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|---|---|---|
| **Last Modified:** 03-12-2013 | 6.4 F | **Doc ID:** NM1000000004HD2 |
| **Model Year:** 2013 | **Model:** RAV4 | **Prod Date Range:** [12/2012 - ] |
| **Title:** 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: GENERAL; 2013 MY RAV4 [12/2012 - ] | | |

# GENERAL

## 1. OUTLINE

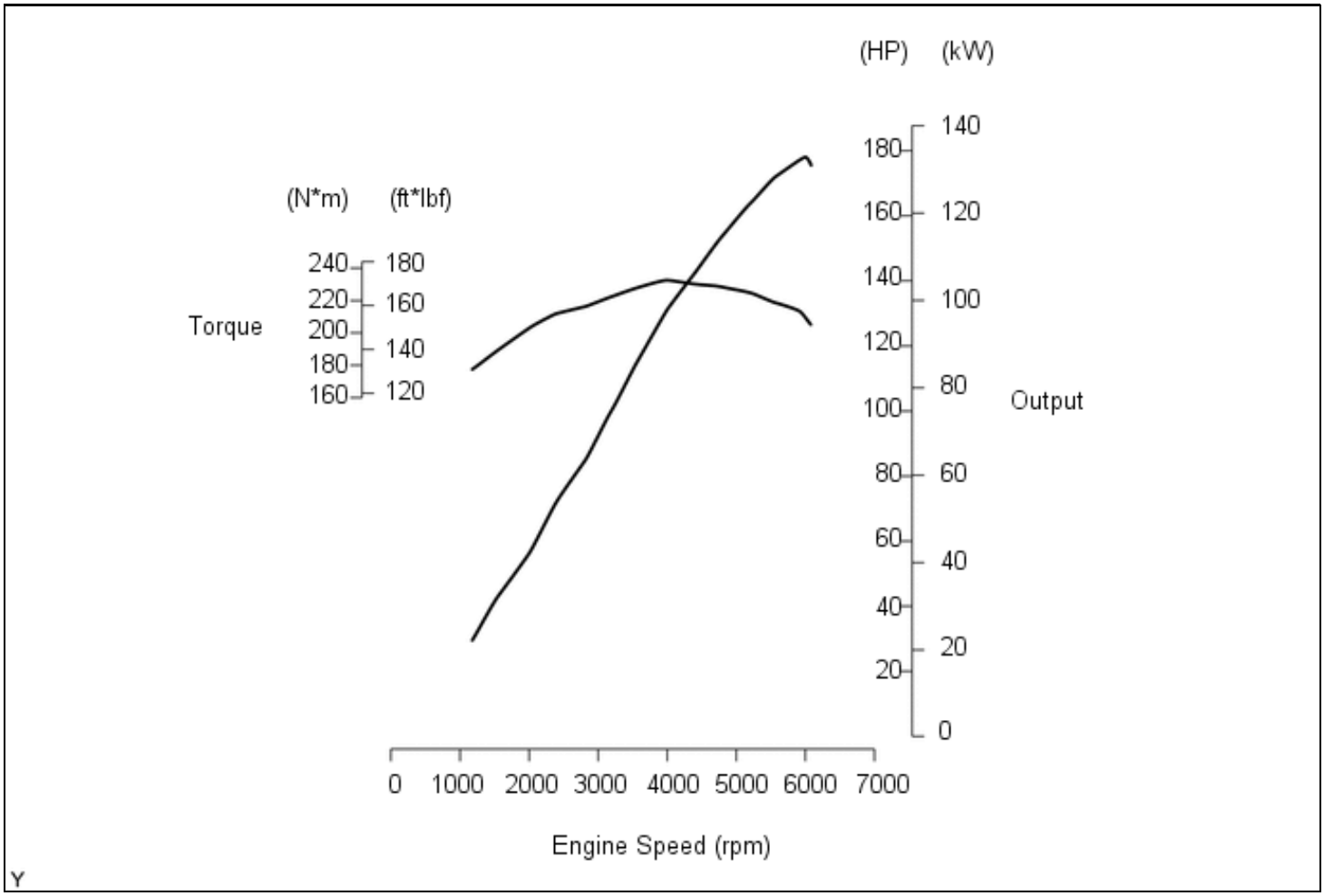
(a) The 2AR-FE engine is an in-line, 4-cylinder, 2.5-liter, 16-valve DOHC engine. This engine uses the Dual Variable Valve Timing-intelligent (Dual VVT-i) system, Direct Ignition System (DIS), Acoustic Control Induction System (ACIS) and Electronic Throttle Control System-intelligent (ETCS-i). It has been developed to achieve high performance, quietness, fuel economy and clean emissions.

