KIA MOTORS

Modelos competidores(Diesel))

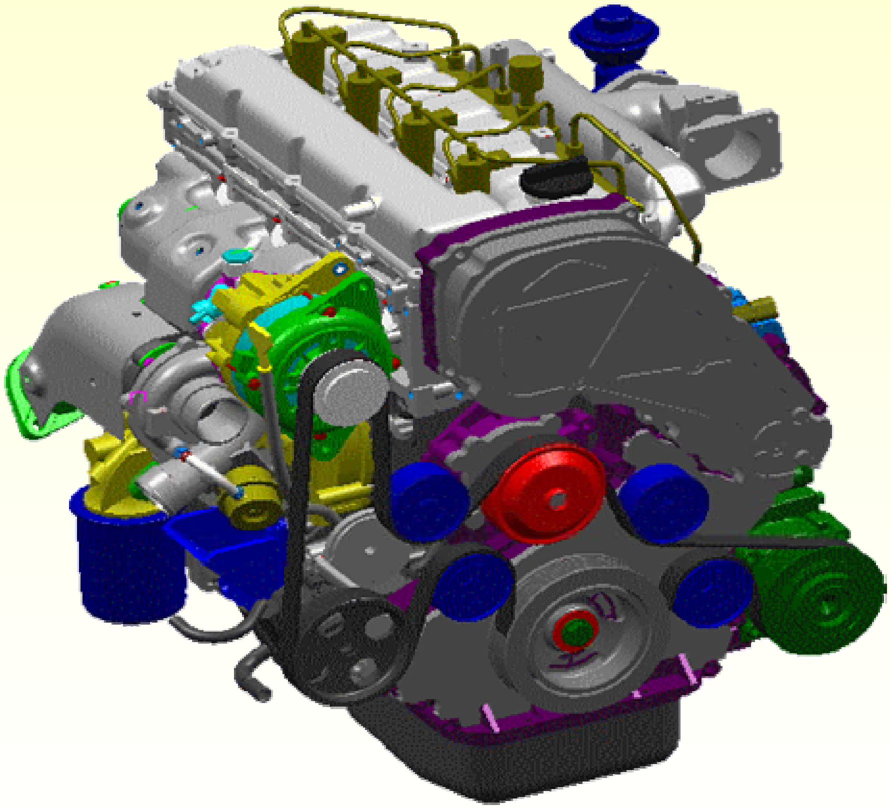
Item/Modelo	Kia Sorento	Hyundai Teracan	Daewoo Rexton	Opel Frontera	Mitsubishi Pajero	LandRover Freelander
Capacidad (cc)	2,497	2,476	2,874	2,171	3,200	1,950
M.Potencia(Ps)	145/4,000	103/3,800	120/4,000	115/3,800	160/3,800	112/4,000
M.Par(kg-m)	33/2,000	24/2,000	25.5/2,400	26.5/1,900	38/2,000	26.5/1,750
Longitud (mm)	4,567	4,710	4,720	4,658	4,280	4,368
Anchura (mm)	1,865	1,860	1,870	1,814	1,875	2,068
Altura (mm)	1,730	1,795	1,760	1,748	1,845	1,708
Entre ejes (mm)	2,710	2,750	2,820	2,702	2,545	2,557
Peso (Kg)	1,957	1,975	1,950	1,884	2,055	1,771

Especificaciones del motor

Items / Modelo			A 2.5 TCI CRDI	Σ3.5 (V6)	SIRIUS-Ⅱ (2.4ℓ I4)
Tipo			IN-LINE 4 Cylinder	V6	IN-LINE 4 Cylinder
Sistema de válvulas			DOHC	DOHC	DOHC
Max. Potencia (Ps/rpm)			145/4000	195/5500	140/5500
Max. Par (kg-m/rpm)			33/2000	30/3000	20.2/3000
Tipo de inyección			Direct Injection	MPI	MPI
Capacidad (cc)			2,497	3,497	2,361
Diámetro X carrera (mm)			91x96	93x85.8	86.5x100
Relación de compresión			17.7:1	10:1	10:1
Cruce de válvulas	Admisión	Abre(APMS)	8’	11.5’	12’
		Cierra(DPMS)	38’	60.5’	56’
	Escape	Abre(BBDC)	52’	43.5	54’
		Cierra(ATDC)	8’	20.5’	14’
Juego de válvulas			0,(HLA)	0,(HLA)	0,(HLA)
Ralentí (rpm)			800±50	700±100	800±50
Avance de encendido (BTDC)			-	10’ ± 2’	5’±2’
Orden de encendido			1-3-4-2	1-2-3-4-5+6	1-3-4-2

Vista del motor – A 2.5 TCI (CRDI)

A –2.5 TCI –CRDI



Vista del motor – Σ 3.5 (V6)

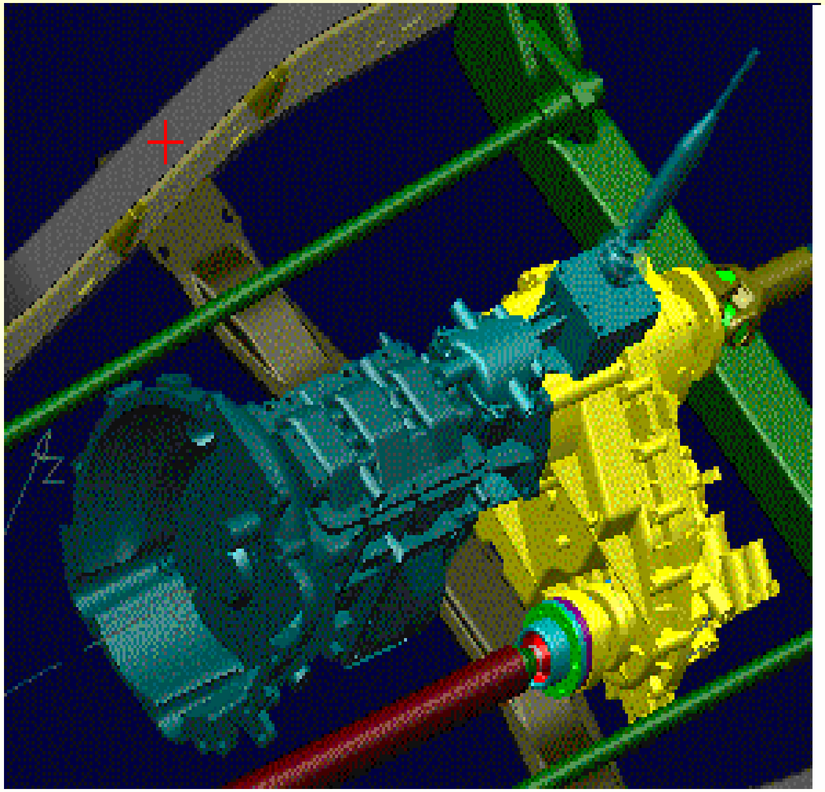
Sigma(Σ) 3.5ℓ

Sirius-Ⅱ 2.4ℓ (In-Line)

Cambio

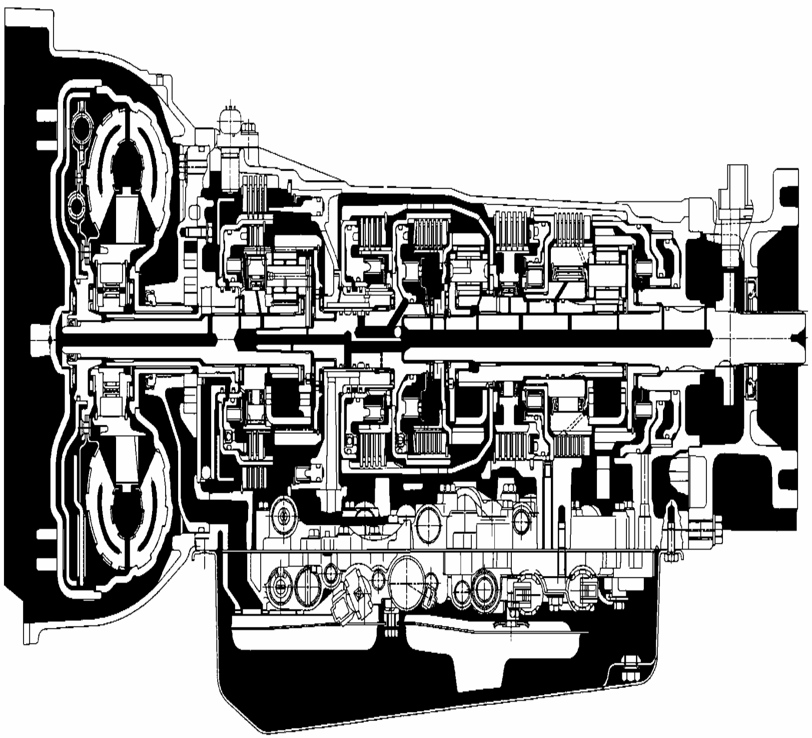
■ Cambio manual :

→ M5UR1



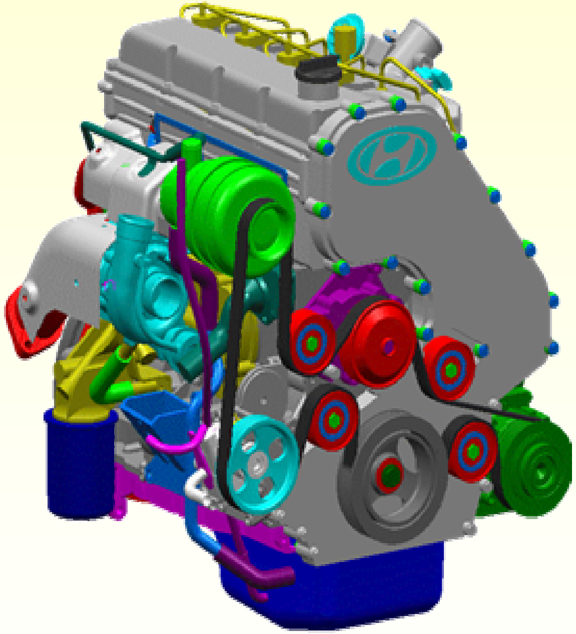
■ Cambio automático :

→ 30-40LEI



Motor diesel

A-2.5 TCI

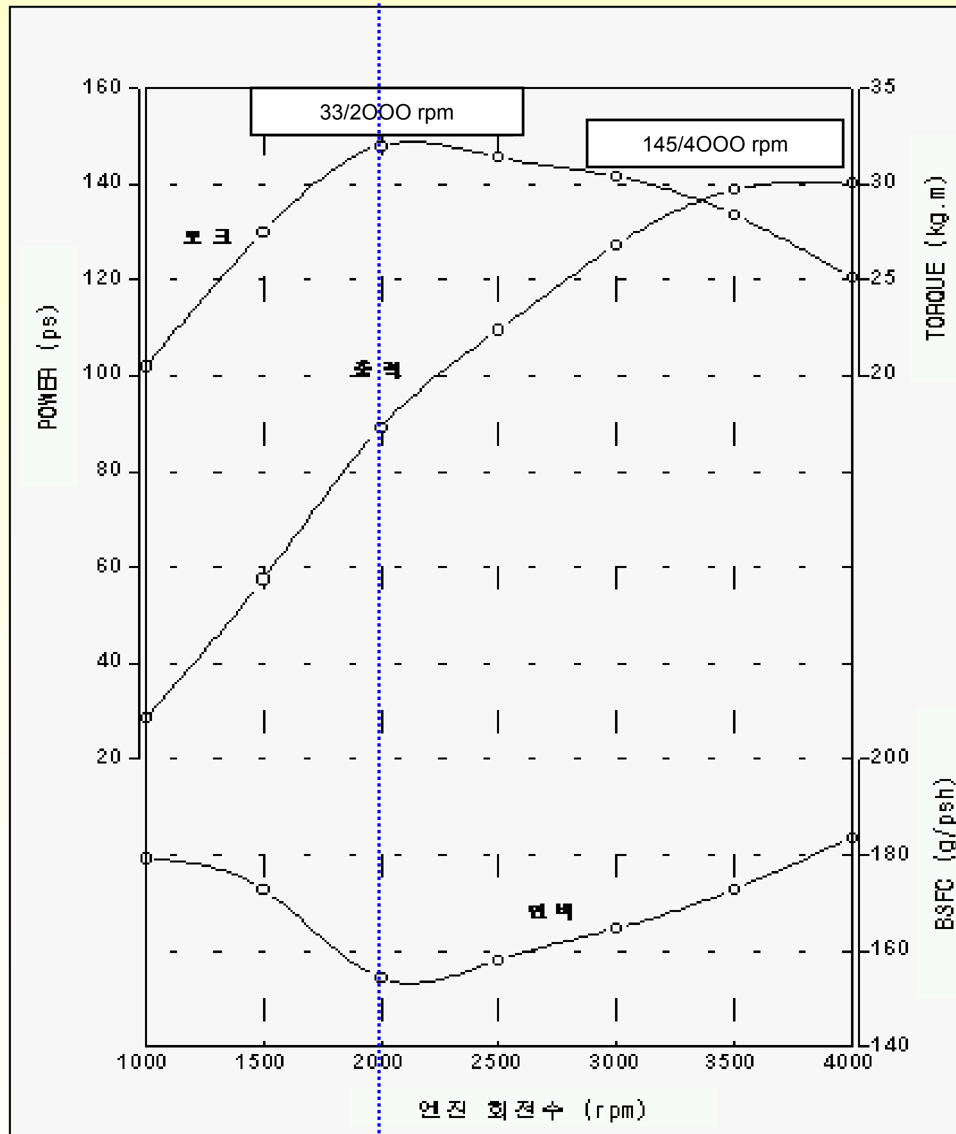


A-2.5 TCI (CRDI)

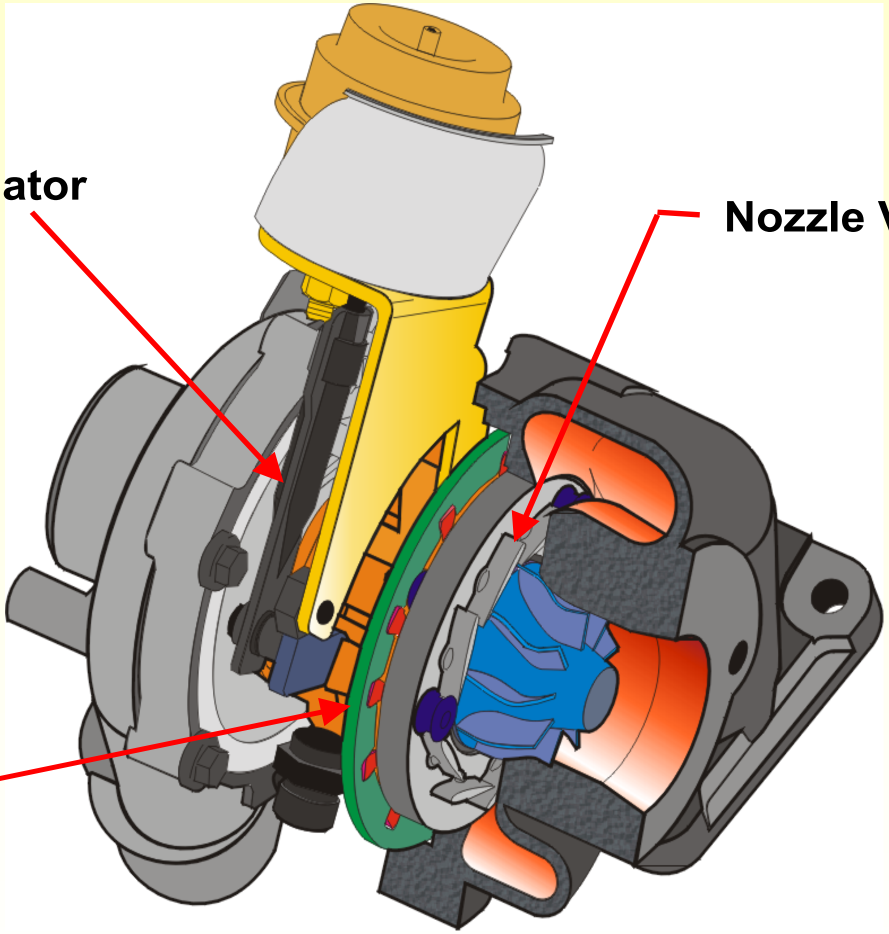
- Incrementada la potencia específica y reducido el consumo
  - DOHC 4 válvulas por cilindro
  - Turbo con intercooler
  - Electronic Diesel Control(EDC) de Bosch con Common Rail
  - Inyectores de alta precisión controlados electrónicamente montados en el centro de la cámara de combustión
  - Alta presión de inyección, aprox. 1,350 bar
- Reducido las emisiones, ruidos y vibraciones
  - Inyección piloto antes de la principal
  - Arboles contrarrotantes
  - EGR con catalizador por oxidación
  - Soporte de árboles de levas y doble cárter

A-2.5 TCI (CDRI) – Curvas del motor

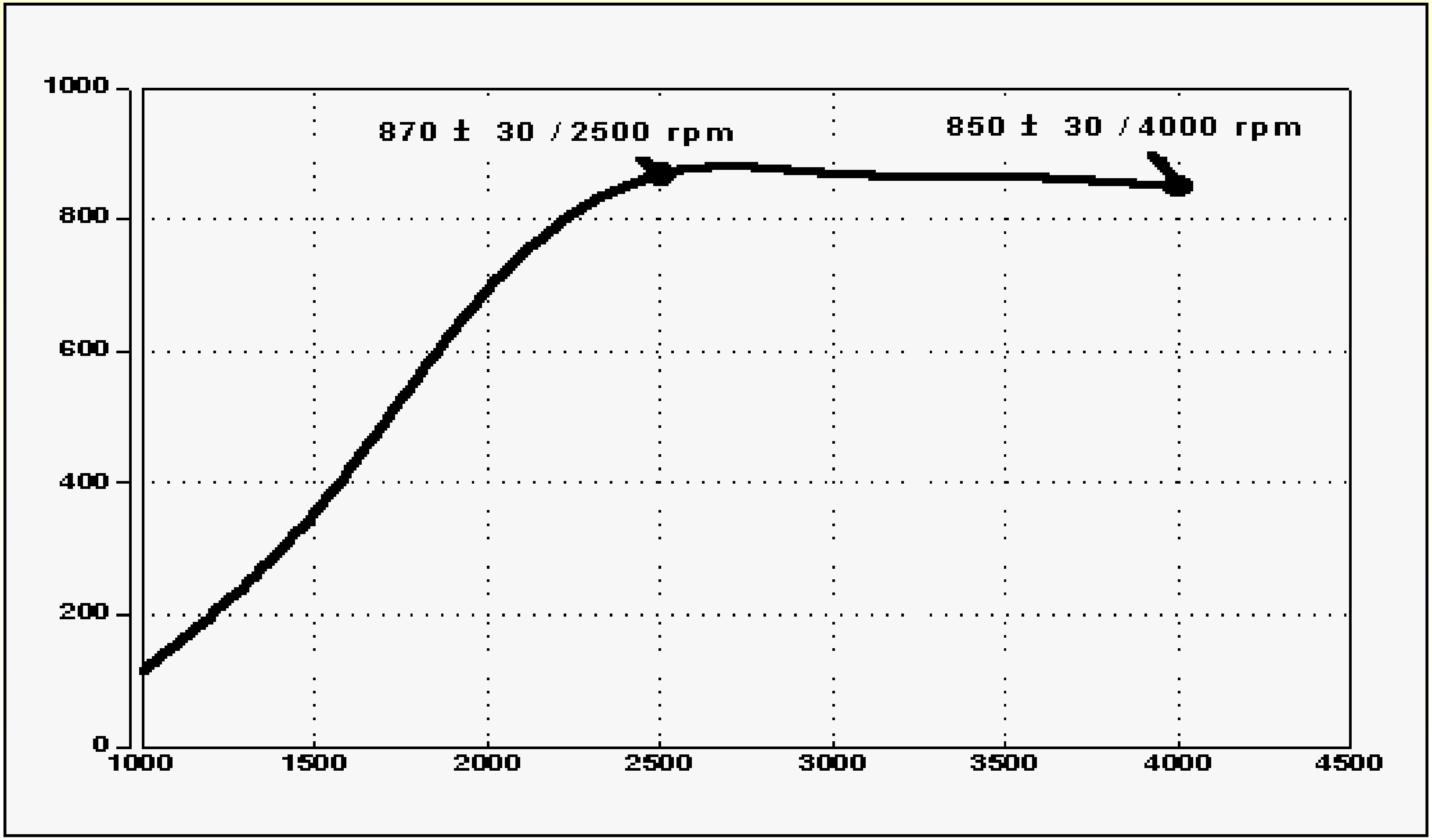
Prueba : JIS 82 NET
Motor : D4CB(A2.5 TCI)



■ VGT (Turbo de Geometría Variable)

