+)-Negative battery terminal (-)

Oscilloscope Setting

- 1 V/DIV (Y), 10 ms/DIV (X), DC range

Vehicle Condition

- Vehicle speed is 10 km/h {6.2 mph}

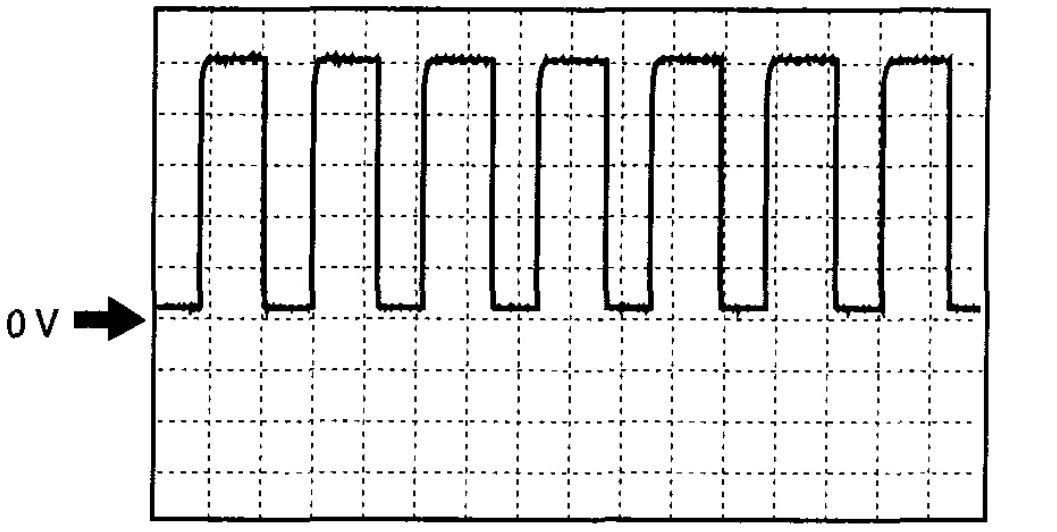


Fig. 12: Waveform Graph (Vehicle Speed Signal)
Courtesy of MAZDA MOTORS CORP.

CMP Signal

PCM Terminals

- 2S (+) - Negative battery terminal (-)

Oscilloscope Setting

- 2 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

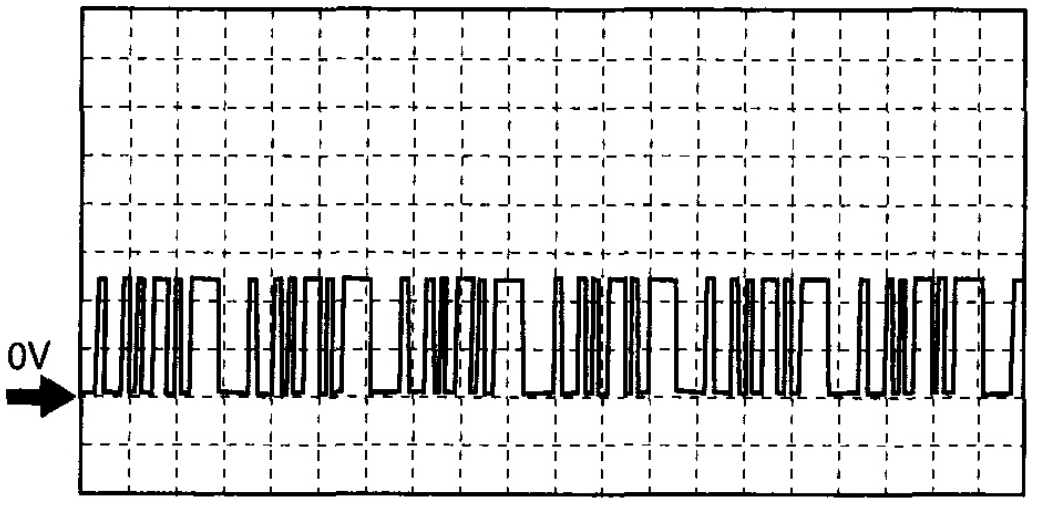


Fig. 13: Waveform Graph (CMP Signal)
Courtesy of MAZDA MOTORS CORP.

CKP Signal

PCM Terminals

- 2W (+) - Negative battery terminal (-)

Oscilloscope Setting

- 2 V/DIV (Y), 10 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

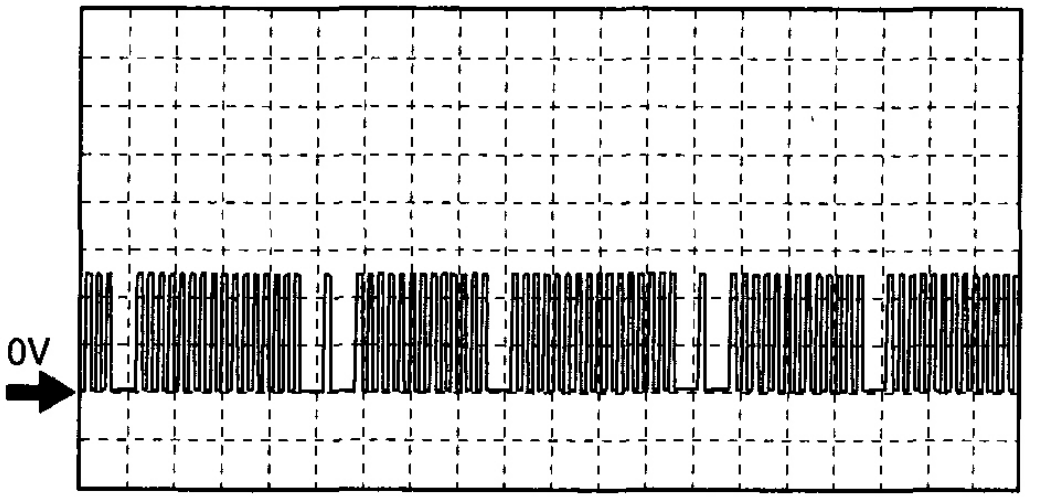


Fig. 14: Waveform Graph (CKP Signal)
Courtesy of MAZDA MOTORS CORP.

Generator Field Coil Control Signal

PCM Terminals

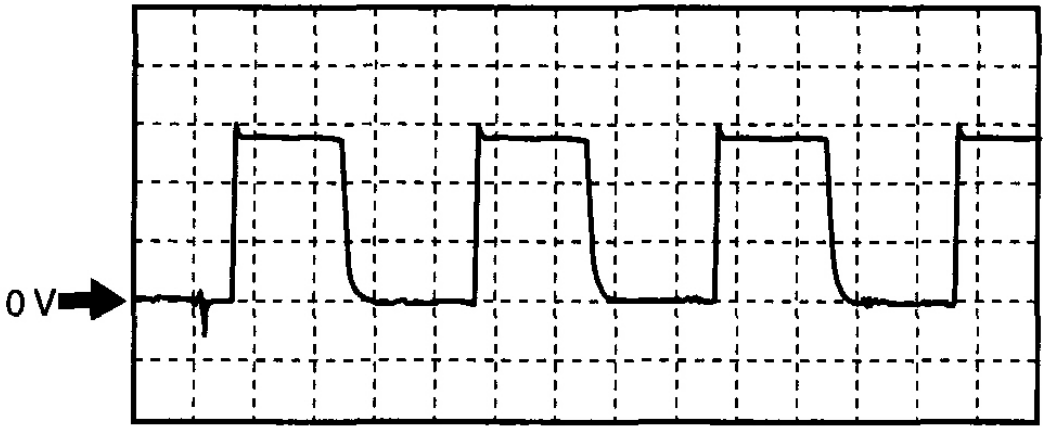
- 2AI (+) - Negative battery terminal (-)

Oscilloscope Setting

- 0.5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up



BDJ3940W015

Fig. 15: Waveform Graph (Generator Field Coil Control Signal)
Courtesy of MAZDA MOTORS CORP.

Generator Output Voltage Signal

PCM Terminals

- 2AJ (+) - Negative battery terminal (-)

Oscilloscope Setting

- 2 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

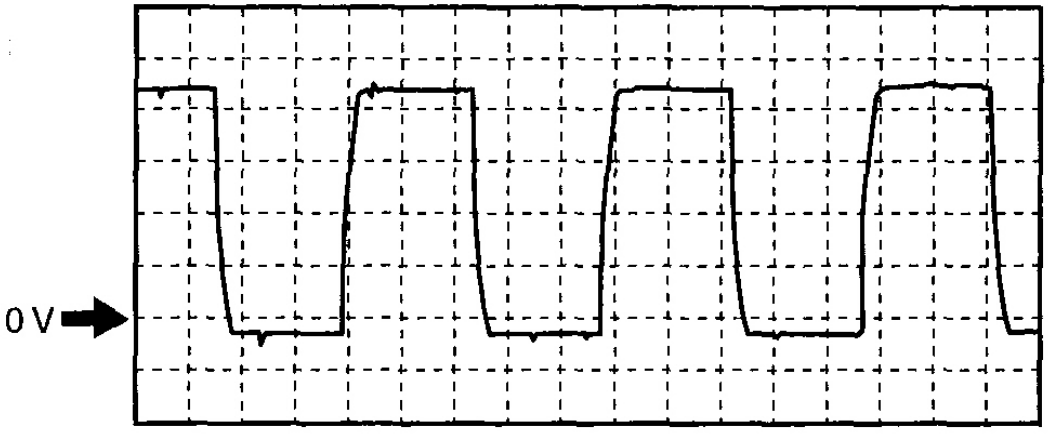


Fig. 16: Waveform Graph (Generator Output Voltage Signal)
Courtesy of MAZDA MOTORS CORP.

Ignition Timing Signals

PCM Terminals

- IGT1 (No.1): 2BA (+) - Negative battery terminal (-)
- IGT2 (No.2): 2AW (+) - Negative battery terminal (-)
- IGT3 (No.3): 2AX (+) - Negative battery terminal (-)
- IGT4 (No.4): 2AT (+) - Negative battery terminal (-)

Oscilloscope Setting

- 2 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

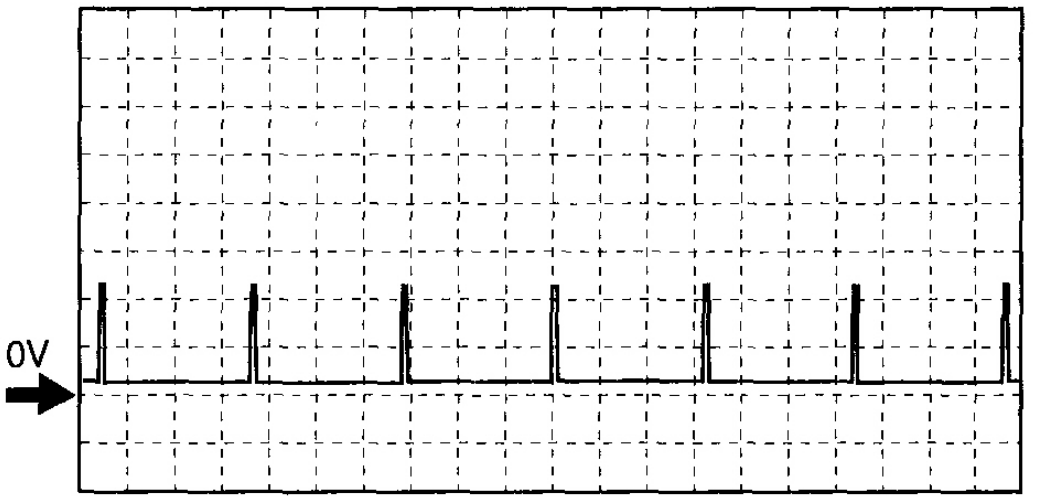


Fig. 17: Waveform Graph (Ignition Timing Signals)
Courtesy of MAZDA MOTORS CORP.

Fuel Injection Signals

PCM Terminals

- Fuel Injection No.1: 2BB (+) - Negative battery terminal (-)
- Fuel Injection No.2: 2BC (+) - Negative battery terminal (-)
- Fuel Injection No.3: 2BD (+) - Negative battery terminal (-)
- Fuel Injection No.4: 2AZ (+) - Negative battery terminal (-)

Oscilloscope Setting

- 10 V/DIV (Y), 10 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up

Fig. 18: Waveform Graph (Fuel Injection Signals)
Courtesy of MAZDA MOTORS CORP.

Front HO2S Heater Control Signal

PCM Terminals

- 2BG (+) - Negative battery terminal (-)

Oscilloscope Setting

- 5 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle Condition

- Idle after warm-up (no load)

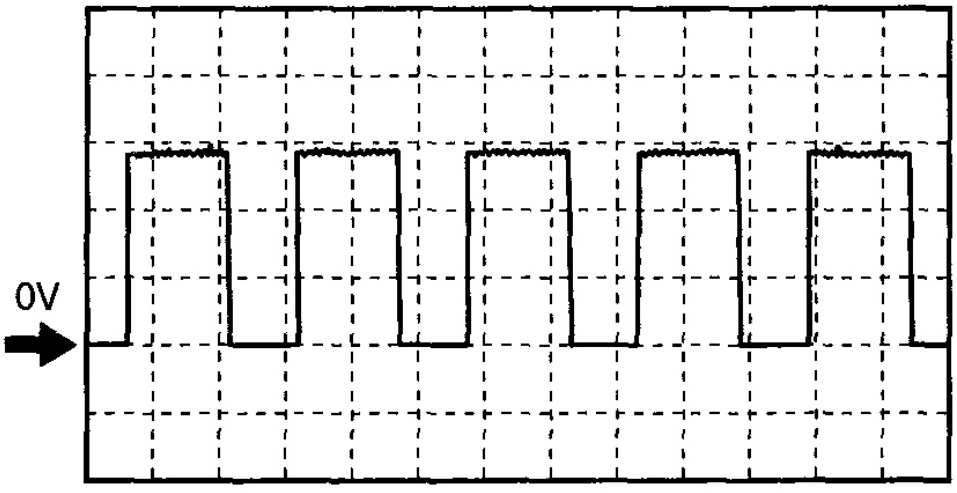


Fig. 19: Waveform Graph (Front HO2S Heater Control Signal)
Courtesy of MAZDA MOTORS CORP.

USING THE M-MDS OR EQUIVALENT

NOTE:

- **PIDs for the following parts are not available on this model. Go to the appropriate part inspection reference.**
  - **CMP sensor**
  - **Main relay**

1. Connect the **SST** (M-MDS or equivalent) to the DLC-2.

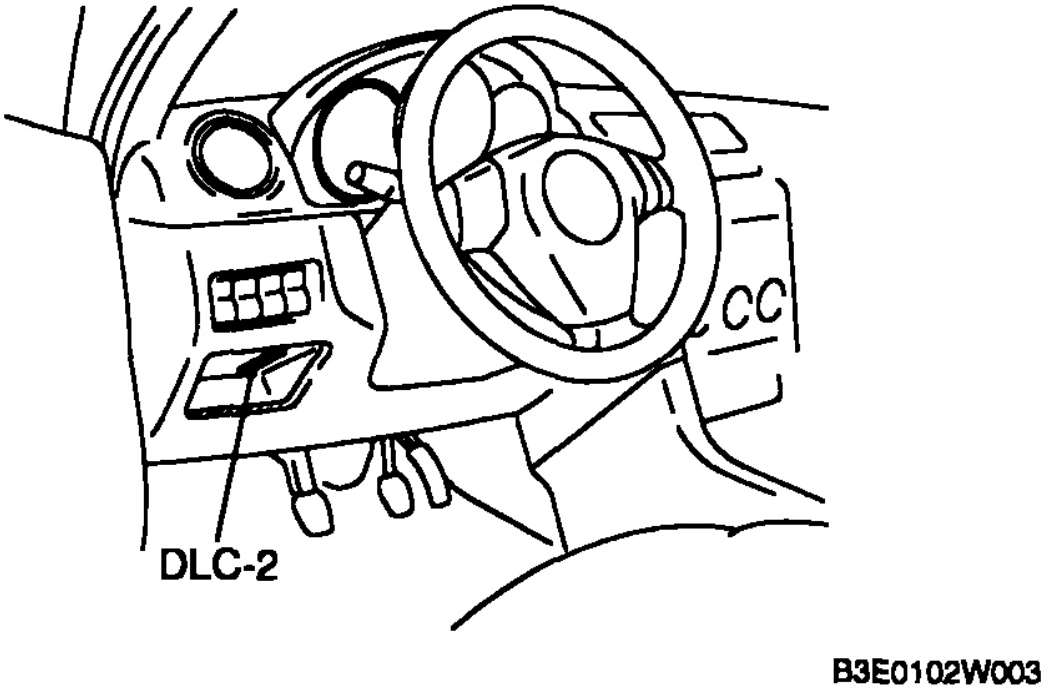


Fig. 20: Locating Connector DLC-2
Courtesy of MAZDA MOTORS CORP.

2. Turn the ignition switch to ON position.
3. Measure the PID value.
    - If PID value is not within the specification, follow the instructions in "Inspection item (s)" column.

NOTE:

- **The PID/DATA MONITOR function monitors the calculated value of the input/output signals in the PCM. Therefore, an output device malfunction is not directly indicated as a malfunction of the monitored value for the output device. If a monitored value of an output device is out of specification, inspect the monitored value of the input device related to the output control.**
- **For input/output signals except those of the monitoring items, use a voltmeter to measure the PCM terminal voltage.**
- **The simulation items that are used in the ENGINE CONTROL SYSTEM OPERATION INSPECTION are as follows.**
    - **ACCS, ALTF, EVAPCP, FAN1, FAN2, FAN3, FP, FUELPW1, GENVDSD, HTR11, HTR12, IMTV, INJ_1, INJ_2, INJ_3, INJ_4, SEGRP, test, VT DUTY1 Wt**

PID/DATA Monitor Table (Reference)

PID/DATA MONITOR TABLE

Item (definition)	Unit/Condition		Condition/Specification (Reference)	Inspection item(s)	PCM terminal
AAT (Ambient air temperature)	°C	°F	• Ignition switch is turned to the ON position: Indicate the ambient air temperature	• The following PIDs ○ IAT	-
AC_REQ (Refrigerant pressure switch (high, low)	On/Off		• Refrigerant pressure is more than the specification or less than the specification. (Refrigerant pressure switch (high, low) is off.): Off • Except above: On	• Refrigerant pressure switch (high, low) • A/C amplifier	1AU
ACCS (A/C relay)	On/Off		• A/C relay is ON: On • A/C relay is OFF: Off	• The following PIDs ○ CPP(1), CPP/PNP(1), ECT, RPM, TP, TR(2), AC_REQ, COLP	1I
AFR (Air/fuel ratio)	-		• Idle after warm-up: Approx. 1	• Front HO2S	2AD
AFR_ACT (Actual air/fuel ratio)	-		• Idle after warm-up: Approx. 1	• Front HO2S • Rear HO2S	-
ALTF (Generator field coil control duty value)	%		• Ignition switch is turned to the ON position: 0% • Idle, E/L is operating: Duty value increases.	• Generator	2AI
ALTT V (Generator			• Idle (no E/L): Approx. 14 V	• Generator	2AJ

output voltage)	V	(This is an internal calculation value and differs from the terminal voltage.)		
APP (Accelerator pedal position)	%	• Accelerator pedal released: 0% • Accelerator pedal depressed: 100%	• The following PIDs ○ APP1, APP2	1AO, 1AP
APP1 (APP sensor No.1)	%	• Accelerator pedal released: Approx. 32% • Accelerator pedal depressed: Approx. 78%	• APP sensor	1AO
	V	• Accelerator pedal released: Approx. 1.6 V • Accelerator pedal depressed: Approx. 3.9 V		
APP2 (APP sensor No.2)	%	• Accelerator pedal released: Approx. 21% • Accelerator pedal depressed: Approx. 67%	• APP sensor	1AP
	V	• Accelerator pedal released: Approx. 1.0 V • Accelerator pedal depressed: Approx. 3.4 V		
ARPMDES (Target engine speed)	RPM	• Indicate the target engine speed.	• The following PIDs ○ CPP(1), CPP/PNP(1), ECT, IAT, RPM, TP, MAF, MAP, VSS,	-

					AC_REQ, COLP	
BARO (Barometric pressure)	kPa	Bar	PSI	• Ignition switch is turned to the ON position: Indicate the barometric pressure	-	-
	V			• Ignition switch is turned to the ON position (at sea level): 4.1 V		
BOO (Brake switch)	On/Off			• Brake pedal depressed: On • Brake pedal released: Off	• Brake switch	1AB, 1AF
CATT11_DSD (Catalyst temperature)	°C		°F	• Ignition switch is turned to the ON position: Indicate the catalyst temperature	-	-
CHRGLP (Generator warning light)	On/Off			• Idle, Generator warning light illuminate: On • Idle, Generator warning light not illuminate: Off	• Generator warning light	-
COLP (Refrigerant pressure switch (middle))	On/Off			• Refrigerant pressure is more than the specification. (Refrigerant pressure switch (middle) is on.): On • Refrigerant pressure is less than the specification. (Refrigerant pressure switch (middle) is off.): Off	• Refrigerant pressure switch (middle)	1J
CPP(1) (Clutch				• Clutch pedal	• CPP switch	1D

pedal position)	On/Off		depressed: On • Clutch pedal released: Off.		
CPP/PNP(1) (Shift lever position)	Drive/Neutral		• Neutral: Neutral • Other than neutral: Drive	• Neutral switch	1X
DTCCNT (Number of DTC detected)	-		• Number of DTCs stored	-	-
ECT (Engine coolant temperature)	°C	°F	• Ignition switch is turned to the ON position: Indicate the ECT	• ECT sensor	2AH
	V		• ECT is 20°C {68° F}: Approx. 3.0 V • ECT is 80°C {176°F}: Approx. 0.9 V		
EQ_RAT11 (Actual lambda signal)	-		• Idle after warm-up: Approx. 1	• Front HO2S	-
EQ_RAT11_DSD (Target lambda)	-		• Target lambda (Excess air factor = supplied air amount/theoretical air/fuel ratio)	• Front HO2S	-
ETC_ACT (Throttle control)	°		• Accelerator pedal released: Approx. 0° • Accelerator pedal depressed: Approx. 94.5°	• TP sensor	-
ETC_DSD (Throttle control desired)	%		• Indicate the target throttle valve opening ratio	• The following PIDs ○ APP, RPM	-
	°		• Indicate the target throttle valve opening angle		
EVAPCP (Purge solenoid valve duty value)			• Ignition switch is turned to the ON position: 0% • Increase the	• The following PIDs ○ ECT, IAT, RPM, TP,	2C

