

2009 Mazda RX-8 Service Highlights

FOREWORD

This manual contains on-vehicle service and/or diagnosis procedures for the Mazda RX-8.

For proper repair and maintenance, a thorough familiarization with this manual is important, and it should always be kept in a handy place for quick and easy reference.

All the contents of this manual, including drawings and specifications, are the latest available at the time of printing. As modifications affecting repair or maintenance occur, relevant information supplementary to this volume will be made available at Mazda dealers. This manual should be kept up-to-date.

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**Mazda Motor Corporation
HIROSHIMA, JAPAN**

APPLICATION:

This manual is applicable to vehicles beginning with the Vehicle Identification Numbers (VIN), and related materials shown on the following page.

CONTENTS

Title	Section
GENERAL INFORMATION	00
ENGINE	01
SUSPENSION	02
DRIVELINE/AXLE	03
BRAKES	04
TRANSMISSION/TRANSAXLE	05
STEERING	06
HEATER, VENTILATION & AIR CONDITIONING (HVAC)	07
RESTRAINTS	08
BODY & ACCESSORIES	09

There are explanation given only for the sections marked with shadow (■).

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VEHICLE IDENTIFICATION NUMBERS (VIN)

JM1 FE172*9# 400001-
JM1 FE174*9# 400001-
JM1 FE17M*9# 400001-
JM1 FE17P*9# 400001-

RELATED MATERIALS

Material Name	MNAO Part No.	Mazda Material No.
2004 Mazda RX-8 Service Highlights	9999-95-102F-04	3378-1U-03C
2005 Mazda3, Mazda MX-5 Miata, Mazda MX-5, MAZDASPEED MX-5, Mazda MPV, Mazda RX-8 Service Highlights	9999-95-MODL-05	3400-1U-04H
2006 Mazda RX-8 Service Highlights	9999-95-102F-06	3409-1U-05J
2007 Mazda3, MAZDASPEED3, Mazda5, Mazda MX-5, Mazda6, MAZDASPEED6, Mazda RX-8 Service Highlights	9999-95-MODL-07	3422-1U-06G
2008 Mazda3, MAZDASPEED3, Mazda5, Mazda MX-5, Mazda6, Mazda CX-7, Mazda RX-8, Mazda CX-9 Service Highlights	9999-95-010F-08	3431-1U-07I
1995, 1996, 1997, 1998, 1999, 2000 OBD-II Service Highlights	9999-95-OBD2-00	3344-1U-99K
2009 Mazda RX-8 Workshop Manual	9999-95-064B-09	1927-1U-08C
Engine Workshop Manual 13B-MSP	9999-95-E13B-MSP	1773-1U-03C
Manual Transmission Workshop Manual P66M-D	9999-95-423H-06	1848-1U-05F
Automatic Transmission Workshop Manual SJ6A-EL	9999-95-SJ6A-EL	1876-1U-06J
2004 Mazda RX-8 Bodyshop Manual	9999-95-120F-04	3379-1U-03D
2009 Mazda RX-8 Wiring Diagram	9999-95-040G-09	5762-1U-08C

GENERAL INFORMATION

00
SECTION

00-00

GENERAL INFORMATION 00-00

00-00 GENERAL INFORMATION

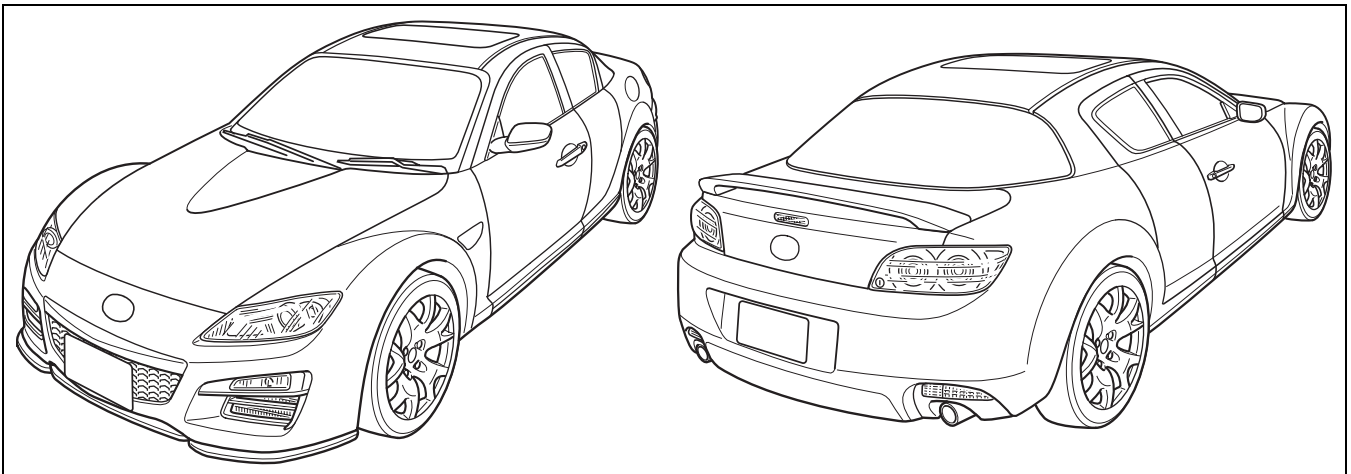
AIM OF DEVELOPMENT 00-00-1
Outline 00-00-1