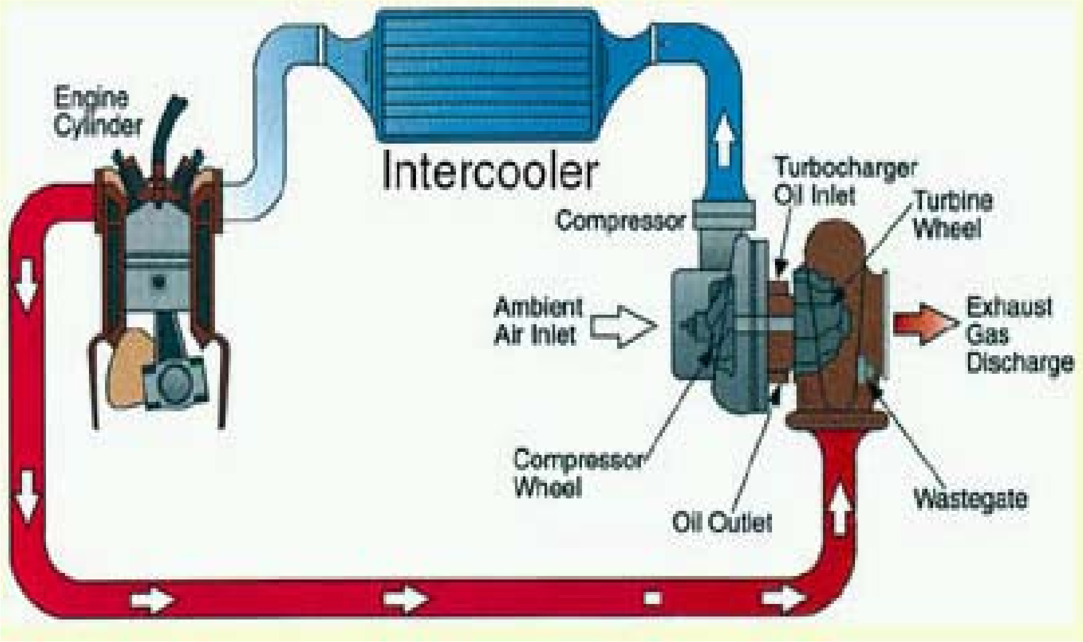


■ Presión del turbo a la salida del intercooler



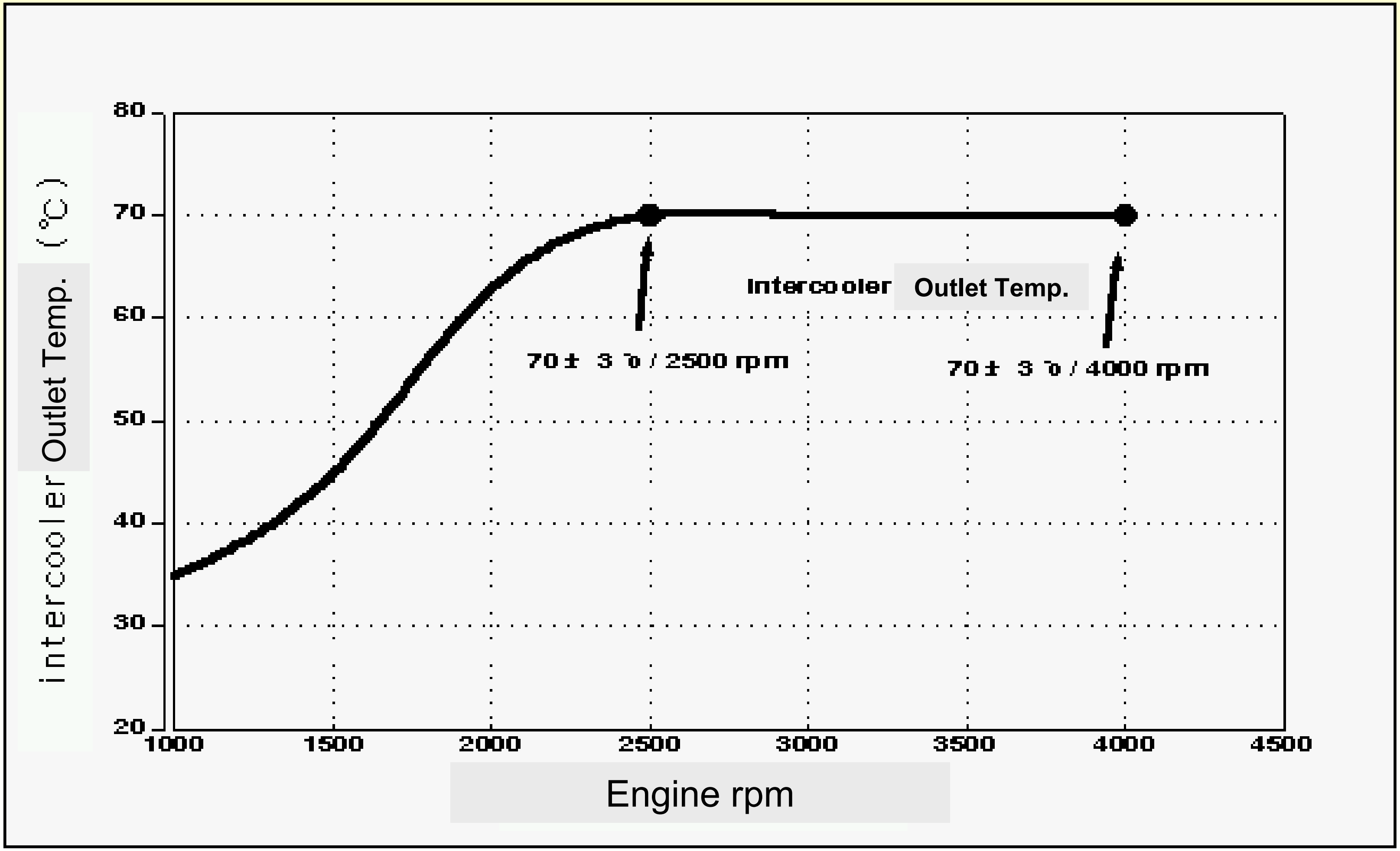
A-2.5 TCI (CDRI) – Intercooler

■ Enfriamiento del aire de admisión

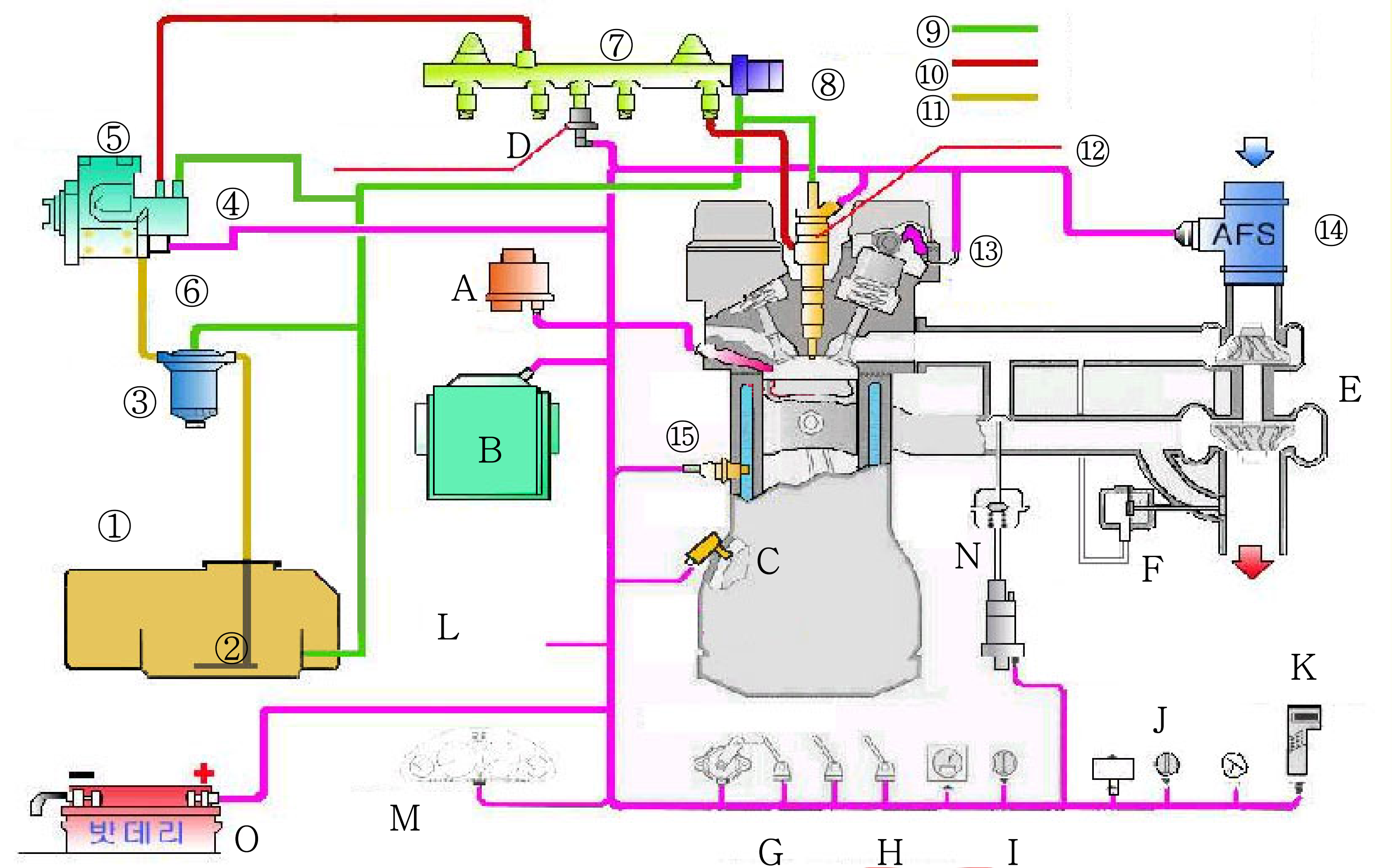


Intercooler

Temperatura del aire a la salida del intercooler



■ Diagrama del sistema – CP3



A-2.5 TCI(CRDI) – Diagrama del sistema de raíl común

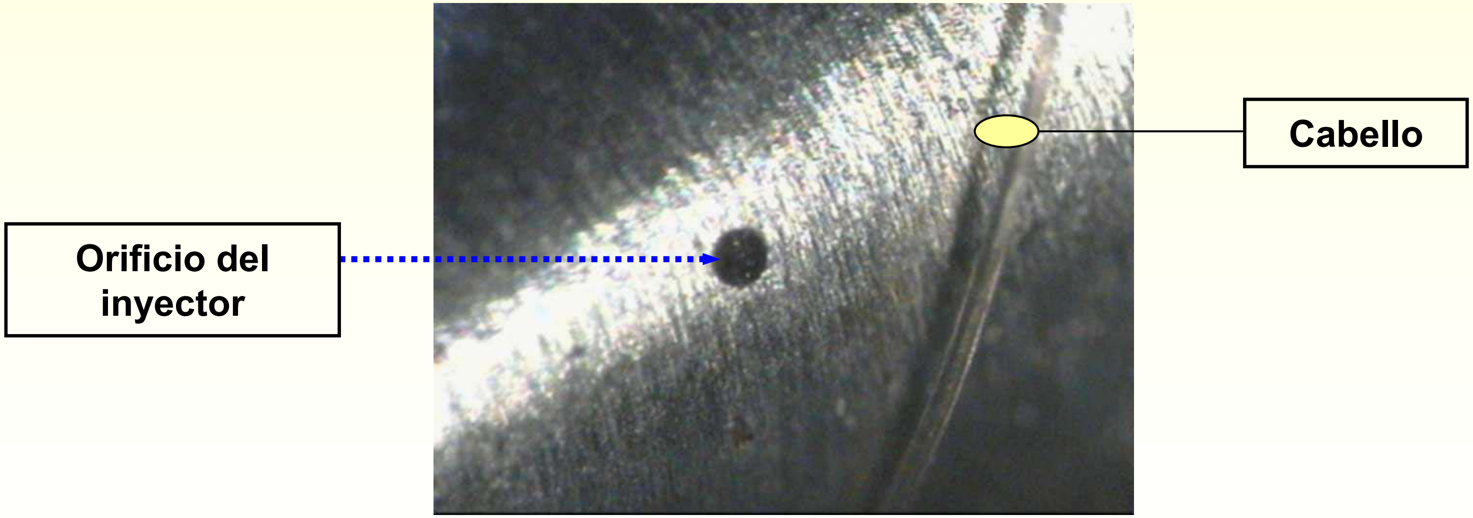
■ Componentes

- ① : Depósito
- ② : Prefiltro
- ③ : Filtro de combustible
- ④ : Bomba de baja presión
- ⑤ : Bomba de alta presión
- ⑥ : Valvula de control
- ⑦ : Raíl común
- ⑧ : Válvula limitadora
- ⑨ : Línea de retorno
- ⑩ : Línea de alta
- ⑪ : Línea de baja
- ⑫ : Inyector
- ⑬ : Sensor del árbol de levas
- ⑭ : Sensor de flujo de aire
- ⑮ : Sensor de temperatura
- A : Relé de calentadores
- B : ECM
- C : Sensor del cigüeñal
- D : Sensor de alta presión
- E : Turbo
- F : Válvula de descarga
- G : Sensor del acelerador
- H : Interruptor de freno
- I : Interruptor del embrague
- J : Interruptor A/C
- K : Conector de diag.
- L : Can Bus
- M : Cuadro
- N : Modulador de vacío para la EGR
- O : Batería

■ Limpieza

La alta presión requerida en los sistemas de raíl común hacen necesario hacer los orificios de los inyectores mucho más pequeños que los de un sistema convencional.

Por ello, la limpieza a la hora de trabajar con estos sistemas es fundamental e imprescindible.



