

**DENSO**

**Diesel Injection Pump**

# **SERVICE MANUAL**

Common Rail System for TOYOTA AVEN-  
SIS 2AD-FTV/FHV Engine

**OPERATION**

**May, 2005**

DENSO CORPORATION

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# 1. PRODUCT APPLICATION INFORMATION

## 1.1 Outline

- The common rail system installed on the TOYOTA Avensis now employs the 2AD-FHV or 2AD-FTV model engines.  
For information on the basic CRS system, refer to "New Common Rail System with DPNR for TOYOTA Avensis" issued in October 2003 (Service Bulletin ECD 0302E.) Changes to old models are explained in each section.  
The piezo injector newly employed in the 2AD-FHV

## 1.2 Application

- The new 2AD-FHV and 2AD-FTV are employed in place of the discontinued 1CD-FTV.
- The Avensis exhaust volume has changed from 2.0L to 2.2L.

Vehicle Name	Vehicle Model	Engine Model	Exhaust Volume	Start of Production
Avensis	ADT251	2AD-FHV	2.2L	April, 2005
		2AD-FTV		

## 1.3 System Components Parts Number

- Below is a list of CRS related parts. Whether a particular part has changed or not is recorded in the "Remarks" column.

Parts Name	DENSO Parts Number	Manufacturer Parts Number	Engine Model	Remarks
Supply Pump	HU294000-0301	22100-0R020-A	2AD-FHV Only (For DPNR system)	Changed
Injector (Piezo Injector)	295900-0011	23670-26011-A		New Design
Rail	HU095440-0620	23810-0R020-C		Replaced with DENSO part
Discharge Valve	294290-0051	23990-30020		Changed
Engine ECU	MB175800-7372	89661-05A20-0		
EDU	131000-1370	89871-20070		
Pc Sensor	499000-6080	89458-60010		
Exhaust Fuel Addition Injector	297700-0030	23710-26010		
DPNR Element	253600-0020	A9945-22013		
A/F Sensor	211200-0400	89467-20060		
	211200-0410	89467-20070		
Exhaust Gas Temperature Sensor	265600-0871	89425-20360		
	265600-0882	89425-20370		
Differential Pressure Sensor	104990-1000	89480-20020		No Change

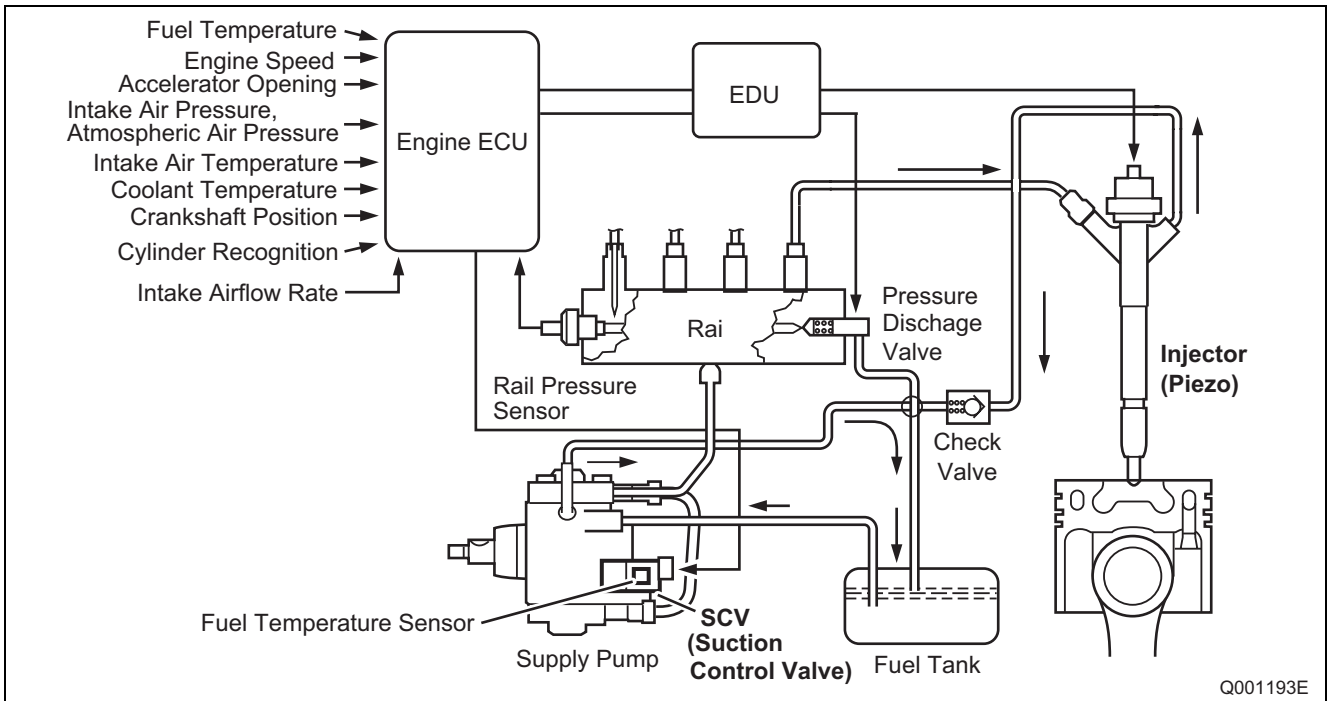
Parts Name	DENSO Parts Number	Manufacturer Parts Number	Engine Model	Remarks
Supply Pump	HU294000-0311	22100-0R010-A	2AD-FTV Only	Changed
Injector	HU095000-5611	23670-0R010-B		Changed
Rail	HU095440-0630	23810-0R010-C		Replaced with DENSO part
Pressure Limiter	HU095420-0300	23280-0R010		Newly Added
Engine ECU	MB175800-7382	89661-05820-0		Changed
EDU	131000-1331	89871-71010-A		
Pc Sensor	499000-6120	89458-71010-A		
Accelerator Position Sensor (RH)	198300-3031	89281-52011	2AD-FHV, -FTV	
Accelerator Position Sensor (LH)	198300-3041	89281-52021		
Coolant Temperature Sensor	179700-0451	89422-33030		
Crankshaft Position Sensor	029600-1420	90919-05064		
Cylinder Recognition Sensor	029600-0740	90919-05029		
Turbo Pressure Sensor	079800-7800	89421-20200		Newly Added
Air Mass Flow Sensor	197400-3070	22204-0N010		
EGR Valve	135000-7140	25620-0R010		Changed
	135000-7160	25620-26090		

## 2. OUTLINE OF SYSTEM

### 2.1 Outline of Composition and Operation

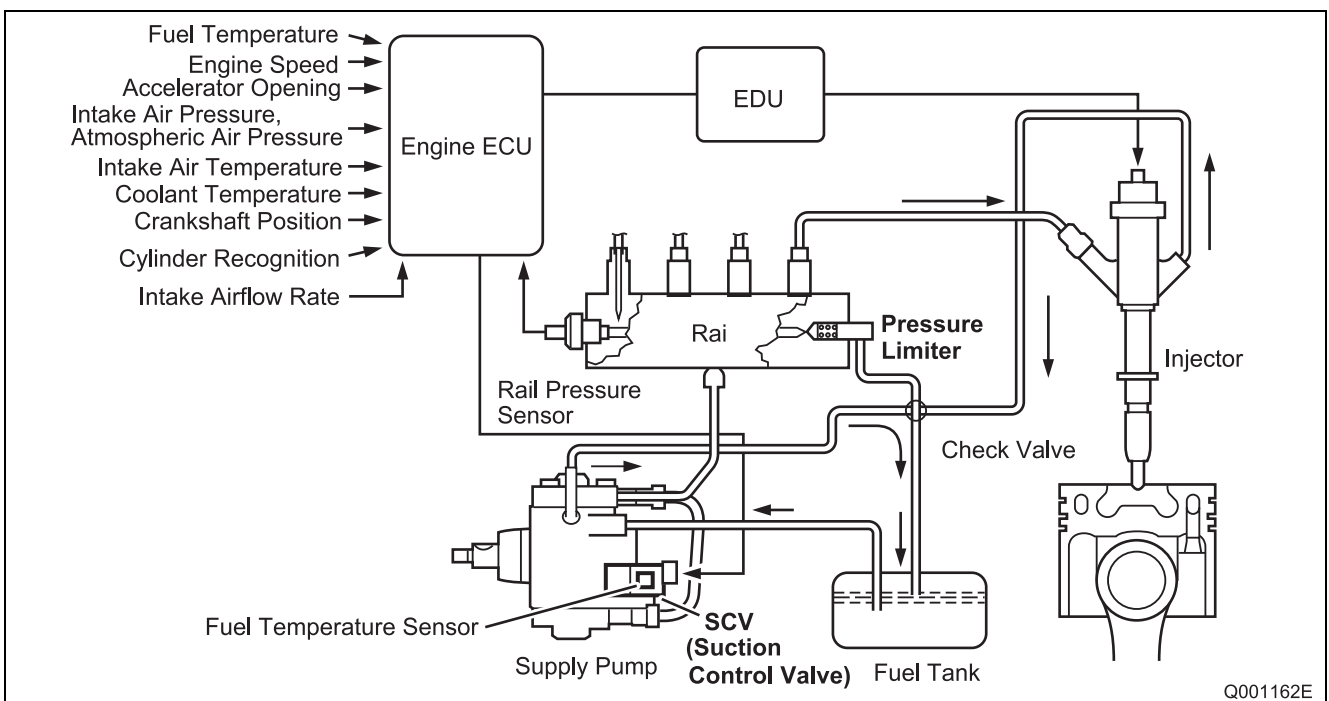
#### (1) 2AD-FHV

- The 2AD-FHV newly employs a piezo injector and compact SCV.



#### (2) 2AD-FTV

- The 2AD-FTV newly employs a pressure limiter and compact SCV.



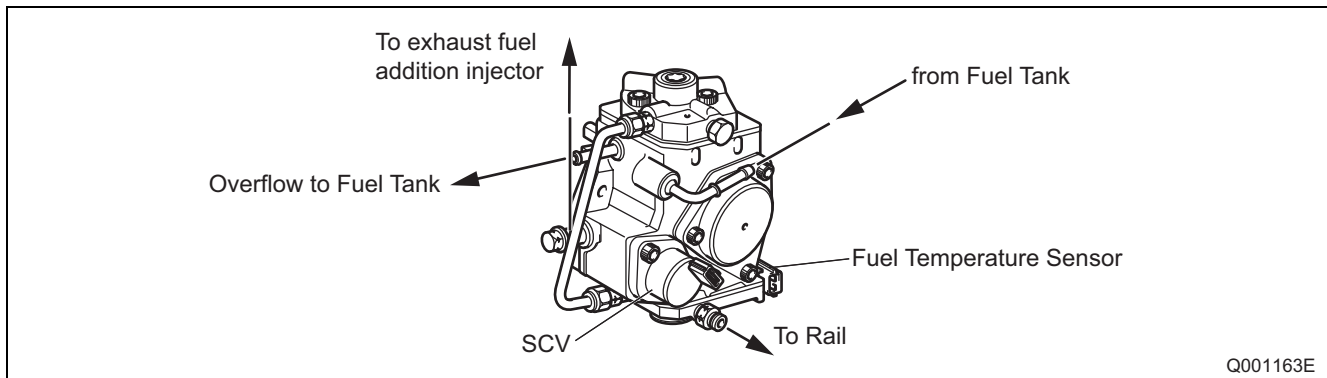


## 3. SUPPLY PUMP

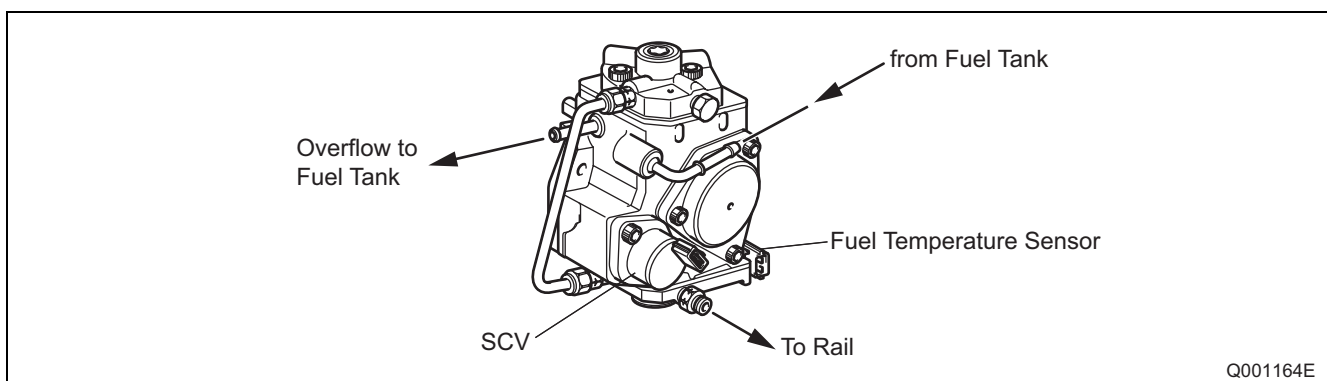
### 3.1 Outline

- A compact SCV is employed.