VEHICLE IDENTIFICATION
NUMBER (VIN) CODE 00-00-5
VEHICLE IDENTIFICATION
NUMBER (VIN) 00-00-5

AIM OF DEVELOPMENT

Outline
External view

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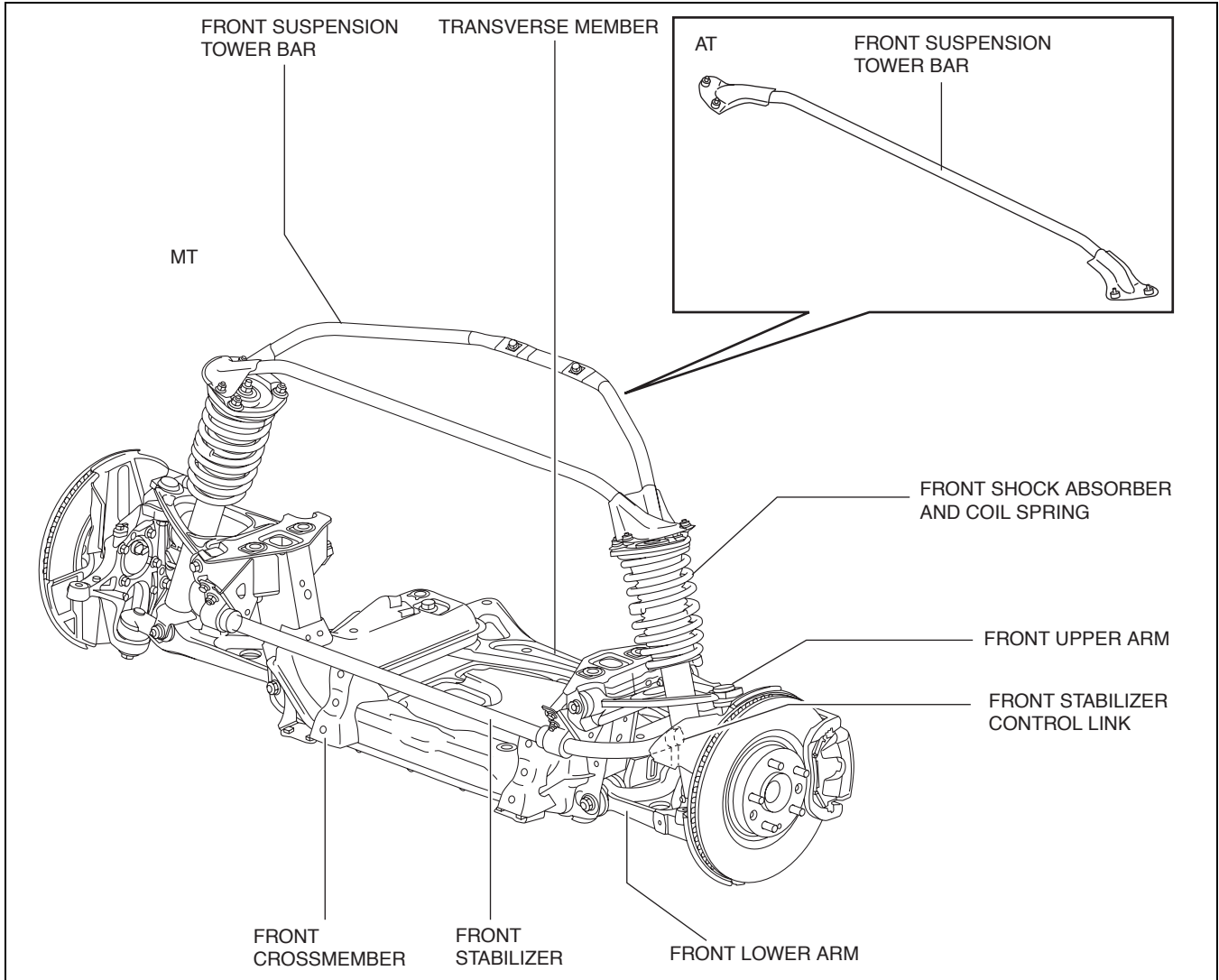


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GENERAL INFORMATION

Suspension

- Trapezoidal front suspension tower bar adopted to improve the rigidity and handling stability. (MT)
- 19-inch wheel and tire adopted for hard suspension.



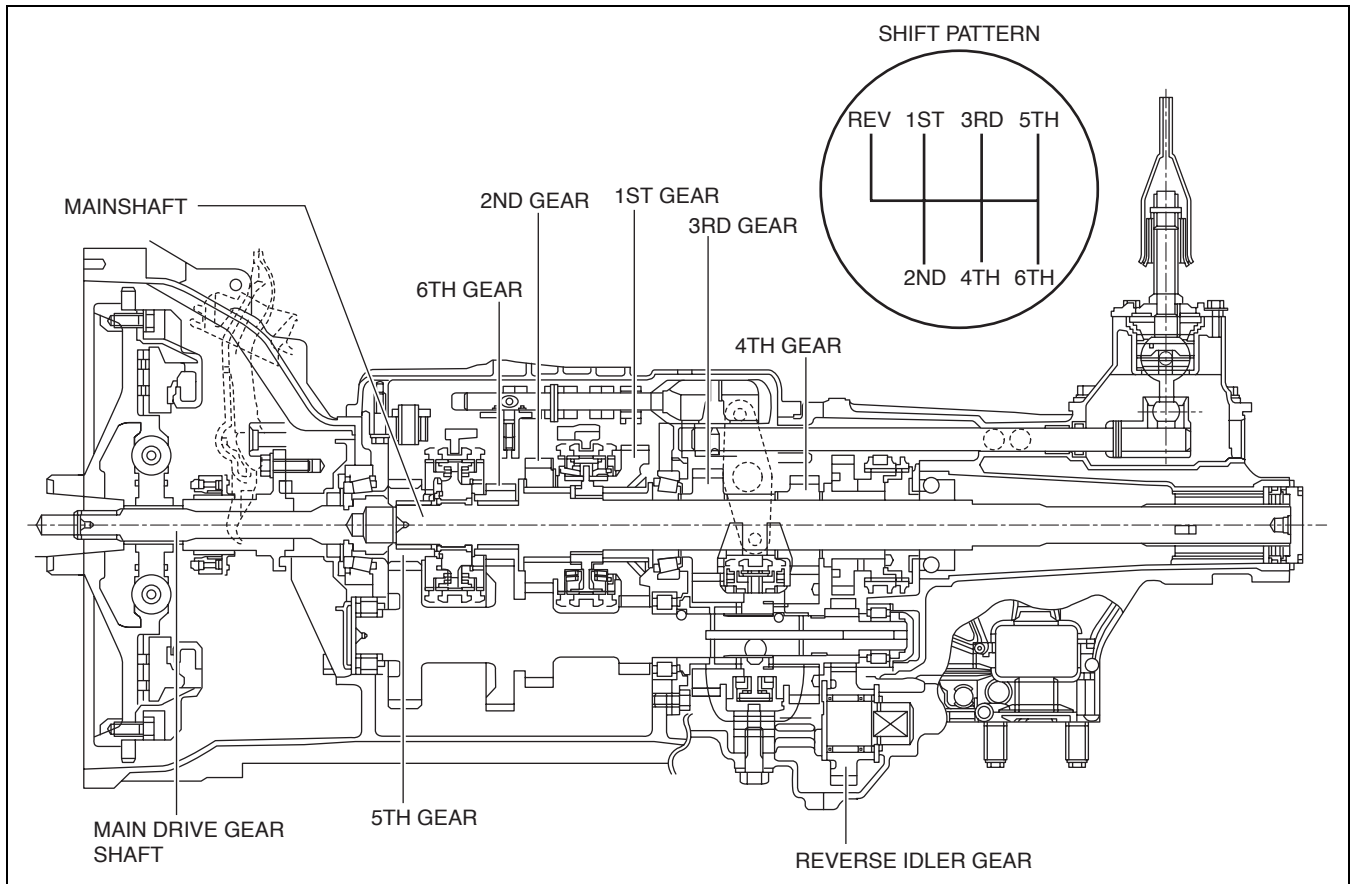
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GENERAL INFORMATION