Sorento – Engine Room

Sensor de flujo de aire

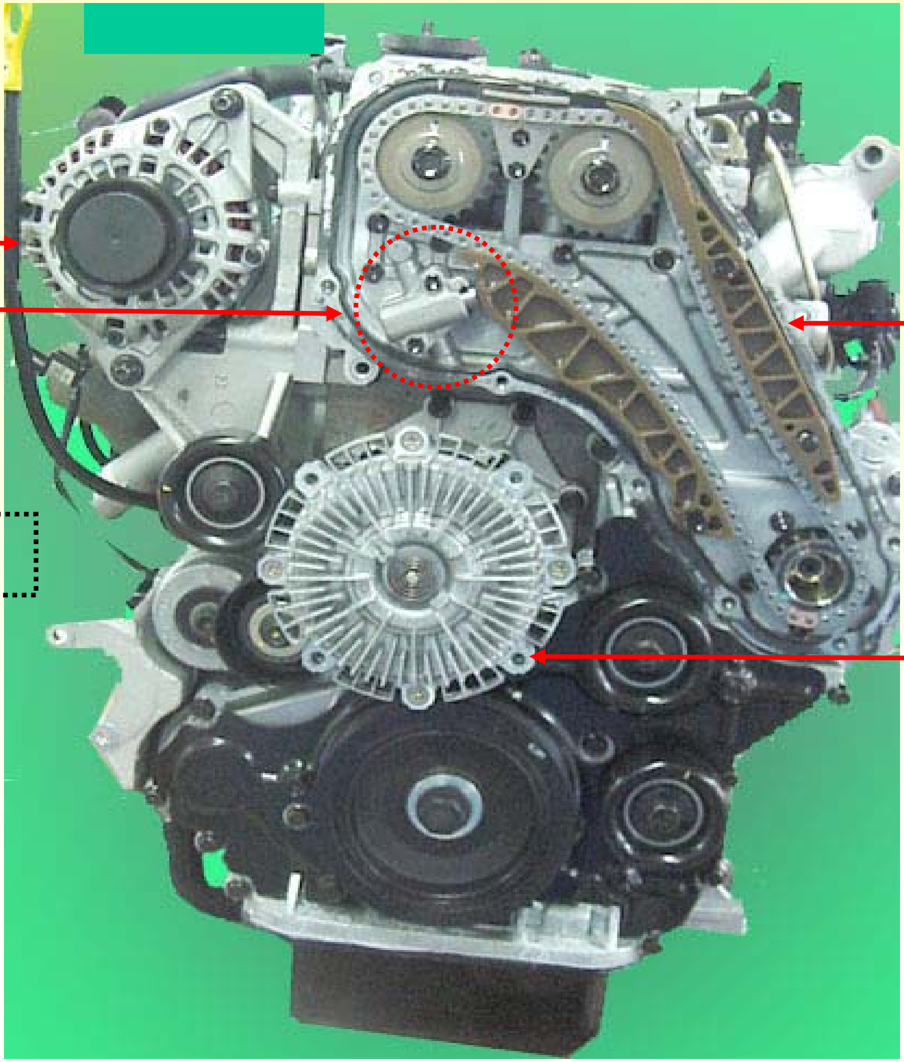
Válvula EGR

Bomba de alta presión

Intercooler

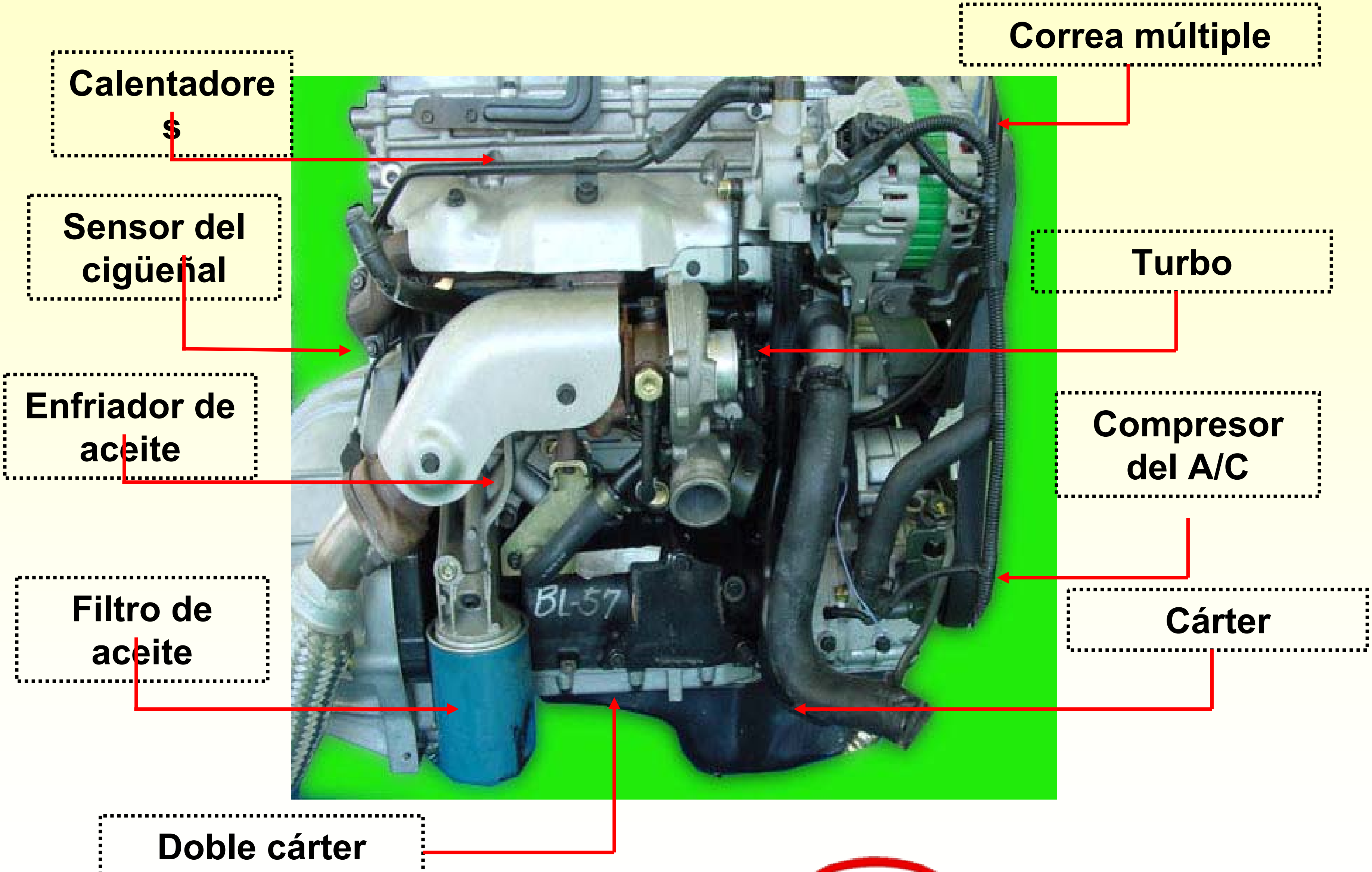
Vantilador del condensador

A 2.5 TCI – Vista frontal



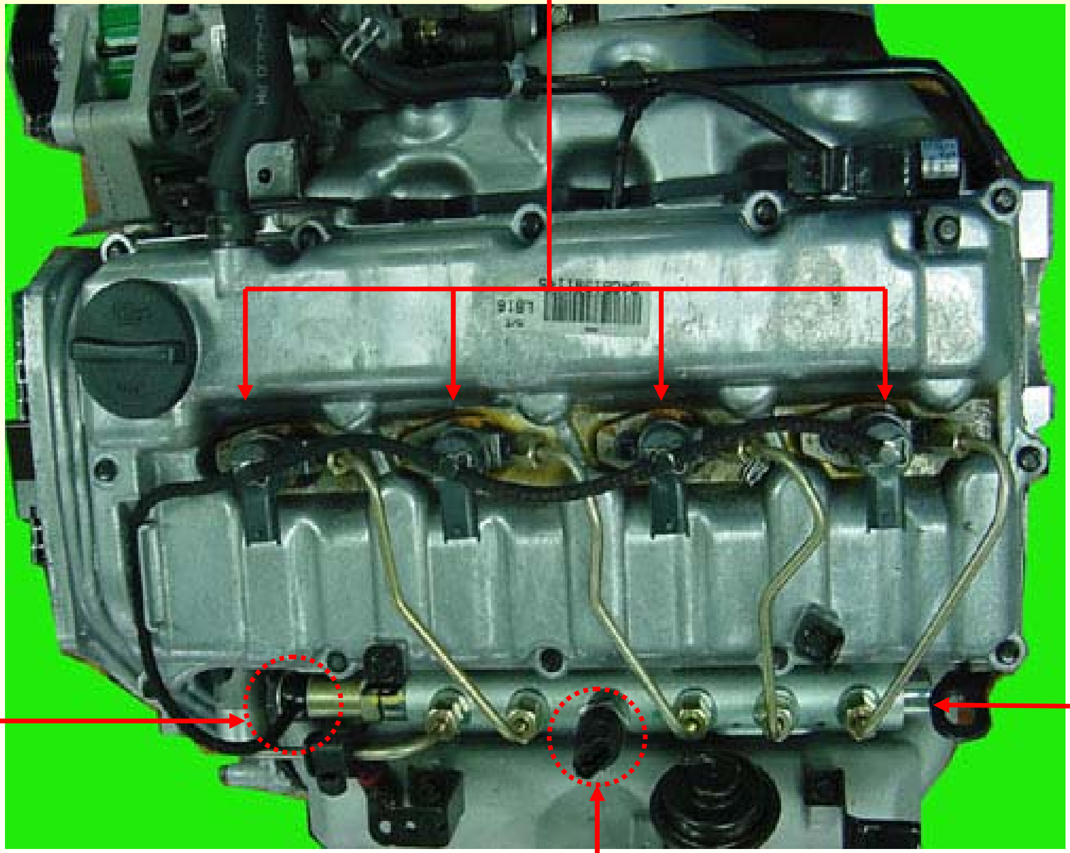
■ Embrague del ventilador

A 2.5 TCI – Vista lateral



KIA MOTORS

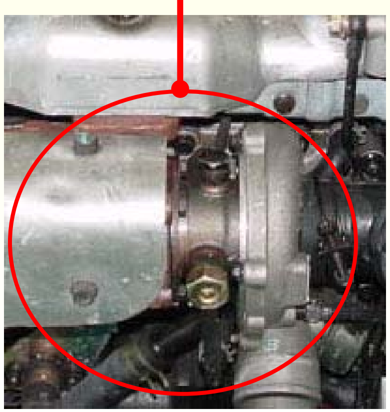
A 2.5 TCI – Vista superior

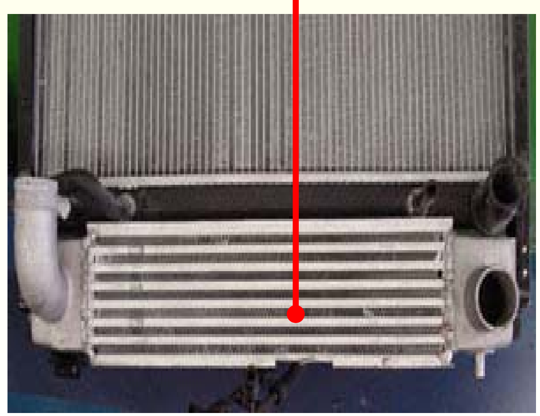


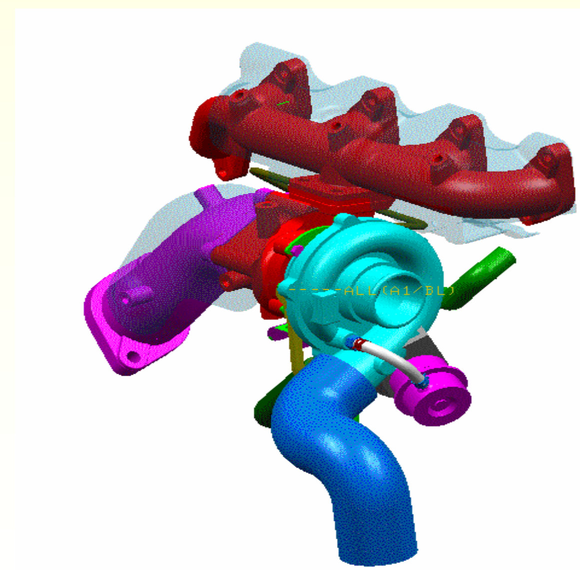
Características - Turbo

■ Turbo

- Turbo refrigerado por agua
- Válvula de descarga
- Intercooler frontal

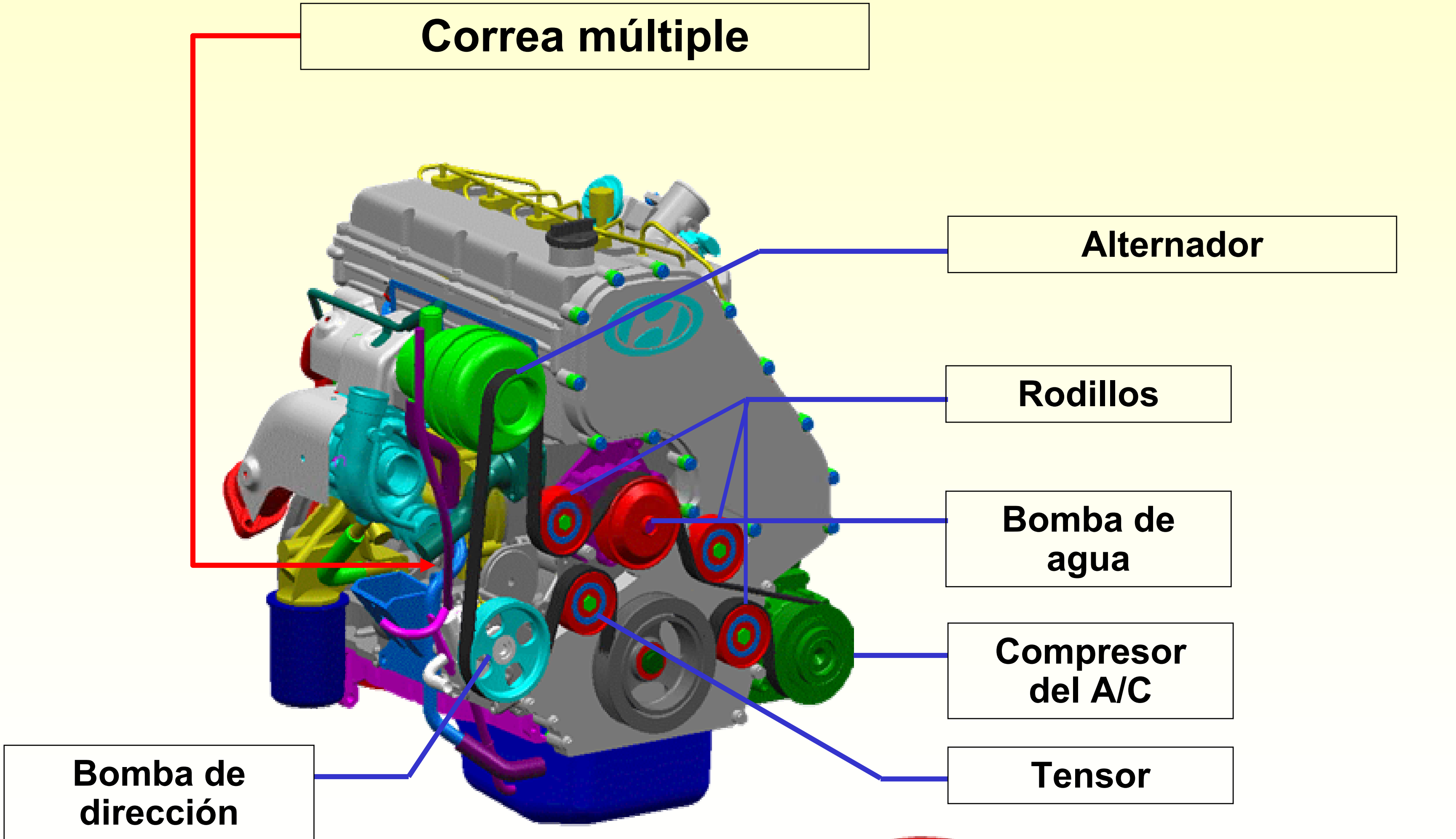






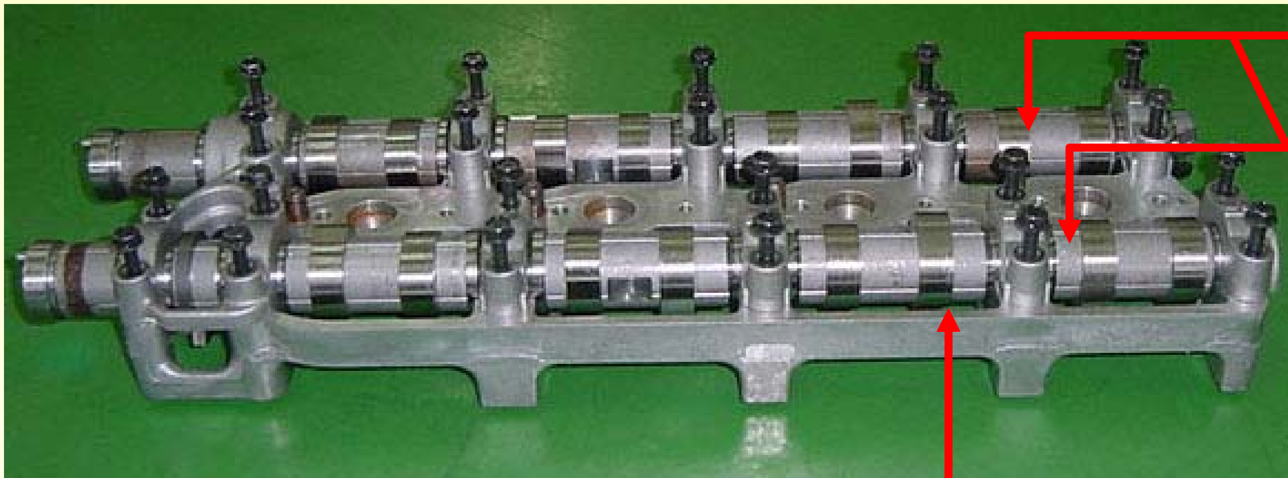
Características – Correa múltiple

- Componentes



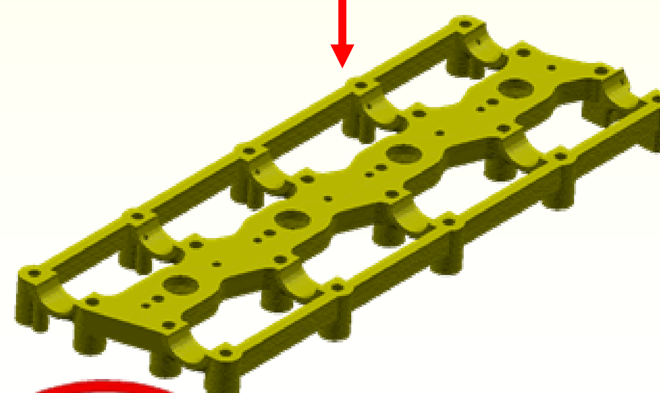
Características – Soporte de los árboles de levas

■ Componentes



Arboles de levas

Soporte

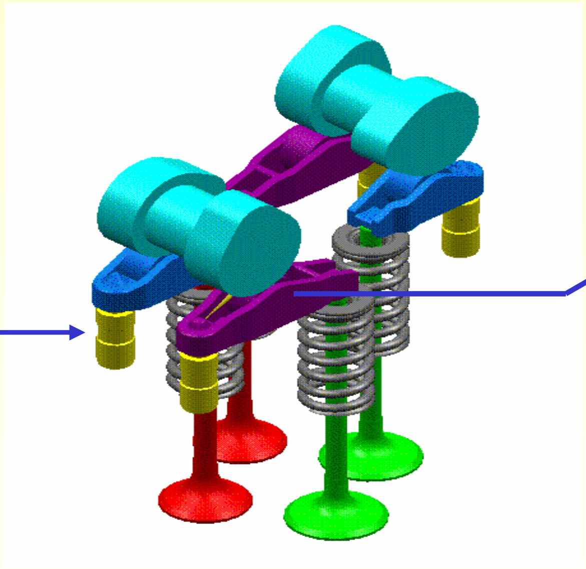


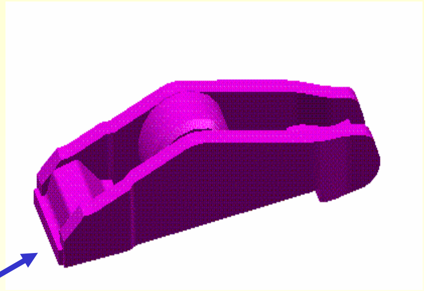
El uso de soporte para los árboles de levas reduce el ruido y las vibraciones .

Características – Válvulas

■ Componentes

- 4 válvulas por cilindro con ajuste hidráulico



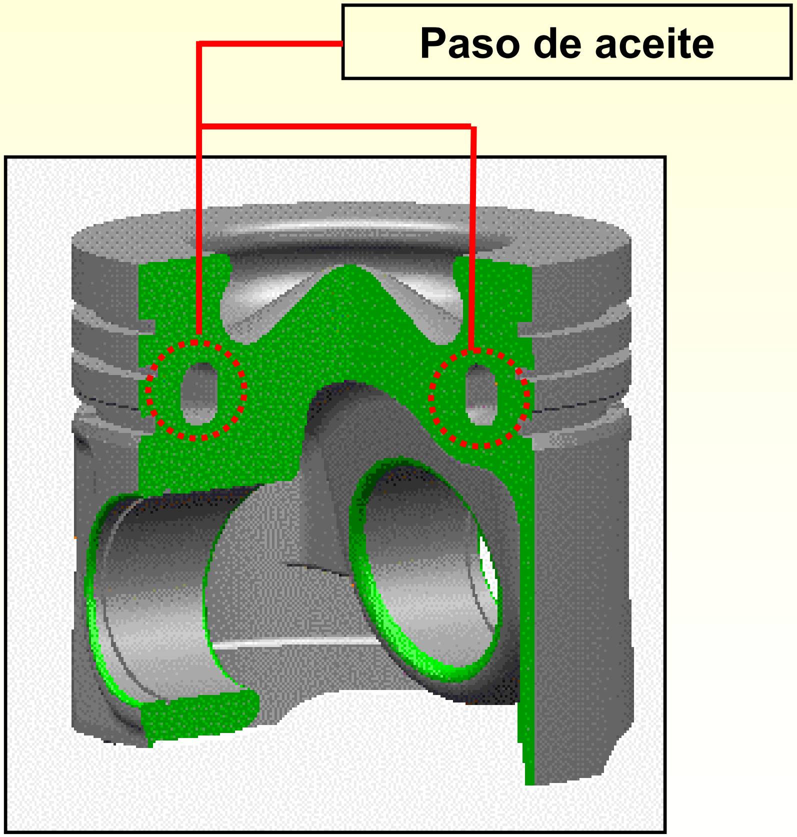


Ajuste hidráulico

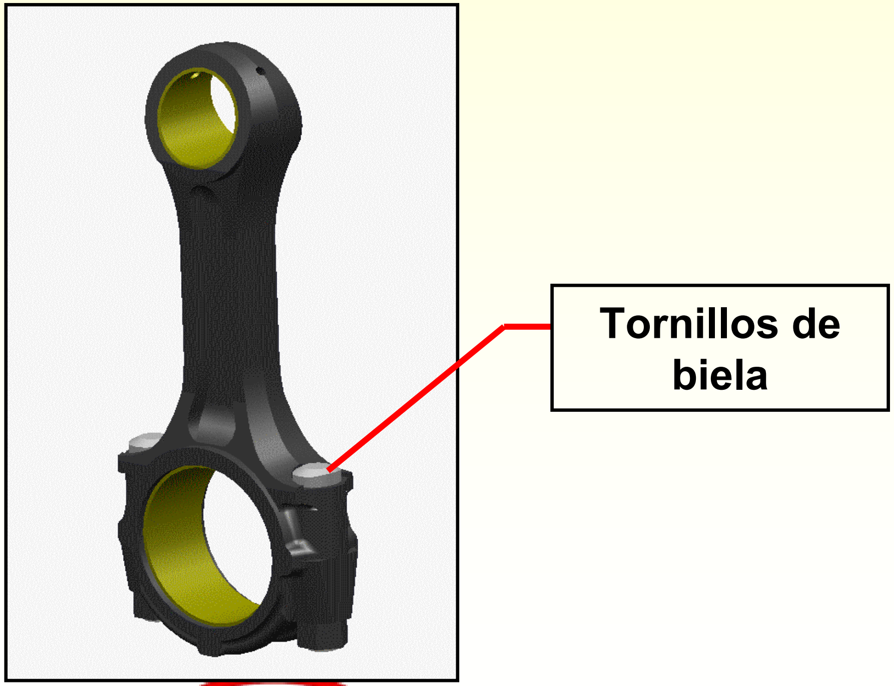
Características – Pistón y biela

■ Componentes

- **Pistones refrigerados por aceite**



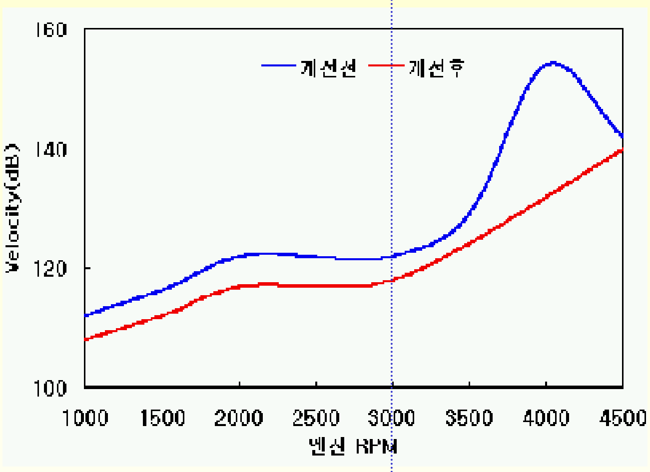
- **Par de apriete de las tapas de biela :**
  - ① apretar a 6.0kg-m
  - ② aflojar
  - ③ Reapretar a 3.5kg-m
  - ④ apretar de 60~64 grados

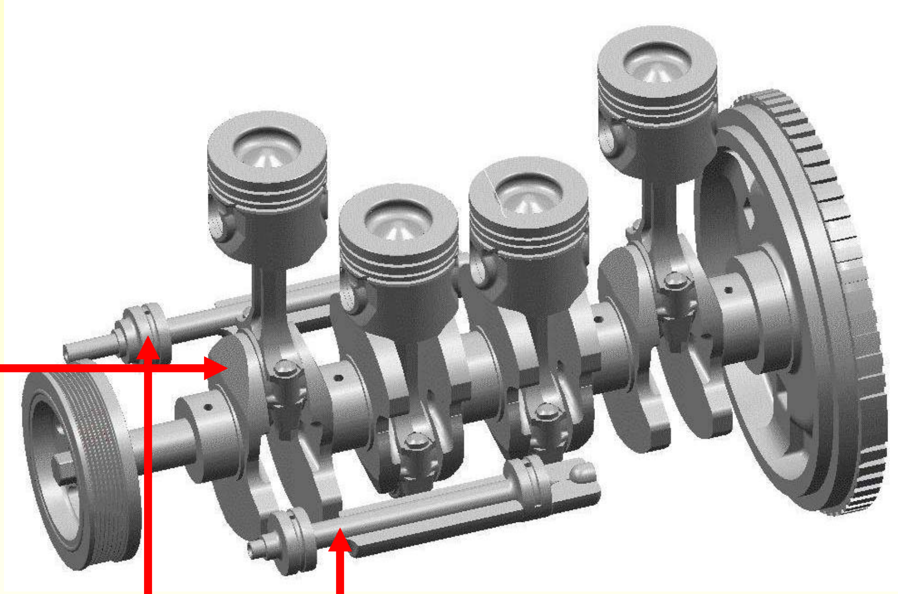


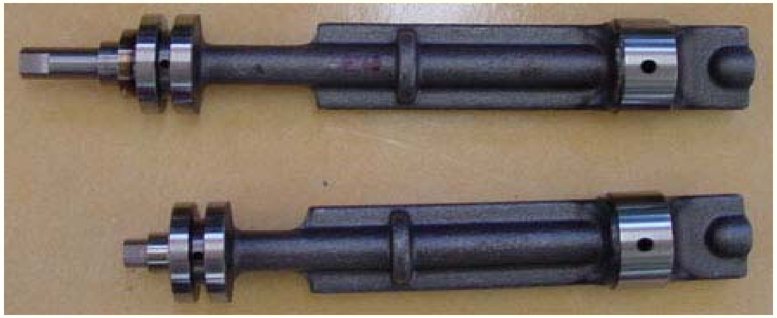
Características – NVH

■ Componentes

8 contrapesos



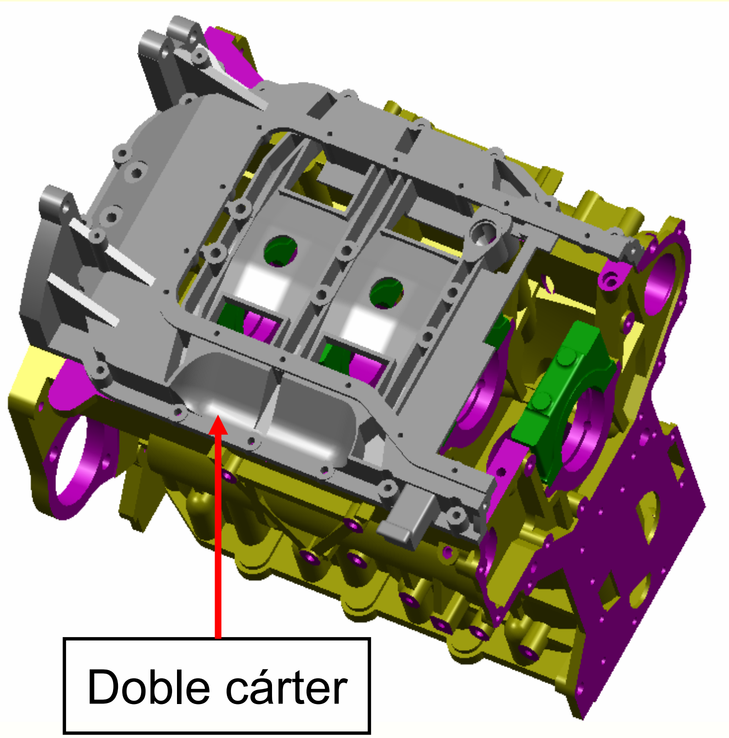


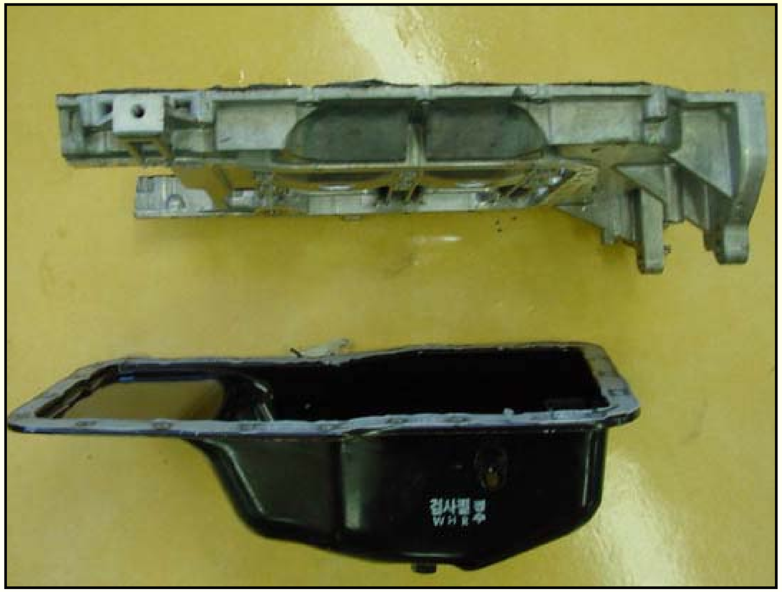


Arboles contrarrotantes

■ Componentes

- Doble cárter

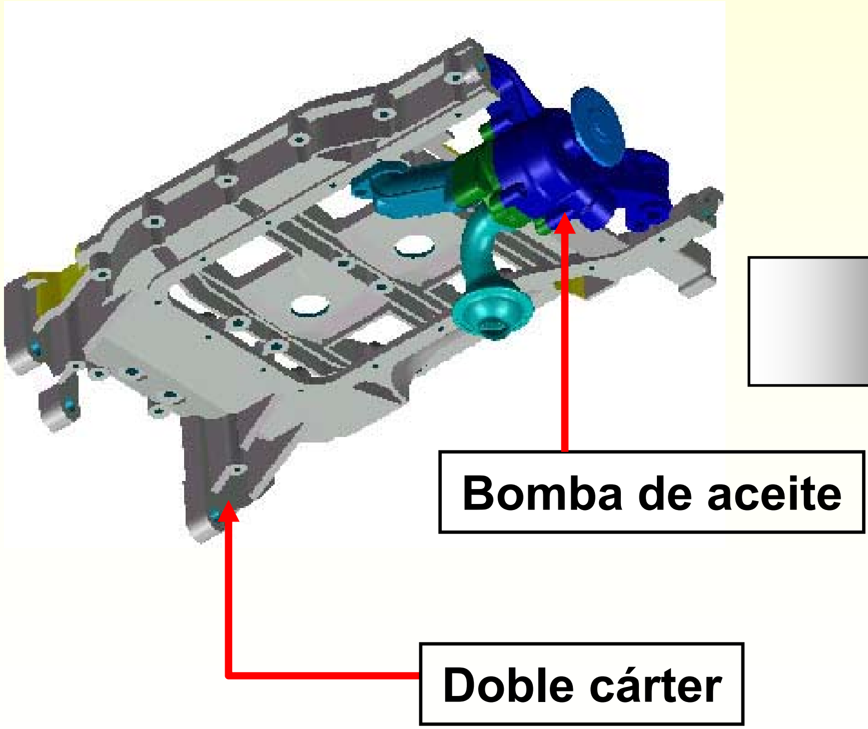




Características – Oil Pump

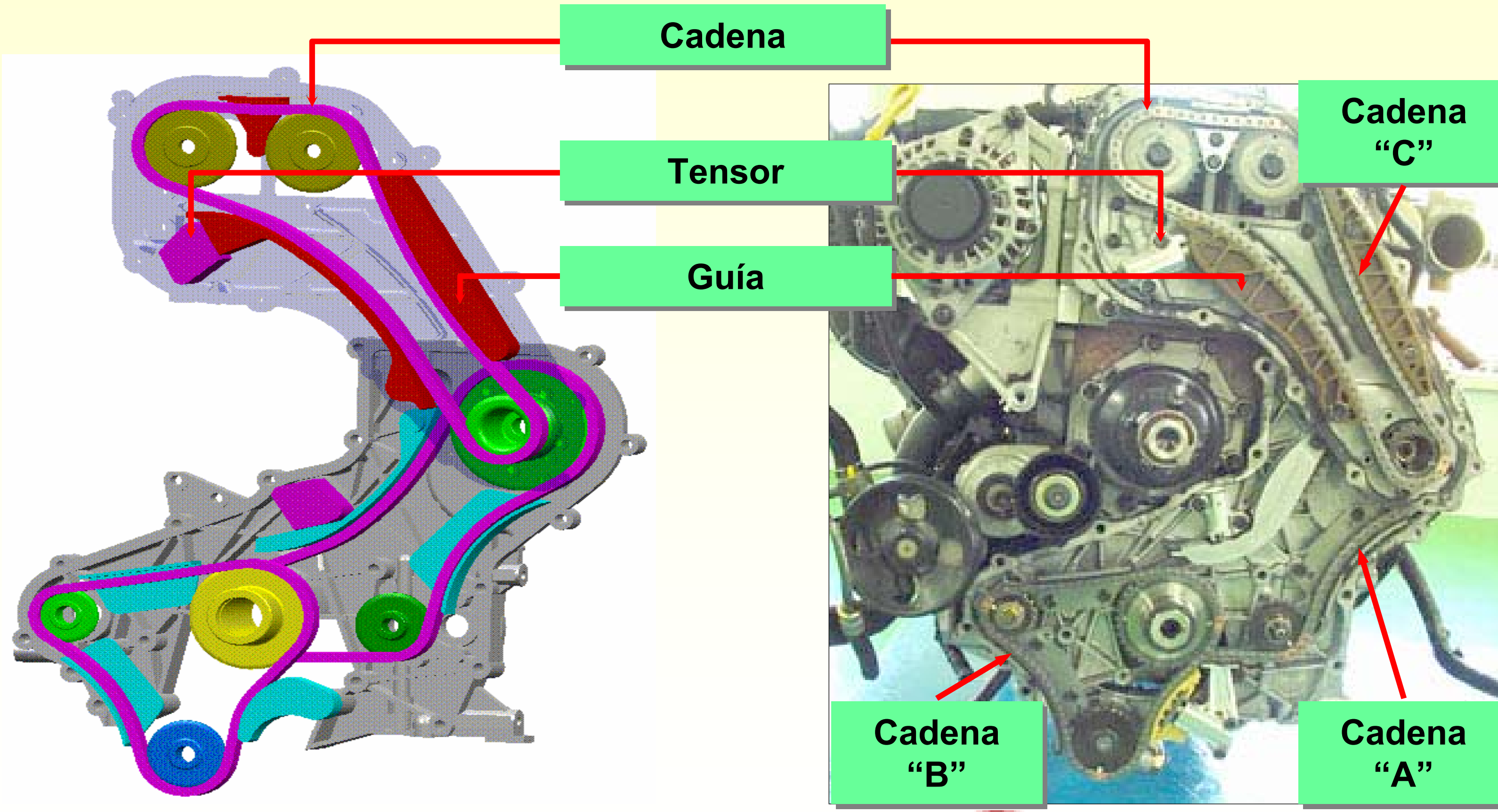
■ Componentes

- **Bomba de aceite montada dentro del cárter**
- **Aceite usado : <u>CE grade 10W30</u>**