#### (1) 2AD-FHV (for DPNR)

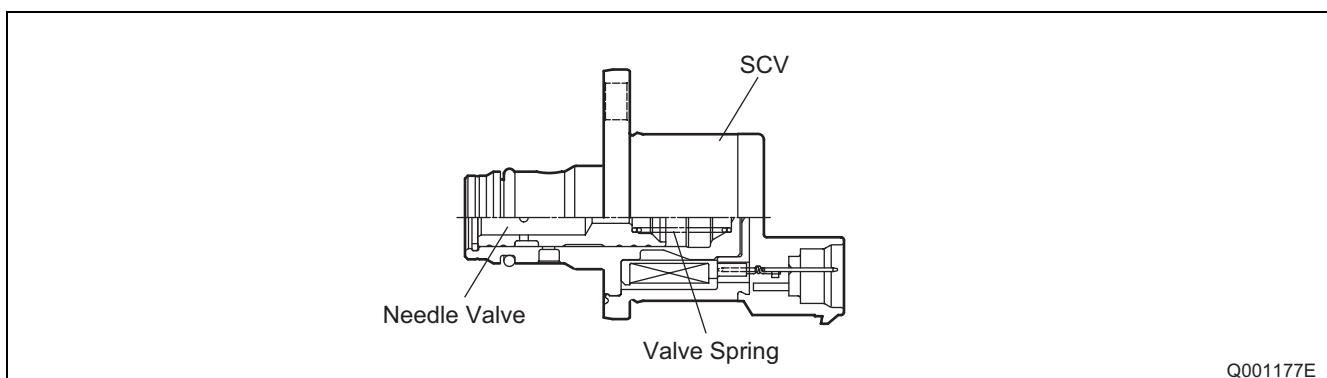


#### (2) 2AD-FTV



### 3.2 SCV

- An increase in response capabilities is realized due to the compactness of the SCV. Refer to "Common Rail System for TOYOTA HILUX, KIYANG INNOVA, INNOVA 1KD/2KD" (Service Manual 00400077E), pages 13-15, issued in July 2004 regarding construction and operation of the SCV.

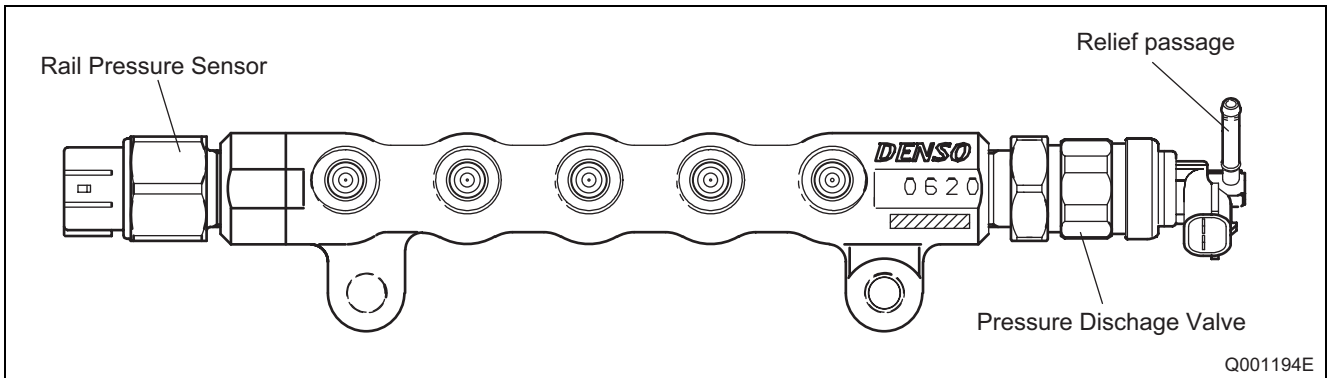


## 4. RAIL

### 4.1 Outline

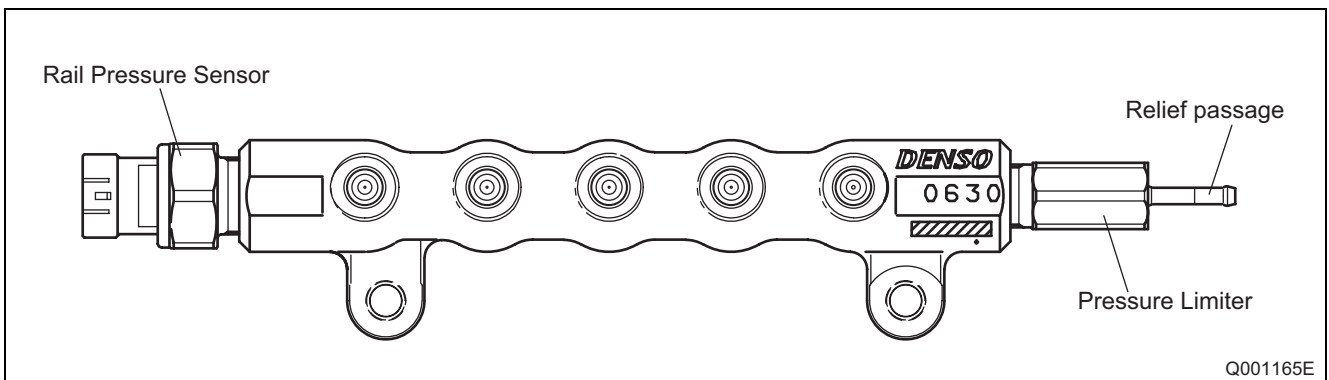
#### (1) 2AD-FHV

- The 2AD-FHV rail has been changed from a non-DENSO product to a DENSO-made rail.



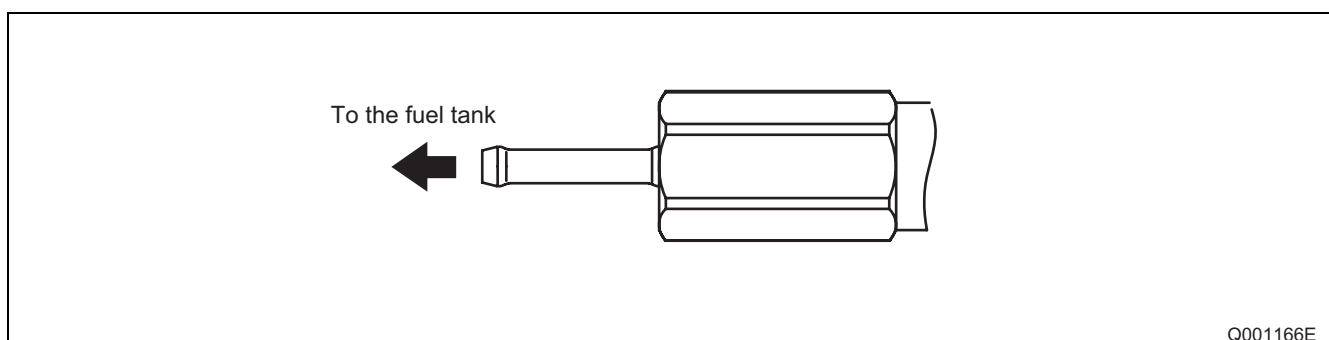
#### (2) 2AD-FTV

- The 2AD-FTV rail has been changed from a non-DENSO product to a DENSO-made rail.
- A pressure limiter is newly employed in place of the discontinued pressure discharge valve.



### 4.2 Pressure limiter

- The pressure limiter releases pressure when the internal pressure of the rail becomes abnormally high. The pressure limiter opens when internal pressure reaches 211MPa (kg/cm<sup>2</sup>) and closes when rail pressure reaches a given set pressure. Fuel released from the pressure limiter is returned to the fuel tank.