## 2. SPECIFICATION

| | | | |
|---|---|---|---|
| No. of Cyls. and Arrangement | | | 4-cylinder, In-line |
| Valve Mechanism | | | 16-valve DOHC, Chain Drive (with Dual VVT-i) |
| Combustion Chamber | | | Pentroof Type |
| Manifolds | | | Cross-flow |
| Fuel System | | | Sequential Multiport Fuel Injection (SFI) |
| Ignition System | | | Direct Ignition System (DIS) |
| Displacement | | | 2494 $cm^3$ (152.2 cu. in.) |
| Bore x Stroke | | | 90.0 x 98.0 mm (3.54 x 3.86 in.) |
| Compression Ratio | | | 10.4 : 1 |
| Max. Output (SAE-NET)*1 | | | 131 kW (176 HP) @ 6000 rpm |
| Max. Torque (SAE-NET)*1 | | | 233 N*m (172 ft*lbf) @ 4100 rpm |
| Valve Timing | Intake | Open | 3° to 43° BTDC |
| | | Closed | 61° to 21° ABDC |
| | Exhaust | Open | 60° to 20° BBDC |
| | | Closed | 4° to 44° ATDC |
| Spark Plug | Manufacture | | DENSO |
| | Type | | SK16HR11 |
| | Plug Gap | | 1.0 to 1.1 mm (0.039 to 0.043 in.) |
| Firing Order | | | 1 - 3 - 4 - 2 |
| Octane Rating | | | 87 or higher |
| Research Octane Number | | | 91 or higher |
| Tailpipe Emission Regulation | | U.S.A. and Canada | ULEV2, SFTP |
| | | Others | Tier2, SFTP |
| Evaporative Emission Regulation | | U.S.A. and Canada | LEV2, ORVR |

| | | |
|---|---|---|
| | Others | Tier2, ORVR |
| Engine Service Mass (Reference)*2 | | 147 kg (324.0 lb) |

*1: Maximum output and torque rating are determined using the revised SAE J1349 procedure.
*2: Weight shows the figure with oil and engine coolant fully filled.




## 3. MAIN FEATURES

(a) The following performance features have been achieved for the 2AR-FE engine through the use of the items listed below:

(1) High performance and reliability

(2) Low noise and vibration

(3) Lightweight and compact design

(4) Good serviceability

(5) Clean emissions and fuel economy

| ITEM | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| | A cylinder head cover sub-assembly made of magnesium alloy is used. | - | - | ○ | - | - |
| | A taper squish shape is used for the combustion chamber. | ○ | - | - | - | ○ |

| | | | | | | |
|---|---|---|---|---|---|---|
| Engine Proper | Spiny-type liners are used in the cylinder bores. | ○ | - | ○ | - | ○ |
| | A cylinder block water jacket spacer is used. | ○ | - | - | - | ○ |
| | The piston skirt is coated with resin. | ○ | ○ | - | - | ○ |
| | Low tension piston rings are used. | ○ | - | - | - | ○ |
| | A resin gear balance shaft is used. | - | ○ | ○ | - | - |
| Valve Mechanism | A timing chain and chain tensioner are used. | - | ○ | - | ○ | - |
| | Valve lash adjuster assemblies are used. | - | ○ | - | ○ | - |
| | Valve rocker arm sub-assemblies are used. | ○ | - | - | - | ○ |
| Lubrication System | An oil filter with a replaceable element is used. | - | - | - | ○ | - |
| Cooling System | TOYOTA Genuine Super Long Life Coolant (SLLC) is used. | - | - | - | ○ | - |
| Intake and Exhaust System | A charcoal filter is used in the air cleaner cap. | - | - | - | - | ○ |
| | An intake manifold made of plastic is used. | - | - | ○ | - | - |
| | A linkless-type throttle body assembly is used. | - | - | ○ | ○ | ○ |
| | A thin-wall ceramic Three-Way Catalyst (TWC) is used. | - | - | - | - | ○ |
| Fuel System | A fuel returnless system is used. | - | - | ○ | ○ | ○ |
| | Quick connectors are used to connect the fuel hose with the fuel pipe. | - | - | ○ | ○ | ○ |
| | 12-hole type fuel injector assemblies with high atomizing performance are used. | ○ | - | - | - | ○ |
| Serpentine Belt Drive System | A serpentine belt drive system is used. | - | - | ○ | ○ | - |
| Engine Control System | Long-reach type iridium-tipped spark plugs are used. | ○ | - | - | ○ | ○ |
| | The Direct Ignition System (DIS) makes ignition timing adjustment unnecessary. | ○ | - | - | ○ | ○ |
| | An Electronic Throttle Control System-intelligent (ETCS-i) is used. | ○ | - | - | - | ○ |
| | A Dual Variable Valve Timing-intelligent (Dual VVT-i) system is used. | ○ | - | - | - | ○ |
| | An Acoustic Control Induction System (ACIS) is used. | ○ | - | - | - | ○ |
| | A tumble control system is used. | ○ | - | - | - | ○ |
| | A starter control (cranking hold function) is used.* | ○ | - | - | - | - |

*: Models with smart key system

**HINT:**

○: Applicable

-: Not applicable