Transmission

- Manual transmission
 - Six-speed P66M-D manual transmission has been adopted.
 - A linked, triple-cone synchronizer mechanism has been adopted for 1st, 2nd, 3rd and 4th gears.
 - A guide plate type reverse lockout mechanism has been adopted.

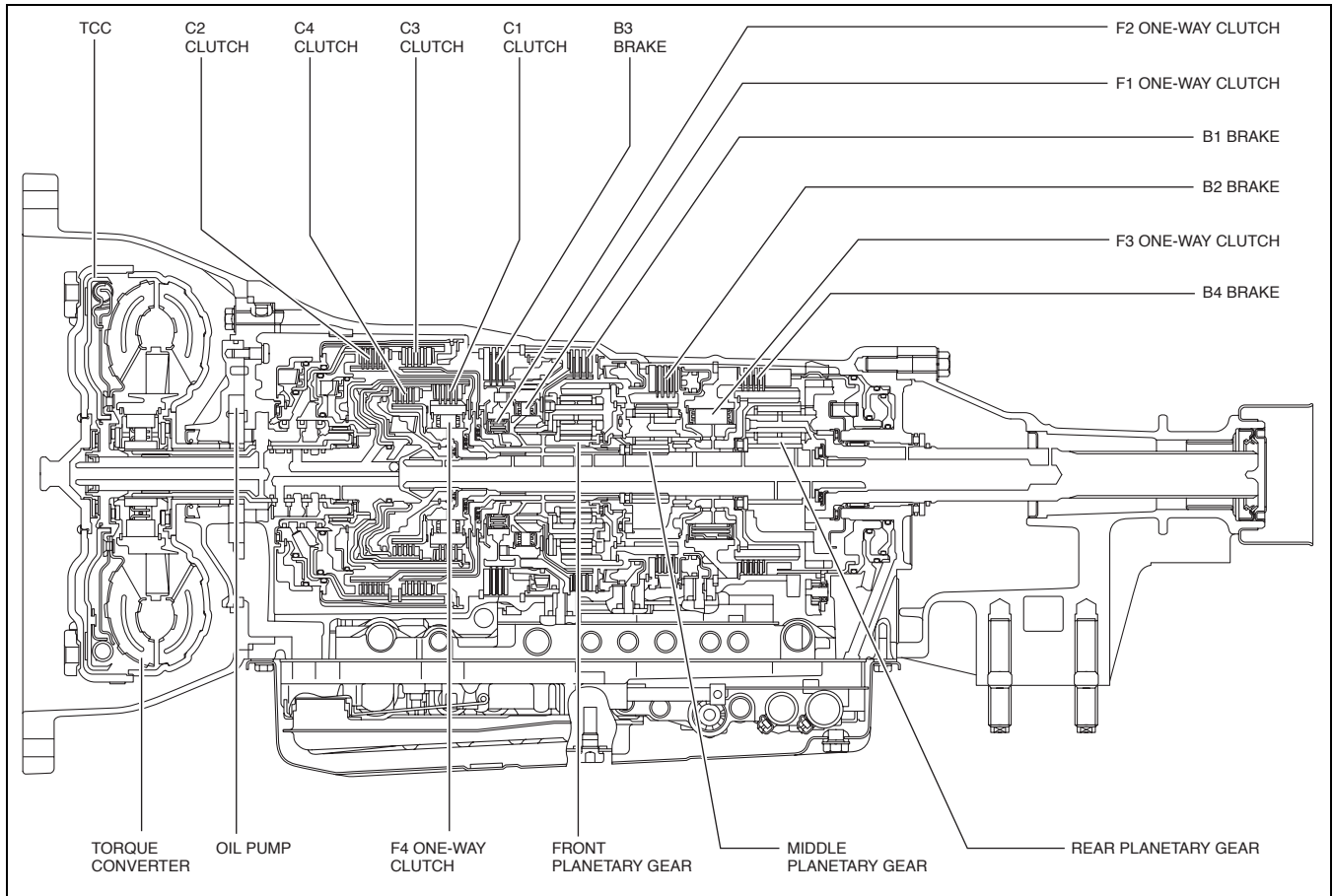
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GENERAL INFORMATION

- Automatic transmission
 - SJ6A-EL type 6-speed AT has been adopted.
 - The Sport AT has been adopted.
 - Newly developed direct active matic control has been adopted.