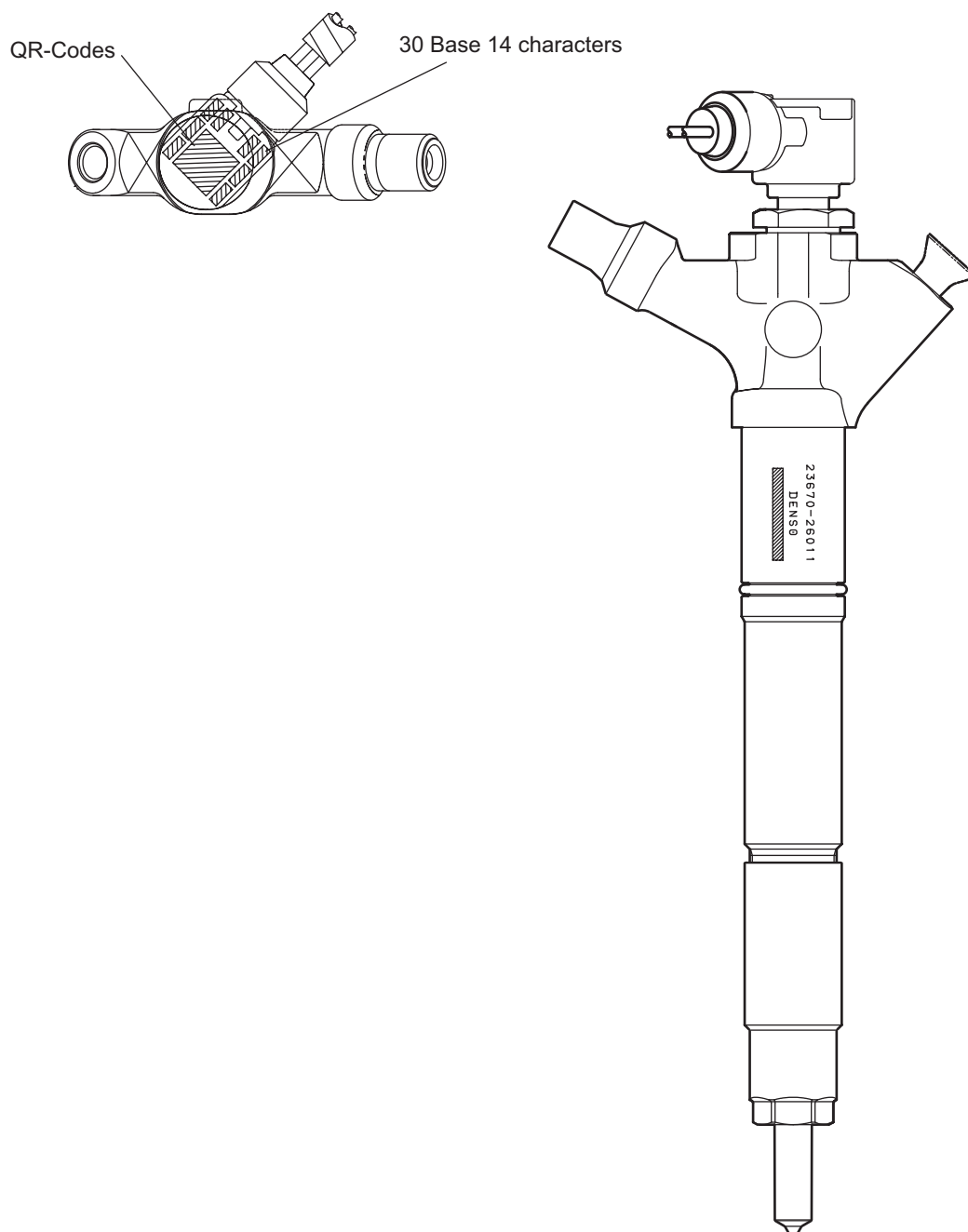


## 5. INJECTOR

### 5.1 Outline

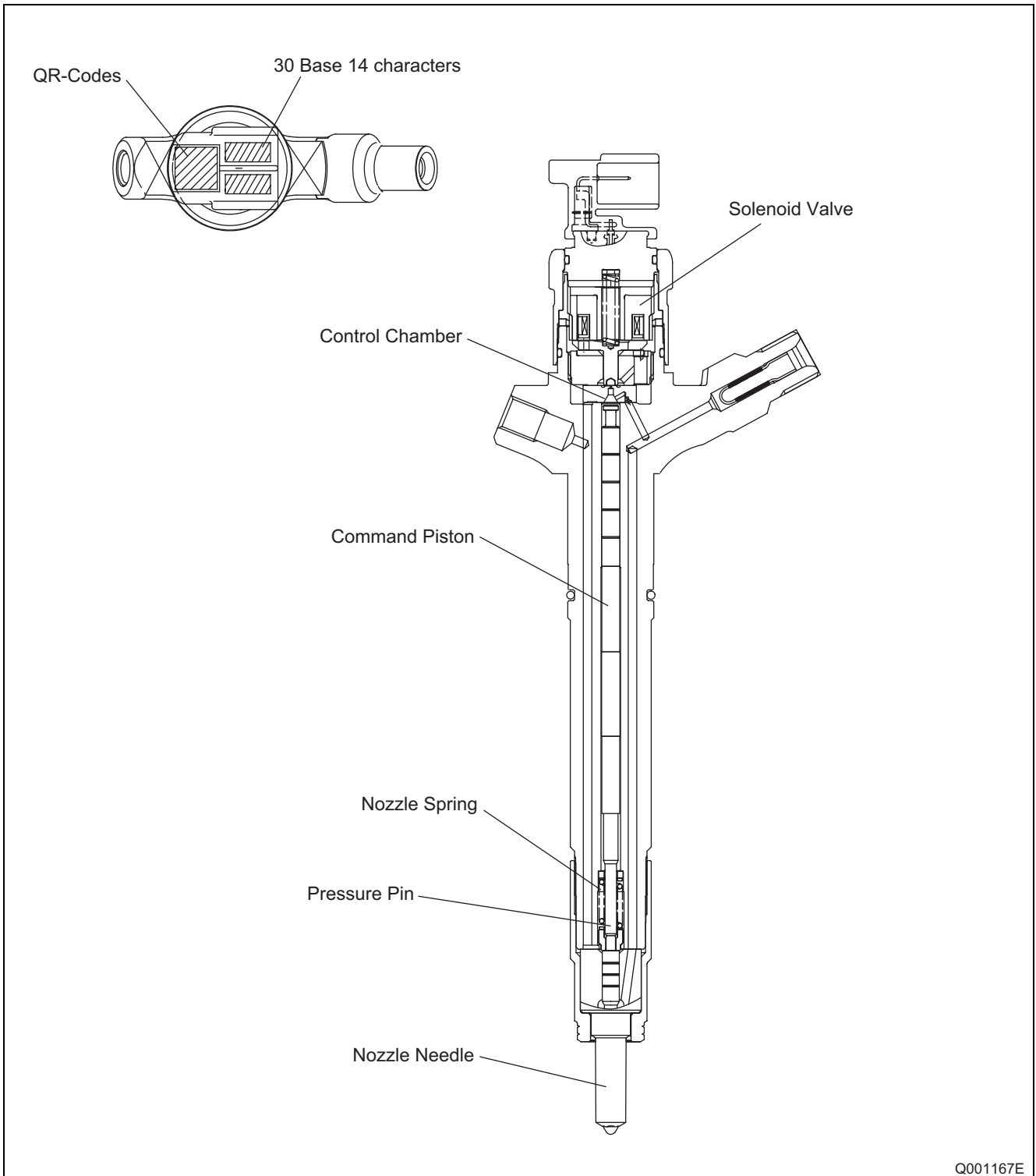
#### (1) 2AD-FHV

- The piezo injector is comprised of a piezo stack, large and small pistons, three-way valve and a needle.



## (2) 2AD-FTV

- The G2 injector employed on the 2AD-FTV has changed from the old conventional shape.
- The G2 injector has not changed in regards to the old model.



## 5.2 Operation (Piezo Injector for 2AD-FHV)

- The piezo injector newly employed in the 2AD-FHV increases responsiveness and makes more precise control possible. The piezo element expands when voltage is applied. The piezo injector uses this characteristic to control the pressure of the control chamber, open and close the needle, and control the start and stop of injection through moving the three-way valve up and down.

The following explains piezo injector operation (reference items (1) - (3) below.)

### (1) Non-injection

- When the piezo element is not energized, the inside of the control chamber and the needle have the same fuel pressure applied to them from the rail, causing the needle to close under needle spring pressure.

### (2) Injection

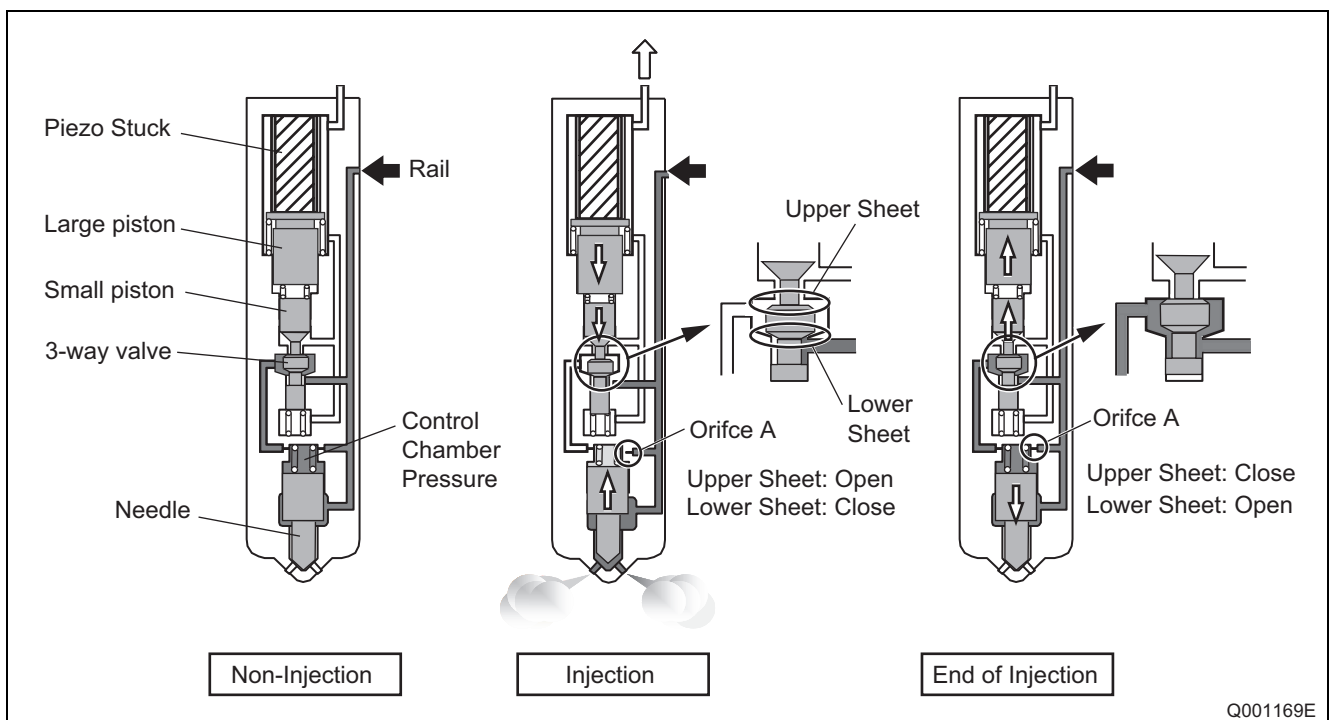
- When the piezo element is energized it expands, pushing the large and small pistons downward.

This further pushes the three-way valve downward, opening the upper sheet and closing the lower sheet. As a result, the passage to the control chamber is sealed off. Since there is not a rapid transfer of pressure to the control chamber due to orifice "A", the pressure in the control chamber drops off.

Due to the drop in fuel pressure in the control chamber, the fuel pressure placed on the needle is greater, pushing the needle upwards and allowing injection to begin.

### (3) End of injection

- Once the piezo element is de-energized it begins to contract, allowing the large piston, small piston and three-way valve to travel upwards. The three-way valve closes the upper sheet and opens the lower sheet. As a result, the passage to the control chamber opens, instantaneously making the fuel pressure inside the control chamber return to rail pressure. The needle is pushed down, and injections stops.

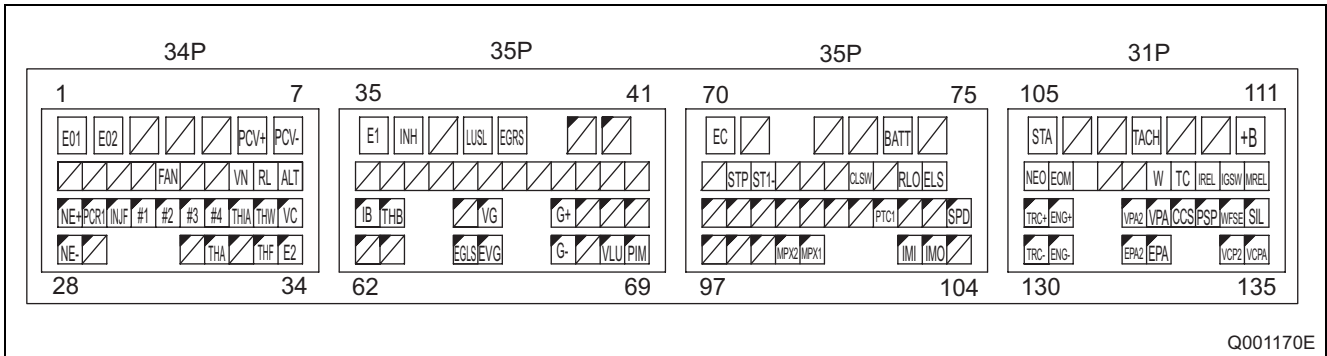


## 6. DESCRIPTION OF CONTOROL SYSTEM COMPONENTS

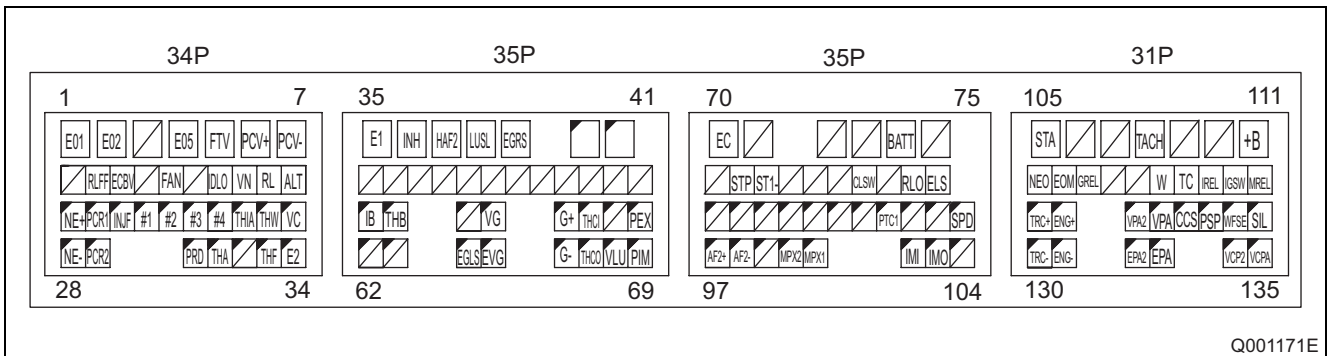
### 6.1 ECU Connector Terminal Layout

- Changes have been made to the ECU. The terminal layout is as per the diagram below.