	%	engine speed (after warm-up): Duty value rises	MAF, O2S11, O2S12, BOO, VPWR • Purge solenoid valve	
FAN1 (Cooling fan relay No.1 control signal)	On/Off	• During test mode CTP: Off WOT: On	• The following PIDs ○ ECT, test, TP	1M
FAN2 (Cooling fan relay No.2 control signal)	On/Off	• During test mode CTP: Off WOT: On	• The following PIDs ○ ECT, test, TP	1N
FAN3 (Cooling fan relay No.3 control signal)	On/Off	• During test mode CTP: Off WOT: On.	• The following PIDs ○ ECT, test, TP	1R
FLI (Fuel level)	%	• Indicate the fuel level	-	-
FP (Fuel pump relay)	On/Off	• Ignition switch is turned to the ON position and a certain period has elapsed: Off • Cranking: On • Idle: On	• Fuel pump relay	1H
FUELPW (Fuel injector duration)	ms	• Idle: Approx. 2.0 ms	• The following PIDs ○ CPP(1), CPP/PNP(1), ECT, IAT, RPM, TP, MAF, O2S11, O2S12, MAP, VSS, TR	2BB, 2BC, 2BD, 2AZ

			(2), BOO, AC_REQ, COLP, VPWR	
FUELSYS (Fuel system status)	OL/CL/OL-Drive/OL-Fault/CL-Fault	• Idle after warm-up: CL	• The following PIDs ○ CPP(1), CPP/PNP (1), ECT, IAT, RPM, TP, MAF, O2S11, O2S12, MAP, VSS, TR (2), BOO, AC_REQ, COLP, VPWR	-
GENVDSD (Target generator voltage)	V	• Indicate the target generated voltage	• The following PIDs ○ ECT, IAT, RPM, VSS, ALTT V, VPWR • Generator	-
HTR11 (Front HO2S heater control)	On/Off	• Ignition switch is turned to the ON position: Off • Idle: On	• The following PIDs ○ ECT, IAT, RPM, TP, MAF, MAP, VPWR	2BG
HTR12 (Rear HO2S heater control)	On/Off	• Ignition switch is turned to the ON position: Off • Idle: On	• The following PIDs ○ ECT, IAT, RPM, TP, MAF, MAP, VPWR	2BE
		• Ignition switch is		

IAT (Intake air temperature)	°C	°F	turned to the ON position: Indicate the IAT	• IAT sensor	1AT
	V		• IAT is 20°C {68° F}: Approx. 2.4 V • IAT is 60°C {140° F}: Approx. 0.9 V		
IMTV (Variable intake air control)	On/Off		• Engine speed is less than 4,750 rpm: On • Engine speed is 4,750 rpm or more: Off	• The following PIDs ○ RPM	2J
INGEAR (Gears are engaged)	On/Off		**MT** • When the following conditions are satisfied: On ○ Other than neutral ○ Clutch pedal released • Except above: Off	• CPP switch • Neutral switch	1D, 1X
			AT • Driving range: On • Except above: Off	• TR switch	-
IVS (CTP condition)	Idle/Off Idle		• Idle: Idle • Other than idle: Off Idle	• The following PIDs ○ TP	-
KNOCKR (Knocking retard)	°		• Ignition switch is turned to the ON position: 0° • Idle: 0°	• KS.	2U
LDP_EVAPCP (EVAP system leak detection pump detect incorrect purge flow)	mA		• Indicate EVAP control system incorrect purge flow detection value	-	-

LDP_IDL (EVAP system leak detection pump idle current)	mA	• Indicate EVAP system leak detection pump idle current	-	-
LDP_MON (EVAP system leak detection pump monitoring current)	mA	• Indicate EVAP system leak detection pump monitoring current	-	-
LDP_REF (EVAP system leak detection pump reference current)	mA	• Indicate EVAP system leak detection pump reference current	-	-
LDP_SLDV (EVAP system small leak detection value)	mA	• Indicate EVAP system small leak detection value	-	-
LDP_VSL_FV (EVAP system very small leak detection fail value)	mA/s	• Indicate EVAP system very small leak detection fail value	-	-
LDP_VSL_SV (EVAP system very small leak detection safe value)	mA/s	• Indicate EVAP system very small leak detection safe value	-	-
LDP_VSLDV (2) (EVAP system very small leak detection value)	mA/s	• Indicate EVAP system very small leak detection value	-	-
LOAD (Engine load)	%	• Idle after warm-up: Approx. 23%	• The following PIDs ○ MAP, IAT, MAF, RPM	-
LONGFT1 (Long term fuel trim)		• Idle after warm-up: Approx.-15 - /+15%	• The following PIDs ○ CPP(1),	-

	%			CPP/PNP [(1)], ECT, IAT, RPM, TP, MAF, O2S11, O2S12, MAP, VSS, TR [(2)], BOO, AC_REQ, COLP, VPWR	
MAF (Mass air flow)	g/s		• Ignition switch is turned to the ON position: Approx. 0 g/s • Idle: Approx. 4.0 g/s	• MAF sensor	1AK
	V		• Ignition switch is turned to the ON position: Approx. 0.7 V • Idle: Approx. 1.4 V		
MAP (Manifold absolute pressure)	kPa	psi	Bar	• Ignition switch is turned to the ON position: Indicate the MAP	• MAP sensor	2AG
	V			• Ignition switch is turned to the ON position (at sea level): 4.1 V • Idle after warm-up: Approx. 1.2 V	
MIL (Malfunction indicator lamp)	On/Off			• Idle, MIL illuminate: On • Idle, MIL not illuminate: Off	• MIL	-
MIL_DIS (Travelled distance since MIL	km		Mile	Travelled distance since MIL illuminated		-

illuminated)				
O2S11 (Front HO2S)	mA	• Idle after warm-up: Approx. 0 mA	• Front HO2S	2AD
O2S12 (Rear HO2S)	V	• Idle after warm-up: Alternates between 0 and 1.0 V	• Rear HO2S	2Q
PSP (PSP switch)	Low/High	• Steering wheel at straight ahead position: Low • While turning steering wheel: High	• PSP switch.	2T
RFCFLAG (PCM adaptive memory produce verification)	Learnt/Not Learnt	• Idle (after running PCM adaptive memory procedure drive mode): Learnt • Right after the negative battery cable is disconnected (before running PCM adaptive memory procedure drive mode): Not Learnt	• Verify after repair procedure	-
RO2FT1 (Rear HO2S fuel trim)	-	• Idle after warm-up: Approx. 0	• The following PIDs ○ O2S12	-
RPM (Engine speed)	RPM	• When the engine is running: Indicate the engine speed	• CKP sensor	2W
SCCS (Cruise control switch)	V	• ON OFF switch pressed in: Approx. 0 V • CANCEL switch pressed in: Approx. 1.1 V • SET/- switch pressed in: Approx. 3.1 V	• Cruise control switch	1AQ

		• RES/+ switch pressed in: Approx. 4.2 V • Except above: Approx. 5.0 V		
SEGRP (EGR control)	-	• Ignition switch is turned to the ON position: 0 Step • Idle: 0 Step • Engine speed is 1,200-4,200 rpm: 0-52 Step	• EGR valve	2K, 2G, 2L, 2H
SEGRP DSD (EGR valve position desired)	%	• Ignition switch is turned to the ON position: 0% • Idle: 0% • Engine speed is 1,200-4,200 rpm: 0-100%	• The following PIDs ○ MAF, TP, ECT, RPM, VSS	-
SELTESTDTC (Diagnostic trouble codes)	-	• Indicate the diagnostic trouble codes	-	-
SHRTFT1 (Short term fuel trim (front))	%	• Idle after warm-up: -25-25%	• The following PIDs ○ CPP(1), CPP/PNP(1), ECT, IAT, RPM, TP, MAF, O2S11, O2S12, MAP, VSS, TR(2), BOO, AC_REQ, COLP, VPWR	-
SHRTFT 12 (Short term fuel trim (rear))		• Idle after warm-up: Approx. 99%	• The following PIDs ○ CPP(1), CPP/PNP	-

	%		(1), ECT, IAT, RPM, TP, MAF, O2S11, MAP, VSS, TR (2), BOO, AC_REQ, COLP, VPWR	
SPARKADV (Ignition timing)	°	• Indicate the ignition timing	• The following PIDs ○ CPP(1), CPP/PNP (2), ECT, IAT, RPM, TP, MAF, KNOCKR, TR(2), BOO, AC_REQ, COLP	2S
Test (Test mode)	On/Off	• Test mode On: On • Test mode Off: Off	-	-
TIRESIZE (Tire revolution per mile)	rev/mile	• Indicate the tire revolution per a mile		-
TP REL (Throttle position signal (relative value))	%	• Accelerator pedal released: Approx. 10% • Accelerator pedal depressed: Approx. 81%	• The following PIDs ○ TP1, TP2	-
TP1 (TP sensor No.1)	%	• Accelerator pedal released: Approx. 10% • Accelerator pedal depressed: Approx. 90%	• TP sensor	2AK
		• Accelerator pedal		

	V		released: Approx. 0.5 V • Accelerator pedal depressed: Approx. 4.5 V		
TP2 (TP sensor No.2)	%		• Accelerator pedal released: Approx. 10% • Accelerator pedal depressed: Approx. 90%	• TP sensor	2AL
	V		• Accelerator pedal released: Approx. 4.5 V • Accelerator pedal depressed: 0.5 V		
TPCT (TP sensor voltage at CTP)	V		• Ignition switch is turned to the ON position: Approx. 0.5 V	• The following PIDs ○ TP1, TP2	-
VPWR (Battery positive voltage)	V		• Indicate the battery voltage	• Battery	1BA
VSS (Vehicle speed)	Km/h	Mph	• Vehicle running: Indicate the vehicle speed	• ABS, DSC HU/CM(3) • VSS(4) • TCM(5)	2O(4) 1AM(3), (5), 1AI(3), (5)
VT ACT1 (Actual valve timing)	°		• Idle: Approx. 0° • Racing: 0-25°	• The following PIDs ○ ECT, RPM, TP, MAF • OCV	2E
VT DIFF1 (Difference between target valve timing and actual valve timing)	°		• Idle: 0°	• The following PIDs ○ ECT, RPM, TP, MAF • OCV	-
VT DUTY1			• Idle: Approx. 10%	• The following	2E

(OCV control)	%		PIDs ○ ECT, RPM, TP, MAF	

(1) MT

(2) California emission regulation applicable model

(3) With ABS, DSC HU/CM

(4) MT without ABS/DSC

(5) AT without ABS/DSC

PCM CONFIGURATION [LF]

1. Connect the M-MDS or equivalent to the DLC-2.

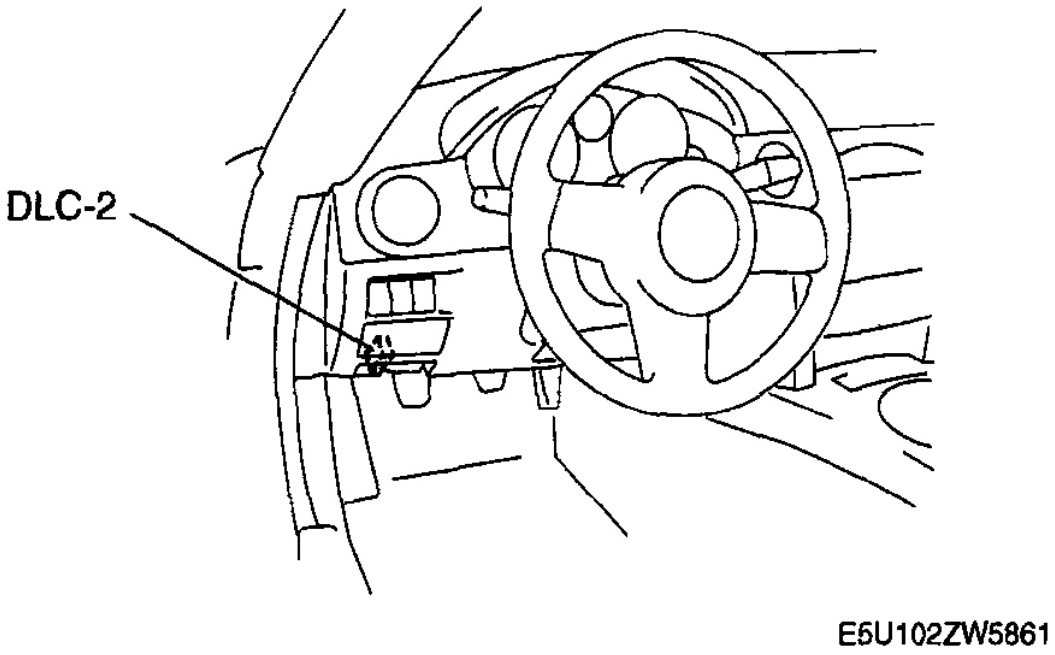


Fig. 21: Locating DLC-2 Connector
Courtesy of MAZDA MOTORS CORP.

2. Set up the M-MDS or equivalent (including the vehicle recognition).
3. Select "Module Programming".
4. Select "Programmable Module Installation".

5. Select "PCM" and perform procedures according to directions on the M-MDS or equivalent screen.

NOTE:

- **If the PCM is replaced with a new one, the PCM stores DTC P0602 and illuminates the MIL even though no malfunction is detected. This means the PCM has not been configured yet.**

6. Retrieve DTC's by the M-MDS or equivalent, then verify that there in no DTC present.
   - If DTC is present, perform applicable DTC inspection. (See **DTC TABLE [LF]** .)

NEUTRAL SWITCH INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

CONTINUITY INSPECTION

1. Remove the neutral switch. (See **NEUTRAL SWITCH REMOVAL/INSTALLATION [M15M-D]** .) (See **NEUTRAL SWITCH REMOVAL/INSTALLATION [P66M-D]** .)
2. Verify that the continuity between neutral switch terminals 1A and 2A is as indicated in **Fig. 22** .
   - If not as indicated in **Fig. 22** , replace the neutral switch. (See **NEUTRAL SWITCH REMOVAL/INSTALLATION [M15M-D]** .) (See **NEUTRAL SWITCH REMOVAL/INSTALLATION [P66M-D]** .)

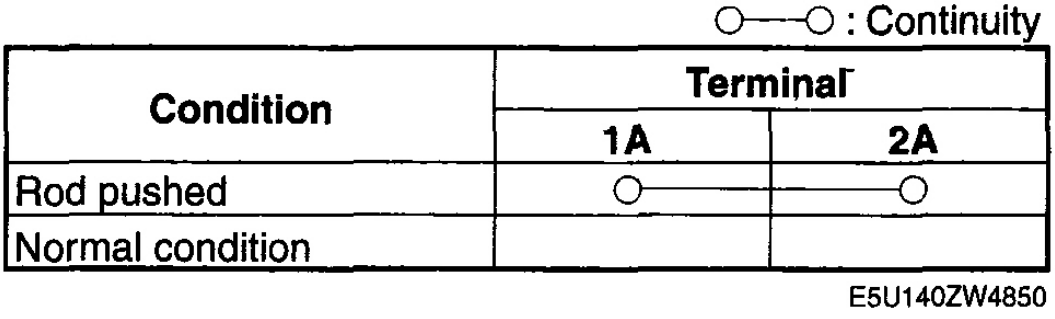


Fig. 22: Neutral Switch Continuity Reference Table
Courtesy of MAZDA MOTORS CORP.

- If the monitor item condition/specification (reference) is not within the specification, even though there is no malfunction, perform the **CIRCUIT OPEN/SHORT INSPECTION** .

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harness for open or short circuit (continuity Inspection).

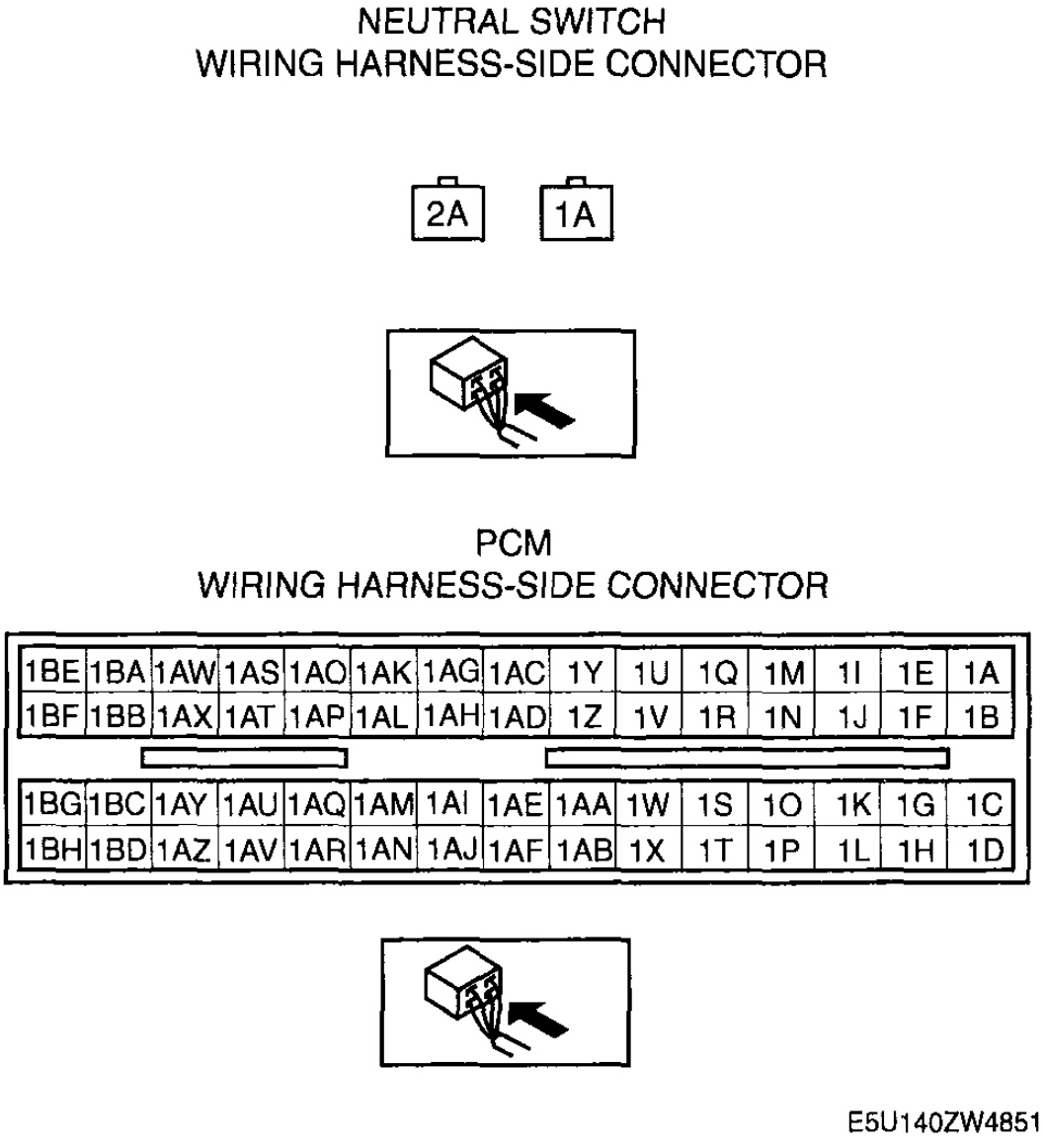


Fig. 23: Identifying Neutral Switch & PCM Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - Neutral switch terminal 2A and PCM terminal 1X

- Neutral switch terminal 1A and body ground

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - Neutral switch terminal 2A and body ground

CLUTCH PEDAL POSITION (CPP) SWITCH INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

CONTINUITY INSPECTION

1. Remove the CPP switch. (See **CLUTCH PEDAL REMOVAL/INSTALLATION** .)
2. Verify that the continuity between CPP switch terminals D and B is as indicated in **Fig. 24** .
   - If not as indicated in **Fig. 24** , replace the CPP switch. (See **CLUTCH PEDAL REMOVAL/INSTALLATION** .)

○—○ : Continuity

Condition	Terminal	
	D	B
Normal condition	○	○
Rod pushed		

E5U140ZW4861

Fig. 24: Clutch Pedal Position Switch Continuity Table
Courtesy of MAZDA MOTORS CORP.

- If the monitor item condition/specification (reference) is not within the specification, even though there is no malfunction, perform the **CIRCUIT OPEN/SHORT INSPECTION** .

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harness for open or short circuit (continuity Inspection).