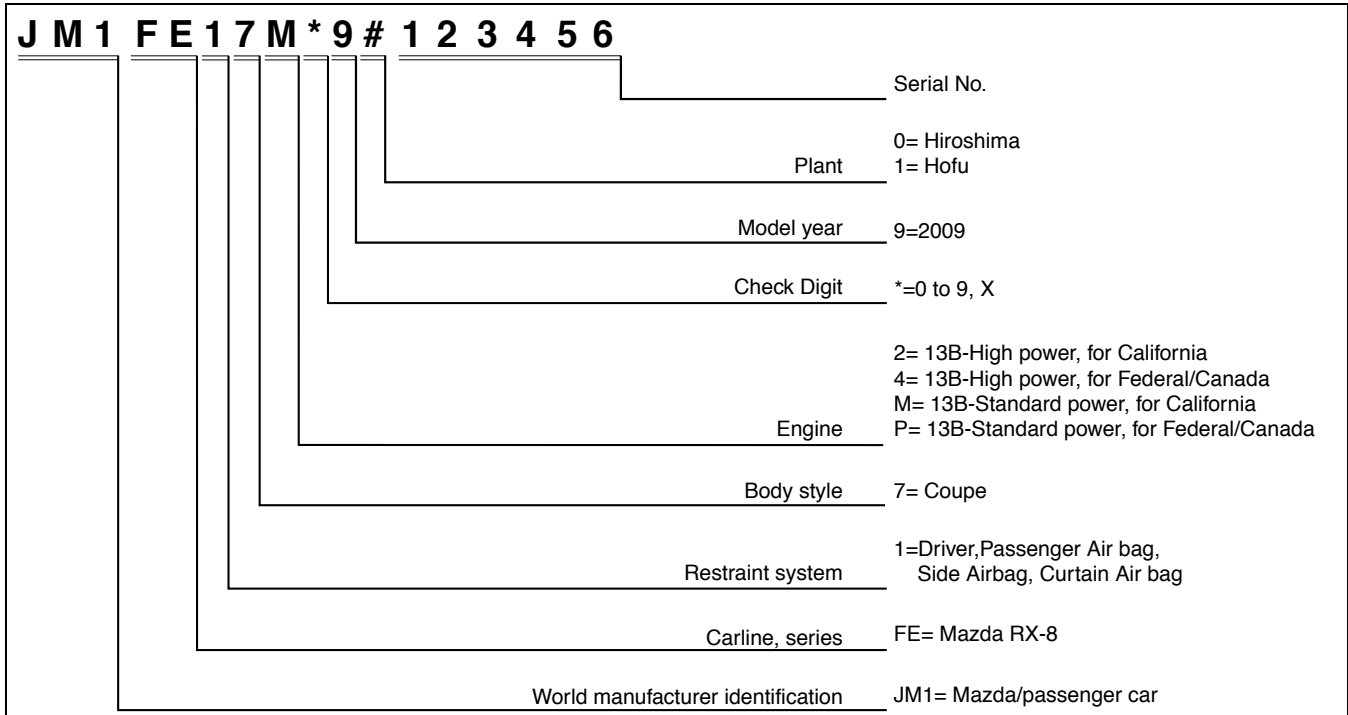


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GENERAL INFORMATION

VEHICLE IDENTIFICATION NUMBER (VIN) CODE

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VEHICLE IDENTIFICATION NUMBER (VIN)

id000000100300

- JM1 FE172*9# 400001—
- JM1 FE174*9# 400001—
- JM1 FE17M*9# 400001—
- JM1 FE17P*9# 400001—

ENGINE

01

SECTION

01-00

OUTLINE [13B-MSP]	01-00	FUEL SYSTEM [13B-MSP].	01-14
ON-BOARD DIAGNOSTIC [13B-MSP].	01-02	EMISSION SYSTEM [13B-MSP]	01-16
MECHANICAL [13B-MSP].	01-10	CHARGING SYSTEM [13B-MSP]	01-17
LUBRICATION [13B-MSP]	01-11	CRUISE CONTROL SYSTEM [13B-MSP].	01-20
COOLING SYSTEM [13B-MSP].	01-12	CONTROL SYSTEM [13B-MSP]	01-40
INTAKE-AIR SYSTEM [13B-MSP].	01-13		

01-00 OUTLINE [13B-MSP]

ENGINE ABBREVIATIONS

[13B-MSP]	01-00-1
ENGINE FEATURES [13B-MSP]	01-00-2
On-board Diagnostic	01-00-2
Mechanical	01-00-2
Lubrication	01-00-2

Cooling System	01-00-2
Charging System	01-00-2
Cruise Control System	01-00-2
Control System	01-00-2
ENGINE SPECIFICATIONS [13B-MSP]	01-00-3

ENGINE ABBREVIATIONS [13B-MSP]

id010050100100

ABDC	After Bottom Dead Center
APV	Auxiliary Port Valve
AT	Automatic Transmission
ATDC	After Top Dead Center
BBDC	Before Bottom Dead Center
BTDC	Before Top Dead Center
CAN	Controller Area Network
CCM	Comprehensive Component Monitor
DC	Drive Cycle
EX	Exhaust
FP	Front Primary
FS	Front Secondary
F/P	Fuel Pump
HI	High
IC	Integrated Circuit
IG	Ignition
IN	Intake
KAM	Keep Alive Memory
KOEO	Key On Engine Off
KOER	Key On Engine Running
LF	Left Front
LH	Left Hand
LO	Low
LR	Left Rear
L/F	Leading Front

OUTLINE [13B-MSP]

L/R	Leading Rear
MT	Manual Transmission
OCV	Oil Control Valve
RH	Right Hand
RP	Rear Primary
RR	Right Rear
RS	Rear Secondary
SSV	Secondary Shutter Valve
SW	Switch
T/F	Trailing Front
T/R	Trailing Rear
VDI	Variable Dynamic Effect Intake
VFAD	Variable Fresh Air Duct

ENGINE FEATURES [13B-MSP]

id010050100200

On-board Diagnostic

To meet OBD-II regulations	<ul style="list-style-type: none"> Diagnostic test modes changed
Improved serviceability	<ul style="list-style-type: none"> DTCs changed KOEO/KOER self-test function changed PID/DATA monitor function changed Simulation test function changed

Mechanical

Reduced engine noise and vibration	<ul style="list-style-type: none"> Stationary gear changed (standard power)
Improved engine torque	<ul style="list-style-type: none"> Auxiliary port adopted (standard power)

Lubrication

Improved lubricity	<ul style="list-style-type: none"> An electric type metering oil pump system adopted Center oil nozzles adopted which discharge oil to the center area of the rotor housings Oil pump changed Oil pan upper block adopted
Improved serviceability	<ul style="list-style-type: none"> Oil filter position changed

Cooling System

Improved cooling performance	<ul style="list-style-type: none"> Radiator changed Water pump changed Cooling fan component changed
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Charging System

Improved generator output	<ul style="list-style-type: none"> Generator changed
---------------------------	---