#### (1) 2AD-FHV



#### (2) 2AD-FTV



< NOTE >

\*1 : 2AD-FHV Only

No.	Code	Terminal Description	No.	Code	Terminal Description
1	E01	Power Earth (Engine Earth)	13	-	
2	E02	Power Earth (Engine Earth)	14	IDLO*1	EDU
3	-		15	VN	E-VRV
4	E05*1	A/F Sensor (Out) Earth	16	RL	Regulator (L terminal)
5	FIV*1	Fuel Additive Valve	17	ALT	Regulator (M terminal)
6	PCV+	PCV	18	NE+	Engine Speed Sensor +
7	PCV-	PCV	19	PCR1	Rail Sensor (Main)
8	-		20	INJF	EDU
9	RLFF*1	EDU	21	#1	EDU
10	ECBV*1	EGR Cooler Bypass VSV	22	#2	EDU
11	-		23	#3	EDU

No.	Code	Terminal Description	No.	Code	Terminal Description
12	Cooling Fan Relay		24	#4	EDU
25	THIA	Intake Air Temp. Sensor	63	-	
26	THW	Coolant Temp. Sensor	64	EGLS	EGR Lift Sensor
27	VC	Sensor Power Supply	65	EVG	Air Flow Meter Earth
28	NE-	Engine Speed Sensor -	66	G-	Cylinder Recognition Sensor -
29	PCR2*1	Rail Sensor (Sub)	67	THCO*1	Exhaust Gas Temp. Sensor (Out)
30	PRD*1	EDU	68	VLU	Diesel Throttle Position Sensor
31	THA	Air Temp. Sensor	69	PIM	Turbo Pressure Sensor
32	-		70	EC	Body Earth
33	THF	Fuel temp. Sensor	71	-	
34	E2	Sensor Earth	72	-	
35	E1	Earth (Engine Earth)	73	-	
36	INH	Combination Switch	74	BATT	Battery
37	HAF2*1	A/F Sensor (Out) Heater	75	-	
38	LUSL	Diesel Throttle Drive IC	76	-	
39	EGRS	EGR Linear Solenoid	77	STP	Stop Light Switch
40	VCS*1	Rail Pressure Sensor (Power Supply)	78	ST1-	Stop Light Switch
41	E2S*1	Rail Pressure Sensor (Earth)	79	-	
42	-		80	-	
43	-		81	-	
44	-		82	CLSW	Clutch Switch
45	-		83	-	
46	-		84	RLO	Regulator
47	-		85	ELS	Tail Light Relay
48	-		86	-	
49	-		87	-	
50	-		88	-	
51	-		89	-	
52	-		90	-	
53	-		91	-	
54	IB	Battery Current Sensor	92	-	
55	THB	Battery Liquid Temp. Sensor	93	PTC1	A/C Amplifier
56	-		94	-	
57	VG	Air Flow Meter	95	-	
58	G+	Cylinder Recognition Sensor +	96	SPD	Speed Sensor (Meter)
59	THCI*1	Exhaust Gas Temp. Sensor (IN)	97	AF2+*1	A/F Sensor (Out)
60	-		98	AF2-*1	A/F Sensor (Out) Ground
61	PEX*1	DPNR Differential Pressure Sensor	99	-	
62	-		100	MPX2	A/C Amplifier, Other

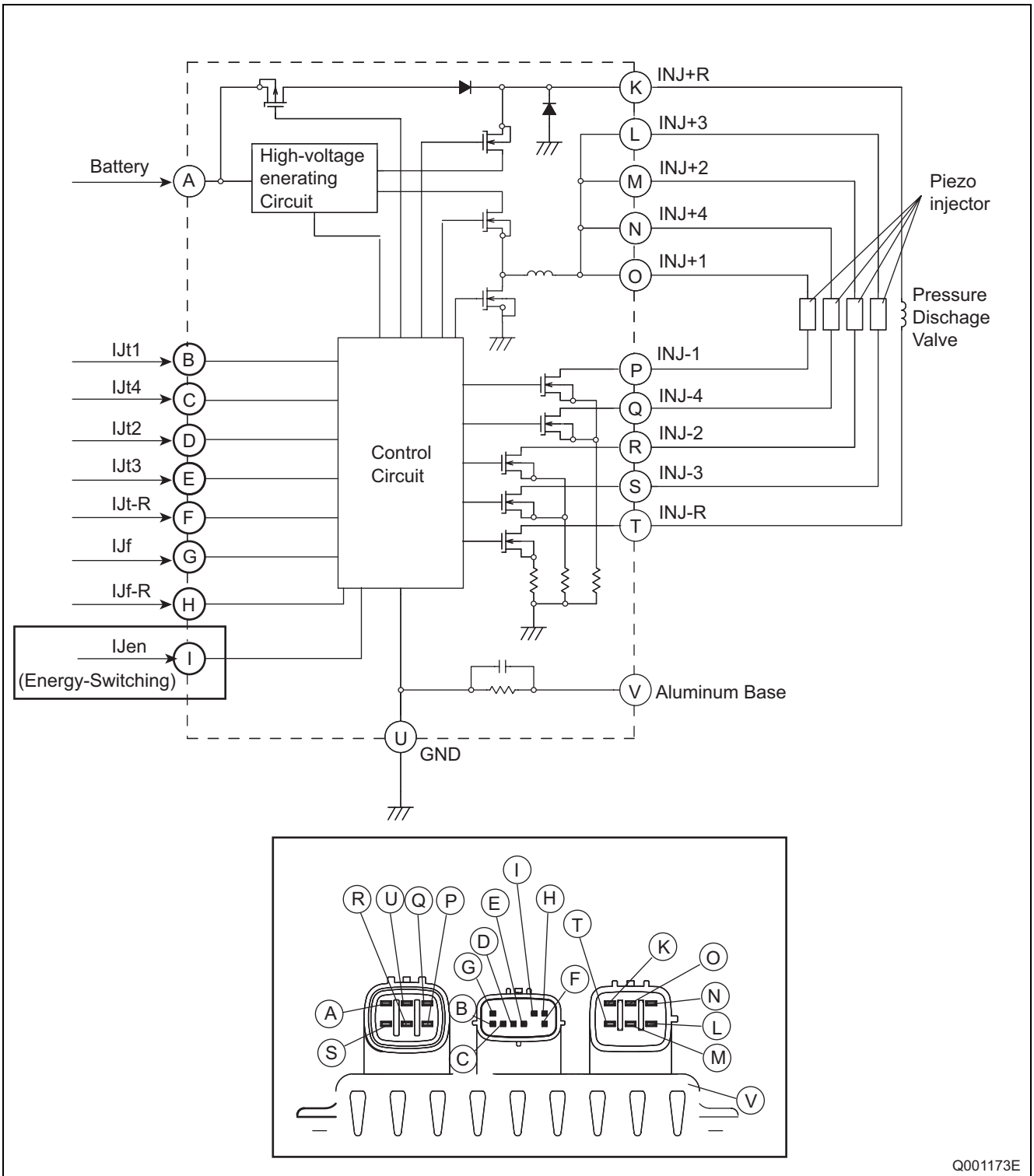
No.	Code	Terminal Description	No.	Code	Terminal Description
101	MPX1	A/C Amplifier, Other	119	IREL	ECU Relay
102	IMI	Immobilizer Input	120	IGSW	Ignition Switch
103	IMO	Immobilizer Output	121	MREL	Main Relay and A/F Relay
104	-		122	TRC+	VSC, TRC ECU
105	STA	Starter Relay	123	ENG+	VSC, TRC ECU
106	-		124	VPA2	Accelerator Position Sensor (Sub)
107	-		125	VPA	Accelerator Position Sensor (Main)
108	TACH	Meter	126	CCS	Cruise Control Switch
109	-		127	PSP	PS Pressure Sensor
110	-		128	WFSE	DLC3
111	+B	Battery + Main Relay	129	SIL	DLC3
112	NEO	VSC, TRC ECU	130	TRC-	VSC, TRC ECU
113	EOM	Immobilizer	131	ENG-	VSC, TRC ECU
114	GREL	Glow Plug Relay	132	EPA2	Accelerator Position Sensor (Earth)
115	-		133	EPA	Accelerator Position Sensor (Earth)
116	-		134	VCP2	Accelerator Position Sensor (Power Supply)
117	W	Warning Light	135	VCPA	Accelerator Position Sensor (Power Supply)
118	TC	Check Connector			

## 6.2 EDU (Electronic Driving Unit)

### (1) 2AD-FHV

- An actuation energy-switching signal (input terminal "IJen") has been added to the EDU.  
During only idle speed operation, a signal is sent to the EDU switching the injector to low energy actuation. As a result, noise reduction at idle speed is achieved.
- The shape of the EDU connector has changed.

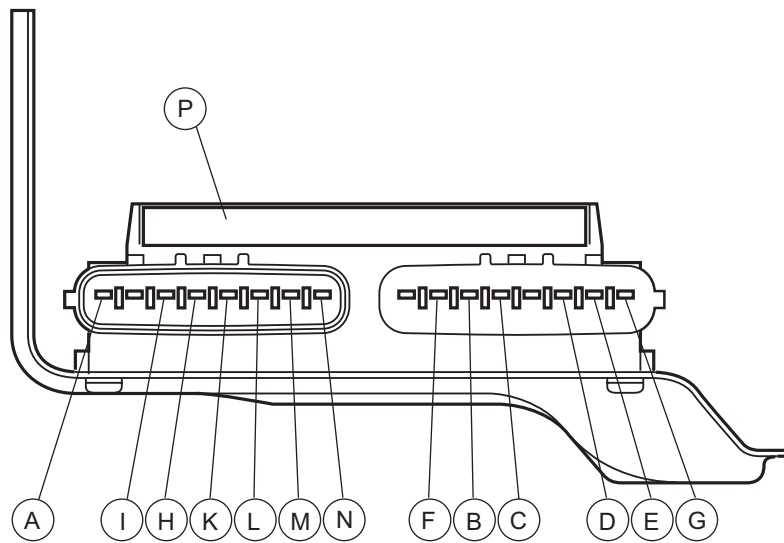
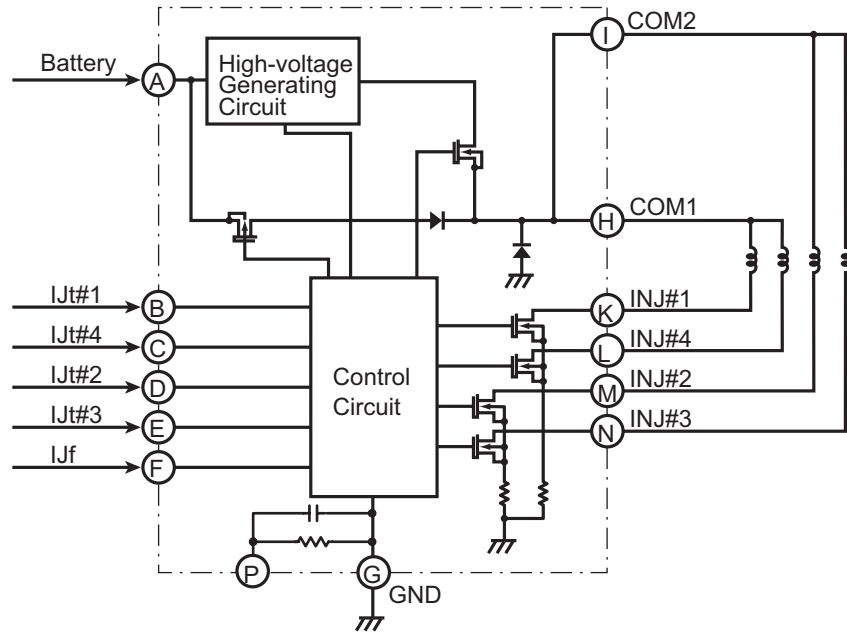




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**(2) 2AD-FTV**

- The discharge valve wiring has been deleted from the EDU wiring diagram.