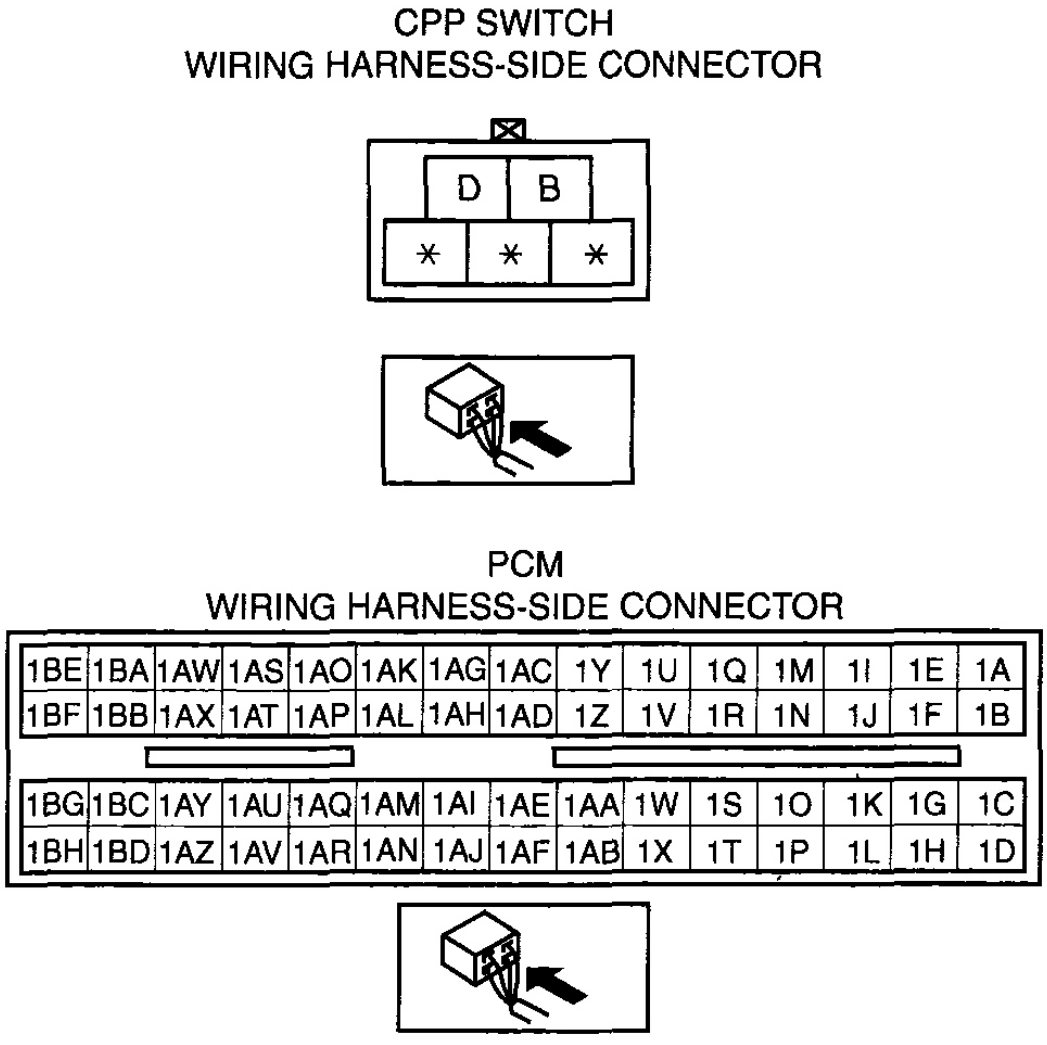


Fig. 25: Identifying CPP Switch & PCM Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - CPP switch terminal B and PCM terminal 1D
  - CPP switch terminal D and body ground

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - CPP switch terminal B and body ground

POWER STEERING PRESSURE (PSP) SWITCH INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

CONTINUITY INSPECTION

1. Inspect the following items:
   - Power steering fluid amount (See **POWER STEERING FLUID INSPECTION** .)
   - Power steering-related inspection (See **STEERING LOCATION INDEX** .)
2. Disconnect the PSP switch connector.
3. Start the engine.
4. Verify that the continuity between PSP switch terminal A and body ground is as indicated in **Fig. 26** .
   - If not as indicated in **Fig. 26** , replace the CPP switch. (See **POWER STEERING OIL PUMP DISASSEMBLY/ASSEMBLY** .)

○—○ : Continuity

Condition	Terminal A	GND
Steering wheel in straight ahead position		
While turning sttering wheel	○	○

B3E0140W526

Fig. 26: Power Steering Pressure Switch Continuity Reference Table
Courtesy of MAZDA MOTORS CORP.

- If the monitor item condition/specification (reference) is not within the specification, even though there is no malfunction, perform the **CIRCUIT OPEN/SHORT INSPECTION** .

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)

2. Inspect the following wiring harness for open or short circuit (continuity Inspection).

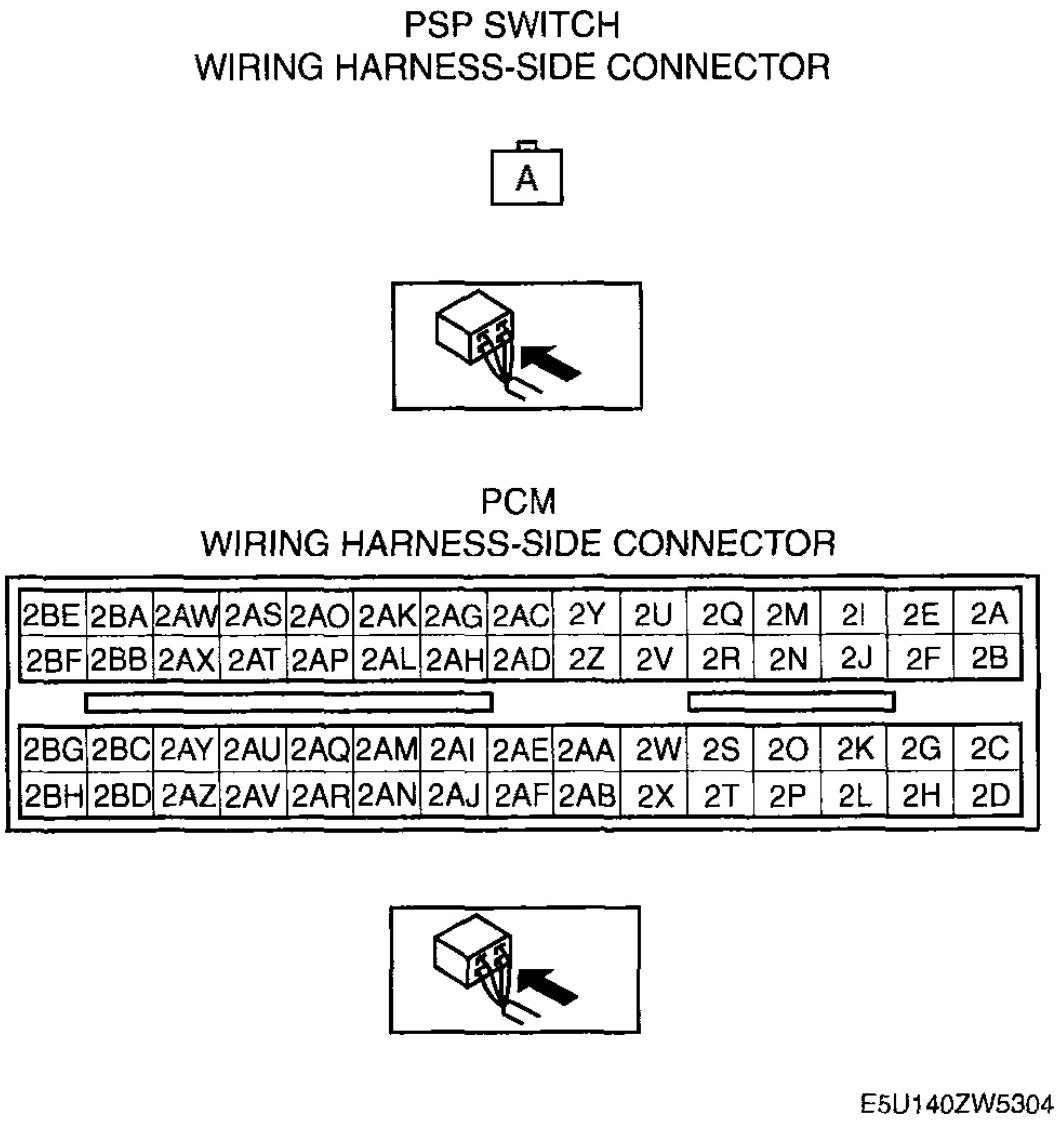


Fig. 27: Identifying PSP Switch & PCM Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - PSP switch terminal A and PCM terminal 2T

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - PSP switch terminal A and body ground

ENGINE COOLANT TEMPERATURE (ECT) SENSOR REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Drain the engine coolant from the radiator. (See **ENGINE COOLANT REPLACEMENT [LF]** .)
4. Remove the service hole cover.
   1. Remove the suspension tower bar (joint), (right side) and (left side). (See **FRONT SUSPENSION TOWER BAR REMOVAL/INSTALLATION** .)
   2. Remove the wiper arm. (See **WIPER ARM AND BLADE REMOVAL/INSTALLATION** .)
   3. Remove the cowl grille. (See **COWL GRILLE REMOVAL/INSTALLATION** .)
   4. Remove the side cowl grille. (See **SIDE COWL GRILLE REMOVAL/INSTALLATION** .)
   5. Move the cooler pipe No.3 and heater pipe slightly out of the way.

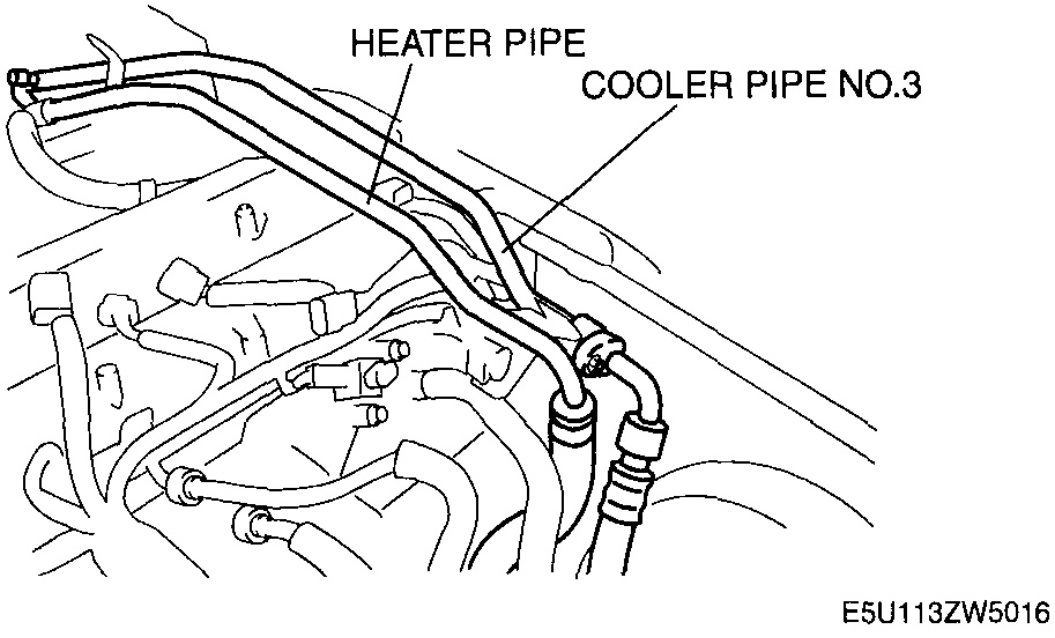


Fig. 28: Identifying Cooler Pipe No. 3 & Heater Pipe
Courtesy of MAZDA MOTORS CORP.

6. Remove the service hole cover. (See **EGR VALVE REMOVAL/INSTALLATION [LF]** .)

5. Disconnect the heater hose and move the heater pipe slightly out of the way.
6. Disconnect the ECT sensor connector.

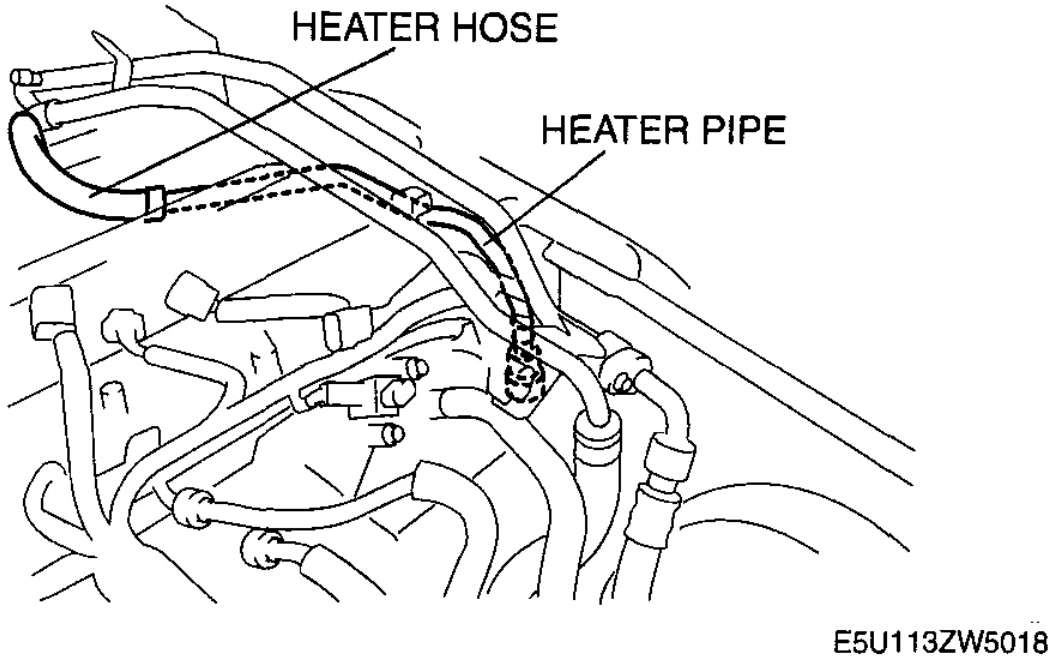


Fig. 29: Identifying Heater Hose & Heater Pipe
Courtesy of MAZDA MOTORS CORP.

7. Remove the ECT sensor.

NOTE:

- **Put the double nut together and install the torque wrench. (See TORQUE FORMULAS .)**

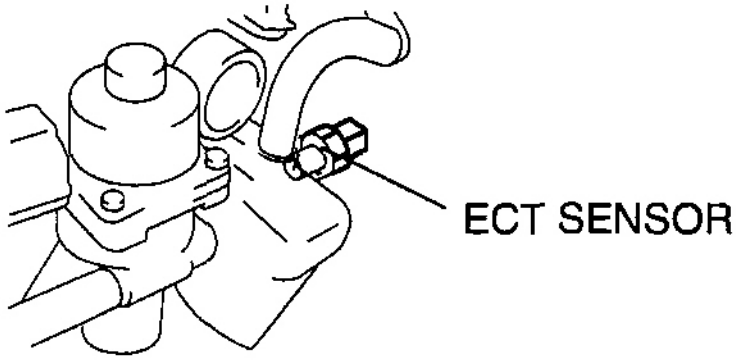


Fig. 30: Identifying ECT Sensor
Courtesy of MAZDA MOTORS CORP.

8. Install in the reverse order of removal.

ECT sensor tightening torque

10-14 N.m {1.1-1.4 kgf.m, 7.4-10.3 ft.lbf}

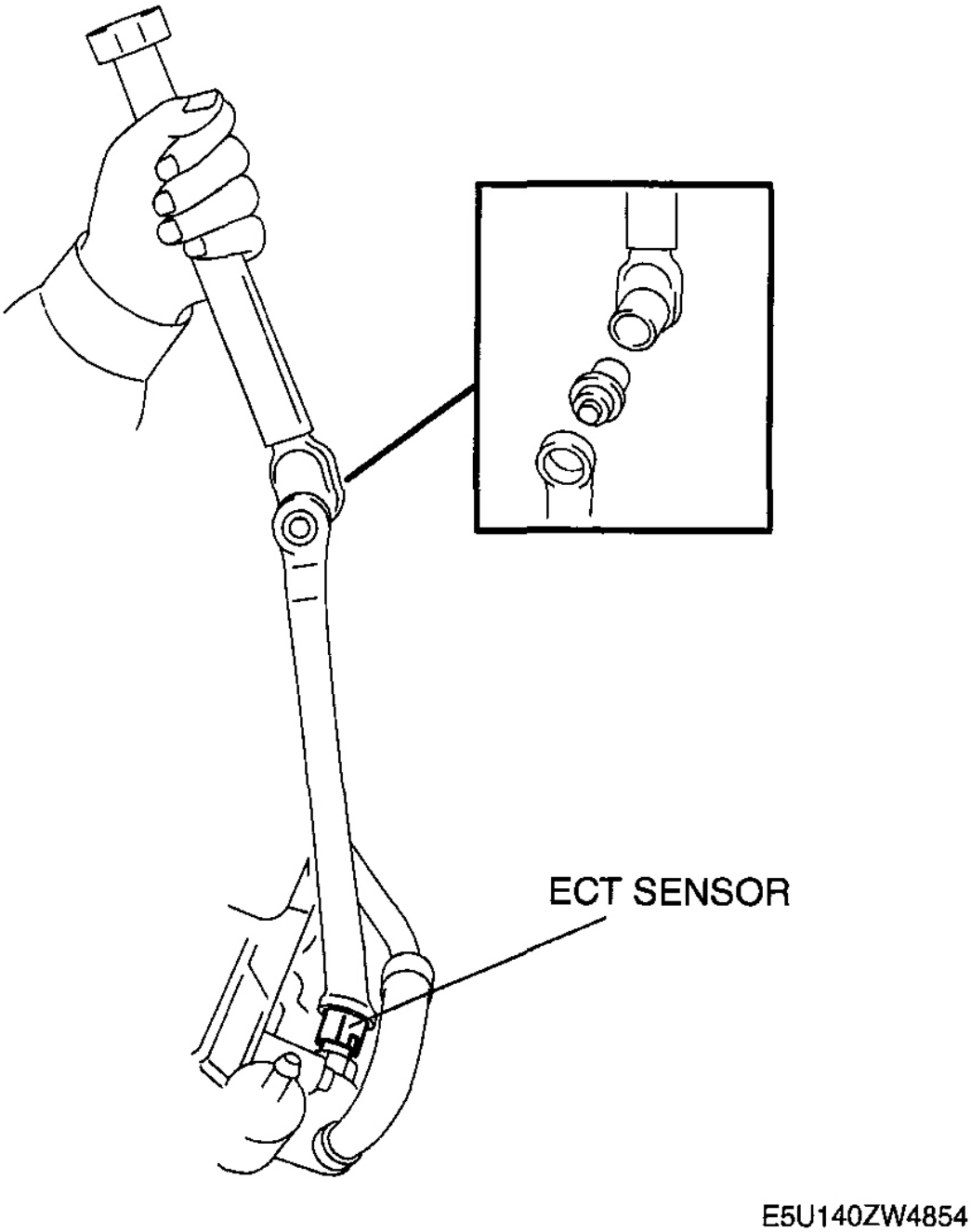


Fig. 31: Installing ECT Sensor
Courtesy of MAZDA MOTORS CORP.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

RESISTANCE INSPECTION

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Disconnect the ECT sensor connector.
4. Remove the ECT sensor. (See **ENGINE COOLANT TEMPERATURE (ECT) SENSOR REMOVAL/INSTALLATION [LF]** .)
5. Place the ECT sensor in the water and while increasing the water temperature, measure the resistance between ECT sensor terminals A and B.
   - If the monitor item status/specification (reference) is not within the specification, even though the ECT sensor resistance is within the specification, perform the **CIRCUIT OPEN/SHORT INSPECTION**.
   - If not within the specification, replace the ECT sensor. (See **ENGINE COOLANT TEMPERATURE (ECT) SENSOR REMOVAL/INSTALLATION [LF]**)

STANDARD ECT SENSOR RESISTANCE SPECIFICATION

Water temperature (°C {°F})	Resistance (kilohm)
20 {68}	35.48-39.20
80 {176}	3.65-4.02

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harnesses for an open or short circuit. (Continuity inspection)

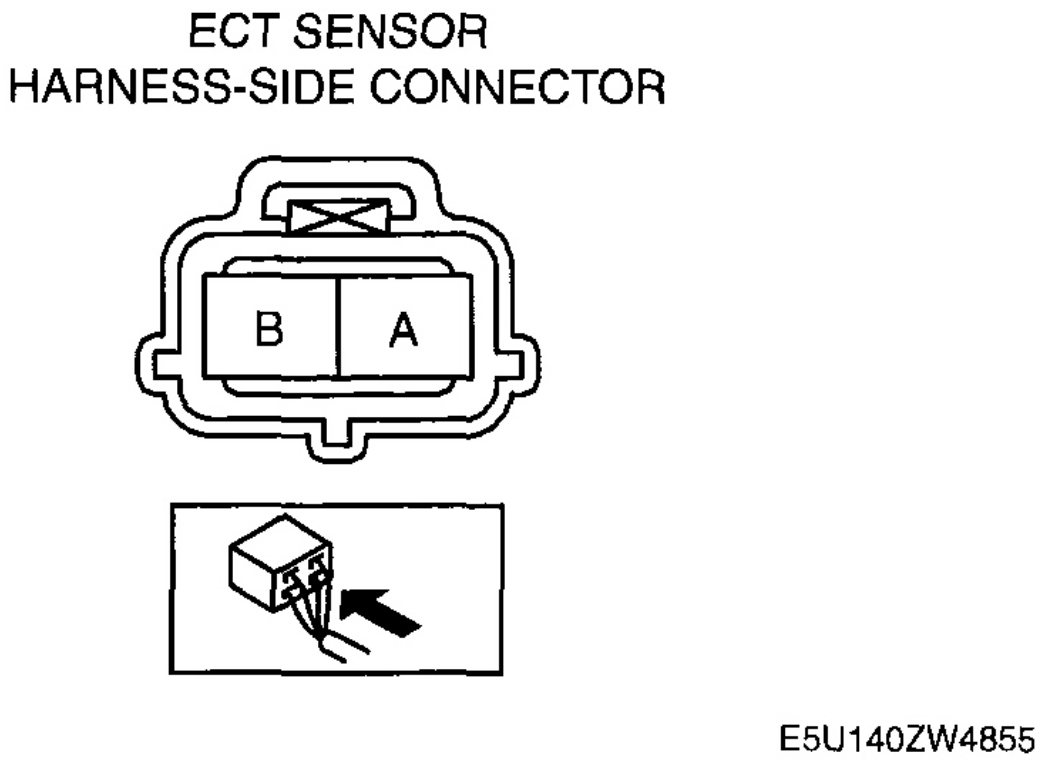


Fig. 32: Identifying ECT Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

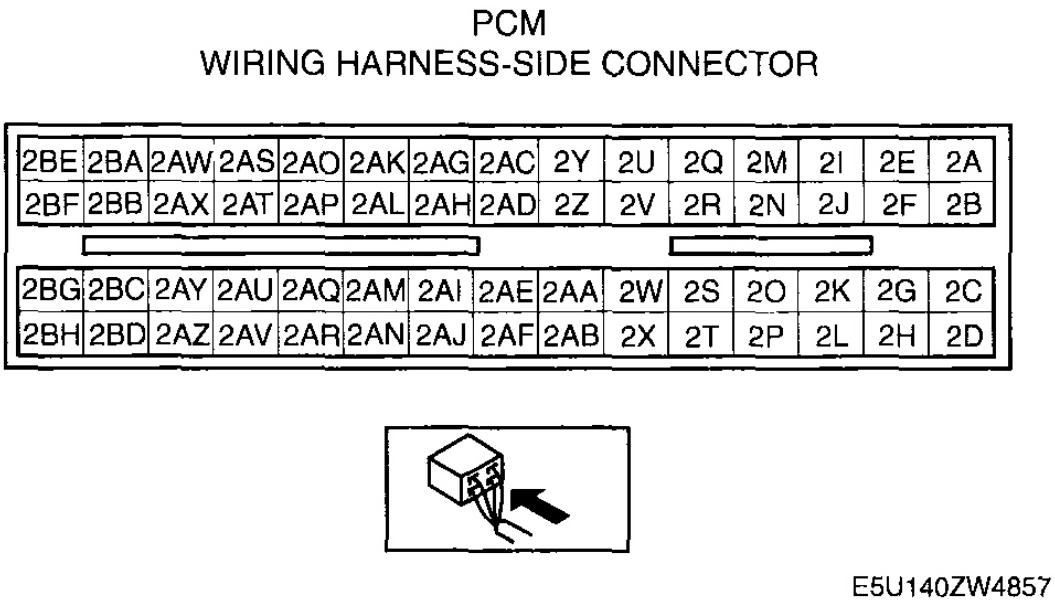


Fig. 33: Identifying PCM Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - ECT sensor terminal A and PCM terminal 2AH
  - ECT sensor terminal B and PCM terminal 2AY

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - ECT sensor terminal A and power supply
  - ECT sensor terminal A and body ground
  - ECT sensor terminal B and power supply

MASS AIR FLOW (MAF)/INTAKE AIR TEMPERATURE (IAT) SENSOR REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Disconnect MAF/IAT sensor connector.
4. Remove the MAF/IAT sensor.