Cruise Control System

Improved driveability	<ul style="list-style-type: none"> Cruise control switch changed
-----------------------	---

Control System

Improved engine torque and output	<ul style="list-style-type: none"> S-DAIS control changed APV position sensor No.1, No.2 adopted
Improved engine reliability	<ul style="list-style-type: none"> KS No.1, No.2 adopted Electrical fan control changed Fuel injection control changed
Improved lubricity	<ul style="list-style-type: none"> Metering oil pump control changed <ul style="list-style-type: none"> — Metering oil pump driver adopted Oil pressure control adopted <ul style="list-style-type: none"> — Oil pressure sensor adopted

OUTLINE [13B-MSP]

ENGINE SPECIFICATIONS [13B-MSP]

id010050113300

Item				Specification				
				2009MY		2008MY		
				13B-MSP (Standard power)	13B-MSP (High power)	13B-MSP (Standard power)	13B-MSP (High power)	
MECHANICAL								
Engine type				Rotary		←		
Rotor arrangement and number				In-line 2-rotor, longitudinal		←		
Combustion chamber type				Bathtub		←		
Displacement (ml {cc, cu in})				654 {654, 40.0}×2		←		
Compression ratio				10.0		←		
Compression pressure (kPa {kgf/cm ² , psi} [rpm])				830 {8.5, 120}[250]		←		
Port timing	IN	Open	Primary port	ATDC	3°		←	
			Secondary port		12°		←	
			Auxiliary port		38°	—	38°	
		Close	Primary port	ABDC	65°		60°	65°
			Secondary port		36°		45°	36°
			Auxiliary port		80°		—	80°
	EX	Open	BBDC		50°		40°	50°
		Close	BTDC		3°		←	
LUBRICATION SYSTEM								
Type				Force-fed type		←		
Oil pressure (reference value) (oil temperature: 100°C {212°F}) (kPa {kgf/cm ² , psi} [rpm])				500 {5.10, 72.5} [3,000]		350 {3.57, 50.8} [3,000]		
Oil pump	Type			Trochoid gear type		←		
	Relief valve opening pressure (reference value) (kPa {kgf/cm ² , psi})			1,080 {11.01, 156.6}		441—490 {4.5—5.0, 64.0—71.0}		
Oil filter	Type			Full-flow, paper element		←		
	Bypass pressure (kPa {kgf/cm ² , psi})			140—180 {1.43—1.83, 20.3—26.1}		78—118 {0.8—1.2, 11.4—17.1}		
Oil capacity (approx. quantity)	Oil replacement (L {US qt, Imp qt})			4.2 {4.4, 3.7}		3.3 {3.5, 2.9}		
	Oil and oil filter replacement (L {US qt, Imp qt})			4.4 {4.6, 3.9}		3.5 {3.7, 3.1}		
	Engine overhaul (L {US qt, Imp qt})			5.6 {5.9, 4.9}		4.7 {5.0, 4.1}		
	Total (dry engine) (L {US qt, Imp qt})			6.3 {6.7, 5.5} 7.0 {7.4, 6.2}		5.7 {6.0, 5.0} 6.4 {6.8, 5.6}		
COOLING SYSTEM								
Type				Water-cooled, forced circulation		←		
Coolant capacity (approx. quantity) (L {US qt, Imp qt})				AT: 9.8 {10, 8.6} MT: 10.0 {10.6, 8.80}		9.8 {10, 8.6}		
Water pump	Type			Centrifugal, V-ribbed belt-driven		←		
Thermostat	Type			Wax		←		
	Opening temperature (°C {F°})			80—84 {176—183}		←		
	Full-open temperature (°C {F°})			95 {203}		←		
	Full-open lift (mm {in})			8.5 {0.33} or more		←		
Radiator	Type			Corrugated fin		←		
Cooling system cap	Cap valve opening pressure (kPa {kgf/cm ² , psi})			73.6—103 {0.75—1.05, 10.7—14.9}		←		
Cooling fan	Type			Electric		←		
	Number of blades			Cooling fan No.1: 5 Cooling fan No.2: 7		←		
	Outer diameter (mm {in})			300 {11.8}		←		

01-00

OUTLINE [13B-MSP]

Item		Specification			
		2009MY		2008MY	
		13B-MSP (Standard power)	13B-MSP (High power)	13B-MSP (Standard power)	13B-MSP (High power)
FUEL SYSTEM					
Injector	Type		Multiple hole design		←
	Type of fuel delivery		Top-feed		←
	Type of drive		Electronic		←
Pressure regulator control pressure		(kPa {kgf/cm ² , psi})	Approx. 390 {3.98, 56.6}		←
Fuel pump type		Electric		←	
Fuel tank capacity (approx. quantity)		(L {US gal, Imp gal})	64.0 {16.9, 14.1}		60 {15.9, 13.2}
Fuel type		Unleaded premium (unleaded high-octane) gasoline		←	
EMISSION SYSTEM					
AIR system		Air pump, air control valve		←	
Catalyst type		Three-way catalyst (monolithic)		←	
EVAP control system		Canister design		←	
PCV system		Closed design		←	
CHARGING SYSTEM					
Battery	Voltage (V)		12		←
	Type and capacity (5 hour rate) (A·h)		80D26L (55)		75D23L (52)
Generator	Output (V-A)		12-110		12-100
	Regulated voltage		Controlled by PCM		←
	Self diagnosis function				
IGNITION SYSTEM					
Ignition system	Type		Distributorless Ignition (DLI)		←
	Spark advance		Electronic		←
	Firing order		When idling: T/F-L/F-T/R-L/R Except for idling: L/F-T/F-L/R-T/R (Independent ignition control)		←
Spark plug	Type	Leading side	N3H5 18 110A (RE7C-L) ^{*1} , N3Y8 18 110A (RE7C-L) ^{*1} , N3Y9 18 110A (RE6C-L) ^{*2}		←
		Trailing side	N3H1 18 110D (RE9B-T) ^{*1} , N3Y1 18 110A (RE9B-T) ^{*1}		←
STARTING SYSTEM					
Starter	Type		Coaxial reduction		←
	Output (kW)		2.0		←
CONTROL SYSTEM					
Neutral switch (MT)		ON/OFF		←	
CPP switch (MT)		ON/OFF		←	
SSV switch		ON/OFF		←	
APV position sensor		Magneto resistance element		-	Hall element
ECT sensor		Thermistor		←	