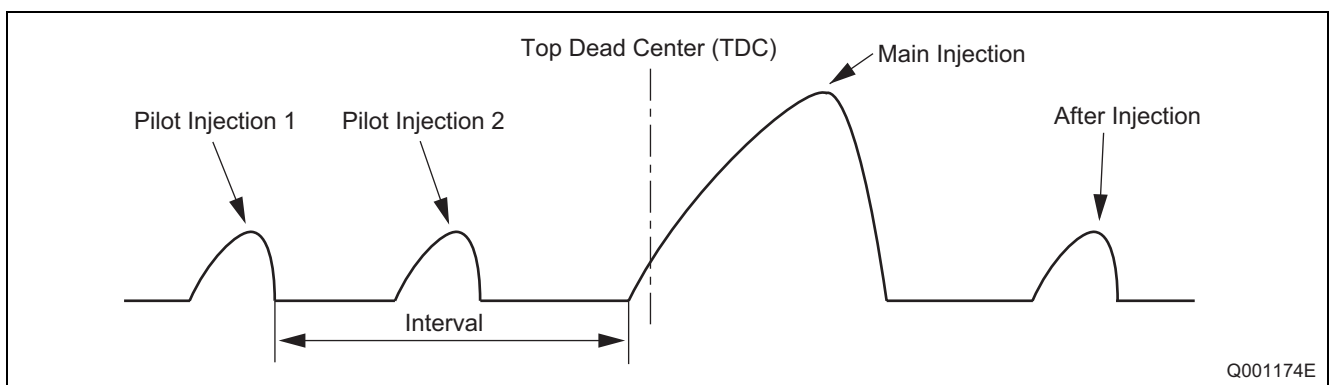
## 7. FUEL INJECTION TIMING CONTROL

### 7.1 Outline

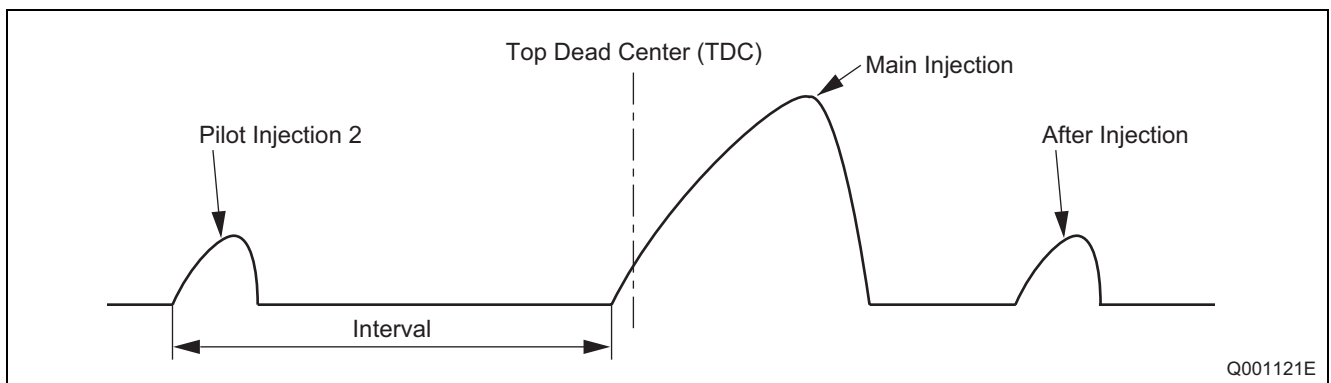
- After injection has been introduced in addition to the injection pattern and control timing. As a result, a reduction in PM as well as combustion noise is realized.

### 7.2 Injection Pattern

#### (1) 2AD-FHV

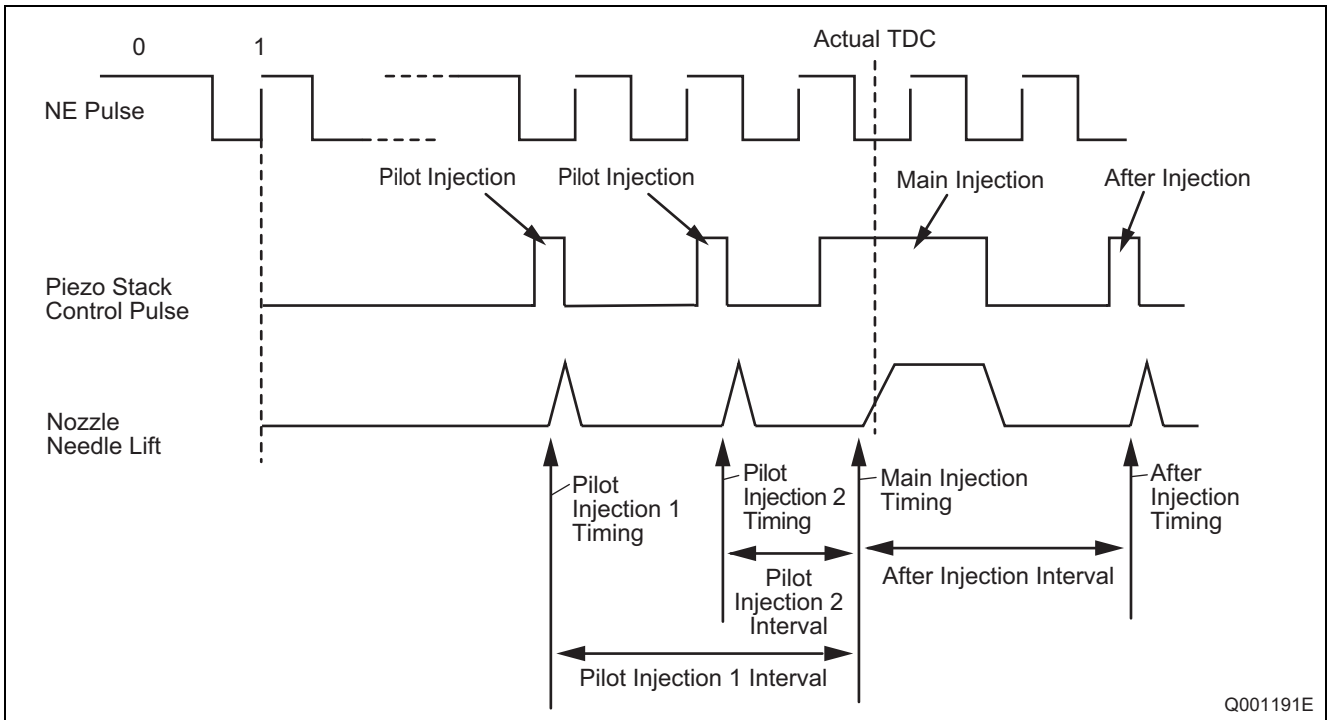


#### (2) 2AD-FTV

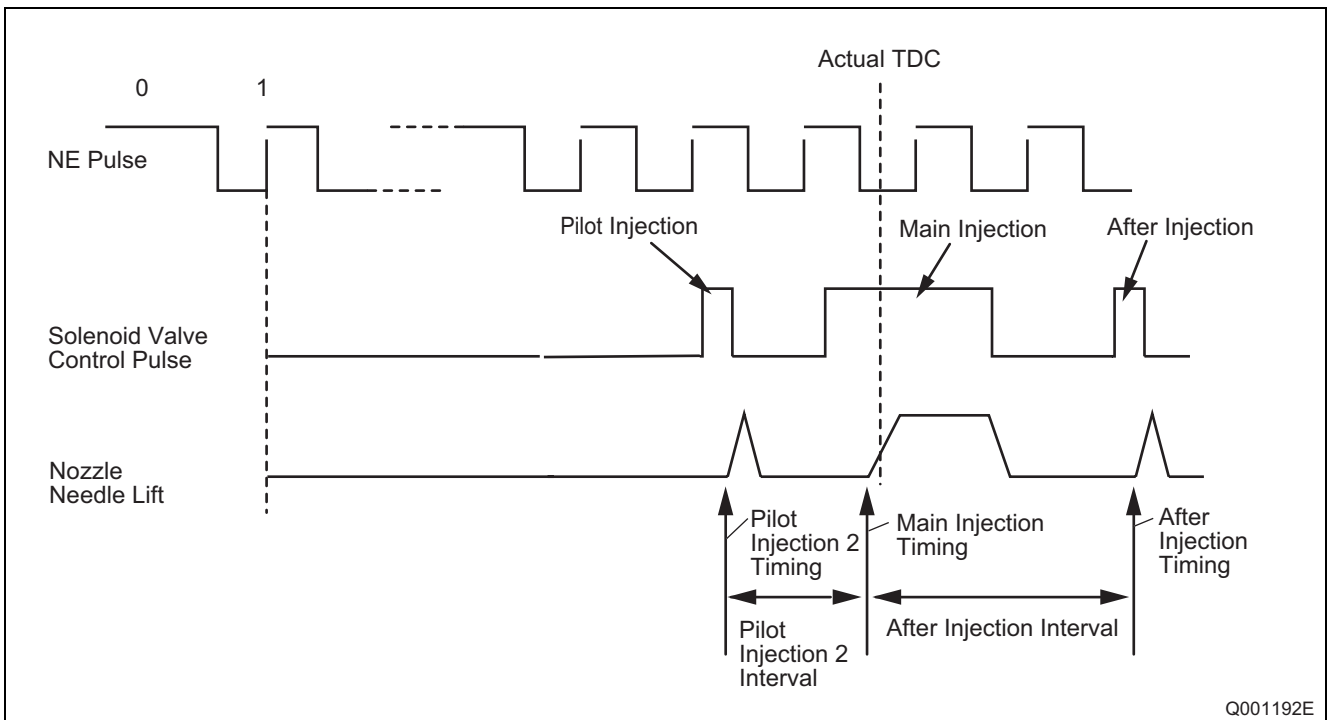


### 7.3 Control Timing

#### (1) 2AD-FHV



#### (2) 2AD-FTV



## 8. DIAGNOSTIC TROUBLE CODES (DTC)

### 8.1 About the Codes Shown in the Table

- Diagnostic trouble codes (SAE codes) that utilize the STT (Intelligent Tester II) are displayed as output codes.
- If multiple DTCs are output, they are shown in order starting with the lowest number