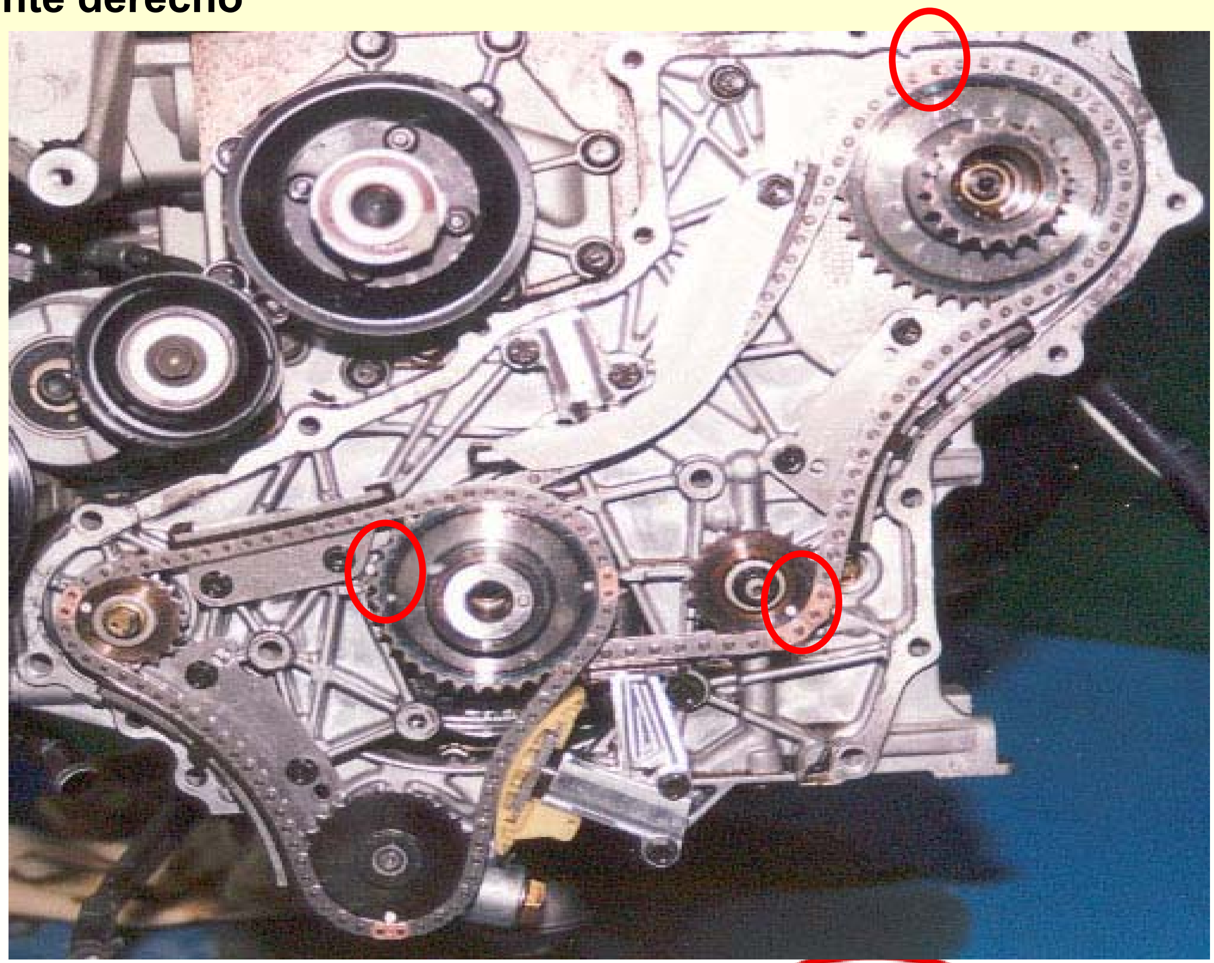
■ Componentes

- Libres de mantenimiento
- Compuesto por tres cadenas : A, B y C



■ Componentes

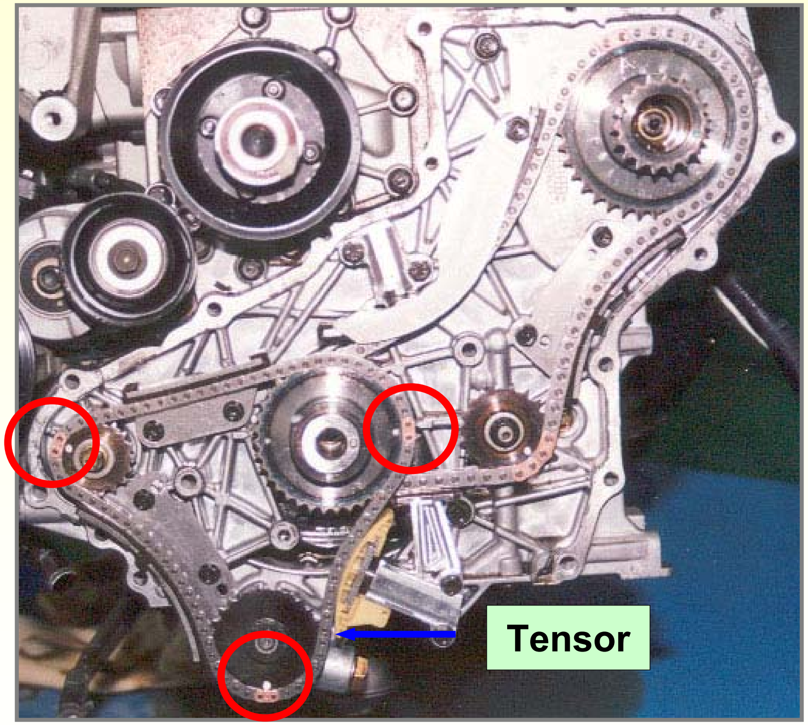
- **Mueve el piñón del cigüeñal, la bomba de alta presión y el árbol contrarrotante derecho**

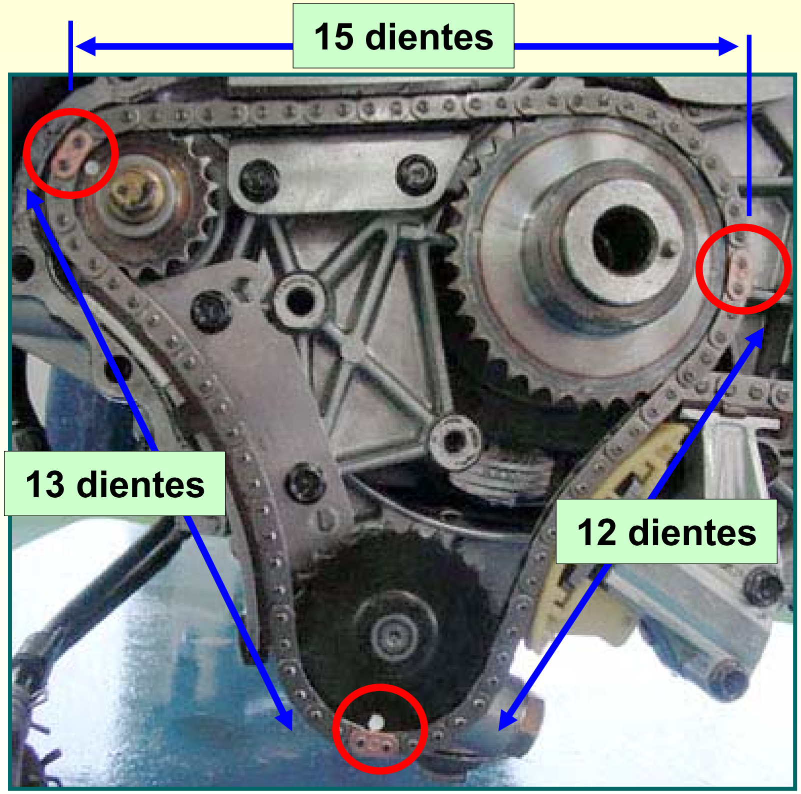


Cadena "B"

■ Componentes

- Mueve el piñón del cigüeñal, la bomba de aceite y el árbol contrarrotante izquierdo
- Marcas alineadas en la instalación inicial
- Adecuado engrase de la cadena y la guía

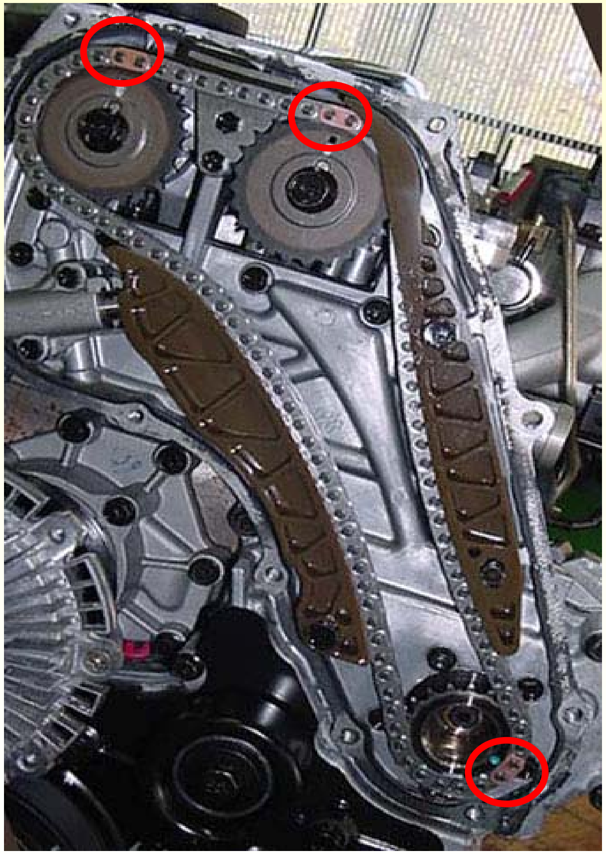




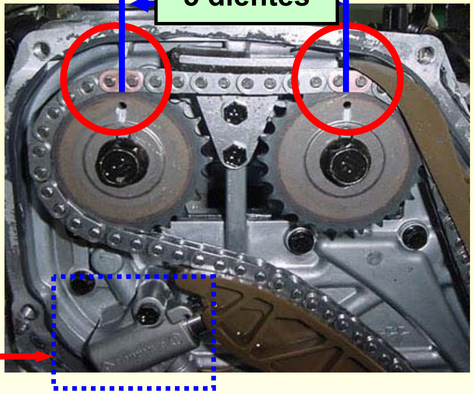
Cadena “C”

■ Componentes

- Mueve la bomba de alta presión y los piñónes de los árboles de levas

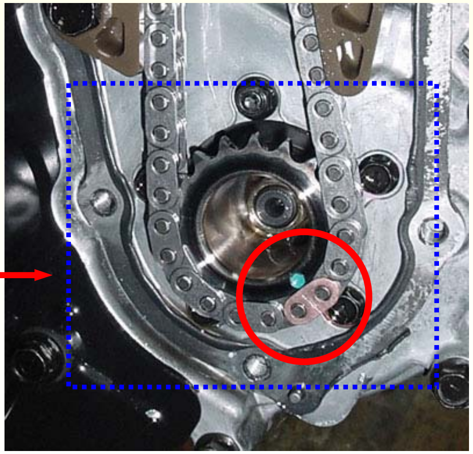


5 dientes



Tensor automático

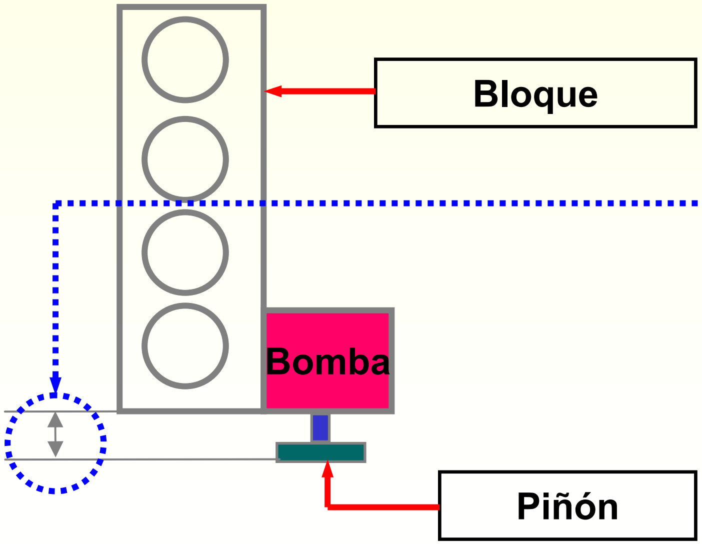
Piñón de la bomba de alta presión



Caution for Timing Chain

■ Reference

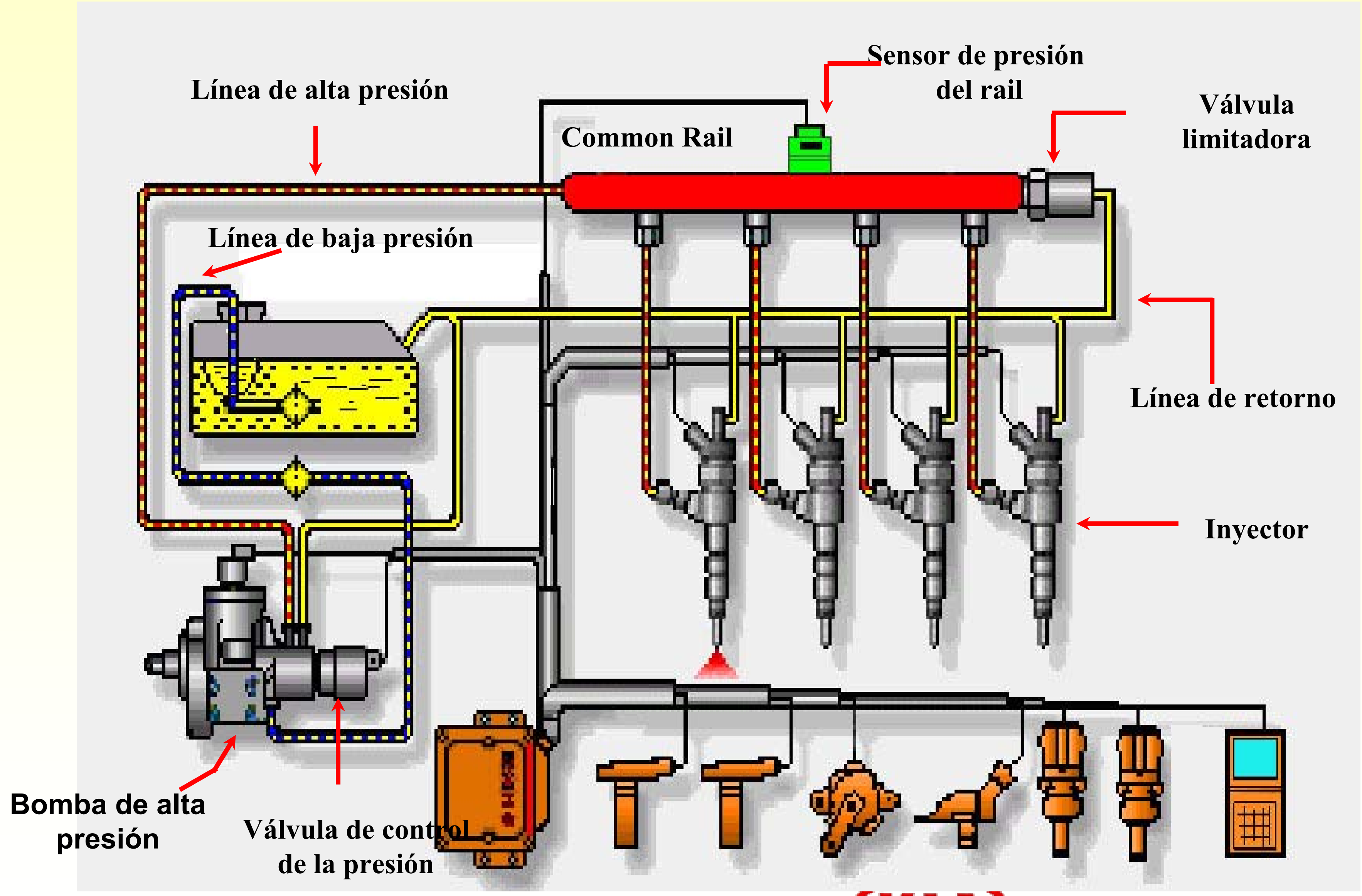
- El reemplazamiento de las cadenas A y B no es posible con el motor montado, sin embargo, la cadena C sí.
- La alineación de las cadenas con los piñones es fundamental, sobre todo en la cadena C.
- Hay tres tipos de piñones para la bomba de alta presión. Cada vez que se cambie el piñón de la bomba, hay que medir la distancia entre el piñón y la bomba y colocar el que corresponda.



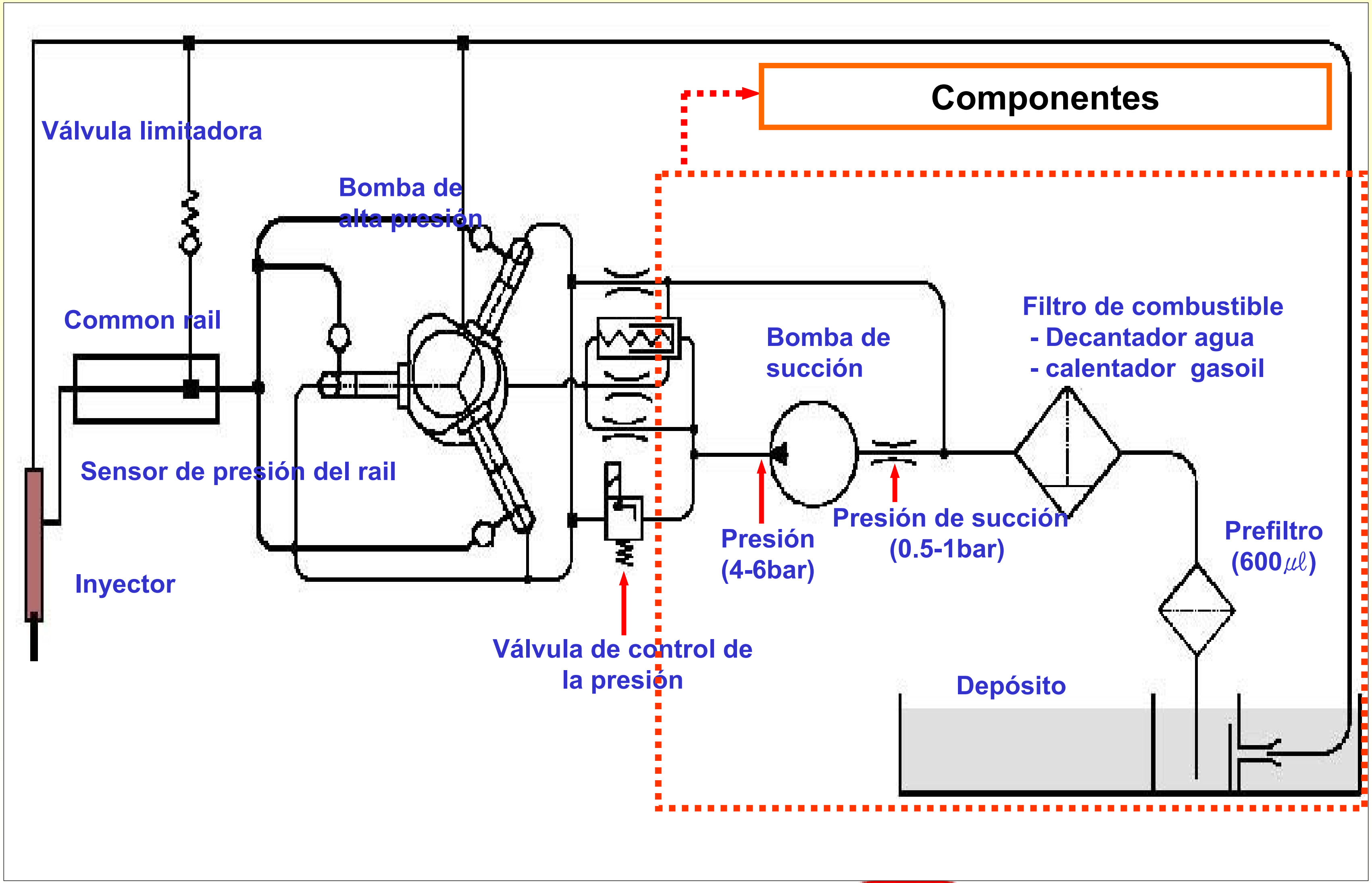
Color	Grosor (mm)	Piñón
Blue	34.2-35.0	A
White	33.4-34.2	B
Red	35.0-35.8	C

Sistema de combustible

Sistema de combustible



Sistema de combustible – Línea de baja presión



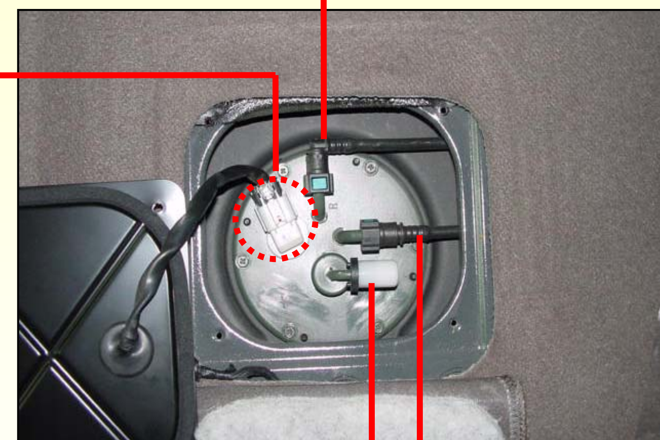
Línea de baja presión - Componentes

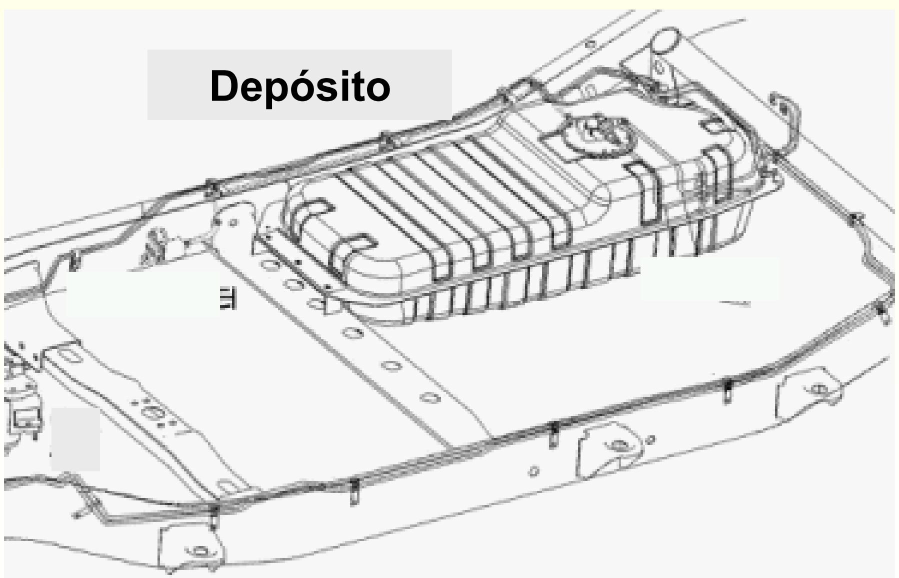
■ Componentes

- **El depósito está situado debajo de la segunda fila de asientos**
- **La capacidad es de 72ℓ**
- **La válvula de corte (situada bajo el filtro del aire) previene fugas de gasoil del depósito al cánister en caso de emergencia**

Retorno

Conector del aforador





Filtro

Salida

Línea de baja presión - Aforador

- Aforador : Detecta le cantidad de gasoil por medio de un potenciómetro que manda la señal al cuadro

- Luz de reserva : Cuando el ptenciómetro marca un cierto valor durante 60 ±20 segundos, la luz de reserva se enciende.