OUTLINE [13B-MSP]

Item	Specification			
	2009MY		2008MY	
	13B-MSP (Standard power)	13B-MSP (High power)	13B-MSP (Standard power)	13B-MSP (High power)
IAT sensor	Thermistor		←	
TP sensor	Hall element		←	
APP sensor	Hall element		←	
MAF sensor (Inside MAF)	Hot-wire		←	
A/F sensor	Zirconia element (all range air/fuel ratio sensor)		←	
HO2S	Zirconia element (Stoichiometric air/fuel ratio sensor)		←	
BARO sensor (built into PCM)	Piezoelectric element		←	
KS	Piezoelectric element		←	
Eccentric shaft position sensor	Magnetic pickup		←	
Oil pressure sensor	Piezoelectric element		-	
PCM temperature sensor (built into PCM)	Thermistor		-	
Metering oil pump switch	-		ON/OFF	
Brake switch	ON/OFF		←	
Throttle valve actuator	DC motor		←	
APV motor	DC motor		-	DC motor
Fuel injector (primary 1)	Multiple hole type (12 holes)		←	
Fuel injector (secondary)	Multiple hole type (4 holes)		←	
Fuel injector (primary 2)	-	-	-	Multiple hole type (4 holes)
Stepping motor (in metering oil pump)	-		Stepping motor	

*1 : Standard equipment

*2 : Hot type plug: Available only for customers who often drive their car at very low speed which causes the plugs to foul easily.

Engine oil specification

Item	U.S.A. and CANADA	Except U.S.A. and CANADA
Engine oil grade	 (ILSAC)	  (ILSAC)
Engine oil viscosity	5W-20 API SL, SM or ILSAC	

01-00

01-02 ON-BOARD DIAGNOSTIC [13B-MSP]

ON-BOARD DIAGNOSTIC OUTLINE

[13B-MSP] 01-02-1
 Features 01-02-1

ON-BOARD DIAGNOSTIC WIRING
DIAGRAM [13B-MSP] 01-02-2

ON-BOARD DIAGNOSTIC SYSTEM
TEST MODE [13B-MSP] 01-02-4
 Sending Diagnostic Data 01-02-4
 Sending Freeze Frame Data 01-02-5

Sending Emission-related
 Malfunction Code01-02-6
 Sending Intermittent Monitoring
 System Test Results01-02-10

DTC DETECTION LOGIC AND
CONDITIONS [13B-MSP]01-02-10

KOEO/KOER SELF-TEST
[13B-MSP]01-02-15

PID/DATA MONITOR AND RECORD
[13B-MSP]01-02-18

SIMULATION TEST [13B-MSP]01-02-20

01-02

ON-BOARD DIAGNOSTIC OUTLINE [13B-MSP]

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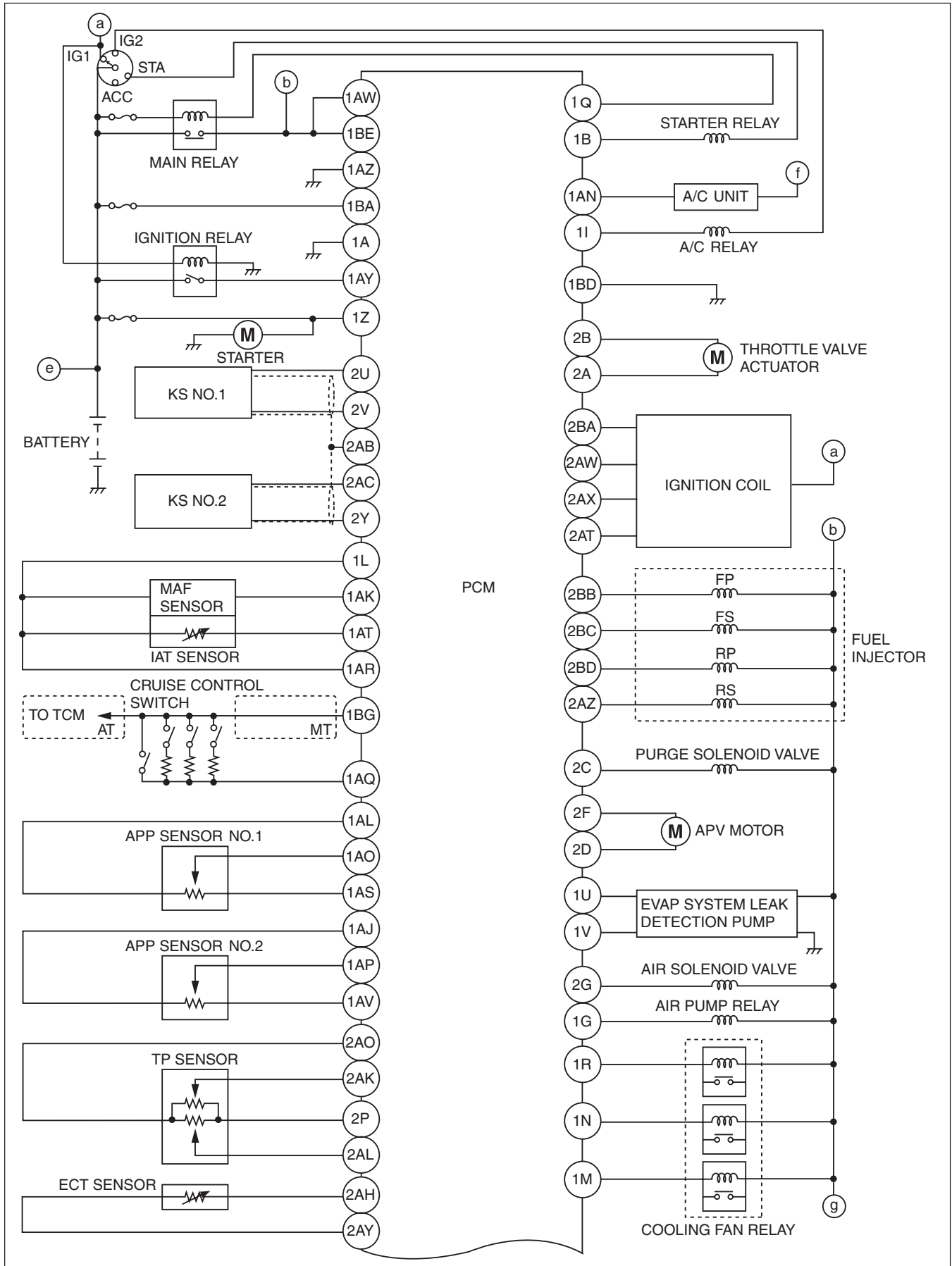
Features