### 8.2 Diagnosis Trouble Code Table

< NOTE >

\*1 : 2AD-FHV Only

\*2 : 2AD-FTV Only

DTC Code (SAE code)	Detection Item	Trouble Area
P0031*1	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• Open in A/F sensor heater circuit</li> <li>• A/F sensor heater</li> </ul>
P0032*1	Oxygen (A/F) Sensor Heater Circuit High (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• A/F sensor heater relay</li> <li>• Engine ECU</li> </ul>
P0045	Turbocharger / Supercharger Boost Control Solenoid Circuit / Open	<ul style="list-style-type: none"> <li>• VRV</li> <li>• Open or short in VRV circuit</li> <li>• Engine ECU</li> </ul>
P0087	Rail System Pressure - Too low	<ul style="list-style-type: none"> <li>• Open or short in fuel pressure sensor circuit</li> <li>• Fuel pressure sensor</li> <li>• Engine ECU</li> </ul>
P0088	Rail System Pressure - Too High	<ul style="list-style-type: none"> <li>• Supply pump (suction control valve)</li> <li>• Rail assembly (pressure discharge valve)*1</li> <li>• Pressure limiter*2</li> <li>• Short in supply pump (suction control valve) circuit</li> <li>• Engine ECU</li> </ul>
P0093	Fuel System Leak Detected - large Leak	<ul style="list-style-type: none"> <li>• Fuel line between supply pump and rail</li> <li>• Fuel line between rail and each injector</li> <li>• Supply pump</li> <li>• Rail</li> <li>• Injectors</li> <li>• Pressure discharge valve*1</li> <li>• Pressure limiter*2</li> <li>• Open or short in EDU circuit (P0200 set simultaneously)</li> <li>• Open or short in injector circuit</li> <li>• EDU (P0200 set simultaneously)</li> <li>• Engine ECU</li> </ul>
P0095	Intake Air Temperature Sensor 2 Circuit	<ul style="list-style-type: none"> <li>• Open or short in diesel turbo IAT sensor circuit</li> </ul>
P0097	Intake Air Temperature Sensor 2 Circuit Low	<ul style="list-style-type: none"> <li>• Diesel turbo IAT sensor</li> </ul>
P0098	Intake Air Temperature Sensor 2 Circuit High	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>
P0100	Mass or Volume Air Flow Circuit	<ul style="list-style-type: none"> <li>• Open or short in mass air flow meter circuit</li> <li>• Mass air flow meter</li> <li>• Engine ECU</li> </ul>

DTC Code (SAE code)	Detection Item	Trouble Area
P0101	Mass or Volume Air Flow Circuit Range / Performance Problem	<ul style="list-style-type: none"> <li>• Mass air flow meter</li> </ul>
P0102	Air Flow Meter Circuit Low Input	<ul style="list-style-type: none"> <li>• Open or short in mass air flow meter circuit</li> </ul>
P0103	Air Flow Meter Circuit High Input	<ul style="list-style-type: none"> <li>• Mass air flow meter</li> <li>• Engine ECU</li> </ul>
P0105	Turbo Pressure / Atmospheric Pressure Circuit	<ul style="list-style-type: none"> <li>• Open or short in turbo pressure sensor circuit</li> <li>• Turbo pressure sensor</li> <li>• Turbocharger assembly</li> <li>• EGR valve assembly</li> <li>• Engine ECU</li> </ul>
P0106	Turbo Pressure / Atmospheric Pressure Circuit Range / Performance Problem	<ul style="list-style-type: none"> <li>• Turbo pressure sensor</li> </ul>
P0107	Turbo Pressure / Atmospheric Pressure Circuit Low Input	<ul style="list-style-type: none"> <li>• Open or short in turbo pressure sensor circuit</li> <li>• Turbo pressure sensor</li> </ul>
P108	Turbo Pressure / Atmospheric Pressure Circuit High Input	<ul style="list-style-type: none"> <li>• Turbocharger assembly</li> <li>• EGR valve assembly</li> <li>• Engine ECU</li> </ul>
P0110	Intake Air Temperature Circuit	<ul style="list-style-type: none"> <li>• Open or short in IAT sensor circuit</li> </ul>
P0112	Intake Air Temperature Circuit Low Input	<ul style="list-style-type: none"> <li>• IAT sensor</li> </ul>
P0113	Intake Air Temperature Circuit High Input	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>
P0115	Coolant Temperature Circuit	<ul style="list-style-type: none"> <li>• Open or short in ECT sensor circuit</li> <li>• ECT sensor</li> <li>• Engine ECU</li> </ul>
P0116	Coolant Temperature Circuit Range / Performance	<ul style="list-style-type: none"> <li>• Coolant temperature sensor</li> </ul>
P0117	Coolant Temperature Circuit Low Input	<ul style="list-style-type: none"> <li>• Open or short in ECT sensor circuit</li> </ul>
P0118	Coolant Temperature Circuit High Input	<ul style="list-style-type: none"> <li>• ECT sensor</li> <li>• Engine ECU</li> </ul>
P0120	Throttle Position Sensor / Switch "A" Circuit	<ul style="list-style-type: none"> <li>• Open or short in throttle position sensor circuit</li> <li>• Throttle position sensor</li> <li>• Engine ECU</li> </ul>
P0122	Throttle Position Sensor / Switch "A" Circuit Low Input	<ul style="list-style-type: none"> <li>• Throttle position sensor</li> <li>• Open or short in VLU circuit</li> <li>• Open in VC circuit</li> <li>• Engine ECU</li> </ul>
P0123	Throttle Position Sensor / Switch "A" Circuit High Input	<ul style="list-style-type: none"> <li>• Throttle position sensor</li> <li>• Open in E2 circuit</li> <li>• VC and VLU circuits are short-circuited</li> <li>• Engine ECU</li> </ul>
P0168	Fuel Temperature Sensor Too High	<ul style="list-style-type: none"> <li>• Fuel temperature sensor</li> </ul>
P0180	Fuel Temperature Sensor Circuit "A" Circuit	<ul style="list-style-type: none"> <li>• Open or short in fuel temperature sensor circuit</li> <li>• Fuel temperature sensor</li> <li>• Engine ECU</li> </ul>
P0182	Fuel Temperature Sensor Circuit "A" Circuit Low Input	
P0183	Fuel Temperature Sensor Circuit "A" Circuit High Input	

DTC Code (SAE code)	Detection Item	Trouble Area
P0190	Rail Pressure Sensor Circuit	<ul style="list-style-type: none"> <li>• Open or short in rail pressure sensor circuit</li> <li>• Rail pressure sensor</li> <li>• Engine ECU</li> </ul>
P0192	Rail Pressure Sensor Circuit Low Input	
P0193	Rail Pressure Sensor Circuit High Input	
P0191*1	Rail Pressure Sensor Circuit Range / Performance	<ul style="list-style-type: none"> <li>• Rail pressure sensor</li> </ul>
P0200	Injector Circuit / Open	<ul style="list-style-type: none"> <li>• Open or short in EDU circuit</li> <li>• Injector</li> <li>• EDU</li> <li>• Engine ECU</li> </ul>
P0234	Turbocharger / Supercharger Overboost Condition	<ul style="list-style-type: none"> <li>• E-VRV for turbocharger</li> <li>• Open or short in VRV circuit</li> <li>• Turbocharger</li> <li>• Vacuum hose</li> <li>• EGR valve</li> <li>• Engine ECU</li> </ul>
P0299	Turbocharger / Supercharger Underboost	
P0335	Crankshaft Position Sensor "A" Circuit	<ul style="list-style-type: none"> <li>• Open or short in crankshaft position sensor circuit</li> <li>• Crankshaft position sensor</li> <li>• Crankshaft position sensor plate No.1</li> <li>• Engine ECU</li> </ul>
P0339	Crankshaft Position Sensor "A" Circuit Intermittent	
P0340	Cylinder Recognition Sensor "A" Circuit (Bank 1 or Single Sensor)	<ul style="list-style-type: none"> <li>• Open or short in Cylinder Recognition sensor circuit</li> <li>• Cylinder Recognition sensor</li> <li>• Pump drive shaft pulley</li> <li>• Engine ECU</li> </ul>
P0400	Exhaust Gas Recirculation Flow	<ul style="list-style-type: none"> <li>• EGR valve stuck</li> <li>• EGR valve does not move smoothly</li> <li>• Open or short in E-VRV for EGR circuit</li> <li>• open or short in EGR valve position sensor circuit</li> <li>• EGR valve position sensor</li> <li>• Vacuum pump</li> <li>• Vacuum hose connection loose</li> <li>• Engine ECU</li> </ul>
P0405	Exhaust Gas Recirculation Sensor "A" circuit Low	<ul style="list-style-type: none"> <li>• Open or short in EGR valve position sensor circuit</li> <li>• EGR valve position sensor</li> <li>• Engine ECU</li> </ul>
P0406	Exhaust Gas Recirculation Sensor "A" circuit High	
P0488	Exhaust Gas Recirculation Throttle Position Control Range / performance	<ul style="list-style-type: none"> <li>• Throttle valve stuck</li> <li>• Throttle valve does not move smoothly</li> <li>• Open or short in throttle valve circuit</li> <li>• Open or short in throttle valve position sensor circuit</li> <li>• Throttle position sensor (built in diesel throttle body assembly)</li> <li>• Engine ECU</li> </ul>
P0500	Vehicle Speed Sensor "A"	<ul style="list-style-type: none"> <li>• Open or short in speed sensor circuit</li> <li>• Speed sensor</li> <li>• Combination meter</li> <li>• Engine ECU</li> </ul>

DTC Code (SAE code)	Detection Item	Trouble Area	
P0504	Brake Switch "A" / "B" Correlation	<ul style="list-style-type: none"> <li>• Short in stop light switch signal circuit</li> <li>• Stop light switch</li> <li>• Engine ECU</li> </ul>	
P0516	Battery Temperature Sensor Circuit Low	<ul style="list-style-type: none"> <li>• Battery thermometer sensor</li> </ul>	
P0517	Battery Temperature Sensor Circuit High	<ul style="list-style-type: none"> <li>• Short in battery thermometer sensor circuit</li> <li>• Engine ECU</li> </ul>	
P0544*1	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• Open or short in exhaust gas temperature sensor (on up stream) circuit</li> <li>• Exhaust gas temperature sensor (on up stream)</li> <li>• Engine ECU</li> </ul>	
P545*1	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 1)		
P546*1	Exhaust Gas Temperature Sensor Circuit High (Bank 1 Sensor 1)		
P0560	System Voltage	<ul style="list-style-type: none"> <li>• Open in back-up power source circuit</li> <li>• Low battery voltage</li> <li>• Engine ECU</li> </ul>	
P0606	Engine ECU / PCM Processor	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>	
P0607	Control Module Performance		
P0617	Starter Relay Circuit High	<ul style="list-style-type: none"> <li>• Starter relay circuit</li> <li>• ignition switch</li> <li>• Engine ECU</li> </ul>	
P0627	Fuel Pump Control Circuit / Open	<ul style="list-style-type: none"> <li>• Open or short in suction control valve circuit</li> <li>• Suction control valve</li> <li>• Engine ECU</li> </ul>	
P1229	Fuel Pump System	<ul style="list-style-type: none"> <li>• Short in supply pump (suction control valve) circuit</li> <li>• Supply pump (suction control valve)</li> <li>• Engine ECU</li> </ul>	
P1238	Injector Malfunction	Main	<ul style="list-style-type: none"> <li>• Injector</li> <li>• EDU (P0200 is set simultaneously)</li> <li>• Open or short in engine wire harness (P0200 is set simultaneously)</li> <li>• Connector connection (P0200 is set simultaneously)</li> <li>• Compression pressure</li> <li>• Valve clearance</li> </ul>
		Related	<ul style="list-style-type: none"> <li>• Valve timing</li> <li>• Engine ECU</li> </ul>
P1251	Turbocharger / Supercharger Overboost Condition (Too High)	<ul style="list-style-type: none"> <li>• E-VRV for turbocharger</li> <li>• Open or short in VRV circuit</li> <li>• Turbocharger</li> <li>• Vacuum hose</li> <li>• EGR valve</li> <li>• Engine ECU</li> </ul>	
P1271*1	Fuel Regulator Circuit Malfunction (EDU Drive)	<ul style="list-style-type: none"> <li>• Open or short in pressure discharge valve circuit</li> <li>• Open or short in pressure discharge valve itself</li> <li>• EDU</li> <li>• Engine ECU</li> </ul>	