Relé de la luz de reserva

※ Valor de resistencia del aforador

Posición	Lleno	3/4	1/2	Luz de reserva on	Vacío
Resistencia Valor(Ω)	3±1	18.5±1	32.5±1.5	83±2	110±2
Capacidad del depósito(ℓ)	72	54	36	12	8

Línea de baja presión – Filtro de combustible

■ Componentes

- **El sistema de rail común necesita un gasoil mucho más limpio que un sistema convencional por varias razones.**
- **El agua y los contaminantes sólidos, sobre todo en invierno, dan lugar a desgaste, erosión,filtro obstruido, picaduras, pérdida de presión y eventualmente falta de lubricación de la bomba.**
- **Para reducir estos problemas, el Sorento monta un filtro Bosch con decantador de agua y calentador de gasoil incluidos.**

- Componentes **:**

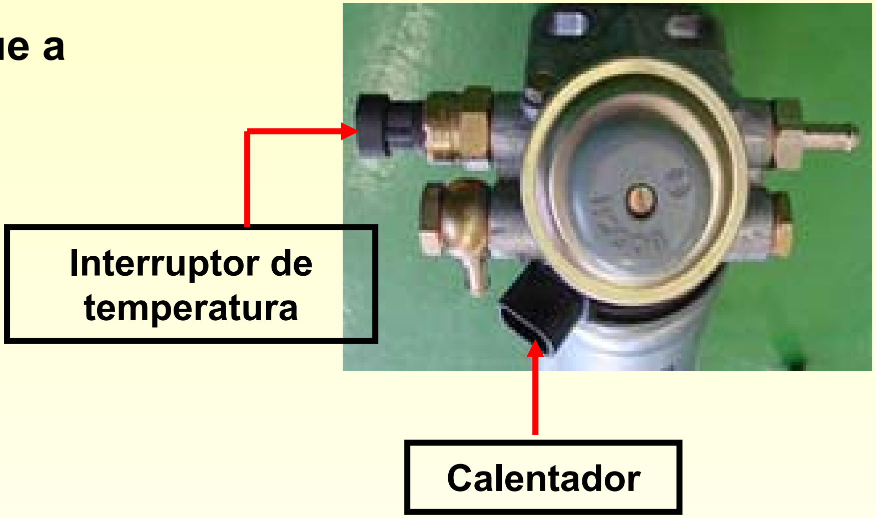
① **Filtro**
② **INterruptor de temperatura del gasoil**
③ **Sensor de agua**
④ **Calentador del gasoil**
⑤ **Purgador**

Línea de baja presión – Sistema de calentamiento

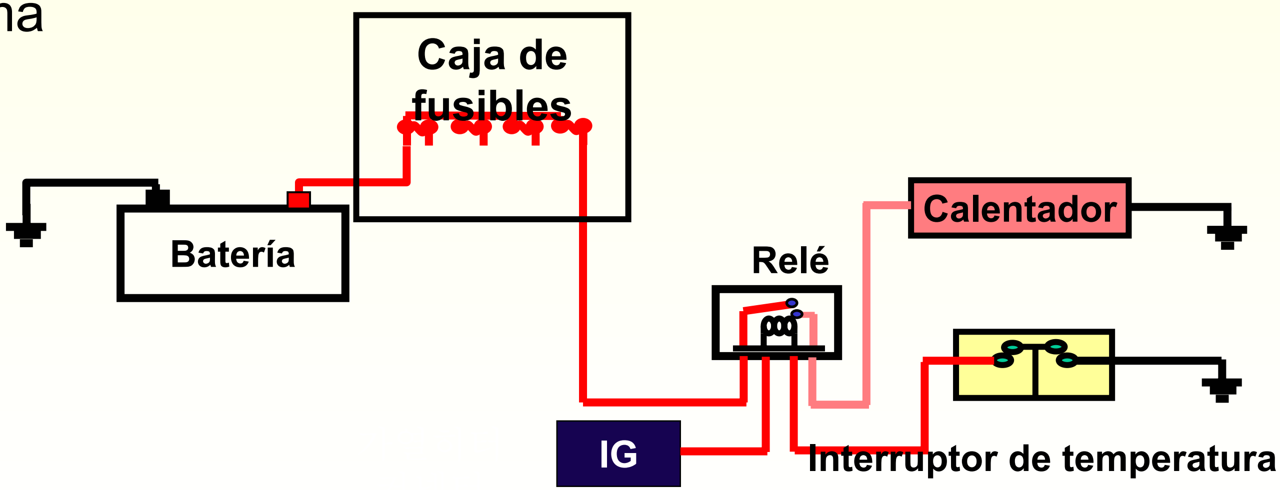
■ Descripción

- Previene que el gasoil se solidifique a bajas temperaturas.

- Funcionamiento :
  - on : por debajo de -5℃
  - off : por encima de 3℃

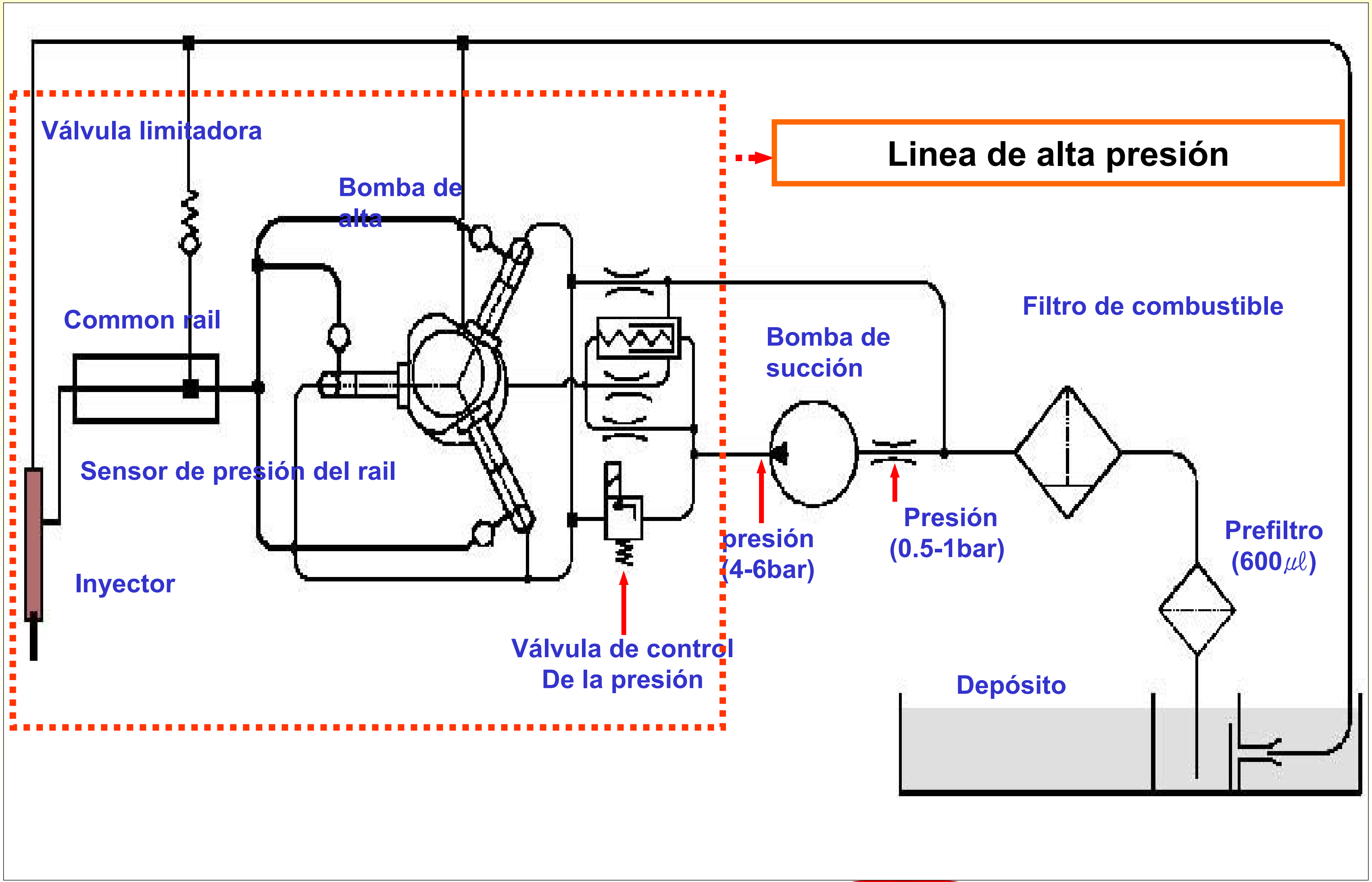


■ Diagrama



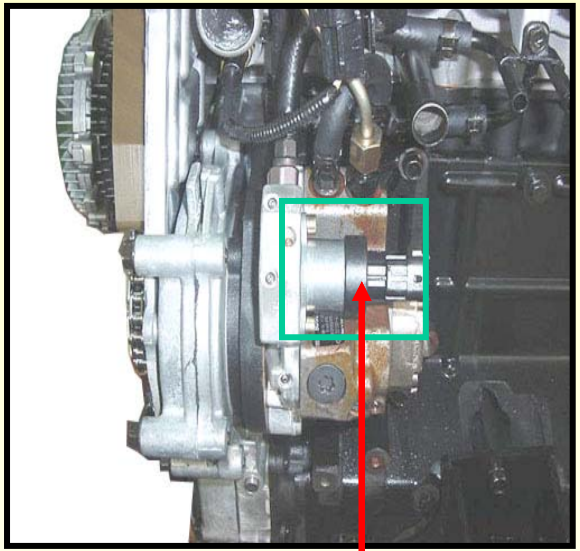
Línea de baja presión – Bomba de aspiración

Sistema de combustible – Línea de alta presión

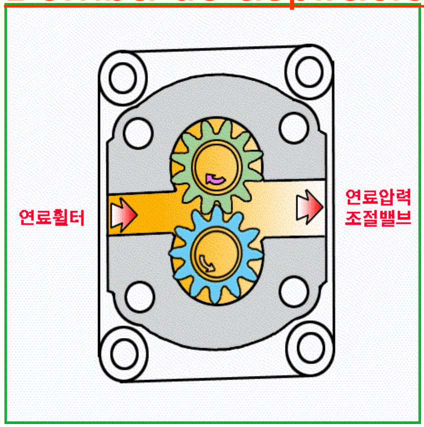


Línea de alta presión – Válvula de control de presión

■ Componentes



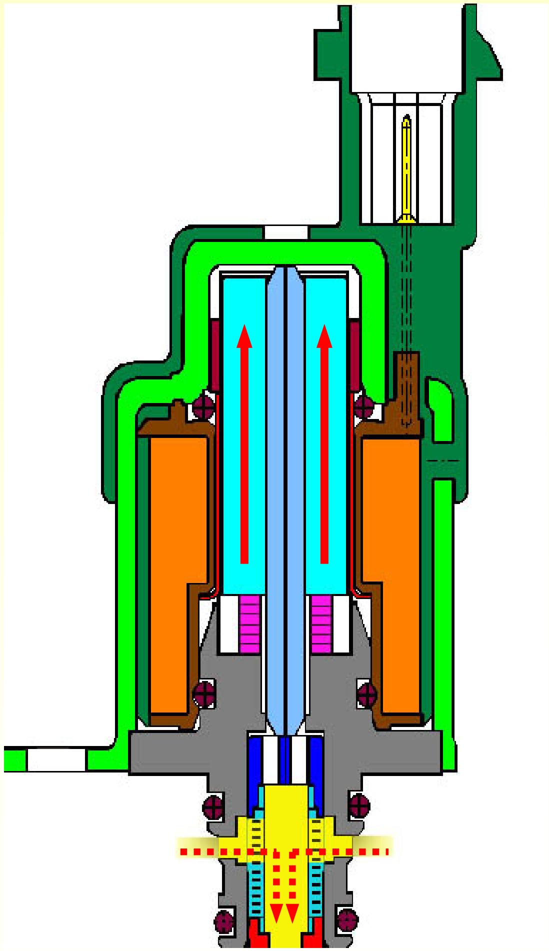
Bomba de aspiración

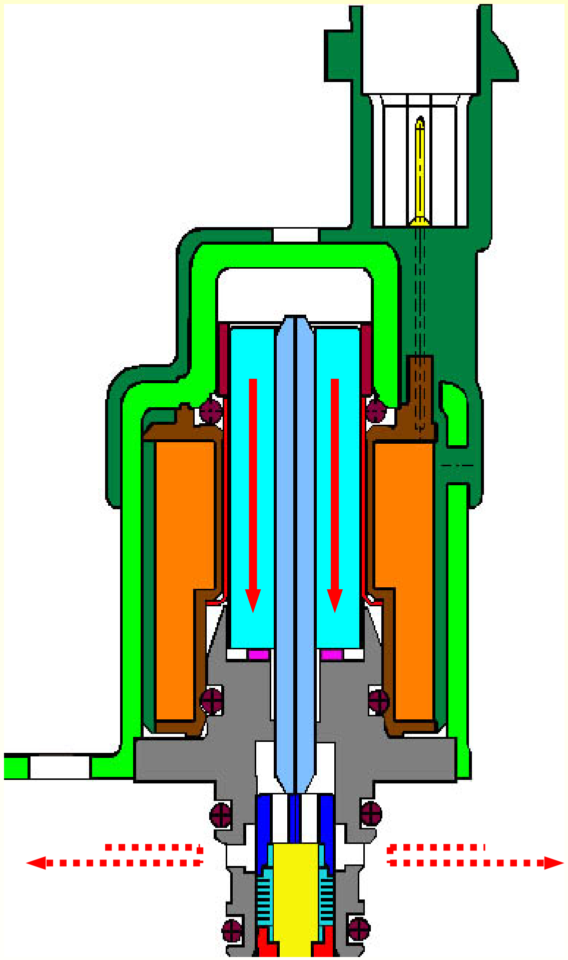


Válvula de control

Bomba de alta

Línea de alta presión – Válvula de control de presión



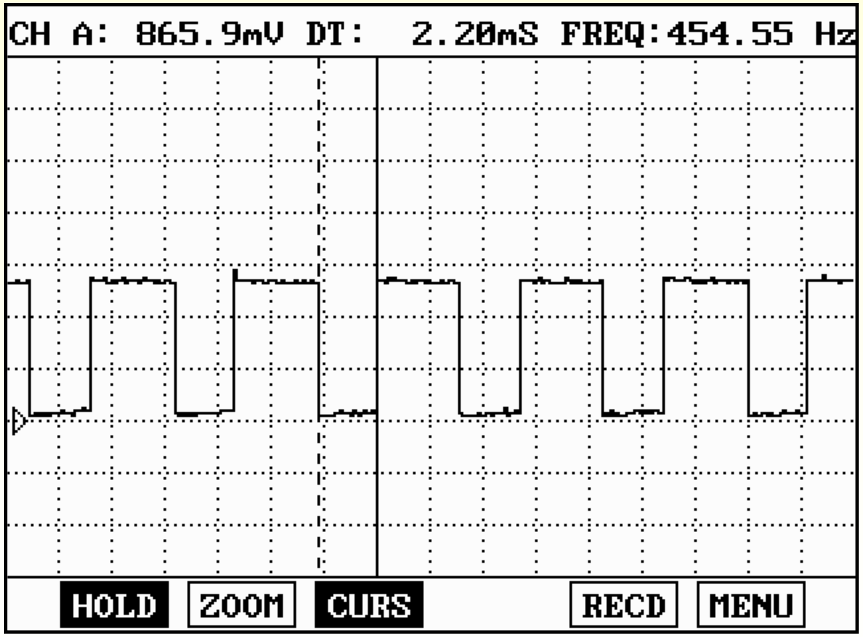


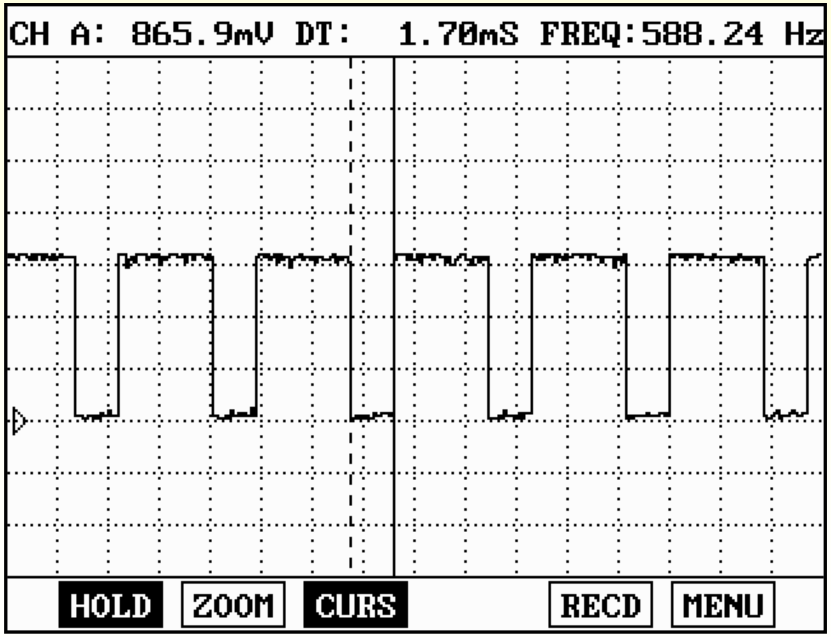
Línea de alta presión – Válvula de control de presión

■ Componentes

- Ralentí (800rpm) :
Ciclo ≒ 45%
Presión del rail ≒ 270bar

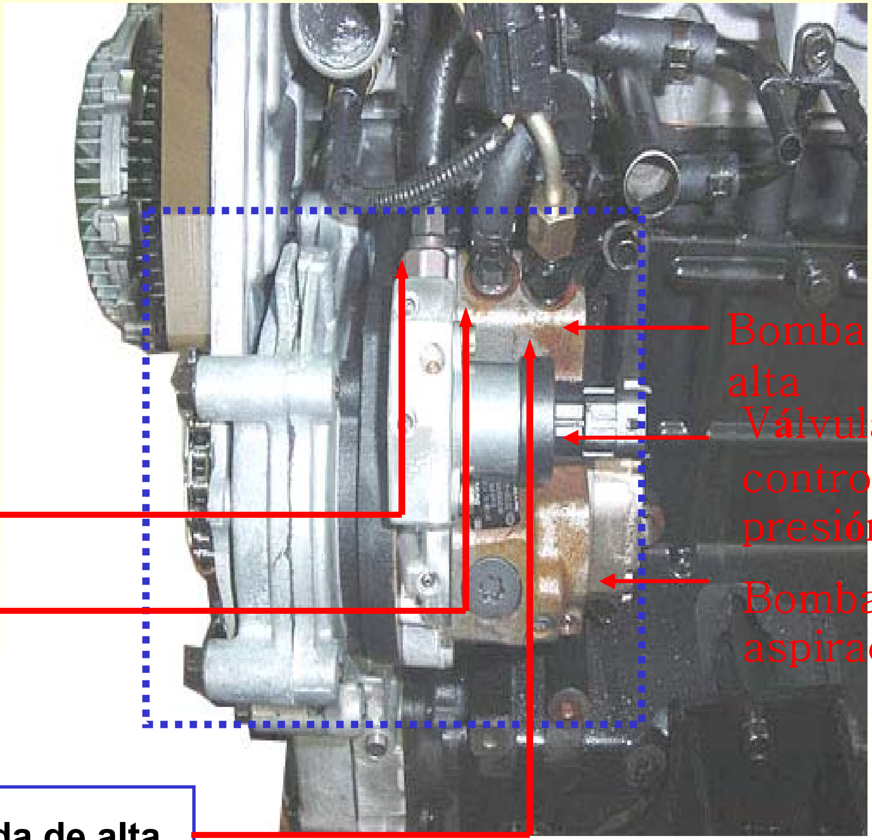
- Carga (4500rpm):
Ciclo ≒ 35%
Presión del rail≒1350bar





Línea de alta preaión – Bomba de alta presión

■ Componentes

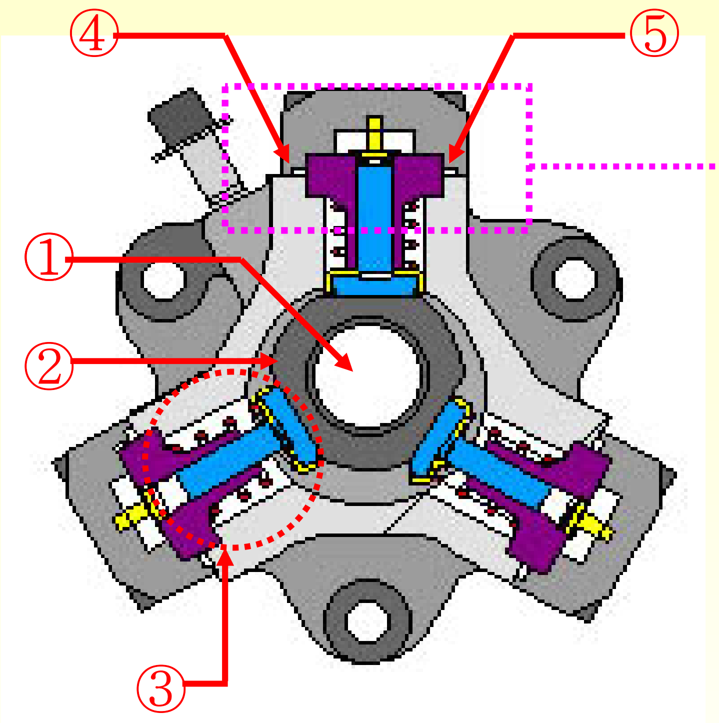


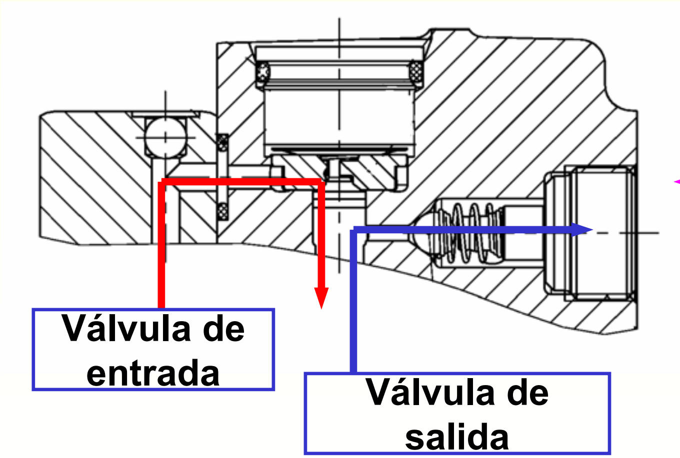
Línea d alta presión – Bomba de alta presión