To meet OBD-II regulations	<ul style="list-style-type: none"> • Diagnostic test modes changed
Improved serviceability	<ul style="list-style-type: none"> • DTCs changed • KOEO/KOER self-test function changed • PID/DATA monitor function changed • Simulation test function changed

ON-BOARD DIAGNOSTIC [13B-MSP]

ON-BOARD DIAGNOSTIC WIRING DIAGRAM [13B-MSP]

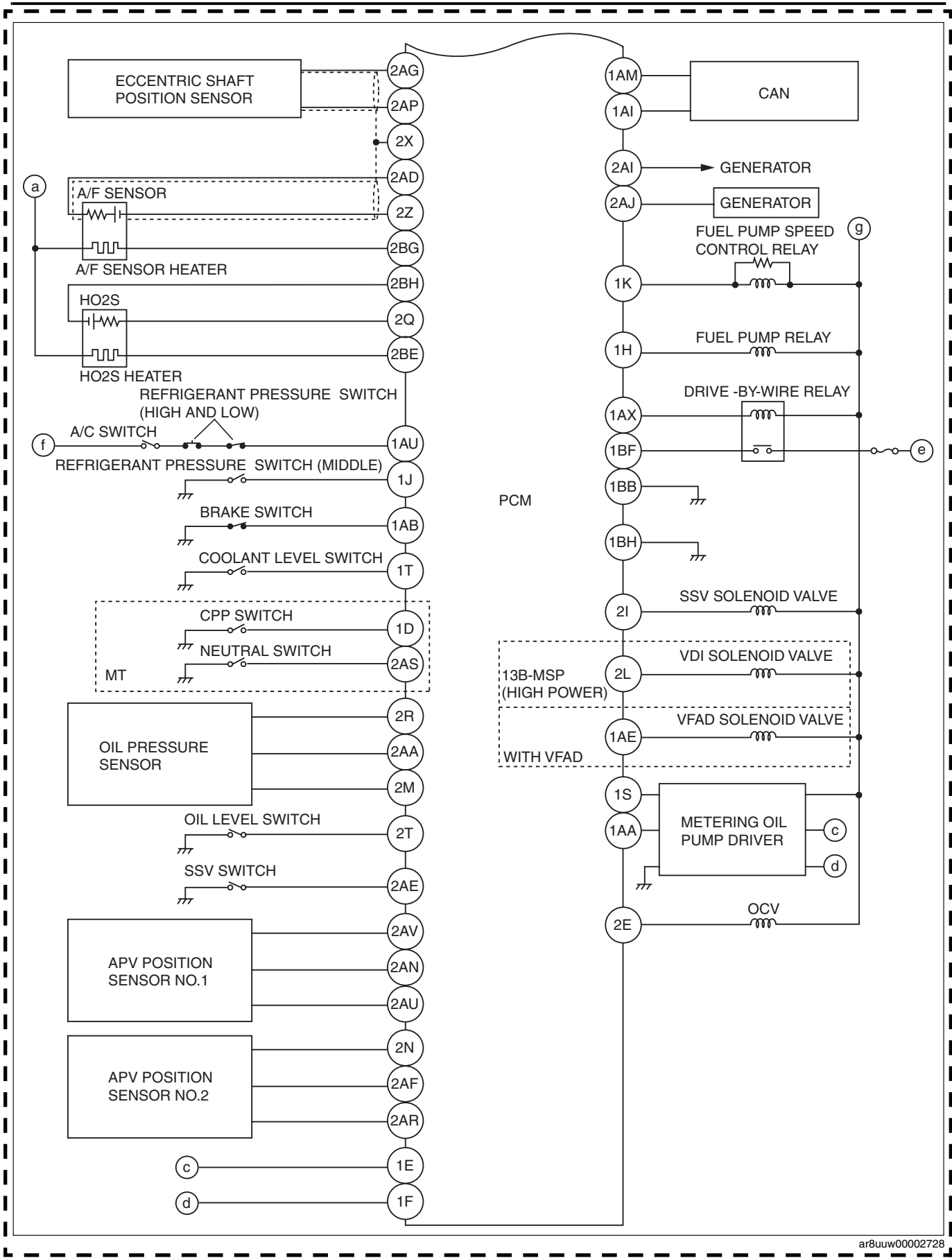
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2009 Mazda RX-8 Service Highlights (3452-1U-08C)
ON-BOARD DIAGNOSTIC [13B-MSP]

01-02



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**2009 Mazda RX-8 Service Highlights (3452-1U-08C)
ON-BOARD DIAGNOSTIC [13B-MSP]**

ON-BOARD DIAGNOSTIC SYSTEM TEST MODE [13B-MSP]

id0102g1100200

Sending Diagnostic Data

PID data monitor

- The PID data monitor items are shown below.

PID data monitor table

N/A: Not applicable

Full names		Unit	
2009MY	2008MY		
Monitor status since DTCs cleared	←	-	
Fuel system loop status	←	Refer to list below.	
LOAD	←	%	
ECT	←	°C	°F
Short term fuel trim	←	%	
Long term fuel trim	←	%	
Engine speed	←	rpm	
Vehicle speed	←	km/h	mph
Spark advance	←	°	
IAT	←	°C	°F
MAF	←	g/s	
Absolute TP	←	%	
AIR control status	←	-	
A/F sensor, HO2S location	←	-	
HO2S output	←	V	
		%	
OBD requirement according to vehicle design	←	-	
Time since engine start	←	s	
Distance travelled while MIL is activated	←	km	mile
Purge solenoid valve control signal	←	%	
Fuel tank level	←	%	
Number of warm-ups since DTCs cleared	←	-	
Distance travelled since DTCs cleared	←	km	mile
BARO	←	kPa	
A/F sensor output current	←	mA	
Estimated catalyst converter temperature	←	°C	°F
Monitor status this driving cycle	←	-	
PCM power supply voltage	←	V	
Absolute load value	←	%	
Command equivalence ratio	←	-	
Relative TP	←	%	
Ambient air temperature	←	°C	°F
TP from TP sensor No.2	←	%	
APP from APP sensor No.1	←	%	
APP from APP sensor No.2	←	%	
Throttle actuator control signal	←	%	

Meaning of fuel system loop status

- The following information is displayed on the tester.
 - Feedback operating: A/F sensor, HO2S being used for feedback is normal.
 - Feedback stops: ECT is lower than the determined feedback zone.
 - Feedback stops: Open loop due to driving condition.
 - Feedback stops: Open loop due to detected system fault.