DTC Code (SAE code)	Detection Item	Trouble Area	
P1272*1	Fuel Regulator Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open or short in pressure discharge valve circuit (P1271 is set simultaneously)</li> <li>• Pressure discharge valve</li> <li>• Supply pump</li> <li>• Engine ECU</li> </ul>	
P1386*1	Injector for Exhaust Fuel Addition	Main	<ul style="list-style-type: none"> <li>• Open or short in exhaust fuel addition injector circuit</li> <li>• Exhaust fuel addition injector</li> <li>• DPNR catalytic converter (Manifold converter sub-assembly)</li> </ul>
		Replaced	<ul style="list-style-type: none"> <li>• Open in exhaust temperature sensor circuit</li> <li>• A/F sensor</li> <li>• Exhaust gas temperature sensor</li> <li>• Supply pump assembly</li> <li>• Mass air flow meter</li> <li>• Fuel leaks in exhaust fuel addition injector</li> <li>• Main injector</li> <li>• Cylinder compression pressure</li> <li>• Valve Clearance</li> <li>• Valve timing</li> <li>• Air intake system has blockages</li> <li>• Air intake system has leakage</li> <li>• Exhaust system has blockages</li> <li>• Exhaust system has leakage</li> <li>• EGR system has blockages</li> <li>• EGR system has leakage</li> <li>• Engine ECU</li> </ul>
P1425*1	Differential Pressure Sensor Circuit	<ul style="list-style-type: none"> <li>• Open or short in differential pressure sensor circuit</li> <li>• Incorrect arrangement differential pressure sensor hose piping</li> <li>• Differential pressure sensor</li> <li>• Engine ECU</li> </ul>	
P1426*1	Differential Pressure Sensor Installation Error	<ul style="list-style-type: none"> <li>• Incorrect arrangement differential pressure sensor hose piping</li> <li>• Differential pressure sensor vacuum hose is clogged</li> <li>• Blockage in vacuum transmitting pipe sub-assembly</li> <li>• Differential pressure sensor</li> <li>• Engine ECU</li> </ul>	
P1427*1	Differential Pressure Sensor Circuit Low	<ul style="list-style-type: none"> <li>• Open or short in differential pressure sensor circuit</li> <li>• Incorrect arrangement differential pressure sensor hose piping</li> <li>• Differential pressure sensor</li> <li>• Engine ECU</li> </ul>	
P1428*1	Differential Pressure Sensor Circuit High		
P1550	Battery Current Sensor Circuit	<ul style="list-style-type: none"> <li>• Short in battery current sensor circuit</li> </ul>	
P1551	Battery Current Sensor Circuit Low	<ul style="list-style-type: none"> <li>• Battery current sensor</li> <li>• Engine ECU</li> </ul>	
P1552	Battery Current Sensor Circuit High		
P1601	EEPRPOM Error-Injector Correction Value, DPNR Thermal Degradation Record	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>	
P1602	Deterioration of Battery	<ul style="list-style-type: none"> <li>• Battery</li> <li>• Engine ECU back-up power source circuit</li> </ul>	
P1611	IC Circuit Malfunction	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>	

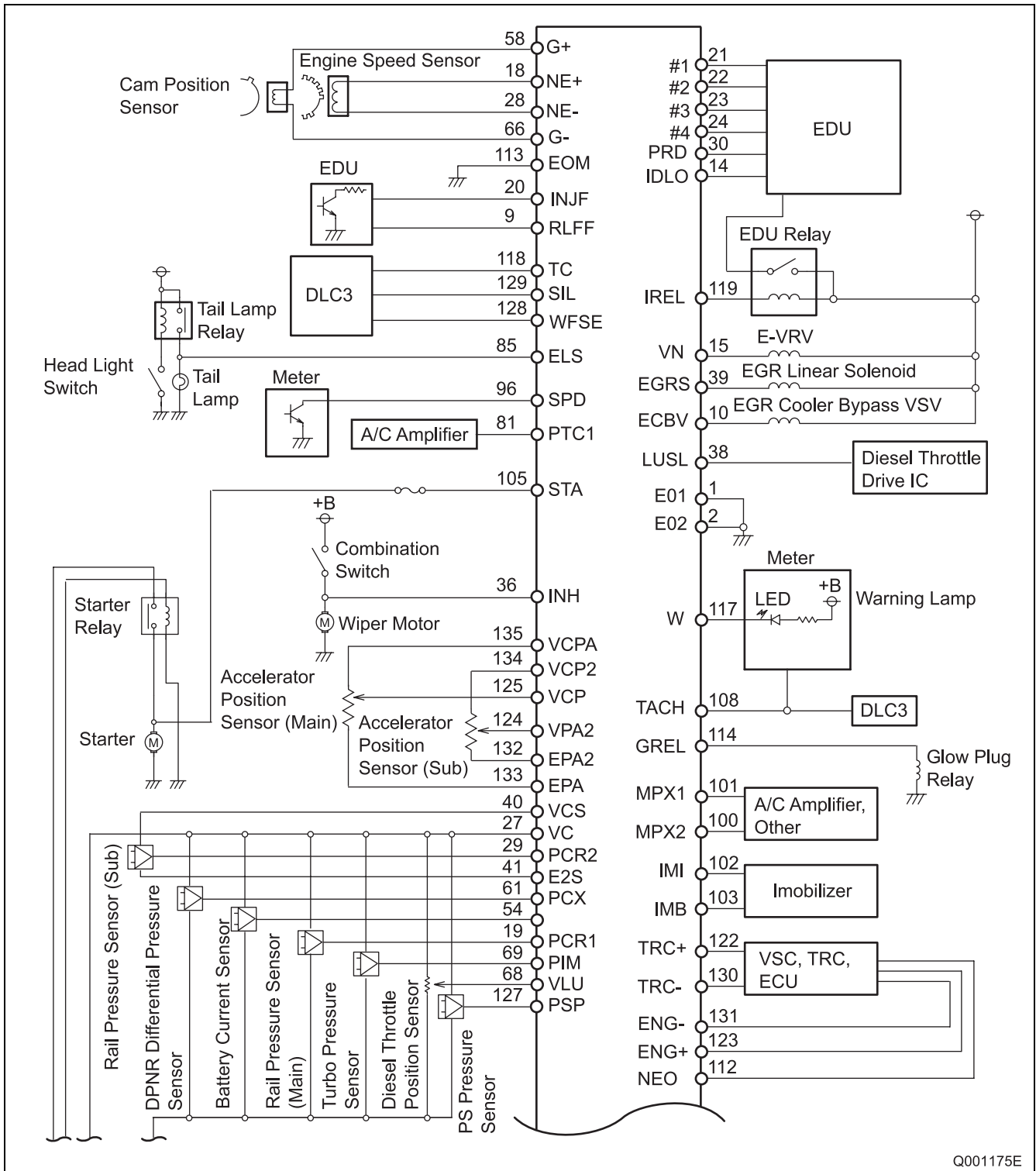
DTC Code (SAE code)	Detection Item	Trouble Area
P1625*1	Idle Signal Transmitter Circuit	<ul style="list-style-type: none"> <li>• Open or short in idle control circuit</li> <li>• Engine ECU</li> </ul>
P2002*1	Particulate Trap Efficiency Below Threshold (Bank 1)	<ul style="list-style-type: none"> <li>• DPNR catalytic converter (Manifold converter sub-assembly)</li> <li>• Differential pressure sensor</li> <li>• Differential pressure sensor vacuum hose is clogged</li> <li>• Blockage in vacuum transmitting pipe sub-assembly</li> <li>• Exhaust gas temperature sensor</li> <li>• Exhaust gas leaks in TOYOTA D-CAT</li> <li>• Mass air flow meter</li> <li>• Engine ECU</li> </ul>
P2031*1	Exhaust Gas Temperature Sensor Circuit (Bank 1 sensor 2)	<ul style="list-style-type: none"> <li>• Open or short in exhaust gas temperature sensor (on down stream)</li> <li>• Exhaust gas temperature sensor (on down stream)</li> <li>• Engine ECU</li> </ul>
P2032*1	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 sensor 2)	
P2033*1	Exhaust Gas Temperature Sensor Circuit High (Bank 1 sensor 2)	
P2047*1	Reductant Injector Circuit / Open (Bank 1 sensor 2)	<ul style="list-style-type: none"> <li>• Open in exhaust fuel addition injector circuit</li> <li>• Exhaust fuel addition injector</li> <li>• Engine ECU</li> </ul>
P2120	Accelerator Position Sensor / Switch "D" Circuit	<ul style="list-style-type: none"> <li>• Accelerator position sensor</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>
P2121	Accelerator Position Sensor / Switch "D" Circuit Range / Performance	<ul style="list-style-type: none"> <li>• Accelerator position sensor circuit</li> <li>• Accelerator position sensor</li> <li>• Engine ECU</li> </ul>
P2122	Accelerator Position Sensor / Switch "D" Circuit Low Input	<ul style="list-style-type: none"> <li>• Accelerator position sensor</li> <li>• Open in VCPA circuit</li> <li>• VPA circuit open or ground short</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>
P2123	Accelerator Position Sensor / Switch "D" Circuit High Input	<ul style="list-style-type: none"> <li>• Accelerator position sensor</li> <li>• Open in EPA circuit</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>
P2125	Accelerator Position Sensor / Switch "E" Circuit	<ul style="list-style-type: none"> <li>• Accelerator position sensor</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>
P2127	Accelerator Position Sensor / Switch "E" Circuit Low Input	<ul style="list-style-type: none"> <li>• Accelerator position sensor</li> <li>• Open in VCP2 circuit</li> <li>• VPA2 circuit open or ground short</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>