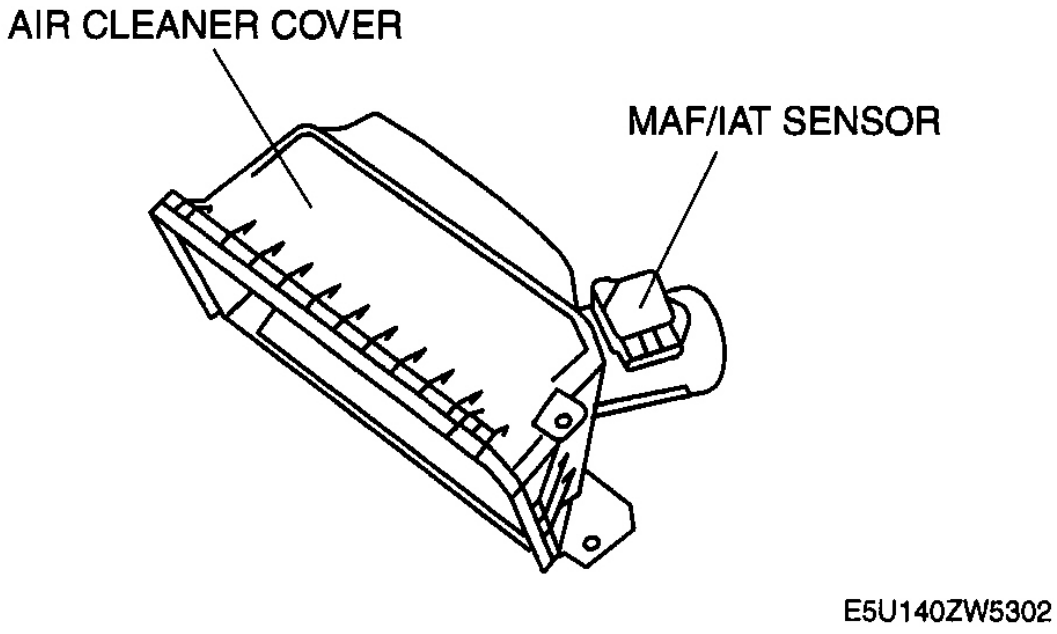


Fig. 34: Identifying MAF/IAT Sensor
Courtesy of MAZDA MOTORS CORP.

5. Install in the reverse order of removal.

   MAF/IAT sensor tightening torque

   0.55-0.82 N.m {5.7-8.3 kgf.cm, 4.9-7.2 in.lbf}

MASS AIR FLOW (MAF) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

VISUAL INSPECTION

1. Visually inspect the MAF sensor for the following:
   - Damage, cracks
   - Rusted sensor terminal
   - Bent sensor terminal
     - If there is any malfunction, replace the MAF/IAT sensor. (See **MASS AIR FLOW (MAF)/INTAKE AIR TEMPERATURE (IAT) SENSOR**

REMOVAL/INSTALLATION [LF] .)

VOLTAGE INSPECTION

1. Remove the MAF/IAT sensor without disconnecting the MAF/IAT sensor connector.
2. Turn the ignition switch to the ON position.
3. As the air gradually approaches the MAF detection part of the MAF/IAT sensor, verify that the MAF sensor output voltage (M-MDS PID: MAF) varies.
    - If it cannot be verified even though the related wiring harnesses have no malfunction, replace the MAF/IAT sensor. (See **MASS AIR FLOW (MAF)/INTAKE AIR TEMPERATURE (IAT) SENSOR REMOVAL/INSTALLATION [LF]** .)

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harness for open or short circuit (continuity Inspection).

Open Circuit

- If there is no continuity, there is an open circuit, Repair or replace the wiring harness.
    - MAF/IAT sensor terminal A and PCM main relay
    - MAF/IAT sensor terminal B and PCM terminal 1P
    - MAF/IAT sensor terminal C and PCM terminal 1AK

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
    - MAF/IAT sensor terminal A and body ground
    - MAF/IAT sensor terminal B and power supply
    - MAF/IAT sensor terminal C and power supply
    - MAF/IAT sensor terminal C and body ground

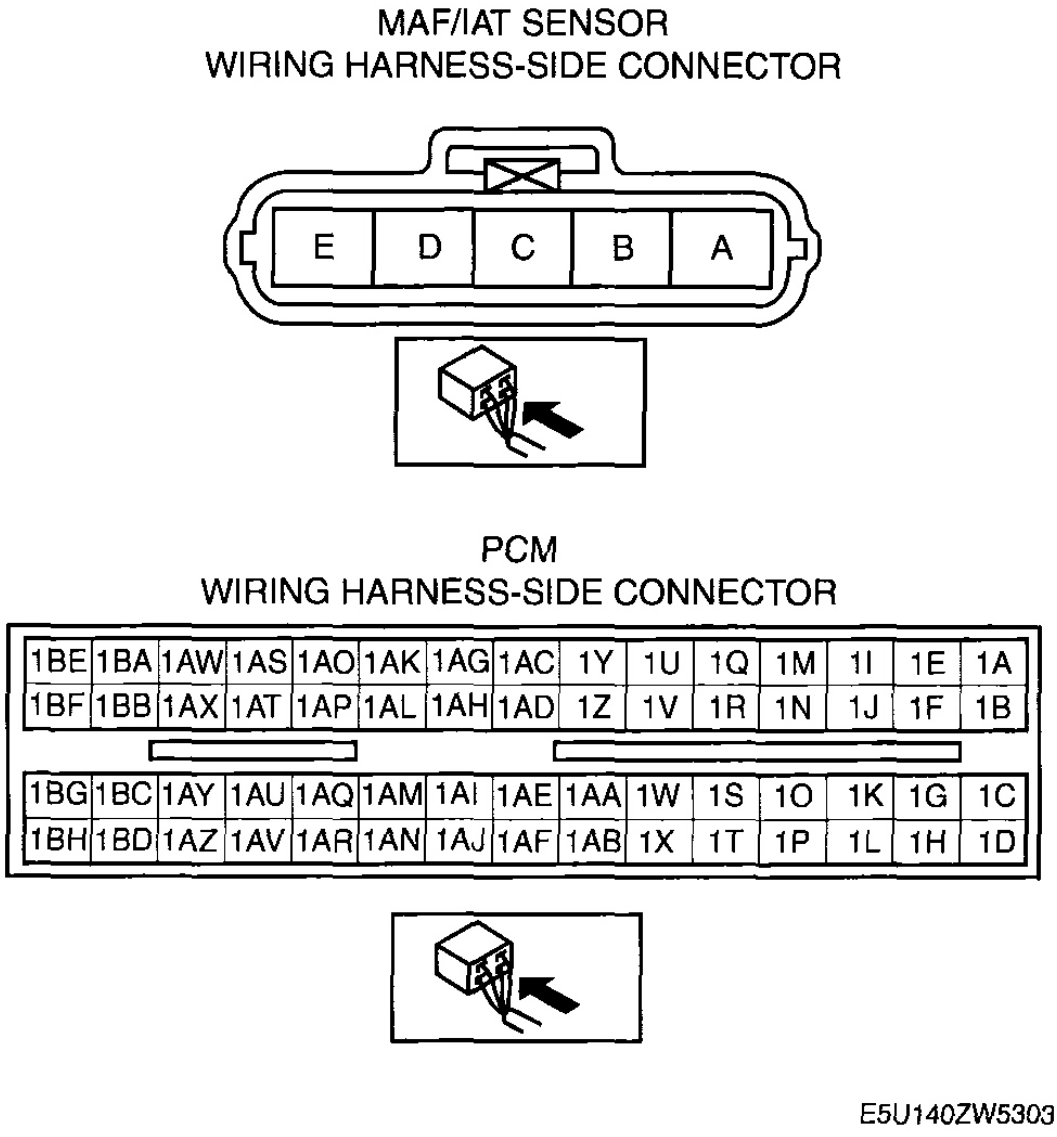


Fig. 35: Identifying MAF/IAT Sensor & PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

INTAKE MAF (G/S) AND ENGINE LOAD CALCULATED VALUE SPECIFICATION

Condition	Intake MAF (g/s)		Engine load calculated value (%)
	MT	AT	
Idle	2.1-2.6	2.3-2.8	13.5-24.0
Engine Speed 2,500 rpm	6.1-7.5	6.7-8.3	11.5-21.5

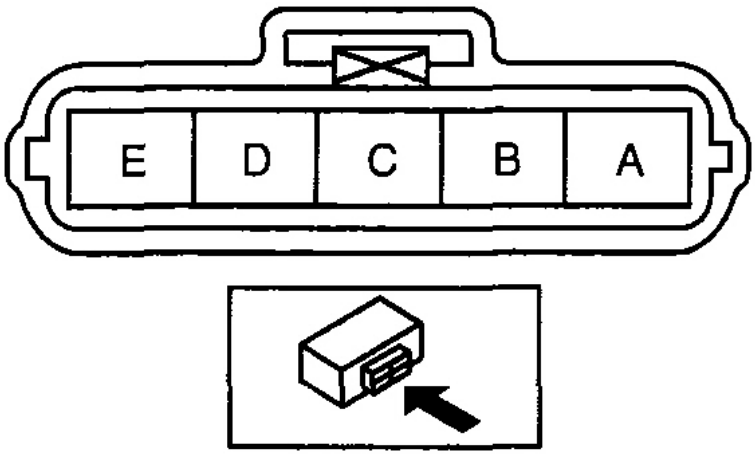
INTAKE AIR TEMPERATURE (IAT) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

RESISTANCE INSPECTION

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Disconnect the MAF/IAT sensor connector.
4. Verify that the resistance between MAF/IAT sensor terminals D and E is within the specification.
   - If the monitor item status/specification (reference) is not within the specification, even though the IAT sensor resistance is within the specification, perform the **CIRCUIT OPEN/SHORT INSPECTION**.
   - If not within the specification, replace the MAF/IAT sensor. (See **MASS AIR FLOW (MAF)/INTAKE AIR TEMPERATURE (IAT) SENSOR REMOVAL/INSTALLATION**



B3E0140W028

Fig. 36: Identifying MAF/IAT Sensor Connectors
Courtesy of MAZDA MOTORS CORP.

STANDARD MAF/IAT SENSOR RESISTANCE SPECIFICATION

Ambient temperature (°C {°F})	Resistance (kilohm)
20 (68}	2.21-2.69

60 {140}	0.493-0.667

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harnesses for an open or short circuit. (Continuity inspection)

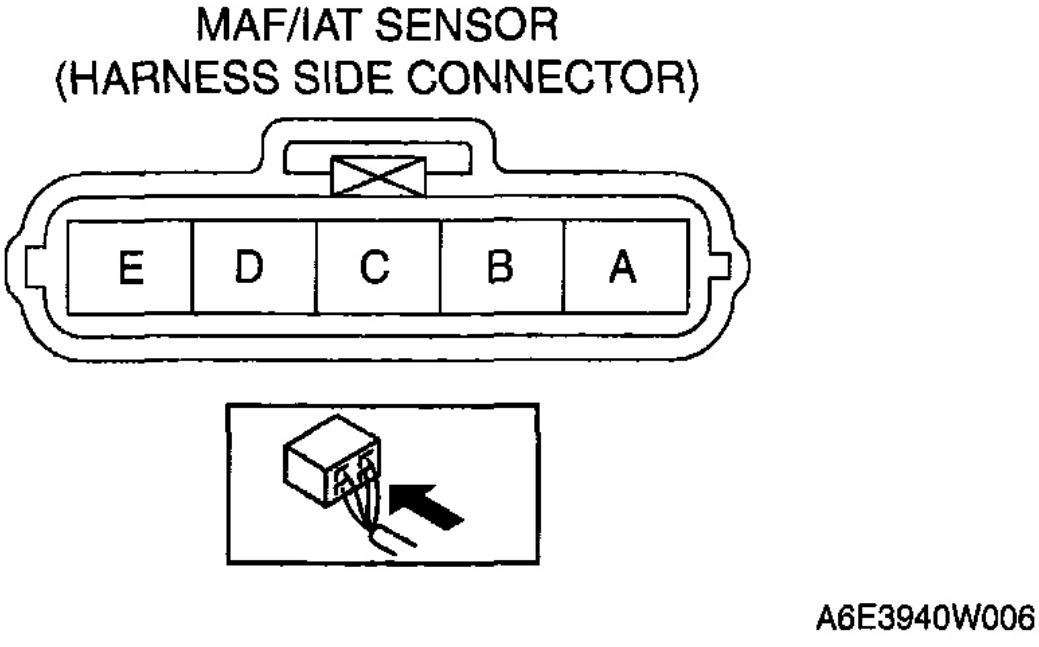


Fig. 37: Identifying MAF/IAT Sensor Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

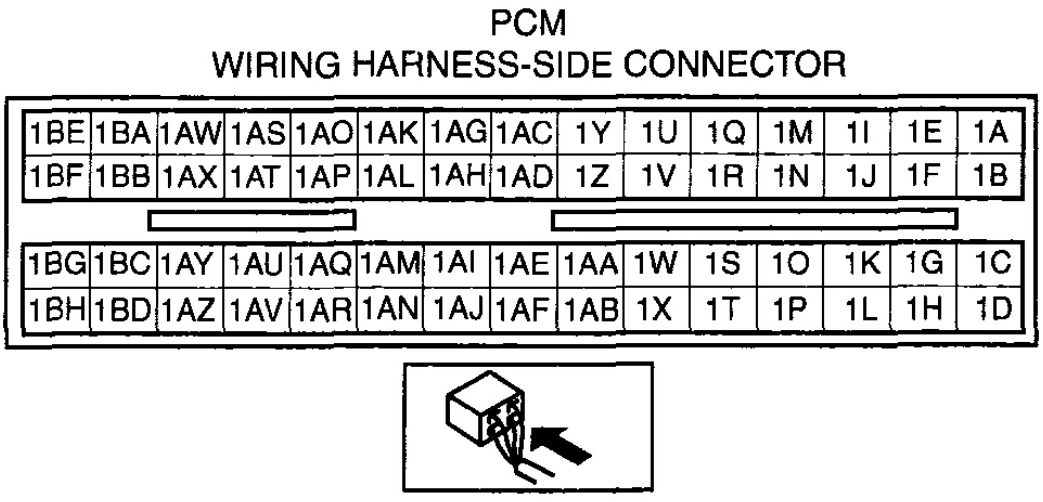


Fig. 38: Identifying PCM Harness Side Connectors
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - MAF/IAT sensor terminal D and PCM terminal 1 AT
  - MAF/IAT sensor terminal E and PCM terminal 1 AR

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - MAF/IAT sensor terminal E and power supply
  - MAF/IAT sensor terminal D and power supply
  - MAF/IAT sensor terminal D and body ground

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Remove the dynamic chamber. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [LF]** .)
4. Remove the MAP sensor.

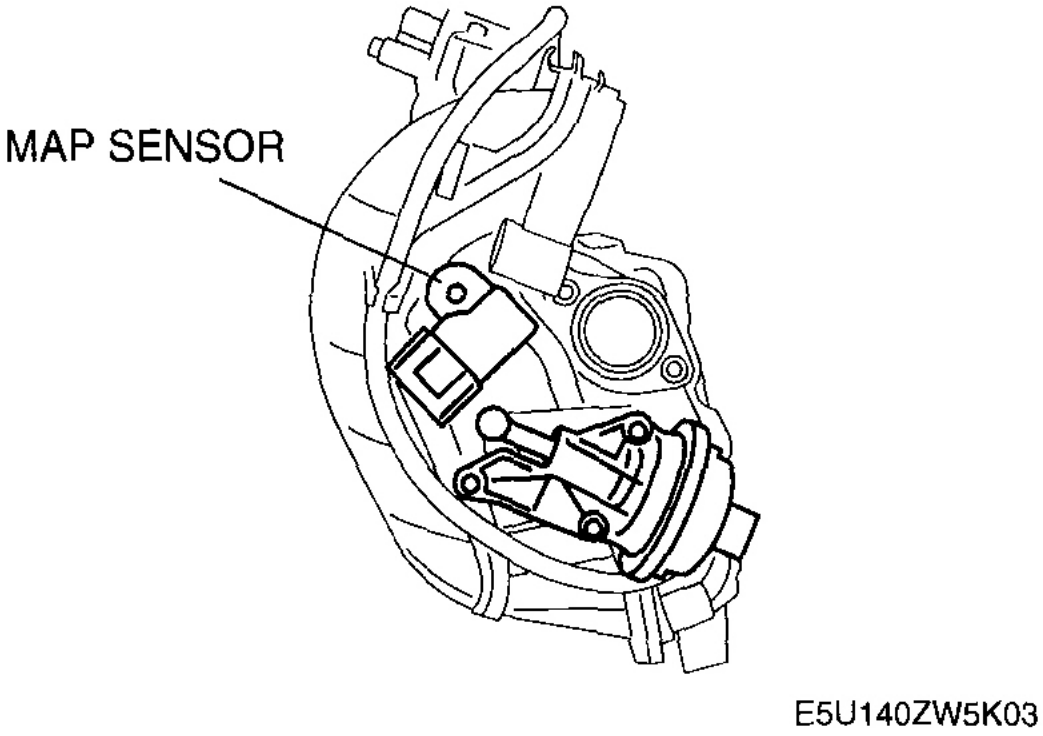


Fig. 39: Removing Manifold Absolute Pressure Sensor
Courtesy of MAZDA MOTORS CORP.

5. Install in the reverse order of removal.

MAP sensor tightening torque

2.7-3.7 N.m {28-37 kgf.cm, 24-32 in.lbf}

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

1. Connect the M-MDS or equivalent to the DLC-2.

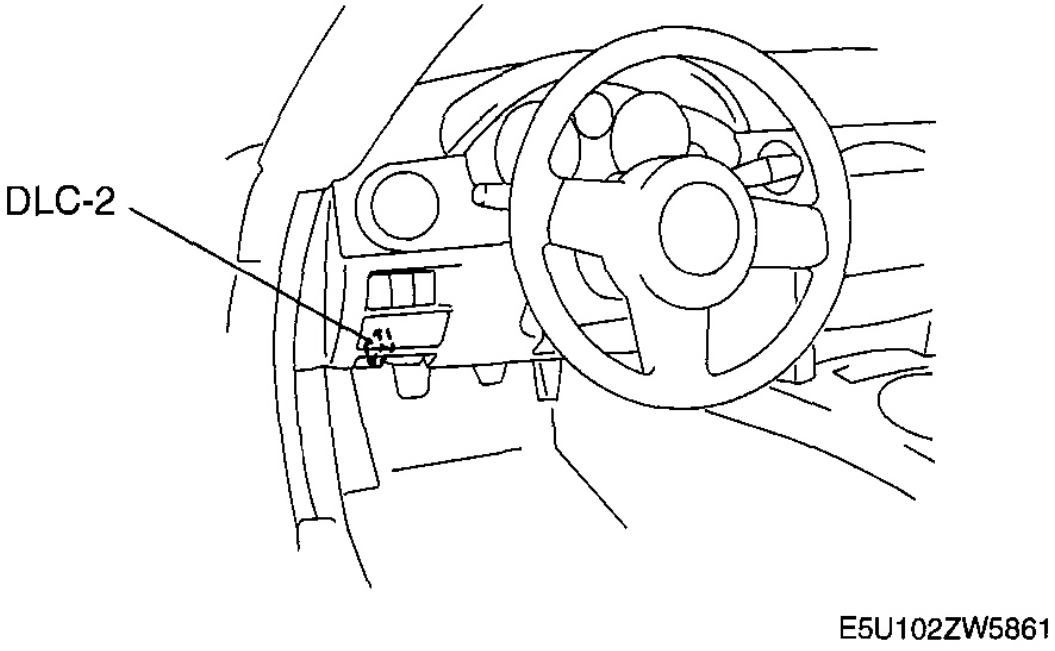


Fig. 40: Identifying Data Link Connector DLC-2
Courtesy of MAZDA MOTORS CORP.