ON-BOARD DIAGNOSTIC [13B-MSP]

On-board system readiness test

- The items supported by the on-board system readiness test are shown below.

Continuous monitoring system

- A/F sensor heater, HO2S heater
- Fuel system
- Misfire
- CCM

Intermittent monitoring system

- A/F sensor, HO2S
- AIR system
- Catalyst
- EVAP system
- Thermostat

01-02

Sending Freeze Frame Data

- The Freeze Frame Data monitor items are shown below.

Freeze Frame Data monitor table

N/A: Not applicable

Full names		Unit	
2009MY	2008MY		
DTC that caused required Freeze Frame Data storage	←	—	
Fuel system loop status	←	Refer to list below.	
LOAD	←	%	
ECT	←	°C	°F
Short term fuel trim	←	%	
Long term fuel trim	←	%	
Engine speed	←	rpm	
Vehicle speed	←	km/h	mph
Spark advance	←	°	
IAT	←	°C	°F
MAF	←	g/s	
Absolute TP	←	%	
AIR control status	←	—	
HO2S output	←	V	
		%	
Time since engine start	←	s	
Purge solenoid valve control signal	←	%	
Fuel tank level	←	%	
Number of warm-ups since DTCs cleared	←	—	
Distance travelled since DTCs cleared	←	km	mile
BARO	←	kPa	
Estimated catalyst converter temperature	←	°C	°F
PCM power supply voltage	←	V	
Command equivalence ratio	←	—	
Absolute load value	←	%	
Relative TP	←	%	
Ambient air temperature	←	°C	°F
TP from TP sensor No.2	←	%	
APP from APP sensor No.1	←	%	
APP from APP sensor No.2	←	%	
Throttle actuator control signal	←	%	

Meaning of fuel system loop status

- The following information is displayed on the tester.
 - Feedback operating: A/F sensor, HO2S being used for feedback is normal.
 - Feedback stops: ECT is lower than the determined feedback zone.
 - Feedback stops: Open loop due to driving condition.
 - Feedback stops: Open loop due to detected system fault.

ON-BOARD DIAGNOSTIC [13B-MSP]

Sending Emission-related Malfunction Code

- The DTCs are shown below.

DTC table

N/A: Not applicable

DTC No.		Condition	MIL	Generator warning light	DC	Monitor item*1	Self test type*2	Memory function
2009MY	2008MY							
B1342	N/A	PCM malfunction	—	—	—	—	C, O	—
P0030	←	A/F sensor heater control circuit problem	ON	—	2	A/F sensor heater, HO2S heater	C	×
P0031	←	A/F sensor heater control circuit low input	ON	—	2	A/F sensor heater, HO2S heater	C, O, R	×
P0032	←	A/F sensor heater control circuit high input	ON	—	2	A/F sensor heater, HO2S heater	C, R	×
P0037	←	HO2S heater control circuit low input	ON	—	2	A/F sensor heater, HO2S heater	C, O, R	×
P0038	←	HO2S heater control circuit high input	ON	—	2	A/F sensor heater, HO2S heater	C, R	×
P0076*5	←	VDI solenoid valve control circuit low input	OFF	—	2	Other	C, O, R	×
P0077*5	←	VDI solenoid valve control circuit high input	OFF	—	2	Other	C	×
P0101	←	MAF sensor circuit range/performance problem	ON	—	2	CCM	C	×
P0102	←	MAF sensor circuit low input	ON	—	1	CCM	C, R	×
P0103	←	MAF sensor circuit high input	ON	—	1	CCM	C, O, R	×
P0107	←	BARO sensor circuit low input	ON	—	1	CCM	C, O, R	×
P0108	←	BARO sensor circuit high input	ON	—	1	CCM	C, O, R	×
P0111	←	IAT sensor circuit range/performance problem	ON	—	2	CCM	C	×
P0112	←	IAT sensor circuit low input	ON	ON	1	CCM	C, O, R	×
P0113	←	IAT sensor circuit high input	ON	ON	1	CCM	C, O, R	×
P0116	←	ECT sensor circuit range/performance problem	ON	—	2	Engine cooling system	C	×
P0117	←	ECT sensor circuit low input	ON	—	1	CCM	C, O, R	×
P0118	←	ECT sensor circuit high input	ON	—	1	CCM	C, O, R	×
P0122	←	TP sensor No.1 circuit low input	ON	—	1	CCM	C, O, R	×
P0123	←	TP sensor No.1 circuit high input	ON	—	1	CCM	C, O, R	×
P0125	←	Insufficient coolant temperature for closed loop fuel control	ON	—	2	Engine cooling system	C	×
P0126	←	Insufficient coolant temperature for stable operation	ON	—	2	Thermostat	C	×
P0130	←	A/F sensor circuit problem	ON	—	2	A/F sensor, HO2S	C, R	×
P0131	←	A/F sensor circuit low input	ON	—	2	A/F sensor, HO2S	C, R	×
P0132	←	A/F sensor circuit high input	ON	—	2	A/F sensor, HO2S	C, R	×
P0133	←	A/F sensor circuit slow response	ON	—	2	A/F sensor, HO2S	C	×
P0134	←	A/F sensor no activity detected	ON	—	2	A/F sensor, HO2S	C, R	×
P0137	←	HO2S circuit low input	ON	—	2	A/F sensor, HO2S	C	×
P0138	←	HO2S circuit high input	ON	—	2	A/F sensor, HO2S	C, O, R	×