■ Componentes

- Componentes principales :

① **Eje principal**
② **Eje excéntrico.**
③ **Pistones**
④ **Válvula de entrada**
⑤ **Válvula de salida**





Línea de alta presión – Rail común

■ Componentes

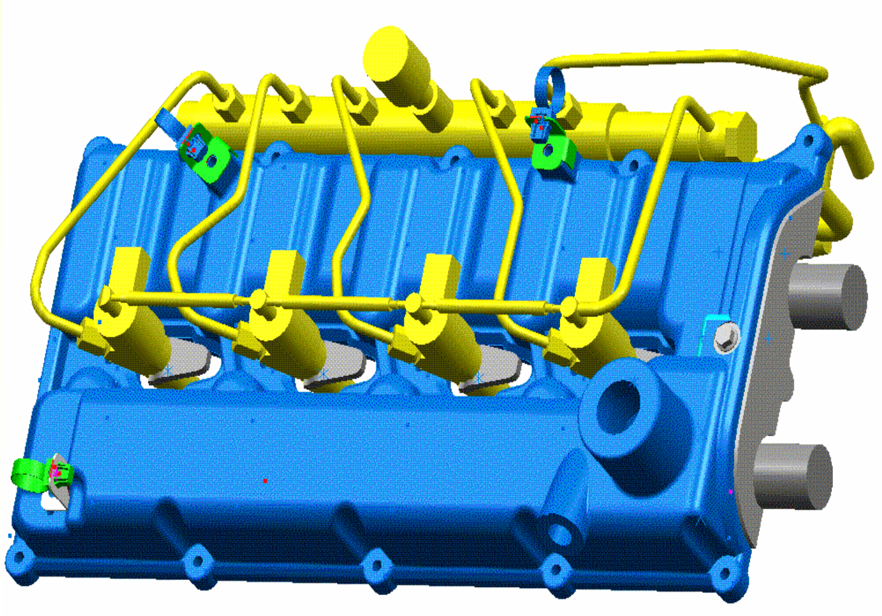
① **Rail**

② **Entrada desde la bomba**

③ **Sensor de presión del rail**

④ **Válvula limitadora de presión**

⑤ **Tuberías de los inyectores**

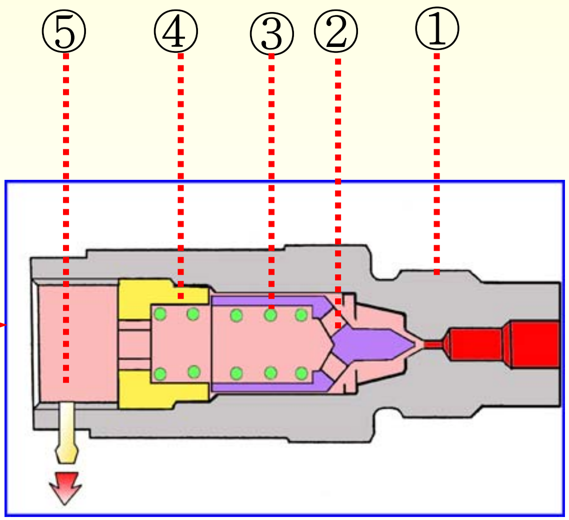


Línea de alta presión – Válvula limitadora de presión

■ Componentes

Válvula mecánica.

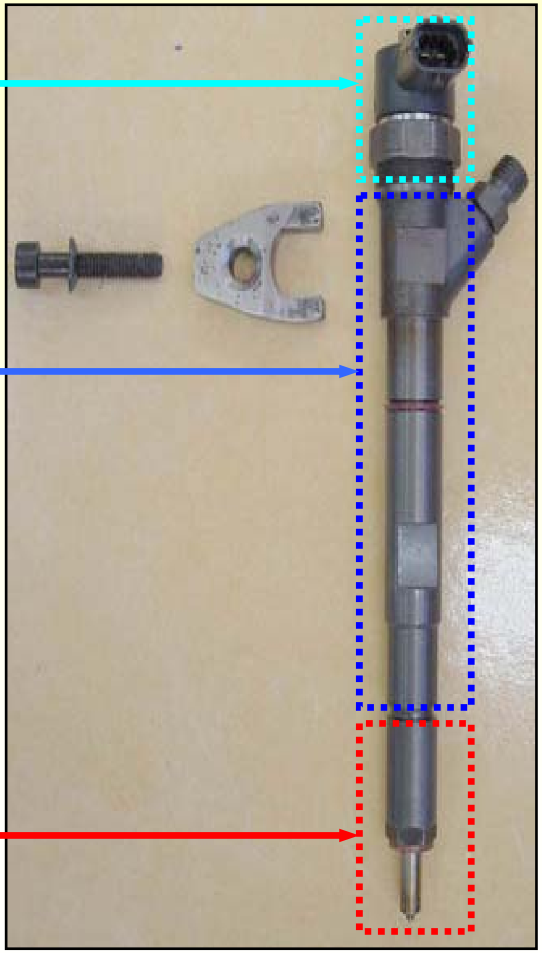
Abre cuando la presión en el rail sube a 1.750 bares



① **Conexión al rail**
② **Paso de combustible**
③ **Pistón**
④ **Muelle**
⑤ **Retorno de combustible**

■ Componentes

- **Situado en el centro de la cámara de combustión, inyecta el combustible en la cantidad y tiempo exacto determinado por la unidad de control.**



Parte del solenoide

Parte mecánica

Parte de inyección

※ Corriente inicial de apertura : 80V/20A

Línea de alta presión – Inyector

■ Componentes

① **Retorno de combustible**

② **Conector**

③ **Solenoide**

④ **entrada de combustible**

⑤ **Bola**

⑥ **Canal de descarga**

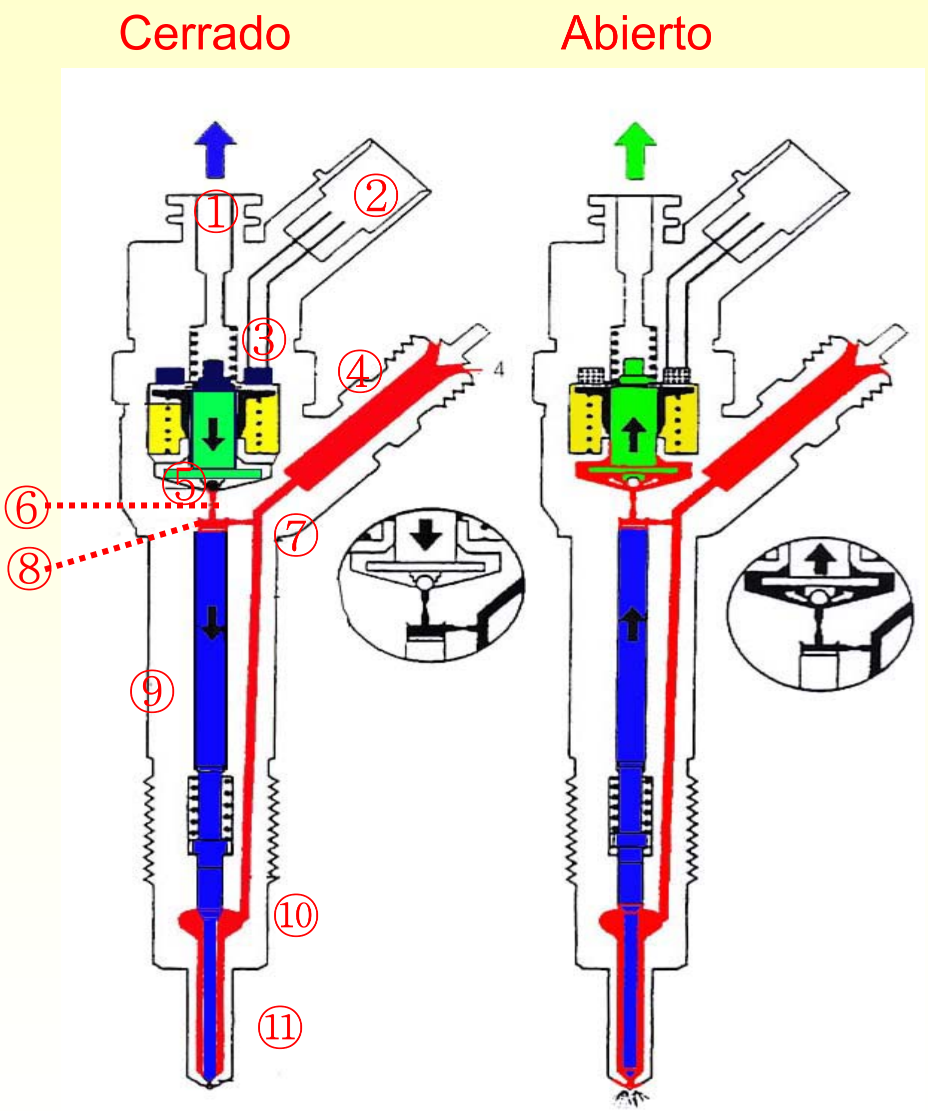
⑦ **Canal de alimentación**

⑧ **Cámara de control**

⑨ **Embolo**

⑩ **Paso de combustible**

⑪ **Aguja**



Componentes :

- Secuencia de la inyección :

A = Intensidad

B = Carrera en mm

C = Presión en alta

D = Tiempo de inyección

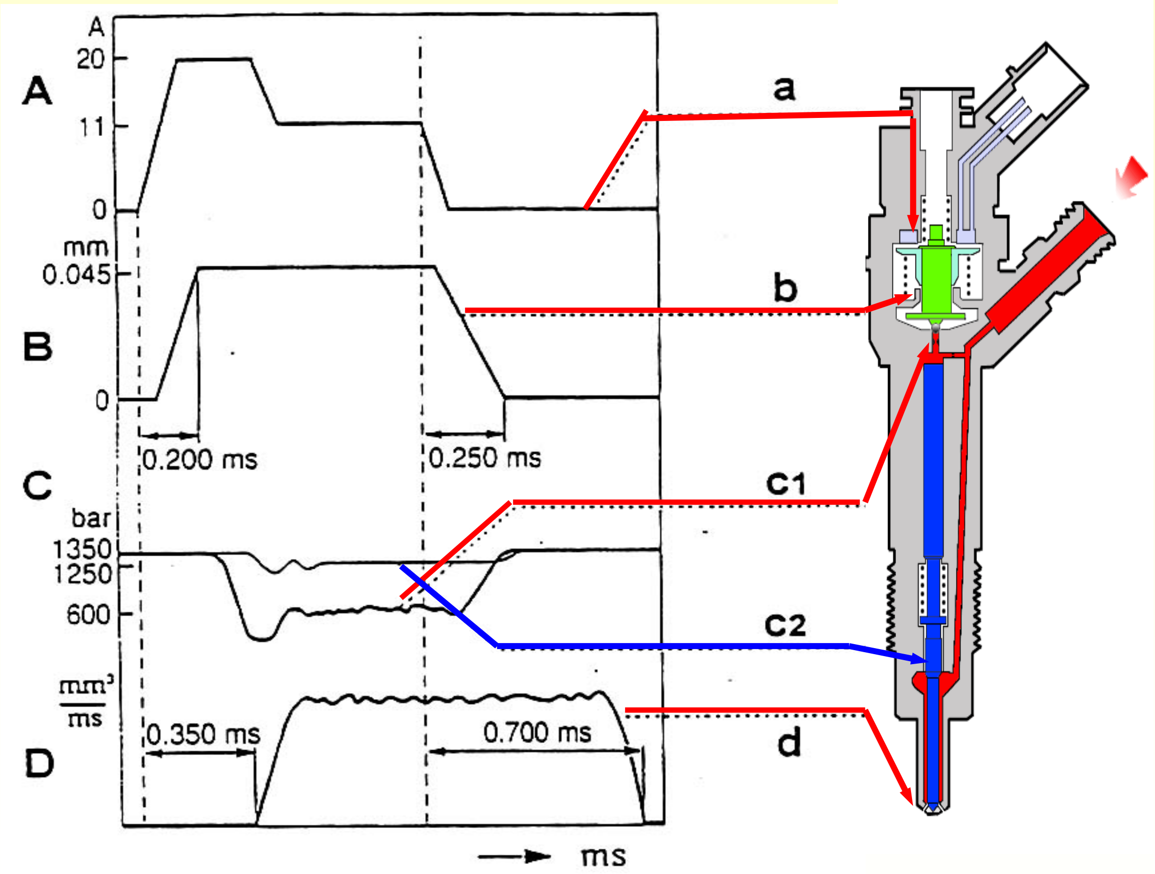
a = Coriiente al solenoide

b = Carrera de la válvula

c1 = Presión en la cámara de control

c2 = Presión de alimentación

d = Inyección



KIA MOTORS

Línea de alta presión – Inyector

Control de la inyección :

1 Descarga del condensador

2 Apertura del inyector

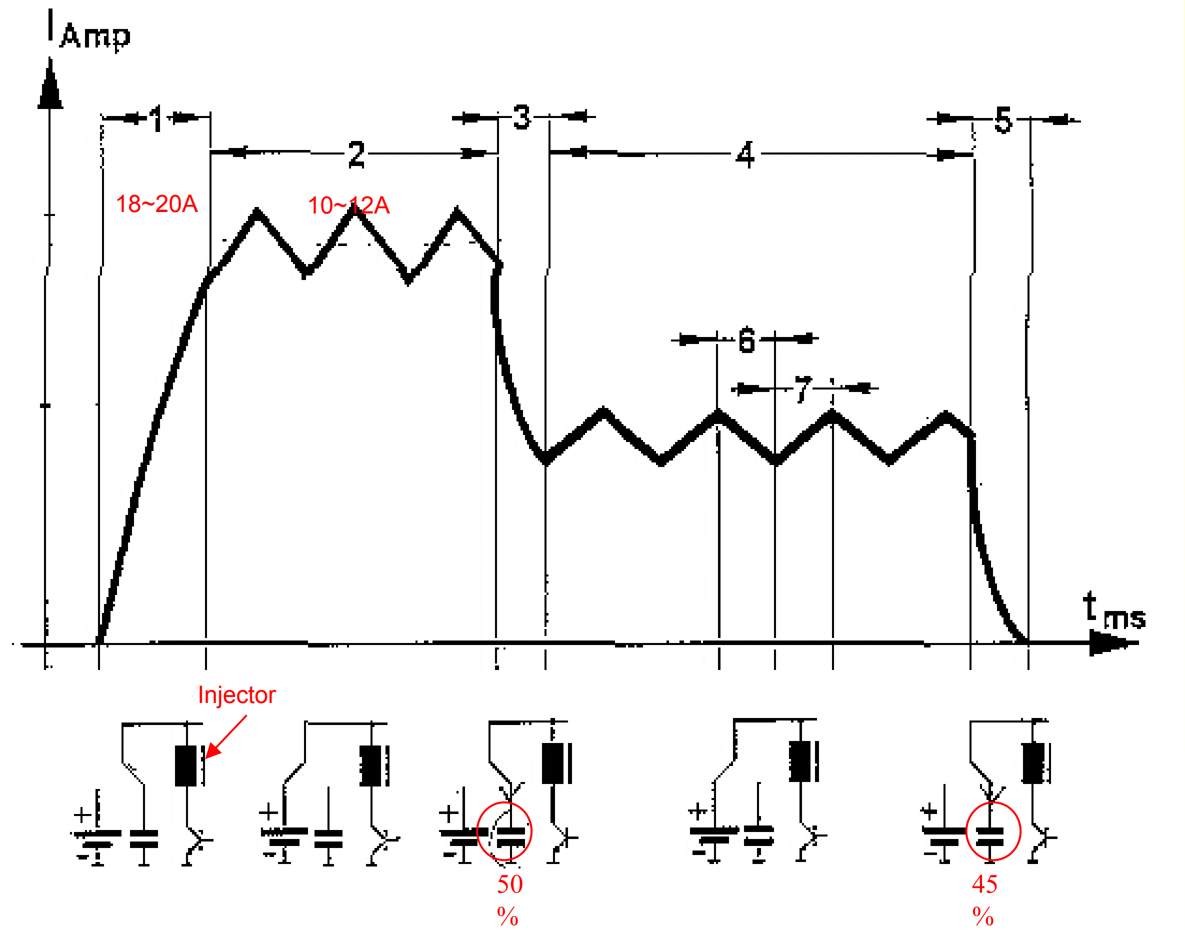
3 Carga del condensador

4 Mantenimiento de la corriente

5 Carga del condensador

6 Corriente de mantenimiento

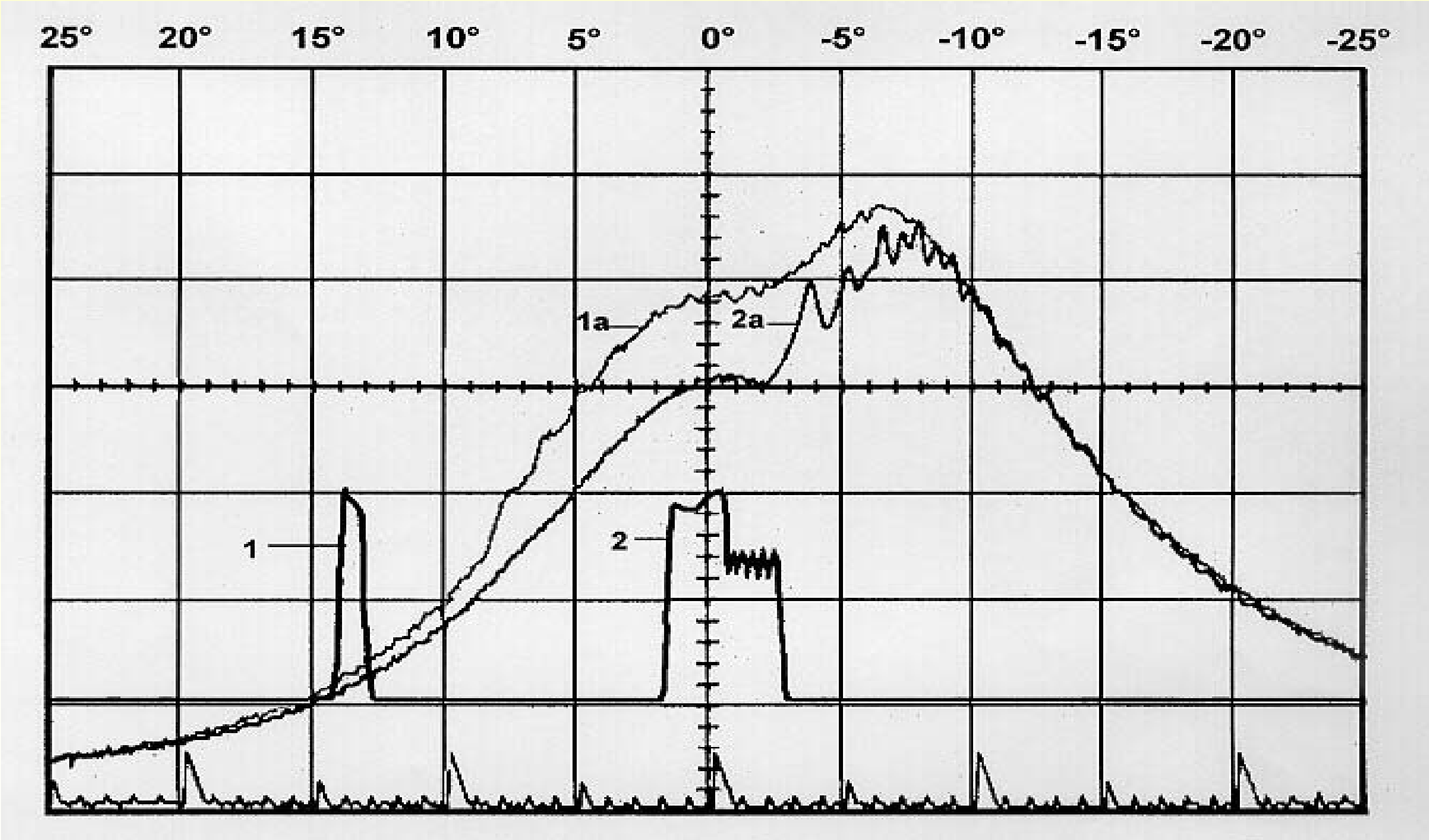
7 Corriente de mentenimiento



Línea de alta presión – Inyector

■ Descripción :

- Inyección piloto :



1 = Inyección piloto

1a = Presión de la inyección con inyección piloto

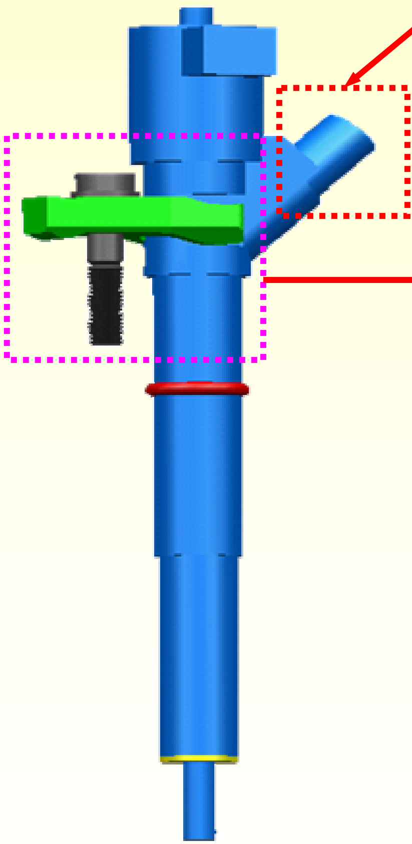
2 = Inyección principal

2a = Presión de la inyección sin inyección piloto

Línea de alta presión – Inyector

■ Descripción :

- Montaje del inyector :

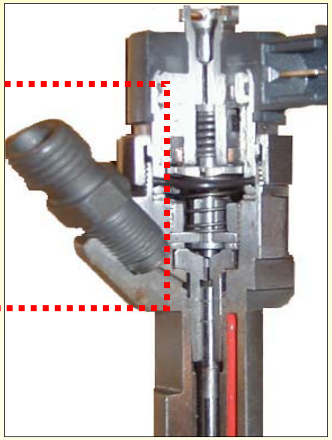


Entrada de combustible

- Par de apriete : 2.5~2.9kg-m

Arandela de sujección

- Par de apriete : 3.1±0.3kg-m



Electronic Diesel Control

(EDC)

EDC – Entradas / Salidas

entradas

1. Sensor de masa de aire
2. ECT Sensor
3. IAT Sensor
4. CKP Sensor
5. CMP Sensor
6. Rail Pressure Sensor
7. Acel. Pedal Sensor
8. Interruptores
   - Freno
   - Embrague
   - A/C
9. Sensor vel. vehículo

ECM

salidas

1. Inyector
2. Válvula control presión
3. Relés
   - Principal
   - Calentadores
   - Ventilador
   - Ventilador condensador
4. VAC modulador de EGR
5. Calentadores refrigerante
6. CAN

EDC – ECM

■ Descripción :

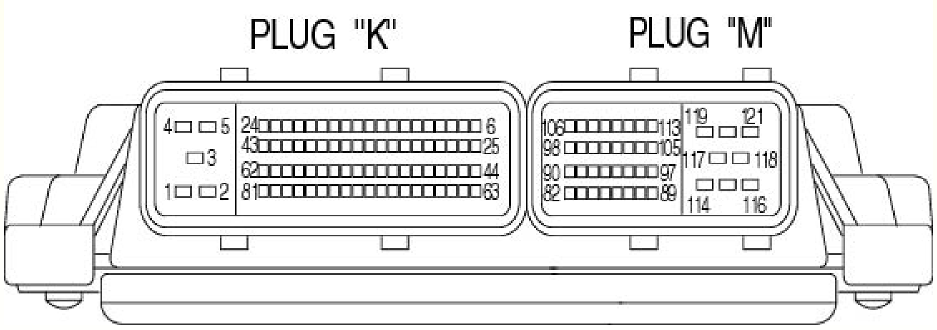
- Borrado de códigos de avería :

Los códigos de avería almacenados en la ECM sólo pueden ser borrados usando el Hi-Scan Pro.