2. Turn the ignition switch to the ON position (Engine off).
3. Select MAP PID on the M-MDS or equivalent.
4. Verify that the MAP PID (pressure) and barometric pressure are practically equal.
   - If not as verified, perform the **CIRCUIT OPEN/SHORT INSPECTION**.
     - If there is no open or short circuit, replace the MAP sensor. (See **MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR REMOVAL/INSTALLATION [LF]** .)
   - If as verified, go to next step.
5. Apply vacuum of **-25.0 kPa {-187 mmHg, -7.38 inHg}** to the MAP sensor, and verify that the MAP variation from that of Step 4 is **approx. 25.0 kPa {187 mmHg, 7.38 inHg}.**
   - If not as verified, perform the **CIRCUIT OPEN/SHORT INSPECTION**.
     - If there is no open or short circuit, replace the MAP sensor. (See **MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR REMOVAL/INSTALLATION [LF]** .)

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harnesses for an open or short circuit. (Continuity Inspection)

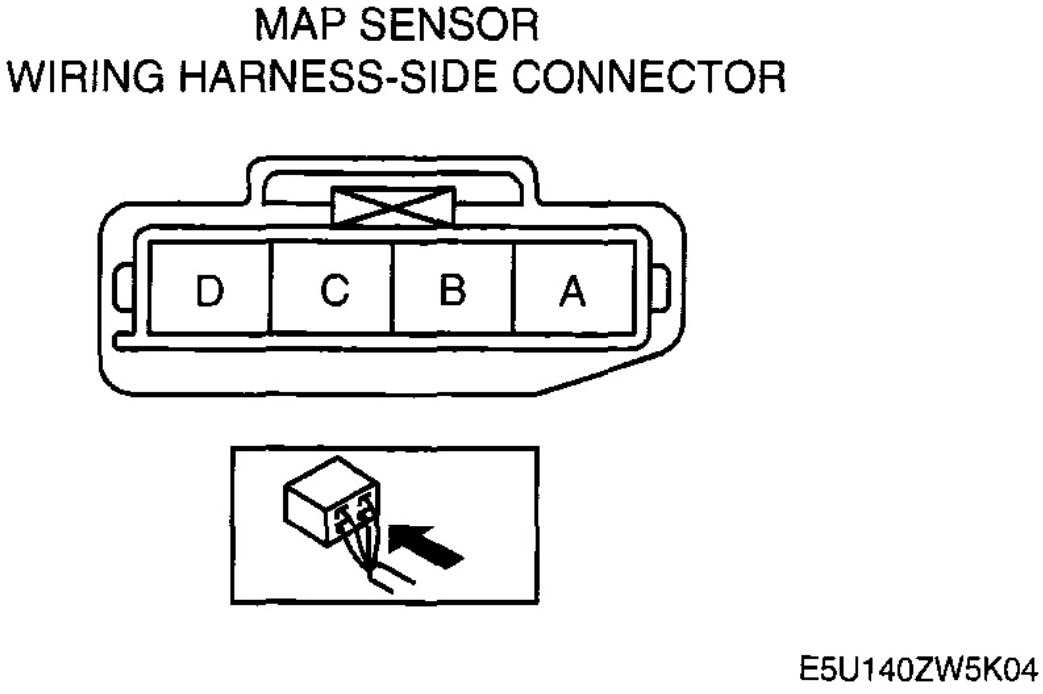
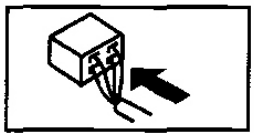


Fig. 41: Identifying MAP Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

PCM
WIRING HARNESS-SIDE CONNECTOR

2BE	2BA	2AW	2AS	2AO	2AK	2AG	2AC	2Y	2U	2Q	2M	2I	2E	2A
2BF	2BB	2AX	2AT	2AP	2AL	2AH	2AD	2Z	2V	2R	2N	2J	2F	2B
2BG	2BC	2AY	2AU	2AQ	2AM	2AI	2AE	2AA	2W	2S	2O	2K	2G	2C
2BH	2BD	2AZ	2AV	2AR	2AN	2AJ	2AF	2AB	2X	2T	2P	2L	2H	2D



E5U140ZW4857

Fig. 42: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - MAP/boost air temperature sensor terminal A and PCM terminal 2AV
  - MAP/boost air temperature sensor terminal C and PCM terminal 2AU
  - MAP/boost air temperature sensor terminal D and PCM terminal 2AG

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - MAP/boost air temperature sensor terminal A and power supply.
  - MAP/boost air temperature sensor terminal C and body ground.
  - MAP/boost air temperature sensor terminal D and power supply.
  - MAP/boost air temperature sensor terminal D and body ground.

THROTTLE POSITION (TP) SENSOR INSPECTION [LF]

CAUTION:

- **This inspection procedure cannot be completed correctly if the accelerator pedal position sensor has a malfunction. Before performing this procedure, verify that any one of the DTCs related to**

the accelerator pedal position sensor is not detected.

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

1. Verify that no DTC related to APP sensor has been detected.
   - If any DTCs related to APP sensor have been detected, perform the DTC inspection. (See **DTC TABLE [LF]** .)
2. Connect the M-MDS or equivalent to the DLC-2.

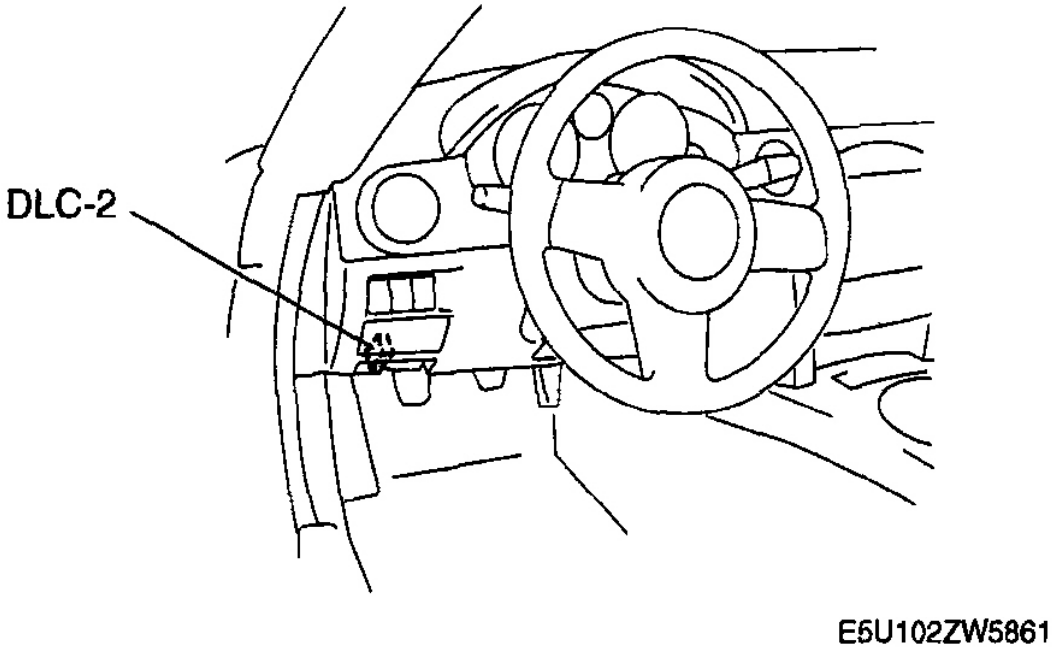


Fig. 43: Locating DLC-2 Connector
Courtesy of MAZDA MOTORS CORP.

3. Turn the ignition switch to the ON position.
4. Select TP1 or TP2 PID (percentage) on the M-MDS or equivalent.
5. Verify that the TP1 or TP2 PID is within the specification when the accelerator pedal not depressed. (See **PCM INSPECTION [LF]** .)
6. Operate the accelerator pedal and verify that the TP1 or TP2 PID (percentage) changes as shown in **Fig. 44** .
   - If not verified, perform the **CIRCUIT OPEN/SHORT INSPECTION** .

- If there is no open or short circuit, replace the throttle body. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [LF]** .)

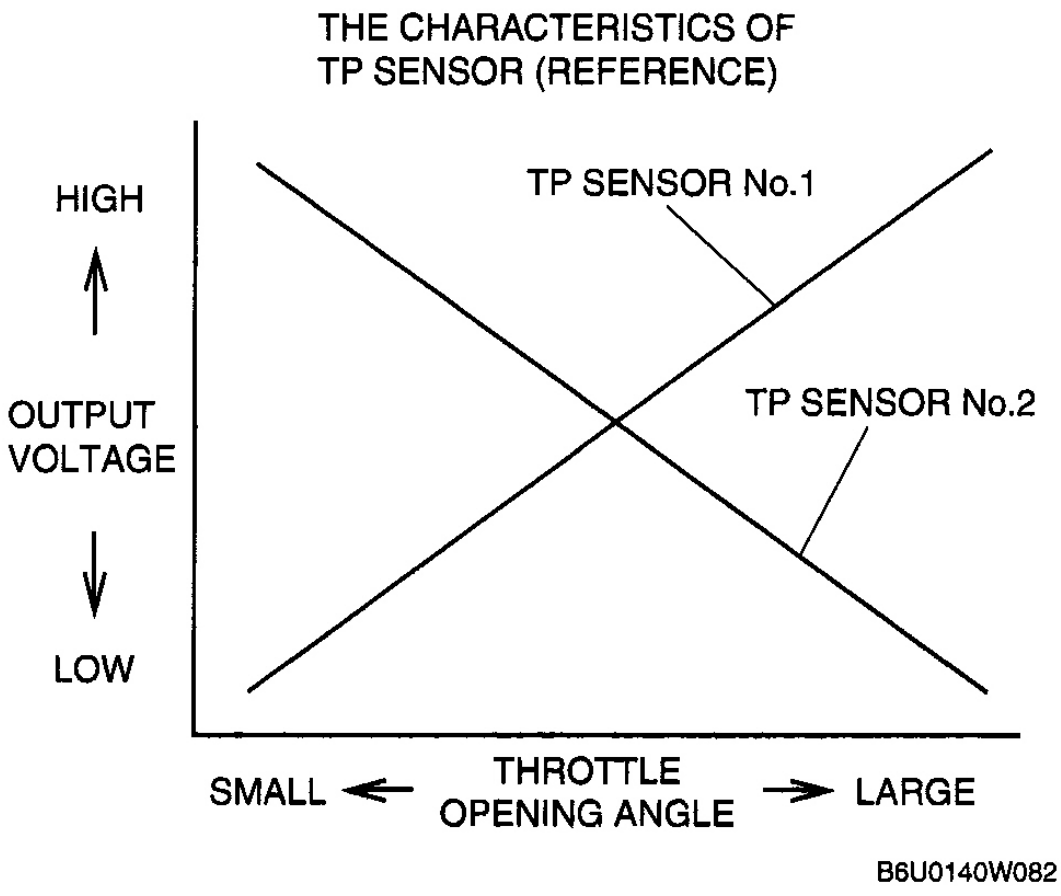


Fig. 44: Throttle Position Sensor Voltage Graph
Courtesy of MAZDA MOTORS CORP.

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Disconnect the throttle body connector.
3. Inspect the following wiring harnesses for an open or short circuit. (Continuity inspection)

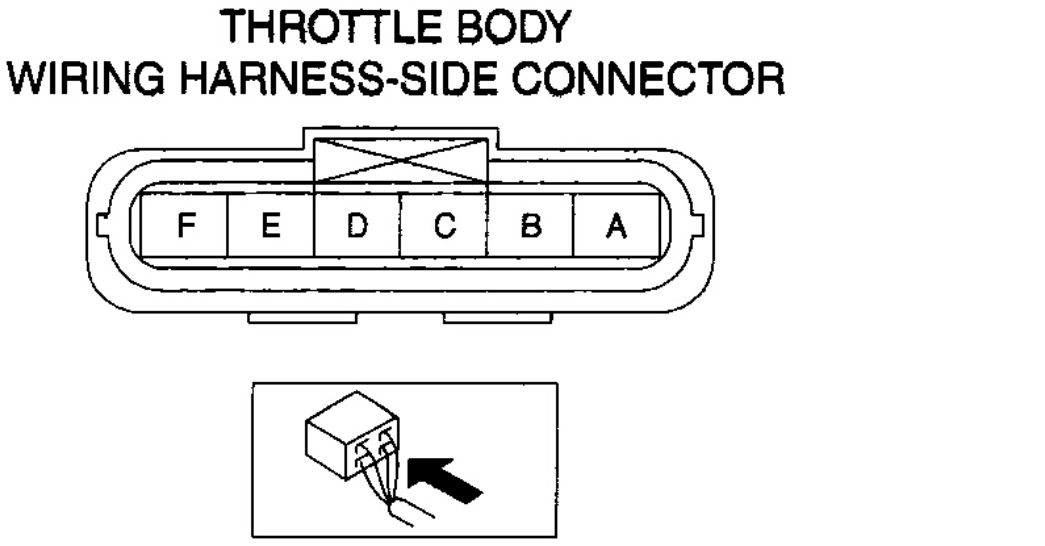


Fig. 45: Identifying Throttle Body Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

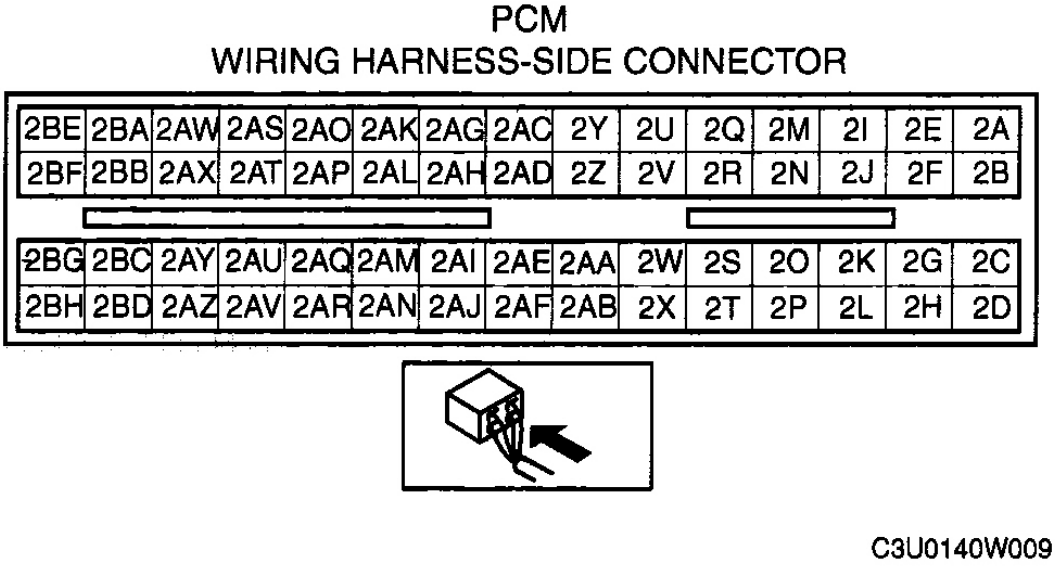


Fig. 46: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity in the following wiring harnesses, there is an open circuit. Repair or replace the wiring harness.
  - Throttle body terminal C and PCM terminal 2AP
  - Throttle body terminal D and PCM terminal 2AL
  - Throttle body terminal E and PCM terminal 2AO
  - Throttle body terminal F and PCM terminal 2AK

Short Circuit

- If there is continuity in the following wiring harnesses, there is a short circuit. Repair or replace the wiring harness.
  - Throttle body terminal C and power supply
  - Throttle body terminal D and body ground
  - Throttle body terminal D and power supply
  - Throttle body terminal E and body ground
  - Throttle body terminal F and body ground
  - Throttle body terminal F and power supply

ACCELERATOR PEDAL POSITION (APP) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

1. Connect the M-MDS or equivalent to the DLC-2.

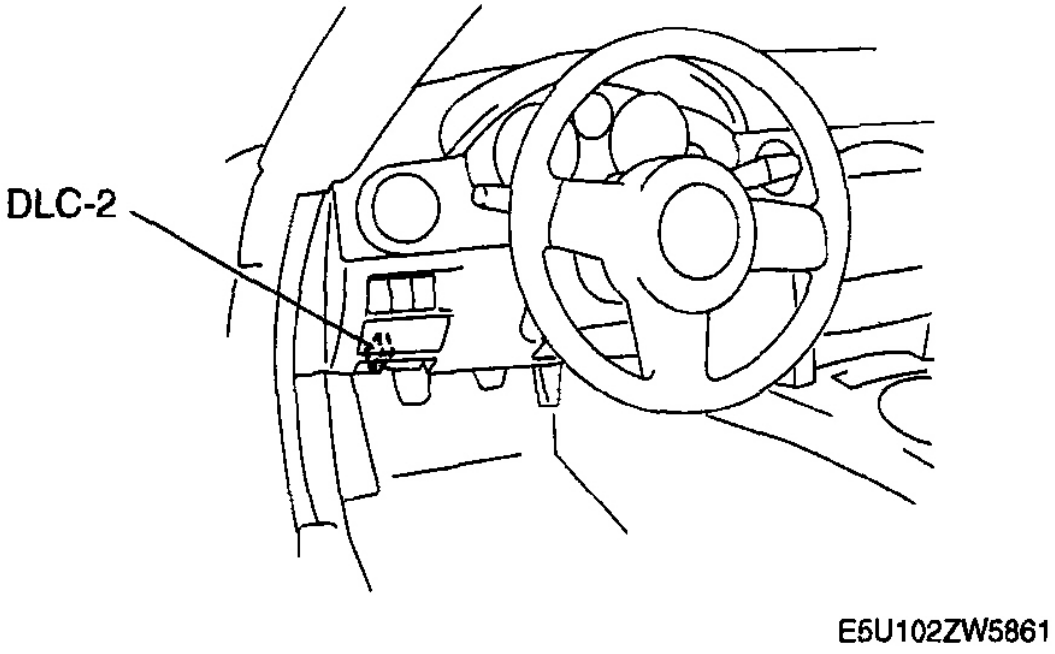


Fig. 47: Locating DLC-2 Connector
Courtesy of MAZDA MOTORS CORP.

2. Turn the ignition switch to the ON position.
3. Select APP1 and APP2 PID on the M-MDS or equivalent.
4. Verify that the APP1 and APP2 PID is within the specification when the accelerator pedal not depressed. (See **PCM INSPECTION [LF]** .)

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Disconnect the APP sensor connector.
3. Inspect the following wiring harnesses for an open or short circuit. (Continuity inspection)

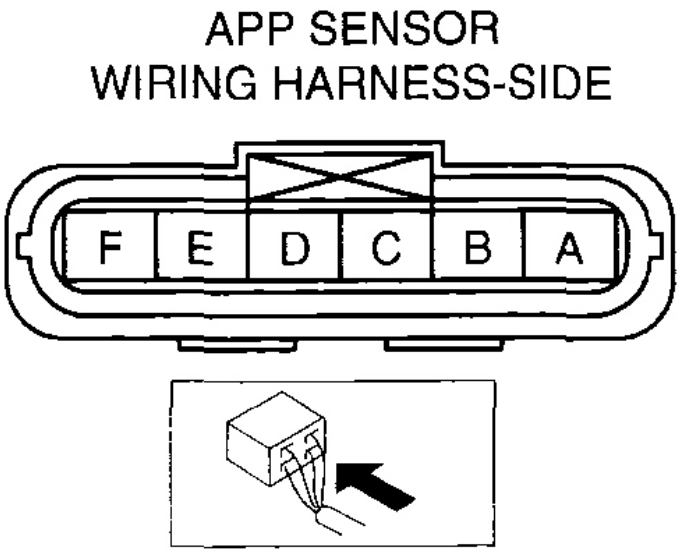


Fig. 48: Identifying APP Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

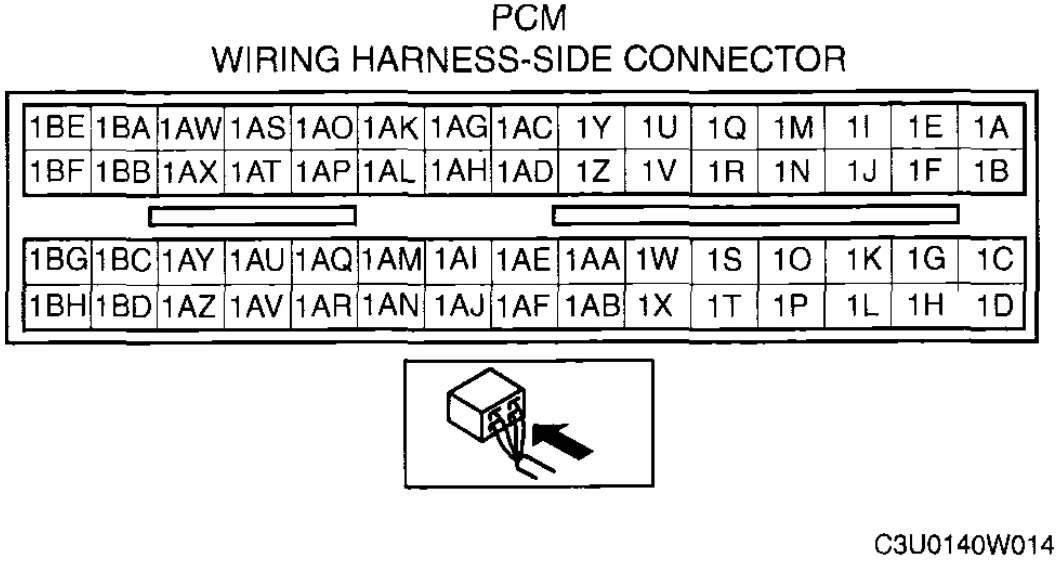


Fig. 49: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity in the following wiring harnesses, there is an open circuit. Repair or replace the wiring harness.
  - APP sensor terminal A and PCM terminal 1AJ
  - APP sensor terminal B and PCM terminal 1AV
  - APP sensor terminal C and PCM terminal 1AP
  - APP sensor terminal D and PCM terminal 1AL
  - APP sensor terminal E and PCM terminal 1AS
  - APP sensor terminal F and PCM terminal 1AO

Short Circuit

- If there is continuity in the following wiring harnesses, there is a short circuit. Repair or replace the wiring harness.
  - APP sensor terminal A and body ground
  - APP sensor terminal B and power supply
  - APP sensor terminal C and body ground
  - APP sensor terminal C and power supply
  - APP sensor terminal D and body ground
  - APP sensor terminal E and power supply
  - APP sensor terminal F and body ground
  - APP sensor terminal F and power supply

CRANKSHAFT POSITION (CKP) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

AIR GAP INSPECTION

1. Verify that the CKP sensor is securely installed.
2. Using a thickness gauge, measure the air gap between the plate projections at the back of crankshaft pulley and the CKP sensor.
   - If not within the specification, inspect the plate projections for cracks or bending.
     - If there is any malfunction, replace the crankshaft pulley. (See **ENGINE REMOVAL/INSTALLATION [LF]** .)