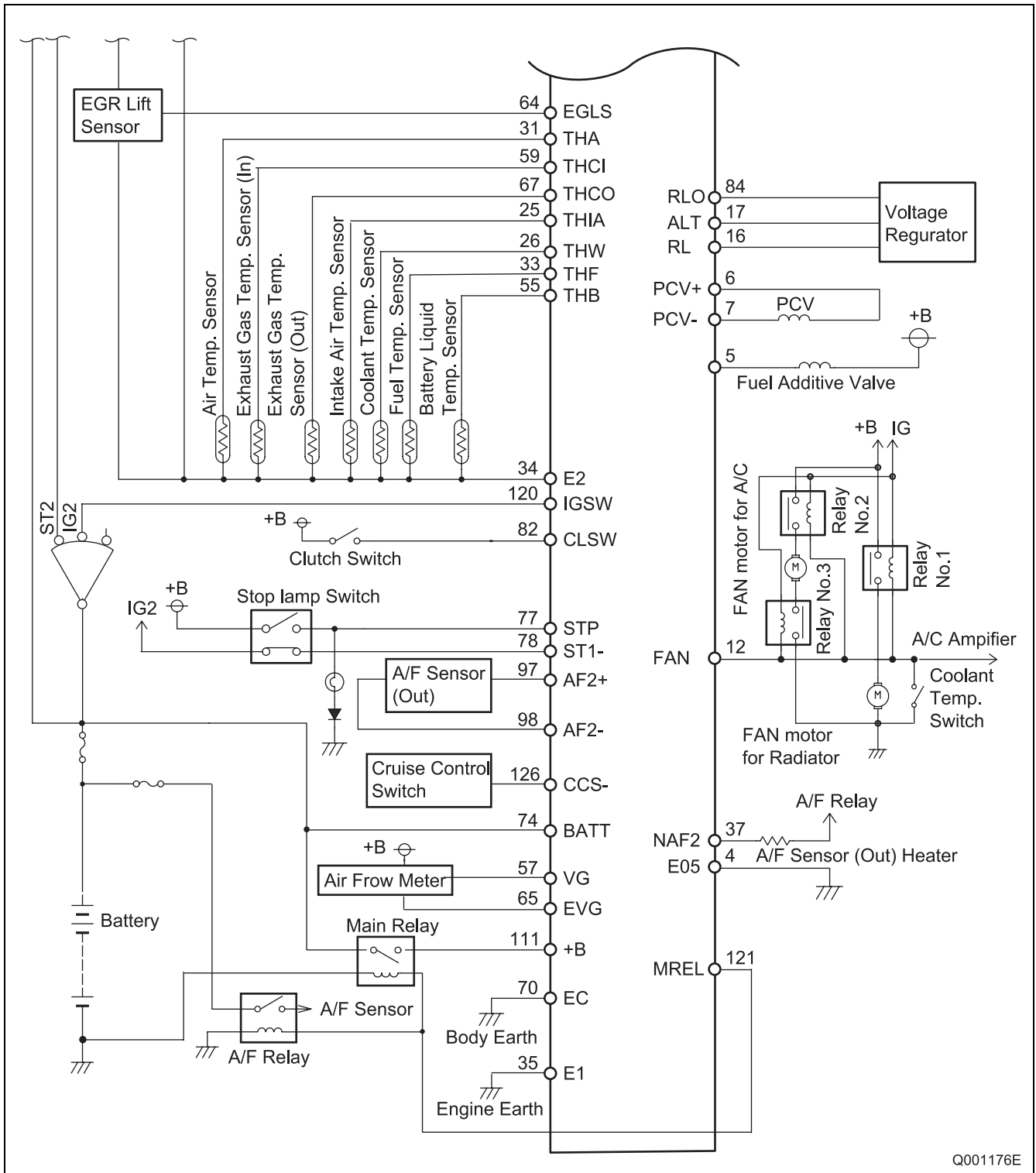
DTC Code (SAE code)	Detection Item	Trouble Area
P2128	Accelerator Position Sensor / Switch "E" Circuit High Input	<ul style="list-style-type: none"> <li>• Accelerator position sensor</li> <li>• Open in EPA2 circuit</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>
P2138	Accelerator Position Sensor / Switch "D"/ "E" Voltage Correlation	<ul style="list-style-type: none"> <li>• VPA and VPA2 circuit are short circuited</li> <li>• Accelerator position sensor</li> <li>• Accelerator pedal</li> <li>• Accelerator pedal rod (arm) deformed</li> <li>• Engine ECU</li> </ul>
P2226	Atmospheric Pressure Circuit	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>
P2227	Atmospheric Pressure Circuit Range / Performance	
P2228	Atmospheric Pressure Circuit low Input	
P2229	Atmospheric Pressure Circuit High Input	
P2237*1	Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1)	
P2238*1	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• Open or short in A/F sensor circuit</li> <li>• A/F sensor</li> </ul>
P2239*1	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• A/F sensor heater</li> <li>• A/F sensor heater relay</li> </ul>
P2252*1	Oxygen (A/F) Sensor	<ul style="list-style-type: none"> <li>• A/F sensor heater and relay circuit</li> </ul>
P2253*1	Oxygen (A/F) Sensor	<ul style="list-style-type: none"> <li>• Engine ECU</li> </ul>
P2502	Charging System Voltage	<ul style="list-style-type: none"> <li>• Open in generator circuit</li> <li>• Generator</li> <li>• Drive belt</li> <li>• Engine ECU</li> </ul>

# 9. EXTERNAL WIRING DIAGRAM

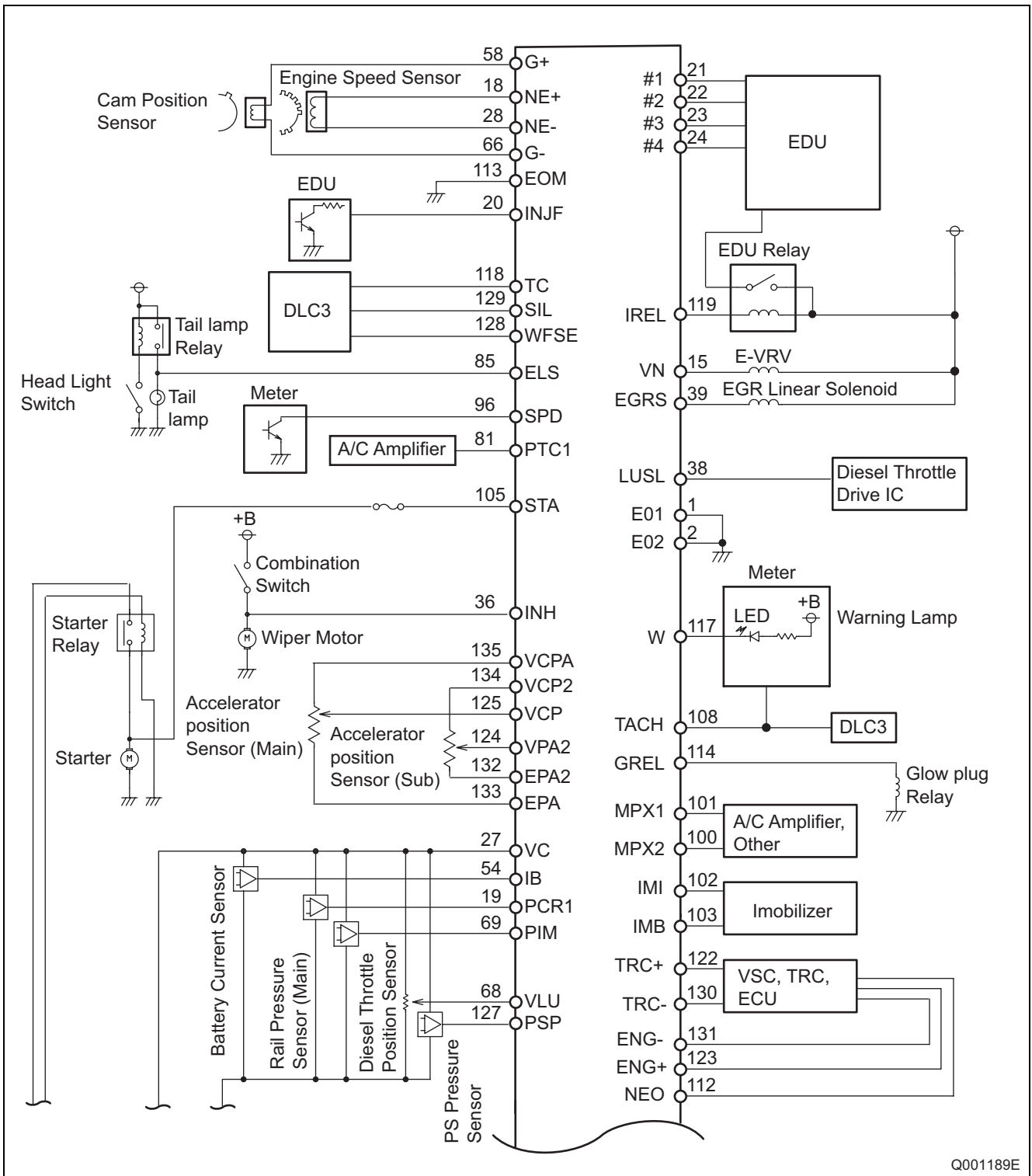
## 9.1 ECU External wiring diagram

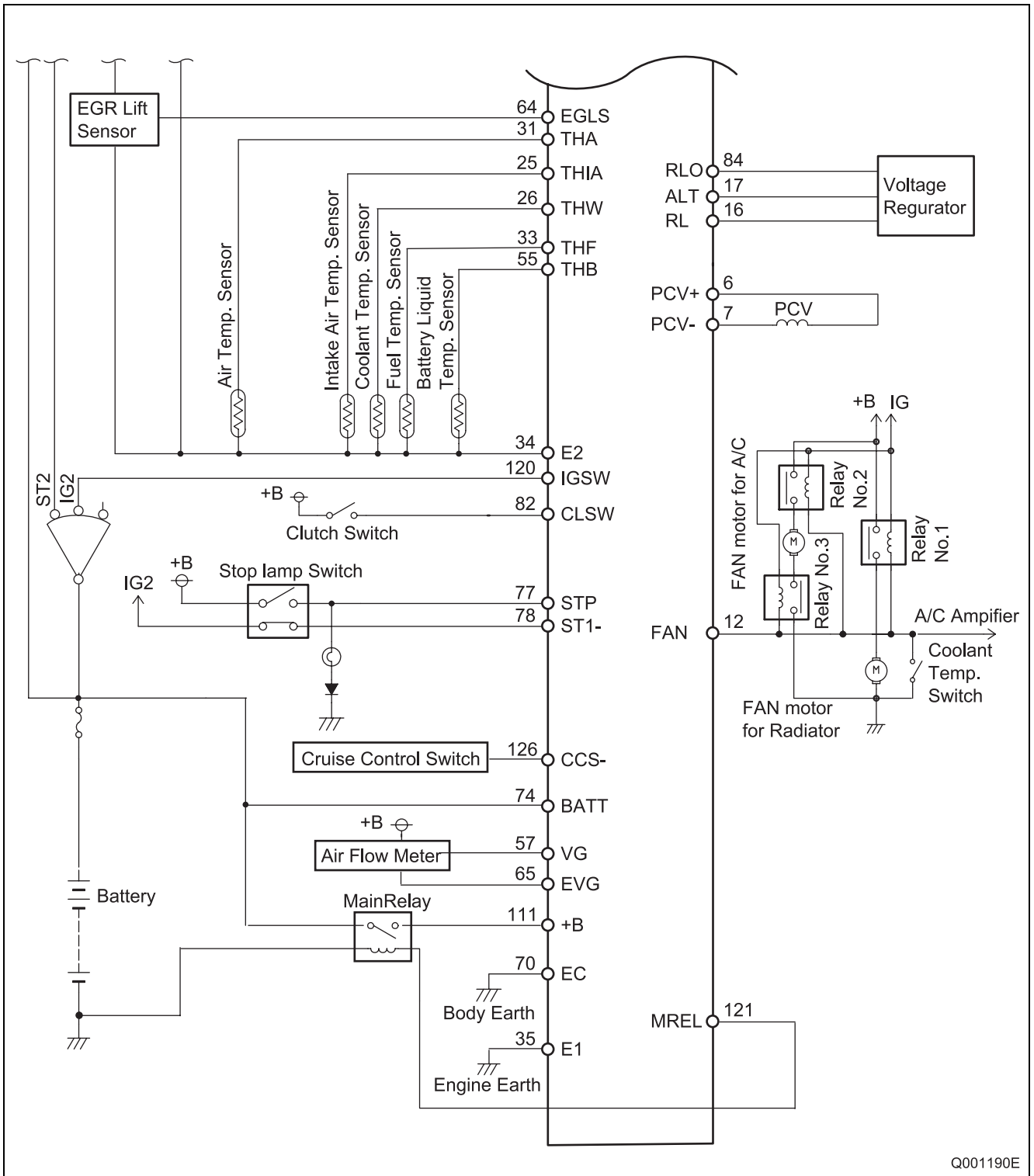
### (1) 2AD-FHV





(2) 2AD-FTV





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