- Función de identificación :

Ya que el Sorento usa la misma ECM, ya sea con cambio manual o cambio automático, es necesario programar el tipo de cambio usado utilizando el Hi-Scan Pro.

Sorento ECM conector



EDC – Emergencia

- **Parada de emergencia**

  Por razones de seguridad, la ECM efectúa una parada del motor cuando hay una avería en los siguientes casos :

  ① Inyectores

  ② Sensor del cigüeñal

  ③ válvula de control de presión

  ④ Fugas de combustible

- **Atención : No se debe trabajar en el sistema de combustible hasta pasados 30 segundos despues de que el motor esté parado.**

EDC – Sensor de masa de aire con película caliente

■ Componentes :

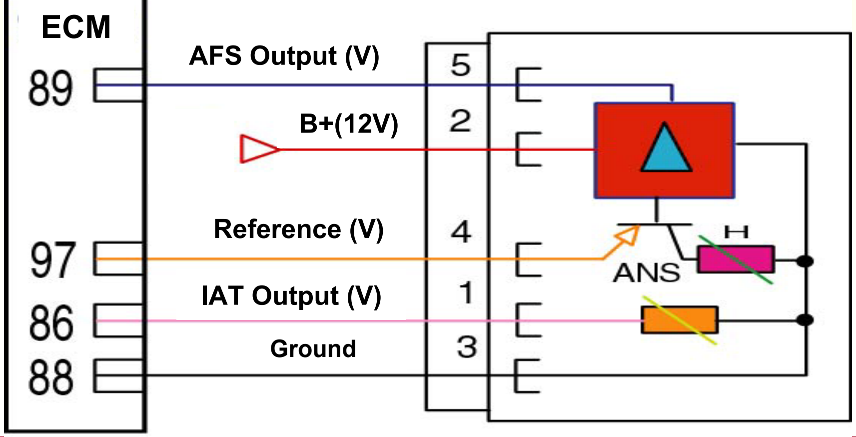
- El principio de funcionamiento está basado en el enfriamiento de la película caliente, esto produce una variación de la resistencia que la unidad traduce en la cantidad de aire que entra. Este valor es usado por la ECM exclusivamente para el funcionamiento de la EGR. El sensor de temperatura del aire de admisión está integrado.

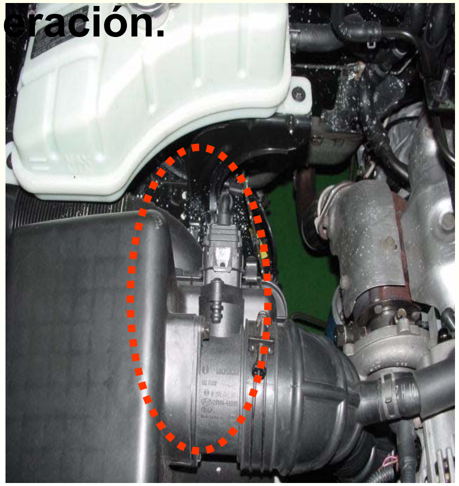
- Functions :

① Control de la EGR

② Corrección del combustible en aceleración y desaceleración.

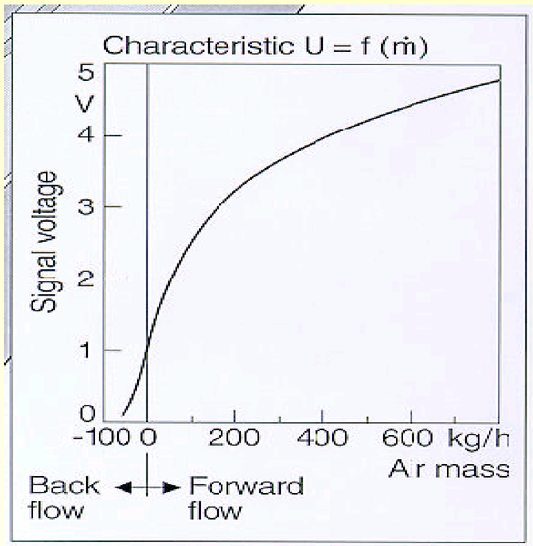
Sensor de aire

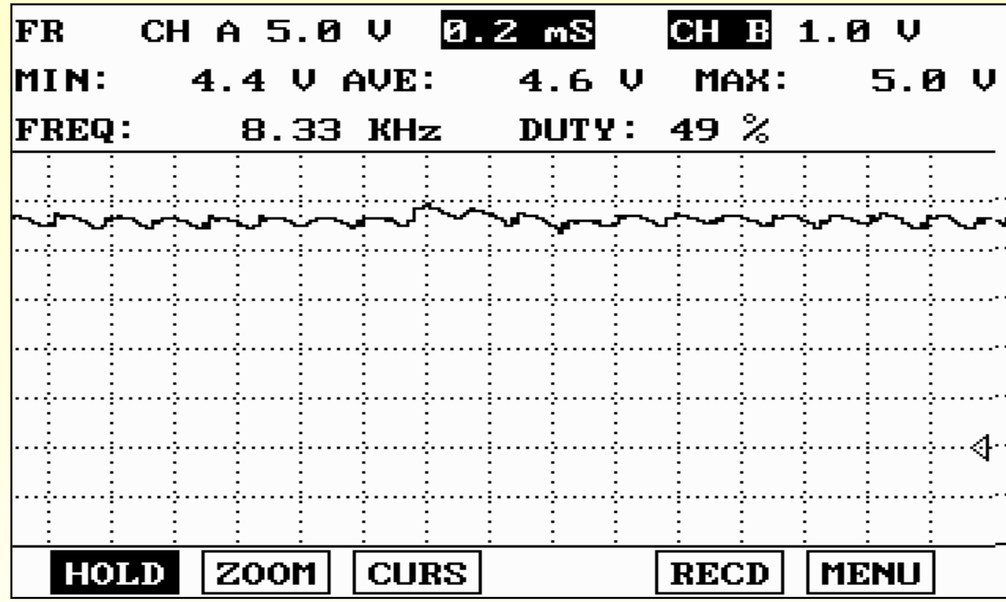




EDC – Sensor de masa de aire

- En caso de avería, las revoluciones del motor se limitan a <u>2250rpm</u>





Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
	C001	Signal below lower limit(Air mass <-20kg/h)					
0100	**C002**	Signal above upper limit(Air mass>800kg/h)		**Y**	**Y**		**Eng. Run**
	C003	General Error(Reference Volt> 4.7~5.1)					

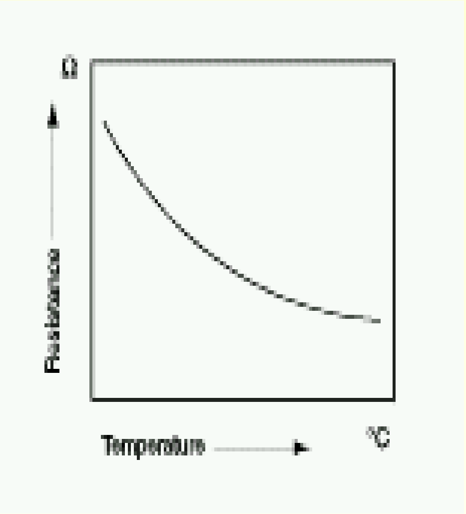
EDC – Sensor de tem. del aire de admisión

■ Descripción :

- **El IAT está integrado en el sensor de masa de aire. Usando una resistencia NTC, el sensor mide la temperatura del aire de admisión.**

Cuando hay una avería en el sensor, el valor de temperatura alternativo es de 50℃.

[Characteristic curve]

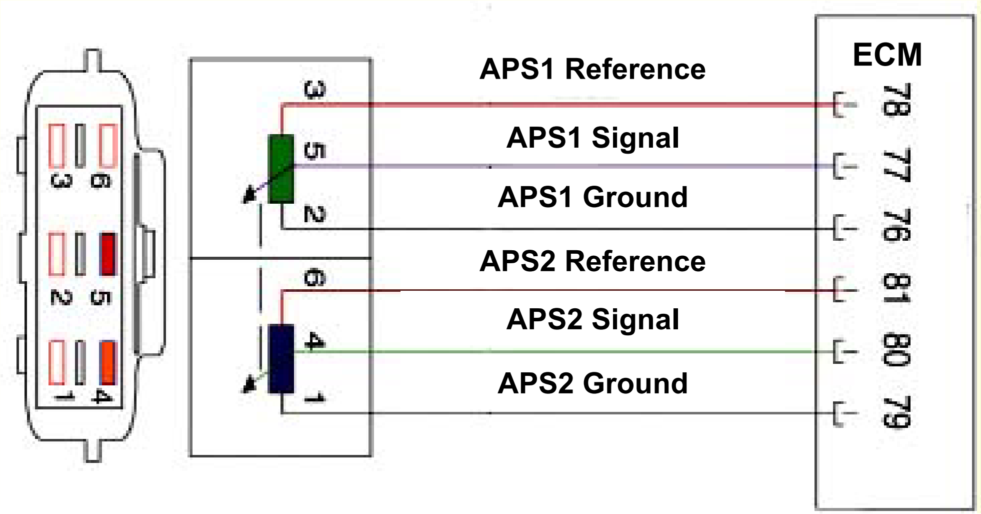


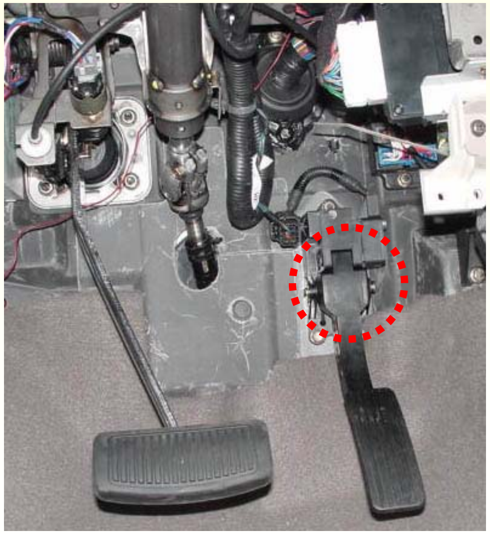
Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
	C001	Signal below lower limit(Signal <224mV)					
0110	**C002**	Signal above upper limit(Signal>4.97V)		**Y**			**IG On**
		(Malfunction set value : 50℃)					

EDC – Sensor del pedal del acelerador

■ Descripción :

- **El sensor del pedal de acelerador está situado en el pedal del acelerador y mide la posición del pedal para controlar la cantidad de inyección a través de la señal que llega a la ECM. El sensor está compuesto de dos potenciómetros APS1 y APS2. El APS 1 es el sensor principal y el APS 2 se usa para controlar el funcionamiento correcto del APS1. El valor del sensor APS 2 es justo la mitad que el valor del APS 1.**



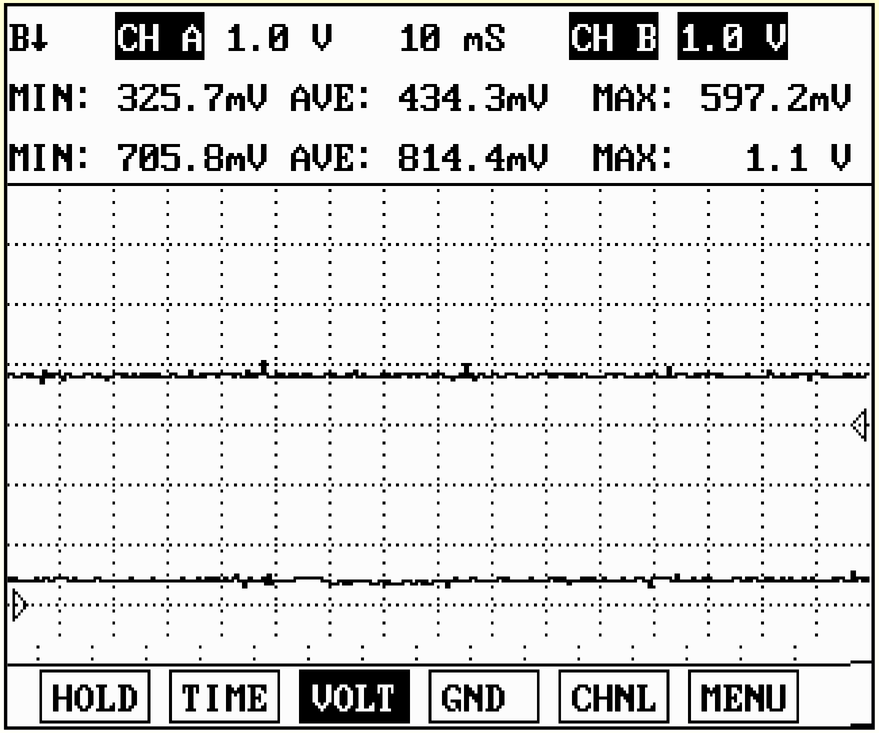


EDC – Sensor del pedal del acelerador

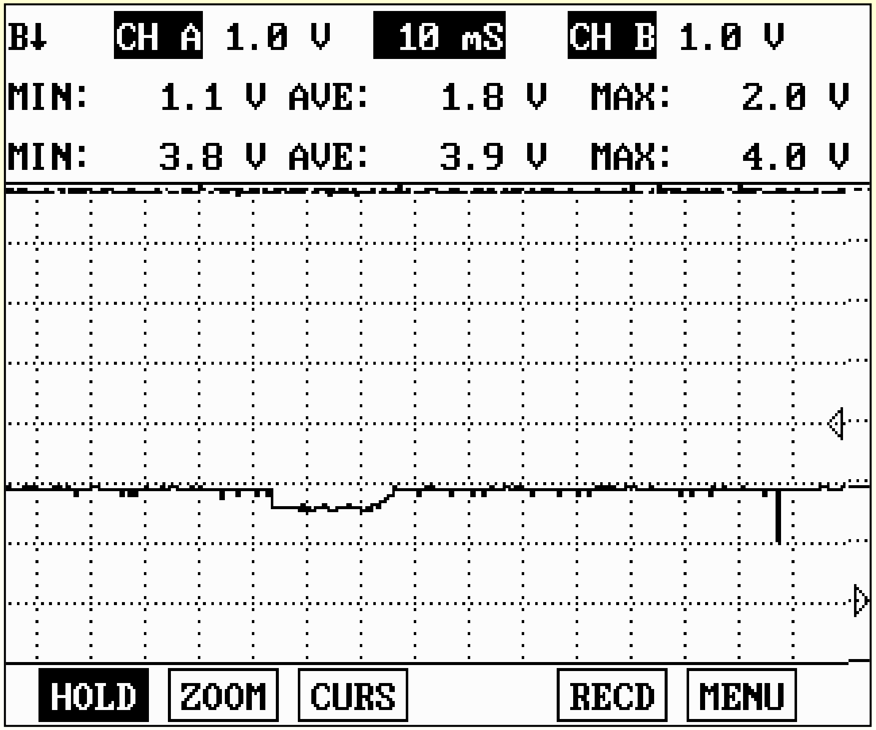
- Cuando hay un fallo del sensor las revoluciones del motor se limitan a 1250rpm

Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
0120	**C001**	Signal below lower limit(Signal <68.4mV)		**Y**	**Y**		**IG On**
	C002	Signal above upper limit(Air mass>4.9V)					
	C003	General error(Reference Volt>1.7~5.1)					
	C004	Plausibility error with brake signal					
0220	**C001**	Signal below lower limit(Signal <68.4mV)		**Y**	**Y**		**IG On**
	C002	Signal above upper limit(Air mass>2.45V)					
	C003	General error(Reference Volt>1.7~5.1)					
	C004	Plausibility error (APS 1 and APS 2)					

- Ralentí :

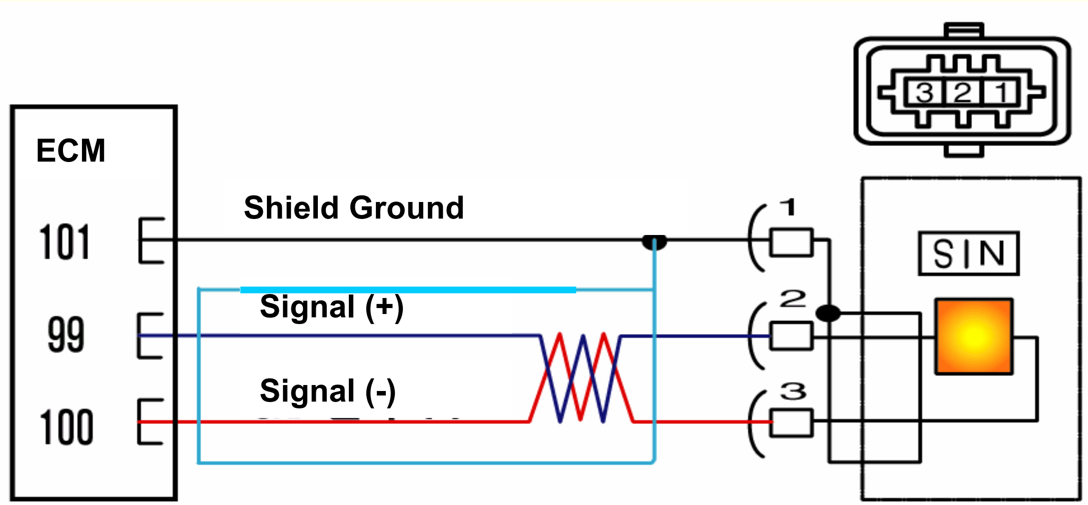


- Carga total :



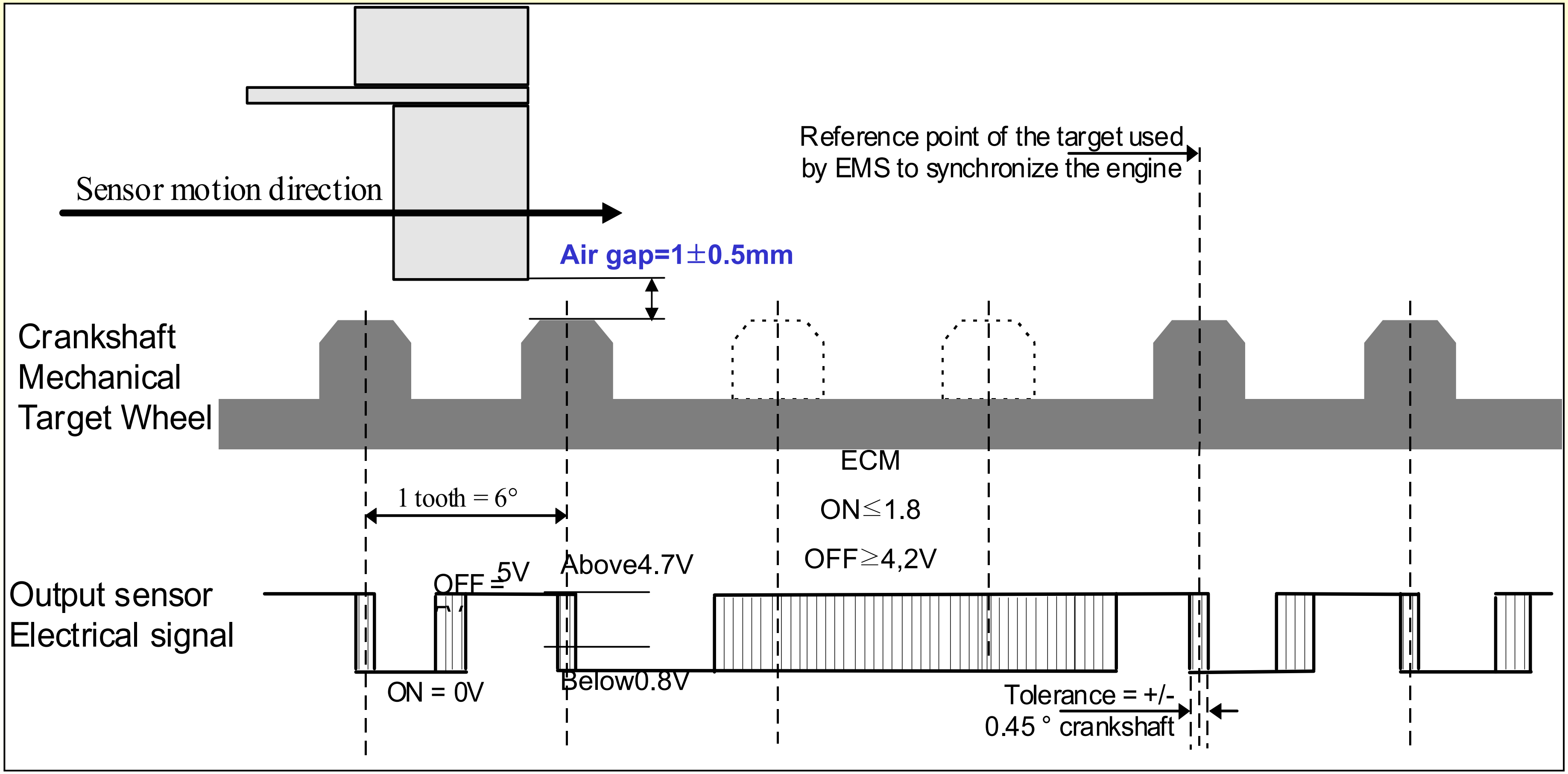
■ Descripción :

- El sensor del cigüeñal (CKP) es del tipo inductivo. Al paso de los dientes de la corona dentada (60 – 2) genera una corriente alterna que envía a la ECM, que traduce la señal y calcula las revoluciones del motor y el PMS.



EDC – Sensor del cigüeñal

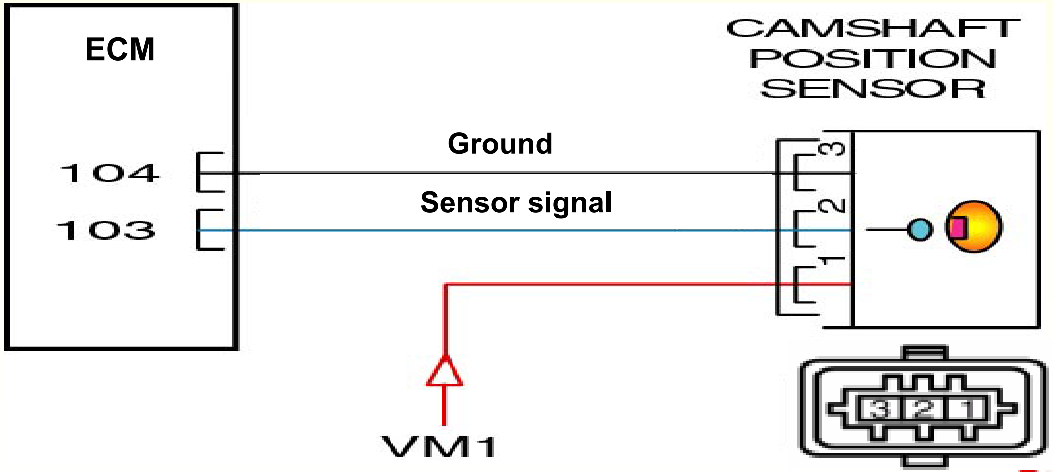
- Si hay código de avería, el motor se para y no vuelve a arrancar.