- If the monitor item condition/specification (reference) is not within the specification, even though there is no malfunction, carry out the **CIRCUIT OPEN/SHORT INSPECTION** .

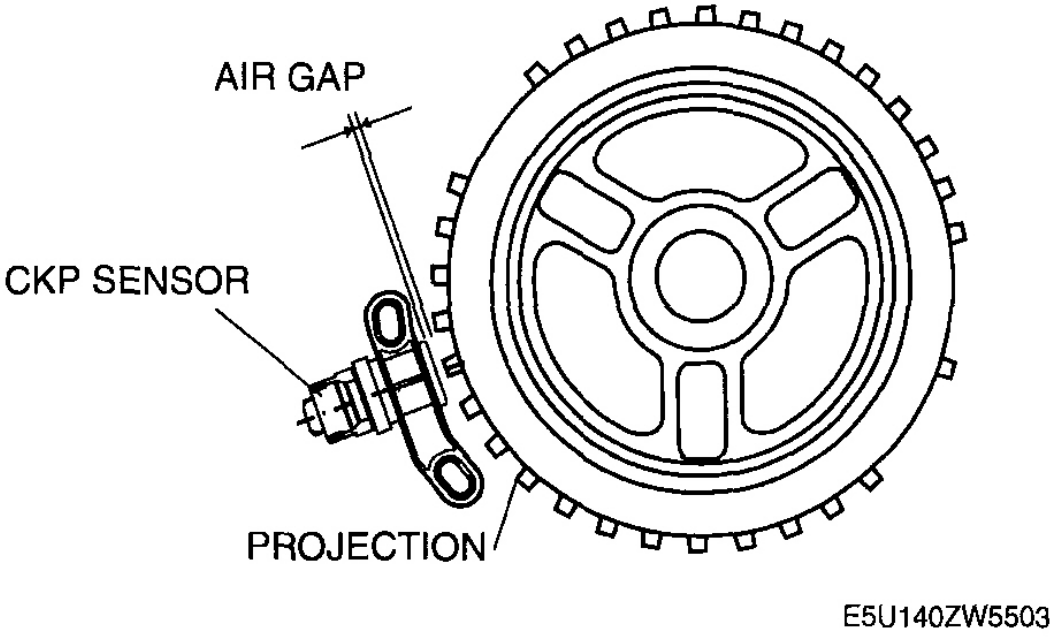


Fig. 50: Identifying Air Gap Between Plate Projections At Back Of Crankshaft Pulley & CKP Sensor
Courtesy of MAZDA MOTORS CORP.

Air gap

0.5-1.5 mm {0.02-0.05 in}

VISUAL INSPECTION

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Remove the CKP sensor. (See **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL/INSTALLATION [LF]** .)
4. Verify that there are no metal shavings on the sensor.
   - If the monitor item condition/specification (reference) is without the specification even though there is no malfunction, carry out the **CIRCUIT OPEN/SHORT INSPECTION** .

VOLTAGE INSPECTION

1. Install all removed parts.
2. Idle the engine.

CAUTION:
- **Water penetrating the connector will cause sensor malfunction. To prevent this, be careful not to damage the wiring harnesses or the waterproof connector so as to cause water penetration.**

3. Measure the output voltage using an oscilloscope.
   - If not within the specification, replace the CKP sensor. (See **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL/INSTALLATION [LF]** .)
   - If the monitor item condition/specification (reference) is without the specification, even though the voltage is within the specification, carry out the **CIRCUIT OPEN/SHORT INSPECTION** .

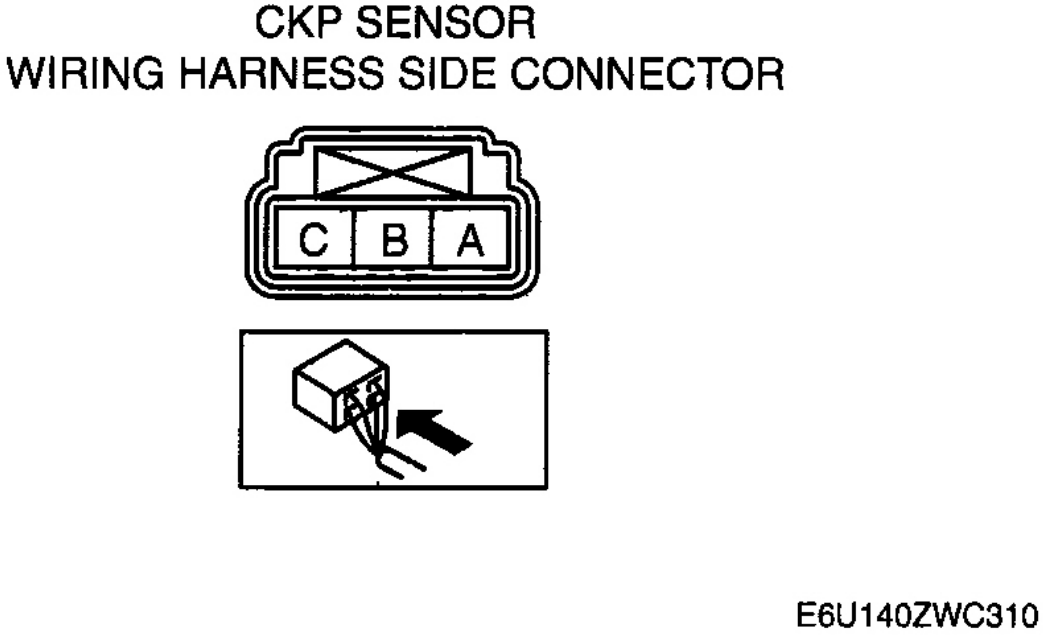


Fig. 51: Identifying CKP Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

CKP SENSOR VOLTAGE SPECIFICATION

Terminal	Voltage (V)	Condition
C	B+	Under any condition
B	4.8 or more	High output(1)
	0.8 or less	Low output(1)

A	0	Under any condition

(1) Output voltage varies with crankshaft rotation.

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harnesses for an open or short circuit. (Continuity Inspection)

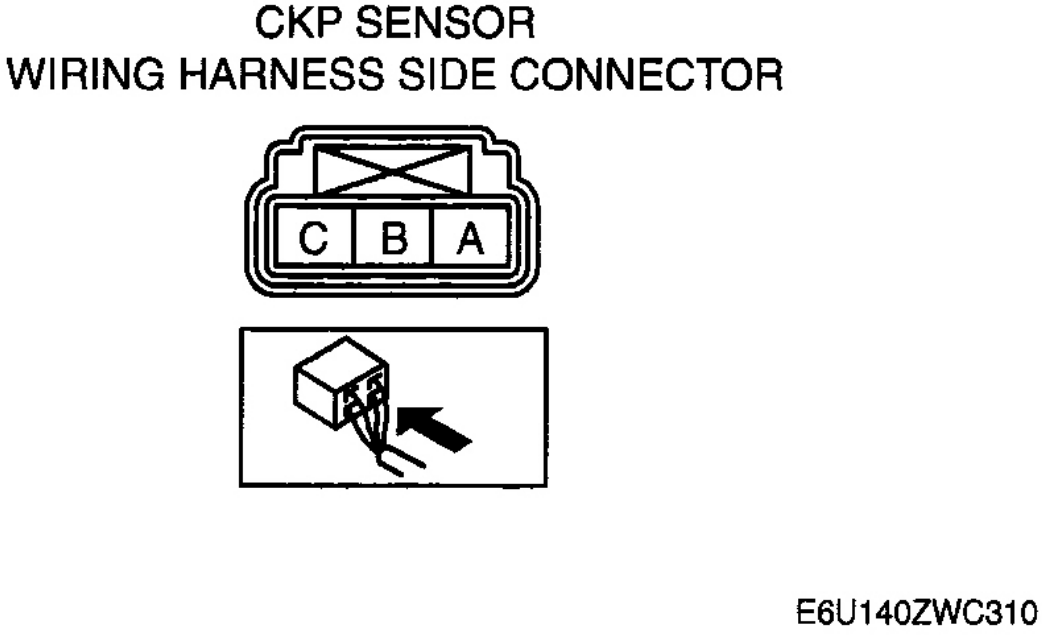


Fig. 52: Identifying CKP Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

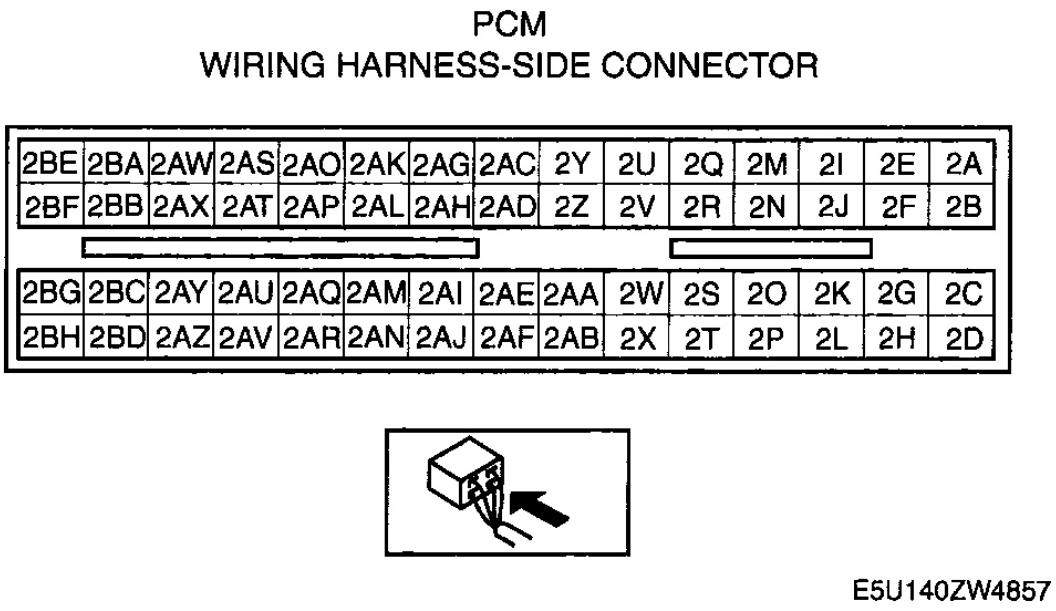


Fig. 53: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, the circuit is open. Repair or replace the wiring harness.
  - CKP sensor terminal A and PCM terminal 2AB
  - CKP sensor terminal B and PCM terminal 2W
  - CKP sensor terminal C and PCM terminal 2AQ

Short Circuit

- If there is continuity, the circuit is shorted. Repair or replace the wiring harness.
  - CKP sensor terminal A and power supply
  - CKP sensor terminal B and power supply
  - CKP sensor terminal B and body ground
  - CKP sensor terminal C and body ground

CRANKSHAFT POSITION (CKP) SENSOR REMOVAL/INSTALLATION [LF]

REMOVAL

1. Remove the battery and battery tray. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)

2. Remove the air cleaner. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [LF]** .)
3. Remove the drive belt. (See **DRIVE BELT REPLACEMENT [LF]** .)
4. Remove the under cover. (See **TRANSVERSE MEMBER REMOVAL/INSTALLATION** .)
5. Disconnect the CKP sensor connector.
6. Remove the installation bolts to remove the CKP sensor.

INSTALLATION

CAUTION:
- **When foreign material, such as an iron chips, gets on the CKP sensor, it can cause abnormal output from the sensor because of flux turbulence and adversely affect engine control. Be sure there is no foreign material on the CKP sensor when replacing.**

1. Perform the following procedure so that piston No.1 is at the top dead center.
    1. Move the ATF hose slightly out of the way. (AT)

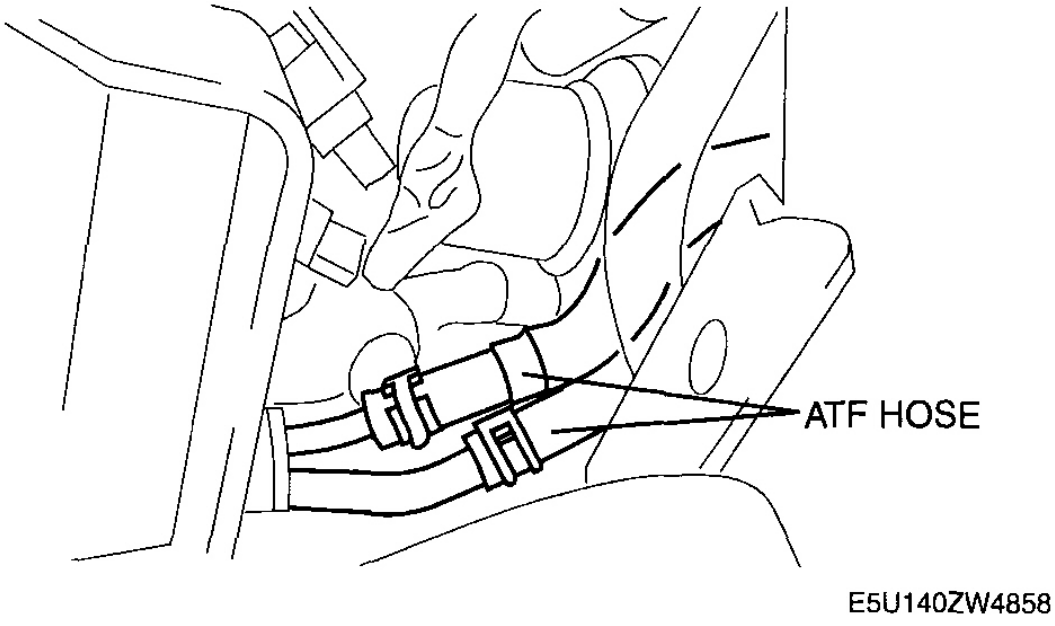


Fig. 54: Identifying ATF Hose
Courtesy of MAZDA MOTORS CORP.

2. Remove the cylinder block lower blind plug and install the **SST.**

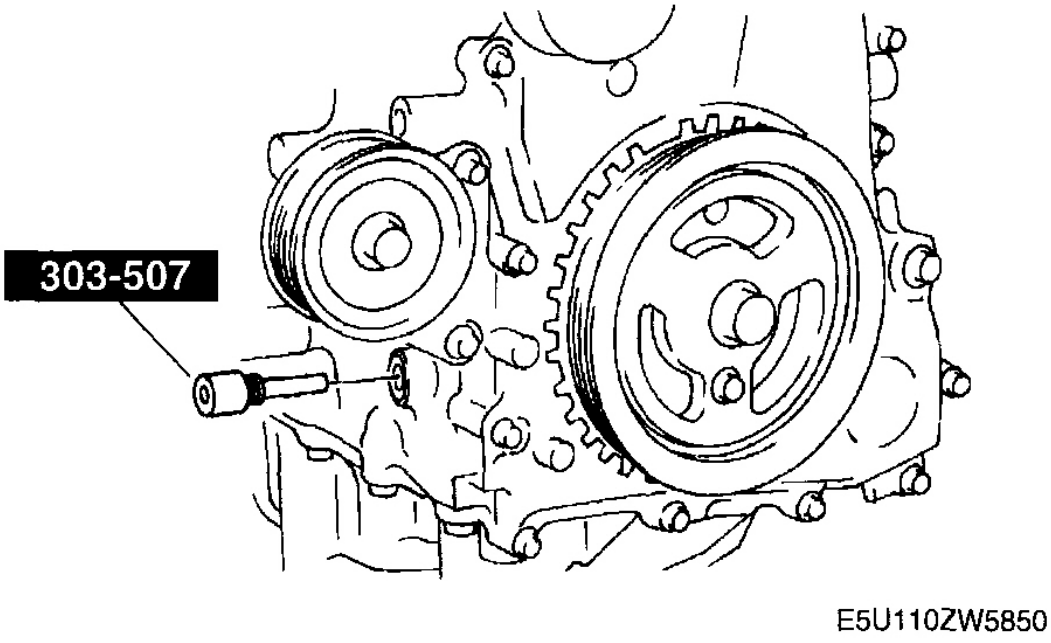


Fig. 55: Installing SST
Courtesy of MAZDA MOTORS CORP.

3. Turn the crankshaft pulley to the clockwise until it stops.

2. Using a straight edge, draw a straight line directly in the center of the 5th tooth of the crankshaft pulley pulse wheel (counting counterclockwise from the empty space).

CAUTION:
- **If the line is not accurately drawn, ignition timing, fuel injection and other engine control systems will be adversely effected. Draw the straight line carefully using a straight edge.**

3. Align the center line of the CKP sensor and the line drawn in Step 2, then install the CKP sensor.

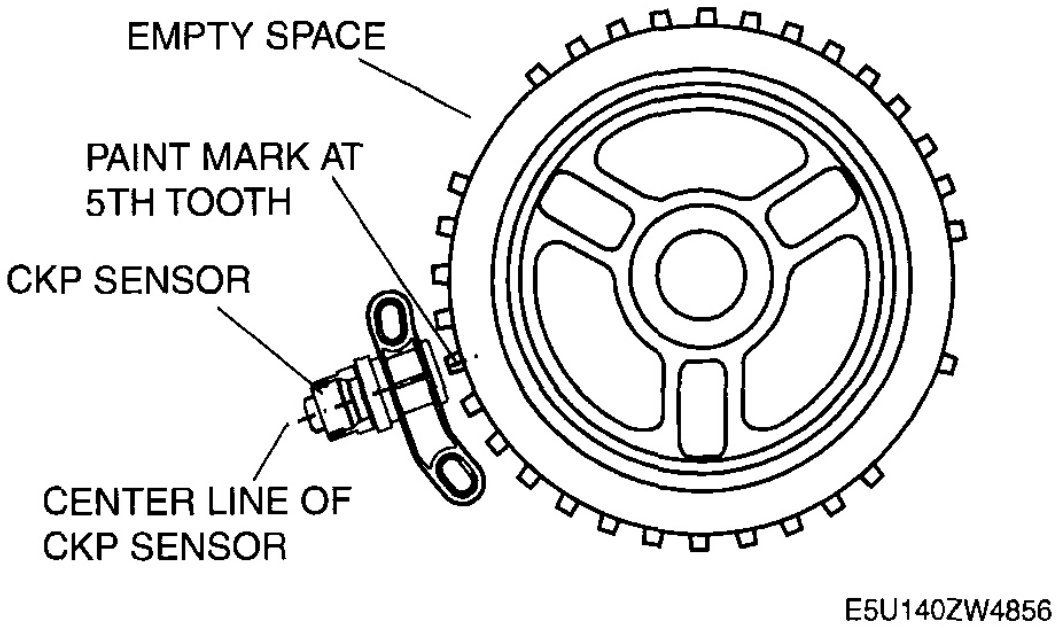


Fig. 56: Installing CKP Sensor
Courtesy of MAZDA MOTORS CORP.

4. Install the CKP sensor fitting bolts.

   Tightening torque

   5.5-7.5 N.m {56-76 kgf.cm, 49-66 in.lbf}

5. Remove the **SST** then install the cylinder block lower blind plug.

   Tightening torque

   18-22 N.m {1.9-2.2 kgf.m, 14-16 ft.lbf}

6. Install in the reverse order of removal.

CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)

CAUTION:
- **When replacing the camshaft position sensor, make sure there**

are no metal shavings adhering as they can cause the sensor output signal to malfunction from fluctuation in magnetic flux resulting in a deterioration in engine control. Cover a removed CMP sensor in plastic to protect it from foreign material adhering to it.

3. Disconnect the CMP sensor connector.
4. Remove the CMP sensor installation bolt.
5. Remove the CMP sensor from the cylinder head cover.

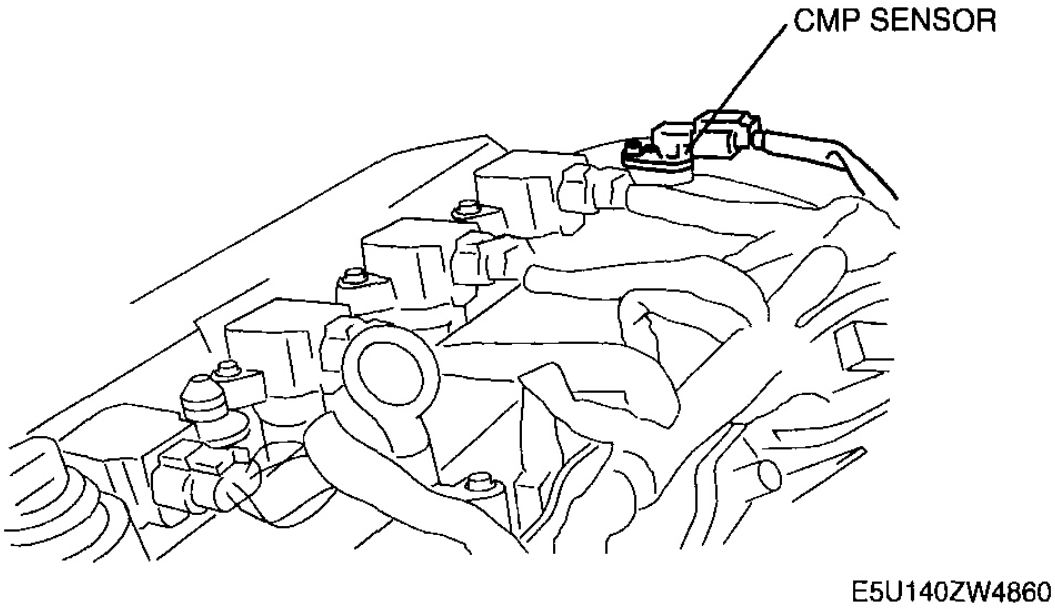


Fig. 57: Identifying CMP Sensor
Courtesy of MAZDA MOTORS CORP.

6. Install in the reverse order of removal.

CMP sensor tightening torque

5.5-7.5 N.m {56-76 kgf.cm, 49-66 in.lbf}

CAMSHAFT POSITION (CMP) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

VISUAL INSPECTION

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Remove the CMP sensor. (See **CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [LF]** .)
4. Verify that there are no metal shavings on the sensor.
   - If the monitor item condition/specification (reference) is not within the specification even though there is no malfunction, carry out the **CIRCUIT OPEN/SHORT INSPECTION** .

VOLTAGE INSPECTION

1. Install all removed parts.
2. Idle the engine.

CAUTION:

- **Water penetrating the connector will cause sensor malfunction. To prevent this, be careful not to damage the wiring harnesses or the waterproof connector so as to cause water penetration.**

3. Measure the output voltage using an oscilloscope.
   - If not within the specification, replace the CMP sensor. (See **CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [LF]** .)
   - If the monitor item condition/specification (reference) is not within the specification, even though the voltage is within the specification, carry out the **CIRCUIT OPEN/SHORT INSPECTION** .

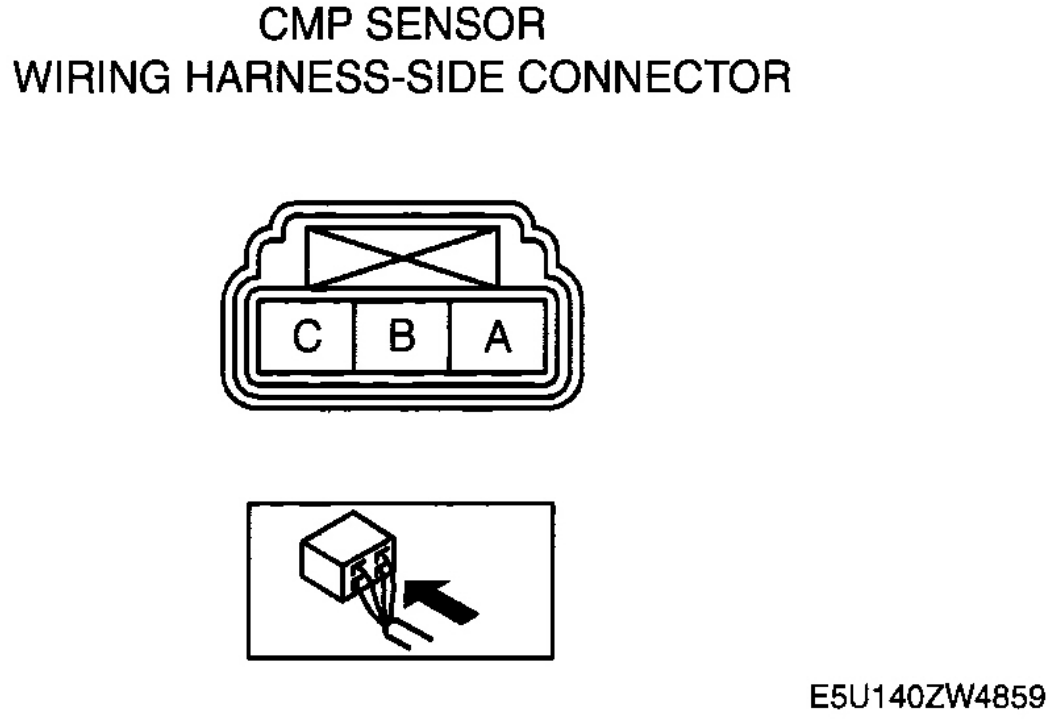


Fig. 58: Identifying CMP Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

CMP SENSOR TERMINALS VOLTAGE SPECIFICATION

Terminal	Voltage (V)	Condition
C	B+	Under any condition
B	4.8 or more	High output(1)
	0.8 or less	Low output(1)
A	0	Under any condition
(1) Output voltage varies with camshaft rotation.		

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Inspect the following wiring harnesses for an open or short circuit. (Continuity Inspection)

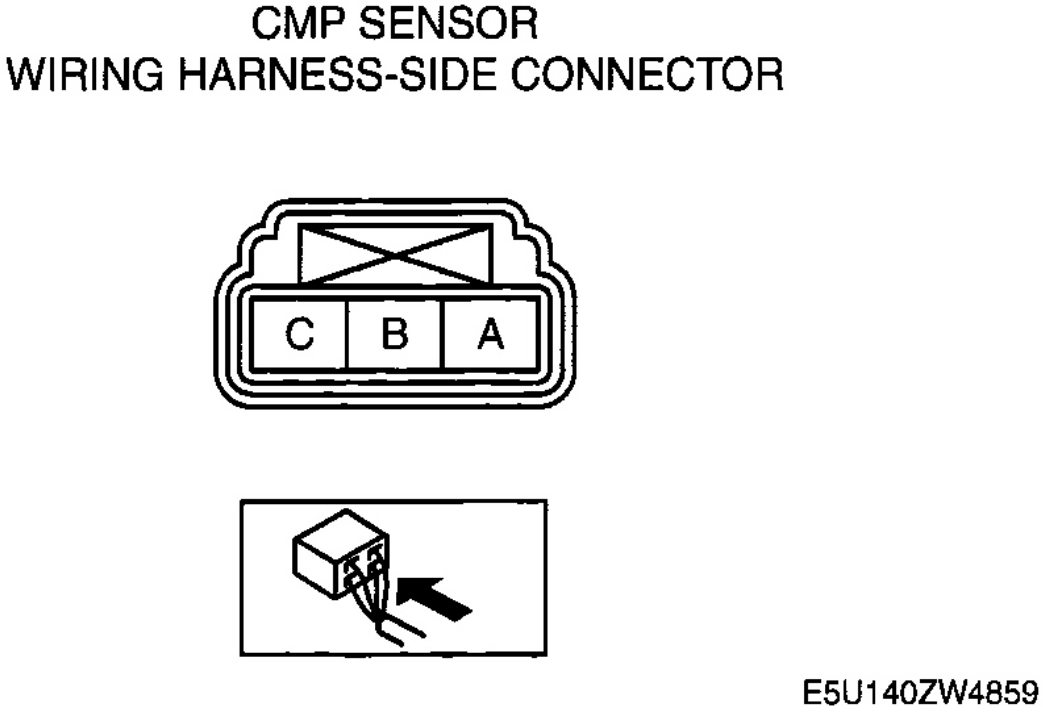


Fig. 59: Identifying CMP Sensor Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

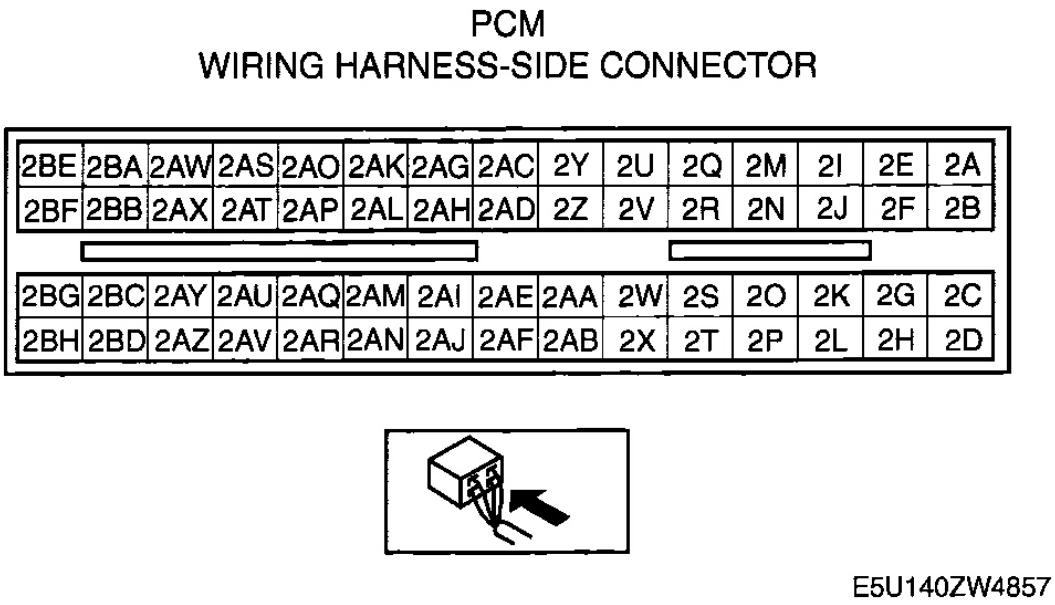


Fig. 60: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, the circuit is open. Repair or replace the wiring harness.
  - CMP sensor terminal A and PCM terminal 2P
  - CMP sensor terminal B and PCM terminal 2S
  - CMP sensor terminal C and PCM terminal 2AM

Short Circuit

- If there is continuity, the circuit is shorted. Repair or replace the wiring harness. I
  - CMP sensor terminal A and power supply
  - CMP sensor terminal B and power supply
  - CMP sensor terminal B and body ground
  - CMP sensor terminal C and body ground

FRONT HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Install the **SST** to the front HO2S.

4. Remove the front HO2S.

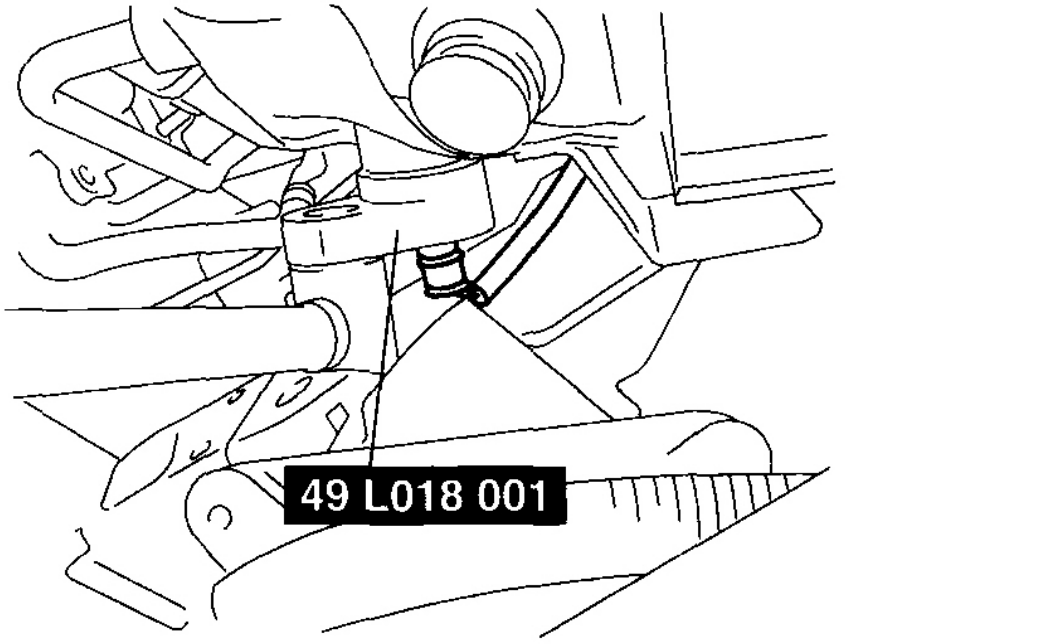


Fig. 61: Removing Front Heated Oxygen Sensor (HO2S)
Courtesy of MAZDA MOTORS CORP.

5. Install in the reverse order of removal.

Front HO2S tightening torque

29-49 N.m {3.0-4.9 kgf.m, 22-35 ft.lbf}

FRONT HEATED OXYGEN SENSOR (HO2S) INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

FRONT HO2S CURRENT INSPECTION

1. Warm up the engine to normal operating temperature.
2. Using the M-MDS or equivalent, monitor the following:

- Vehicle speed (PID: VSS)
- Engine speed (PID: RPM)
- Front HO2S current (PID: O2S11)

3. Drive the vehicle and decelerate the engine speed by releasing the accelerator pedal fully when the engine speed is **3,000 rpm or more.**
4. Verify that the front HO2S current (PID: O2S11) is **0.25 mA or more** while decelerating as shown in **Fig. 62** .

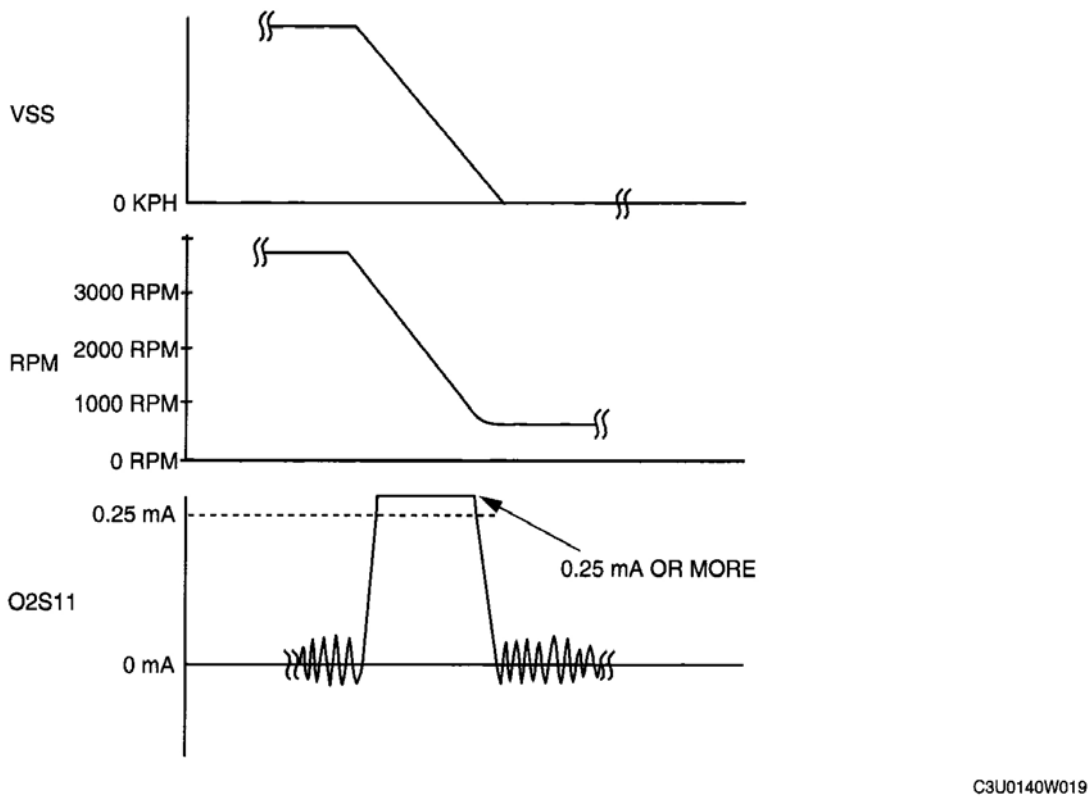


Fig. 62: Front HO2S Current Graph
Courtesy of MAZDA MOTORS CORP.

- If not within the specification, inspect the front HO2S for an open or short circuit. (See **FRONT HO2S CIRCUIT OPEN/SHORT INSPECTION** .) Then if there is no malfunction in the wiring harness, replace the front HO2S. (See **FRONT HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [LF]** .)

FRONT HO2S HEATER RESISTANCE INSPECTION

1. Disconnect the front HO2S connector.
2. Measure the resistance between front HO2S terminals C and D.

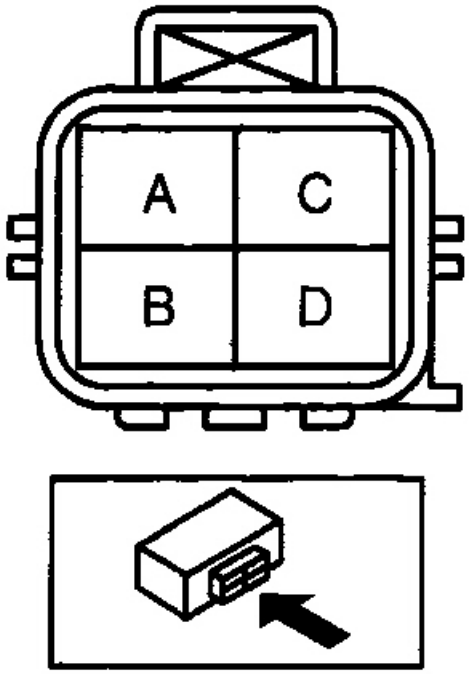


Fig. 63: Identifying Front HO2S Terminals
Courtesy of MAZDA MOTORS CORP.

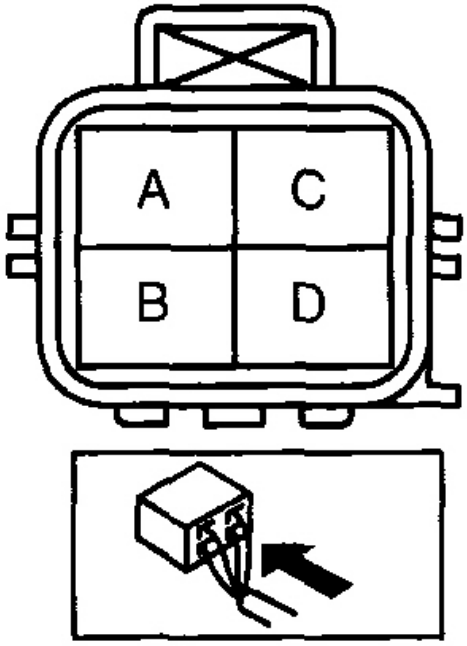
- If not within the specification, replace the front HO2S. (See **FRONT HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [LF]** .)

Front HO2S heater resistance

1-10 ohms

FRONT HO2S CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector. (See **PCM REMOVAL/INSTALLATION [LF]** .)
2. Disconnect the front HO2S connector.
3. Inspect the following wiring harnesses for an open or short circuit. (Continuity inspection)



C3U0140W052

Fig. 64: Identifying Front HO2S Terminals
Courtesy of MAZDA MOTORS CORP.

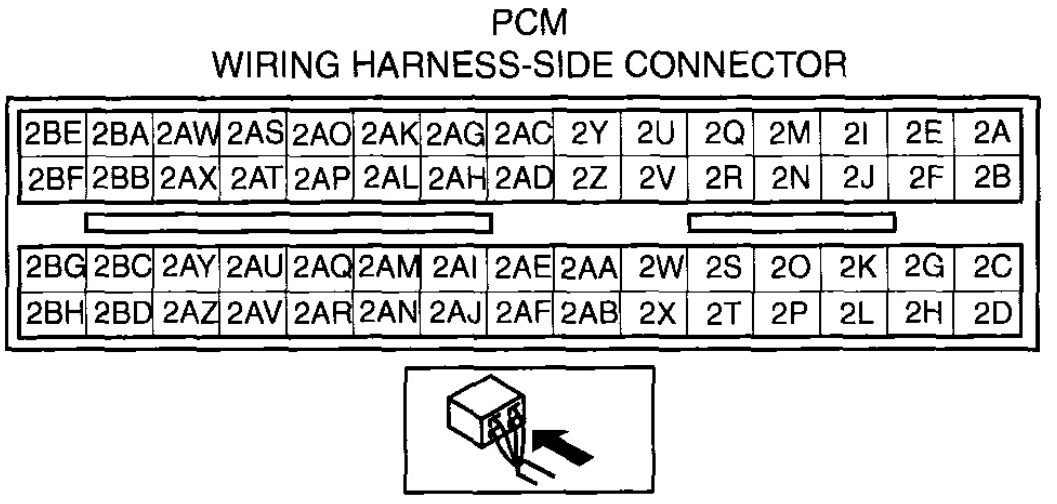


Fig. 65: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity in the following wiring harnesses, there is an open circuit. Repair or replace the wiring harness.
  - Front HO2S terminal A and PCM terminal 2AD
  - Front HO2S terminal B and PCM terminal 2Z
  - Front HO2S terminal C ignition relay
  - Front HO2S terminal D and PCM terminal 2BG

Short Circuit

- If there is continuity in the following wiring harnesses, there is a short circuit. Repair or replace the wiring harness.
  - Front HO2S terminal A and power supply
  - Front HO2S terminal A and body ground
  - Front HO2S terminal B and power supply
  - Front HO2S terminal B and body ground
  - Front HO2S terminal C and body ground
  - Front HO2S terminal D and power supply
  - Front HO2S terminal D and body ground

REAR HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Disconnect the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Install the **SST** to the rear HO2S.
4. Remove the rear HO2S.

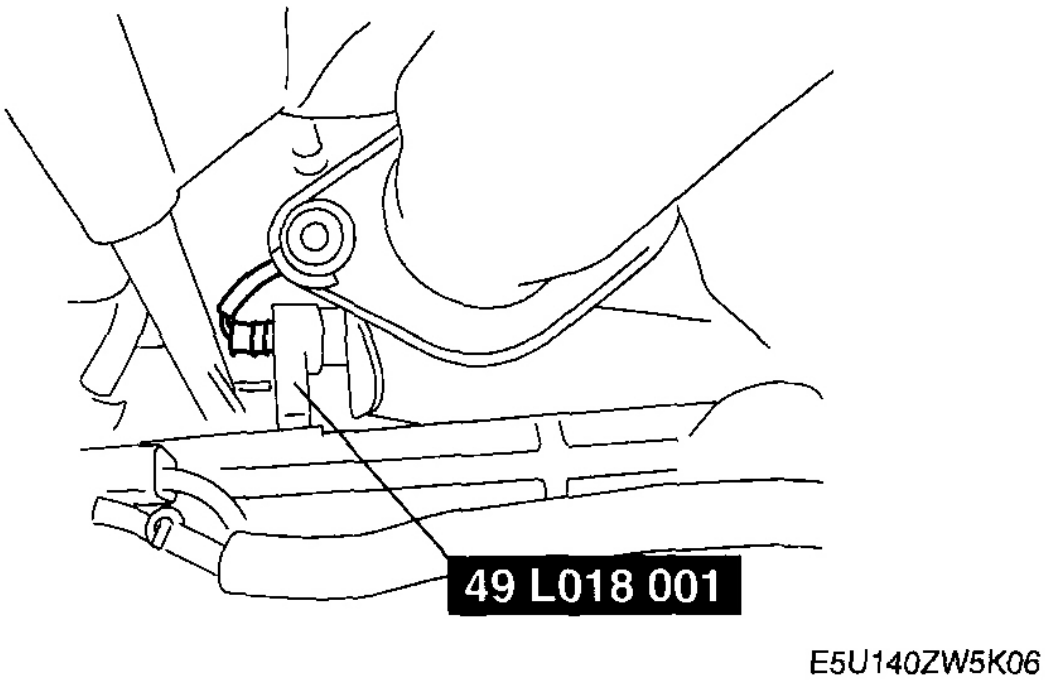


Fig. 66: Removing Rear Heated Oxygen Sensor (HO2S)
Courtesy of MAZDA MOTORS CORP.

5. Install in the reverse order of removal.

Rear HO2S tightening torque

29-49 N.m {3.0-4.9 kg.fm, 22-35 ft.lbf}

REAR HEATED OXYGEN SENSOR (HO2S) INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

REAR HO2S VOLTAGE INSPECTION

1. Warm up the engine to normal operating temperature.
2. Using the M-MDS or equivalent, monitor the following:
   - Vehicle speed (PID: VSS)
   - Engine speed (PID: RPM)
   - Rear HO2S voltage (PID: O2S12)
3. Drive the vehicle and decelerate the engine speed by releasing the accelerator pedal fully when the engine speed is **3,000 rpm or more.**
4. Verify that the rear HO2S outputs a voltage of **0.6 V or more** , one time or more, then verify that the rear HO2S voltage (PID: O2S12) is **0.3 V or less** while decelerating as shown in **Fig. 67** .

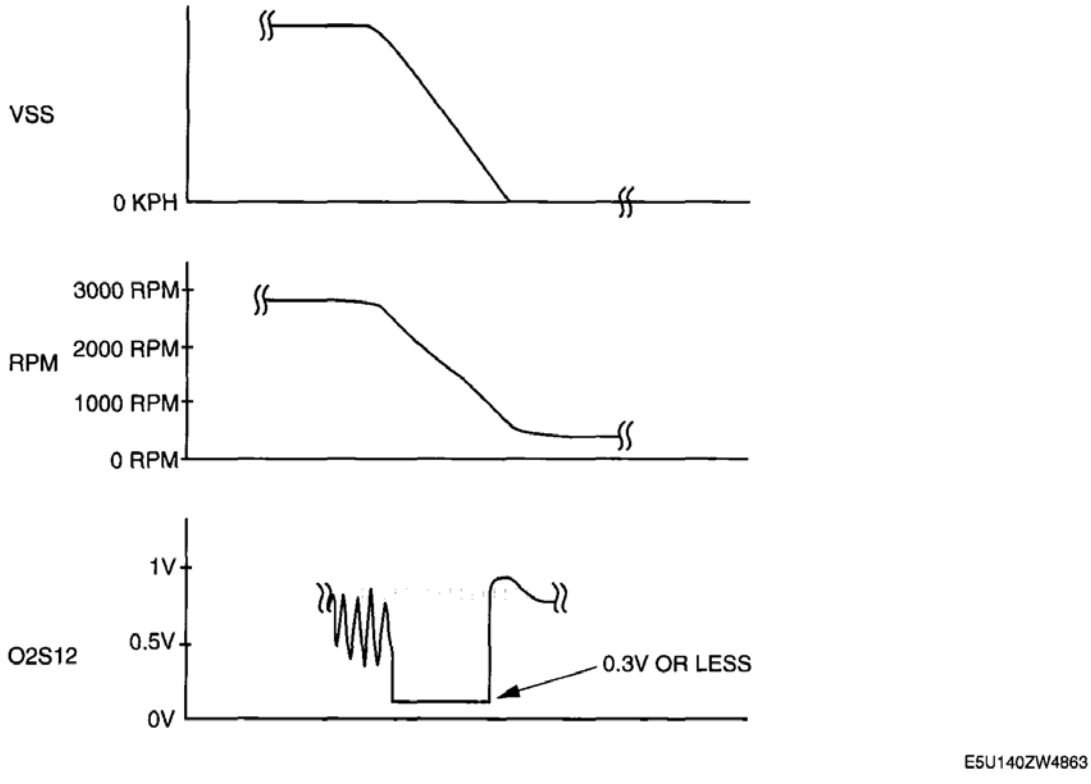


Fig. 67: Rear HO2S Voltage Graph
Courtesy of MAZDA MOTORS CORP.

- If not within the specification, inspect the rear HO2S for an open or short circuit. (See **REAR HO2S CIRCUIT OPEN/SHORT INSPECTION** .) Then if there is no malfunction in the wiring harness, replace the rear HO2S. (See **REAR HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [LF]** .)

REAR HO2S HEATER RESISTANCE INSPECTION

1. Disconnect the rear HO2S connector.
2. Measure the rear HO2S resistance between terminals C and D.
   - If not within the specification, replace the rear HO2S. (See **REAR HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [LF]** .)

Rear HO2S heater resistance

2-50 ohms

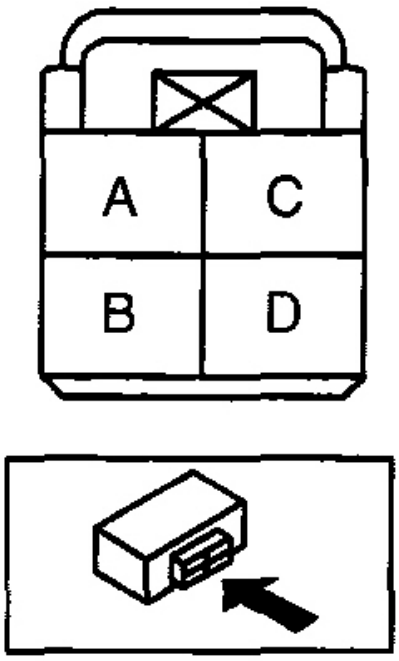


Fig. 68: Identifying Rear HO2S Connector Terminals
Courtesy of MAZDA MOTORS CORP.

REAR HO2S CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector.
2. Disconnect the rear HO2S connector.

3. Inspect the following wiring harnesses for an open or short circuit. (Continuity Inspection)

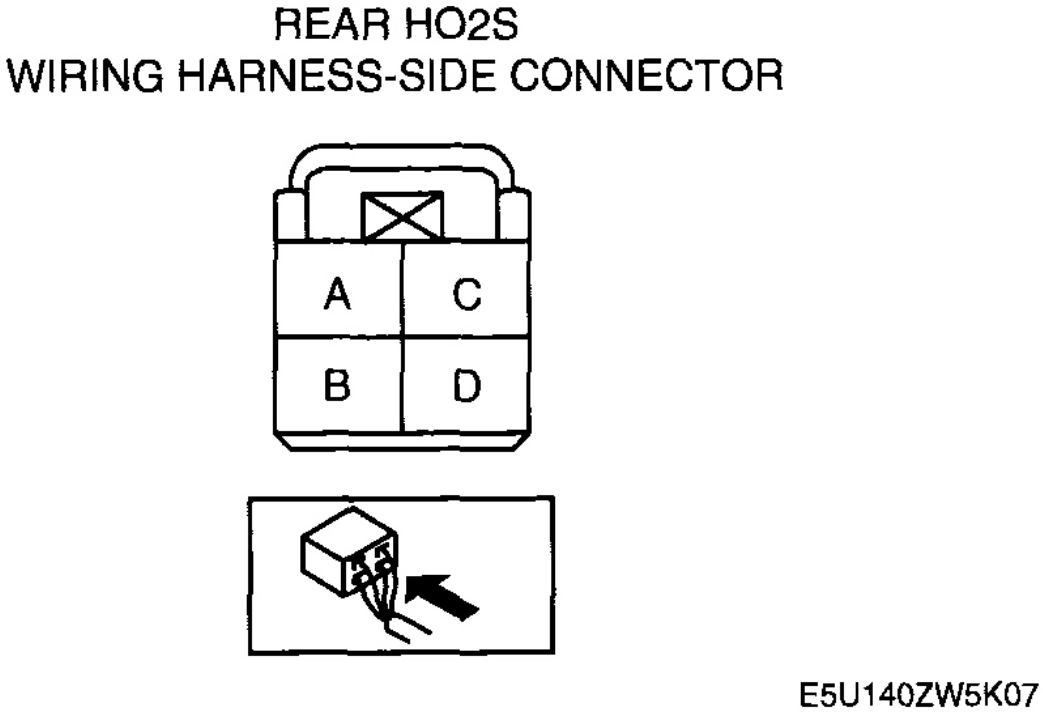


Fig. 69: Identifying Rear HO2S Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

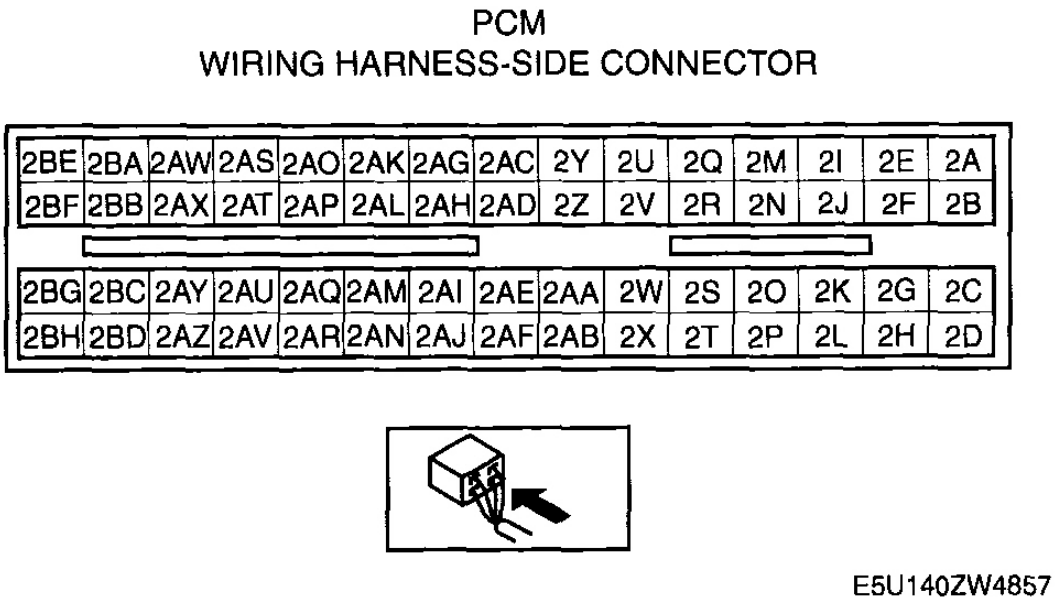


Fig. 70: Identifying PCM Harness Side Connector
Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - Rear HO2S terminal A and PCM terminal 2Q
  - Rear HO2S terminal B and PCM terminal 2BH
  - Rear HO2S terminal C and ignition relay
  - Rear HO2S terminal D and PCM terminal 2BE

Short circuit

- If there is continuity in the following wiring harnesses, there is a short circuit. Repair or replace the wiring harness.
  - Rear HO2S terminal A and power supply
  - Rear HO2S terminal A and body ground
  - Rear HO2S terminal B and power supply
  - Rear HO2S terminal B and body ground
  - Rear HO2S terminal C and body ground
  - Rear HO2S terminal D and power supply
  - Rear HO2S terminal D and body ground

KNOCK SENSOR (KS) REMOVAL/INSTALLATION [LF]

1. Remove the battery cover.
2. Remove the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Remove the dynamic chamber. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [LF]** .)
4. Disconnect the KS connector.

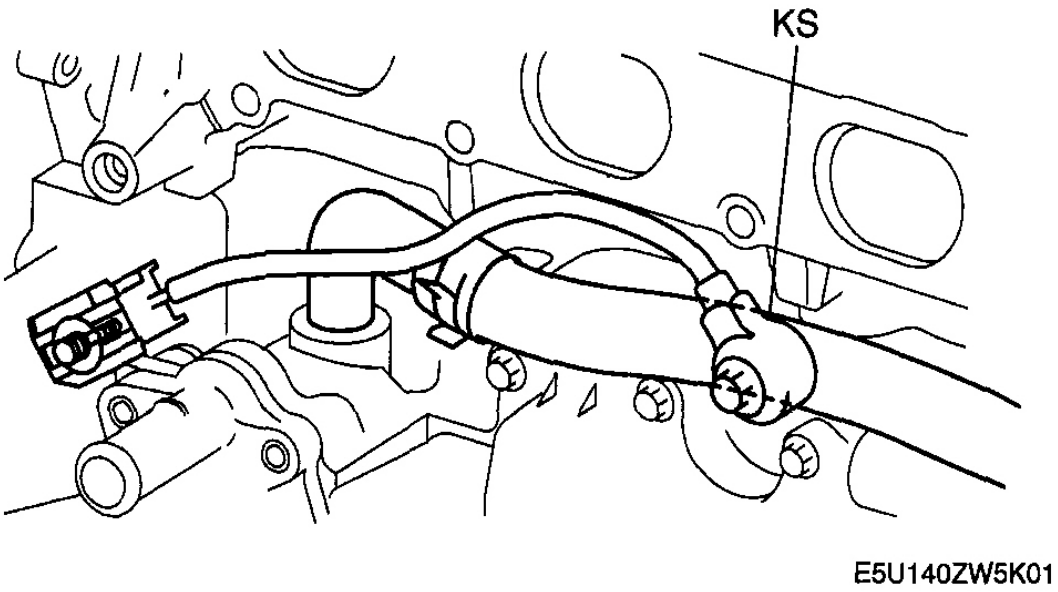


Fig. 71: Identifying Knock Sensor
Courtesy of MAZDA MOTORS CORP.

5. Remove the KS installation bolt, then remove the KS.
6. Install in the reverse order of removal.

KS tightening torque

16-24 N.m {1.7-2.4 kgf.m, 12-17 ft.lbf}

KNOCK SENSOR (KS) INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

RESISTANCE INSPECTION

1. Remove the battery cover.
2. Remove the negative battery cable. (See **BATTERY REMOVAL/INSTALLATION [LF]** .)
3. Disconnect the KS connector.
4. Measure resistance between KS terminals A and B.
   - If not within the specification, replace the KS. (See **KNOCK SENSOR (KS) REMOVAL/INSTALLATION [LF]** .)
   - If the monitor item status/specification (reference) is not within the specification, even though the KS resistance is within the specification, perform the **CIRCUIT OPEN/SHORT INSPECTION**.

KS resistance

Approx. 4.87 megohms

CIRCUIT OPEN/SHORT INSPECTION

1. Disconnect the PCM connector.
2. Inspect the following wiring harnesses for an open or short circuit. (Continuity inspection)

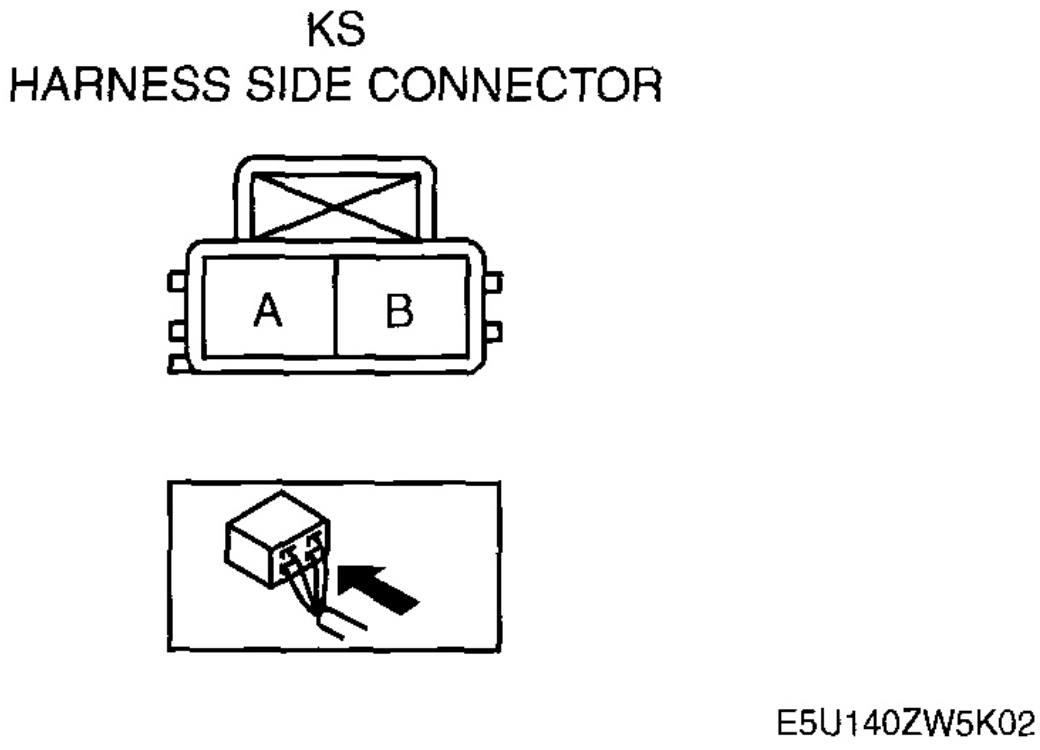


Fig. 72: Identifying Knock Sensor Harness Side Connector

Courtesy of MAZDA MOTORS CORP.

Open Circuit

- If there is no continuity, there is an open circuit. Repair or replace the wiring harness.
  - KS terminal A and PCM terminal 2U
  - KS terminal B and PCM terminal 2V

Short Circuit

- If there is continuity, there is a short circuit. Repair or replace the wiring harness.
  - KS terminal A and power supply
  - KS terminal A and body ground
  - KS terminal B and power supply
  - KS terminal B and body ground

BAROMETRIC PRESSURE (BARO) SENSOR INSPECTION [LF]

NOTE:

- **Before performing the following inspection, make sure to follow the procedure as indicated in the troubleshooting flow diagram. (See TROUBLESHOOTING PROCEDURE .)**

1. Connect the M-MDS or equivalent to the DLC-2.

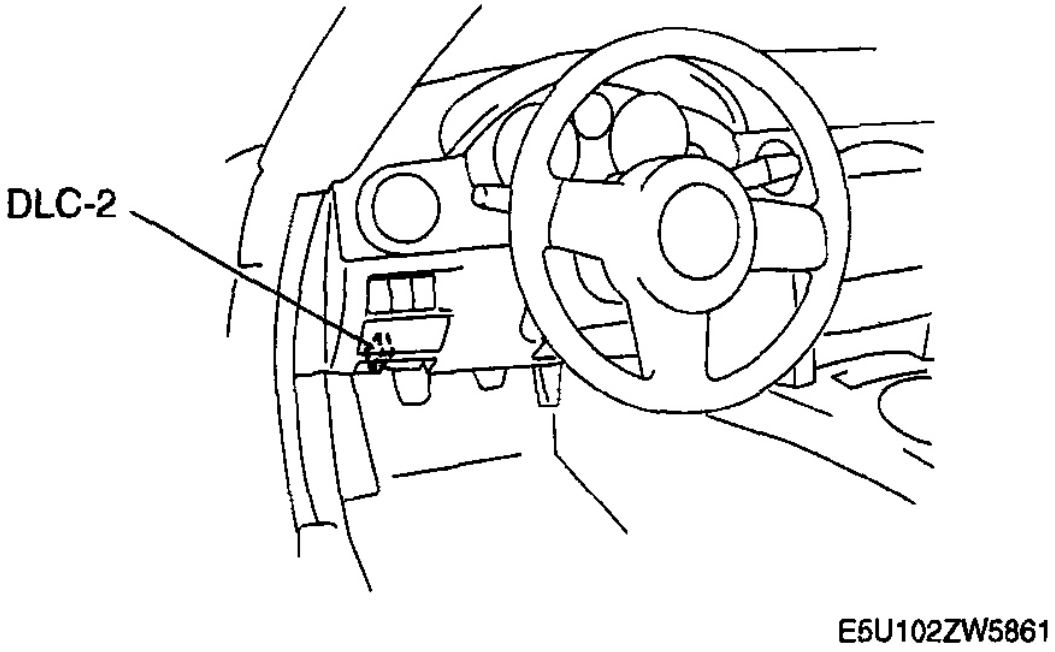


Fig. 73: Locating DLC-2 Connector
Courtesy of MAZDA MOTORS CORP.

2. Turn the ignition switch to the ON position.
3. Select BARO PID on the M-MDS or equivalent.
4. Verify that the BARO PID (pressure) and barometric pressure are practically equal.
    - If not as verified, replace the PCM. (See **PCM REMOVAL/INSTALLATION [LF]** .)