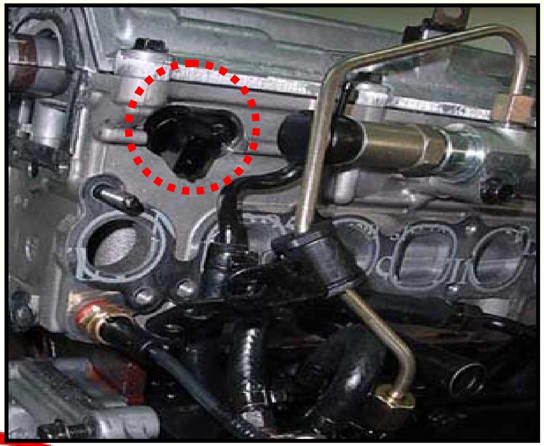


■ Descripción :

- El sensor del árbol de levas (CMP) es del tipo Hall :

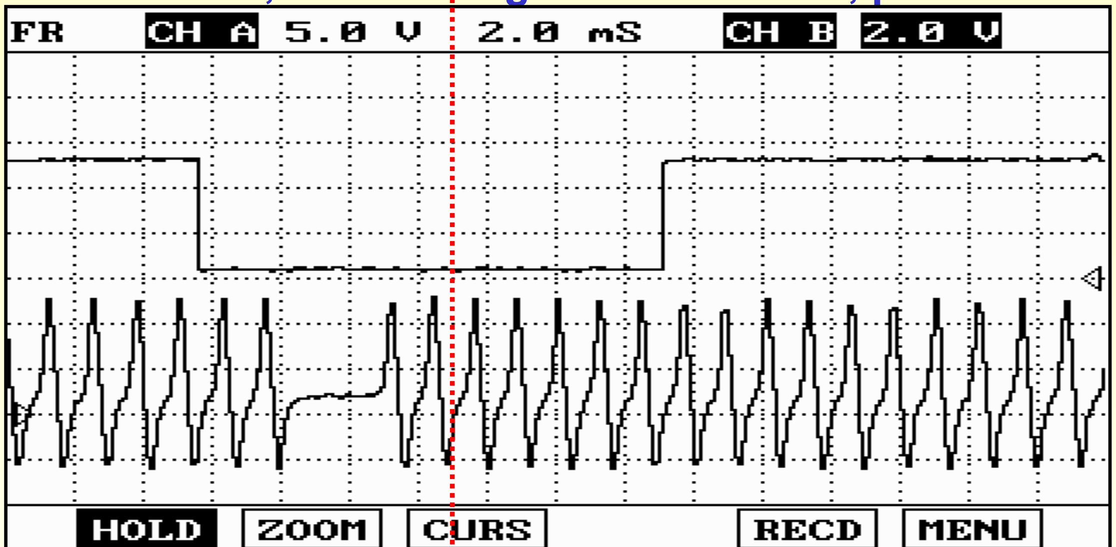
El sensor del árbol de levas controla la posición del árbol delevas enviando una señal a la ECM, de esta manera, la ECM cual es el pistón que está en la carrera de compresión, algo que sólo con el sensor del cigüeñal es imposible determinar.





EDC – Señal del CMP y del CKP

- Si hay un fallo del sensor, el motor sigue funcionando, pero no vuelve a arrancar.



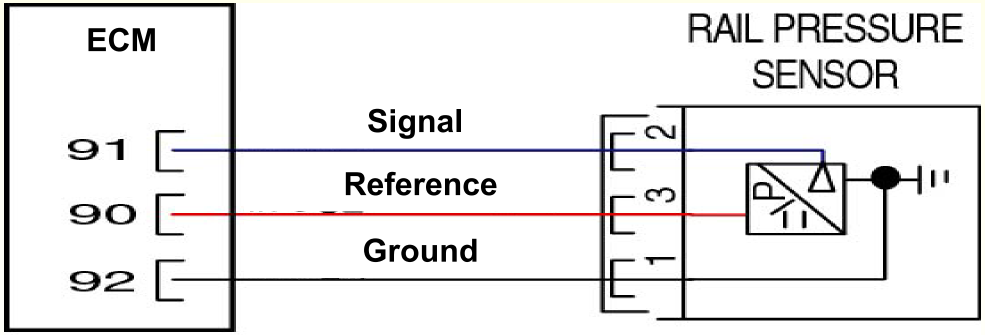
Code		Detail Description	Symptoms				Check Condition
DTC	CC		Fuel = 0	EGR off	Fuel Limit	MIL On	
0340	C001	CMP signal below lower limit(No signal)	No START			Y	Eng. Run
	C002	CMP Signal above upper limit					
	C003	CKP&CMP General error (Rationality check)	Y				
	C004	CKP Plausibility error					

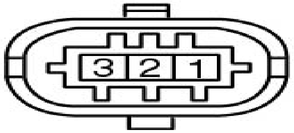
EDC – Sensor de presión del rail (RPS)

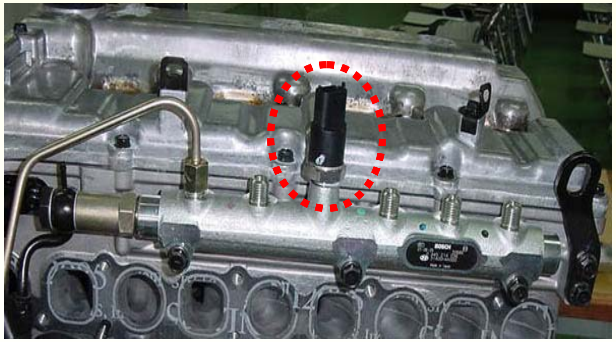
■ Descripción :

- El sensor de presión del rail (RPS) está ubicado en el rail:

El objetivo del sensor es medir la presión del rail en cada momento mandando una señal en forma de voltaje a la ECM.

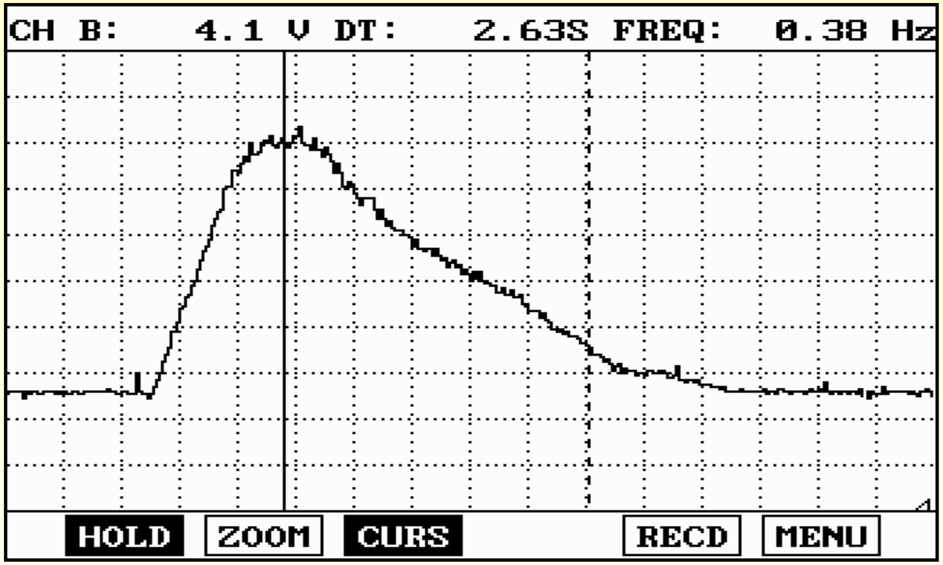






EDC – Sensor de presión del rail (RPS)

- Si falla el sensor, el motor se para y no vuelve a arrancar.



Arranque : 0.5→1.3V(≒250bar)

Ralentí : 1.3V(≒250~260bar)

WOT : 4.1V(≒1350bar)

- sensor monitoring

Code		Detail Description	Symptoms				Check Condition
DTC	CC		Fuel = 0	EGR off	Fuel Limit	MIL On	
	C001	Signal below lower limit(Signal <180mV)					
0190	C002	Signal above upper limit(Signal>4.8V)	Y		Y	Y	Eng.Run
	C003	General Error(Reference Volt> 4.7~5.1)					

EDC – Rail Pressure Sensor(RPS)

- Pressure monitoring : only conduct more than 700 rpm condition

Code		Detail Description	Symptoms				Check Condition
DTC	CC		Fuel = 0	EGR off	Fuel Limit	MIL On	
1181	C005	Maximum pressure exceed(pressure >1480bar)	Y		Y	Y	Eng. Run
	C006	* Pressure lower limit by rpm					
	C008	* Pressure target value check(Negative deviation)					
	C010	* Pressure target value check (Positive deviation)					

※ Pressure lower limit by rpm :

120bar / 800rpm, 180bar / 2000rpm, 230bar / 3000rpm, 270bar / 4000rpm

※ Pressure target value check : (RPS stuck, wiring problem)

350bar / 800rpm, 300bar / 2000rpm, 250bar / 3000rpm

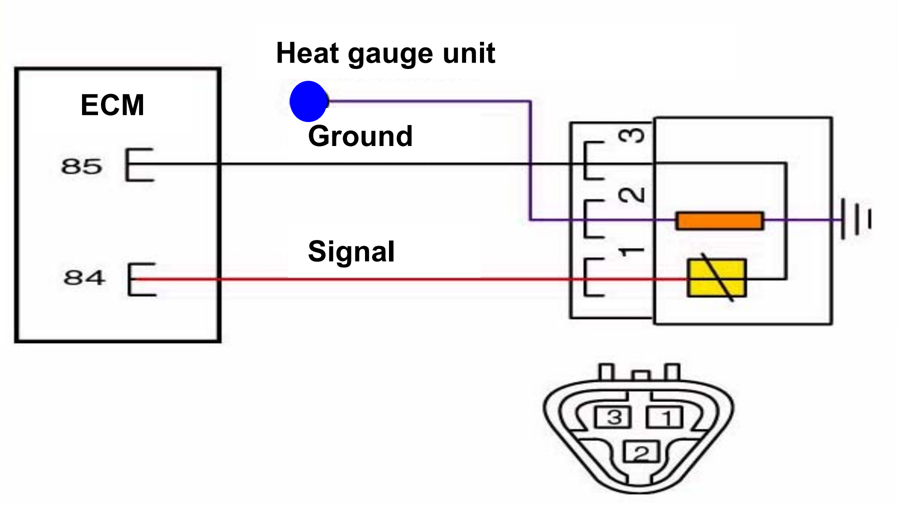
※ Pressure target value check : (fuel leakage, failure from feed pump or high pump)

300bar / 800rpm, 250bar / 2000rpm

EDC – Sensor de tempetatura del refrigerante (WTS)

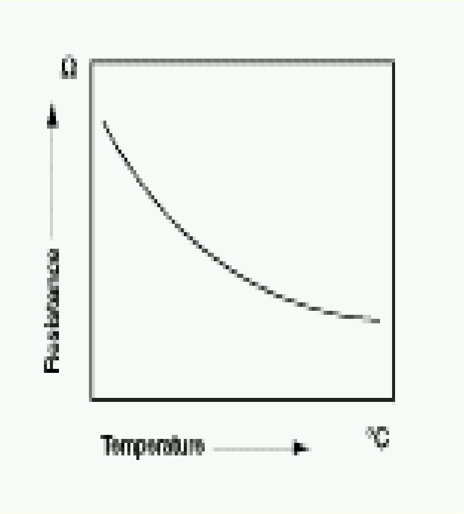
■ Components Descriptions :

- **El sensor está situado en la culata :**
  el sensor del tipo NTC mide la temperatura del refrigerante y manda una señal a la ECM. La resistencia del sensor disminuye cuando la temperatura del refrigerante aumenta.
  La ECM utiliza la señal para calcular el avance de la inyección y adecuar las revoluciones del motor. También disminuye la cantidad de inyección cuando el motor está a la temperatura de servicio.



EDC – Sensor de temperatura del refrigerante (WTS)

[Characteristic curve]



- Si falla el sensor :

① No funciona el A/C ni el precalentamiento del refrigerante, el ventilador funciona constantemente.

② Valor alternativo : después del arranque : 80℃

antes de arrancar : -20℃

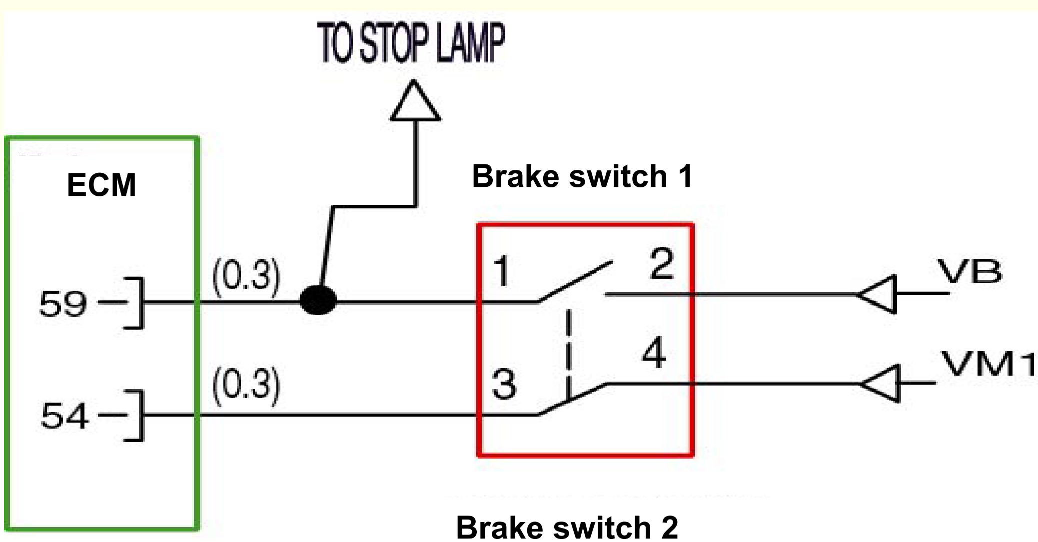
Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
C0115	**C001**	Signal below lower limit(Signal <225mV)					**IG. On**
	C002	Signal above upper limit(Signal>4.9V)					

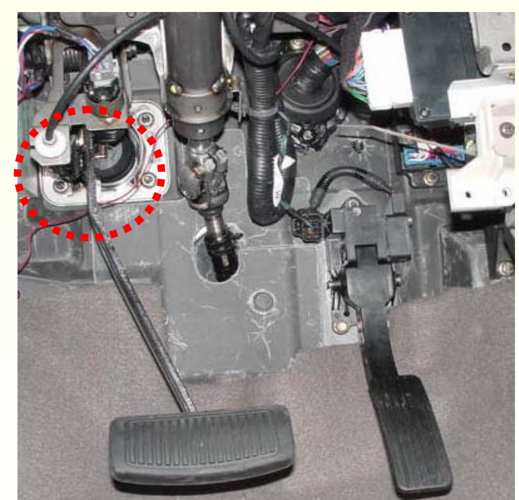
EDC – Interruptor del freno

■ Descripción :

Hay dos interruptores por razones de seguridad. Cuando el pedal de freno se pisa el interruptor 1 se cierra, mientras que el 2 se abre.

A través de estas señales contrarias, la ECM es capaz de controlar en todo momento el estado del interruptor del freno.





EDC – Interruptor del freno

Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
0703	**C004**	Plausibility error (comparing switch 1& 2)					**IG On**

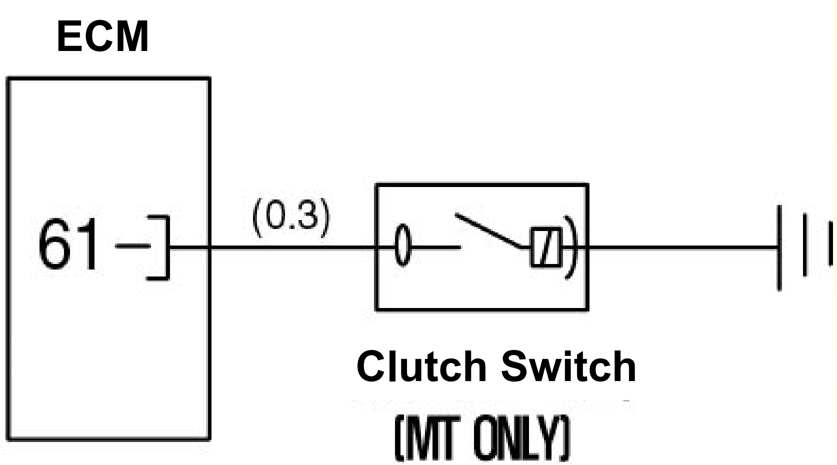
EDC – Interruptor del embrague

■ Descripción :

- Sólo se usa para cambio manual :

① Reduce la emisión de humos al cambiar de marcha

② Control de crucero

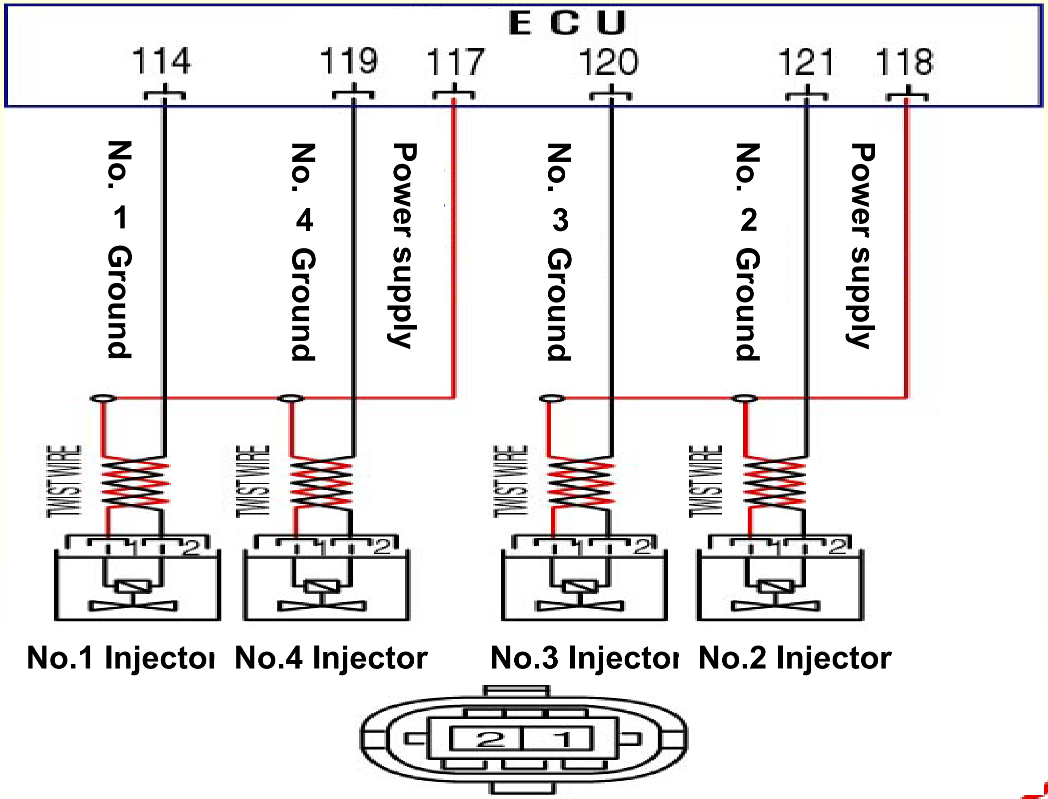


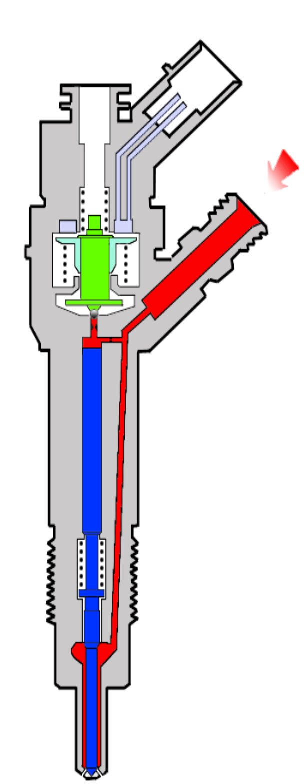
Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
0704	**C004**	Plausibility error (No signal within 80km/h)					**IG On**

EDC – Inyector

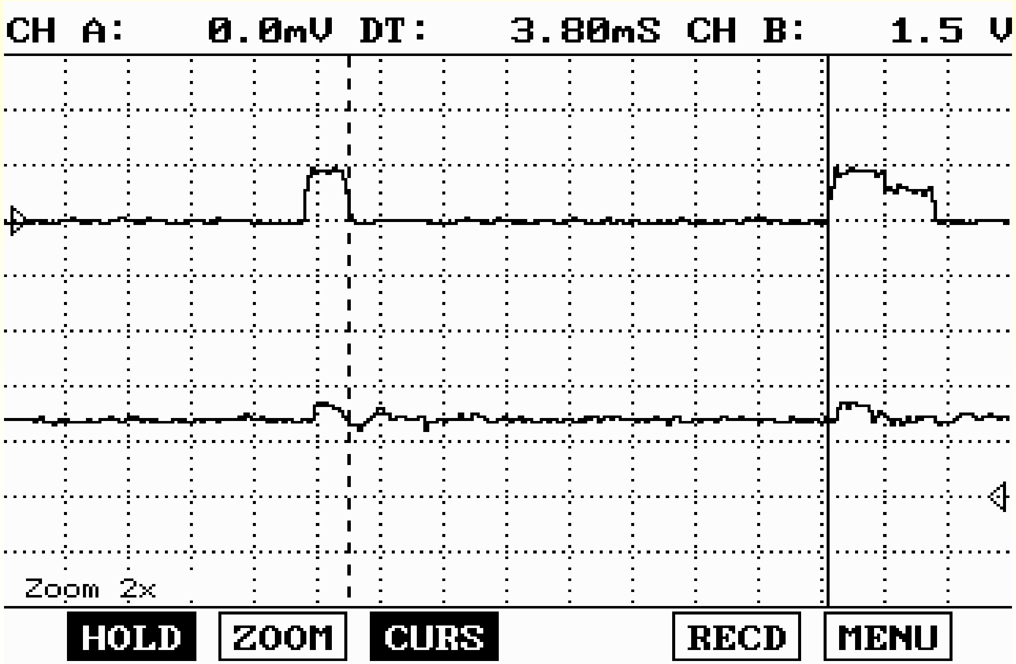
■ Descripción :

Los inyectores montados en el Sorento tiene un sistema servo hidráulico y una bobina. **Corriente de apertura : 20A±1A, corriente de mantenimiento : 12A±1A**

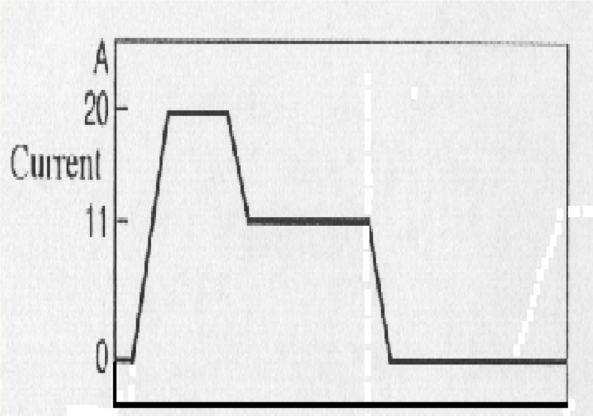




- Si fallan dos o más inyectores el motor se para automáticamente.



[Characteristic curve]



EDC – Inyector

Code		Detail Description	Symptoms				Check Condition
DTC	CC		Fuel = 0	EGR off	Fuel Limit	MIL On	
0201 0202 0203 0204	C018	Low side Line short circuit(current>29.5~34A) High side line short circuit(current>28~36A)			Y	Y	Eng. Run
	C019	Line open circuit					

※ 0201 : Injector No. 1 0202 : Injector No. 2

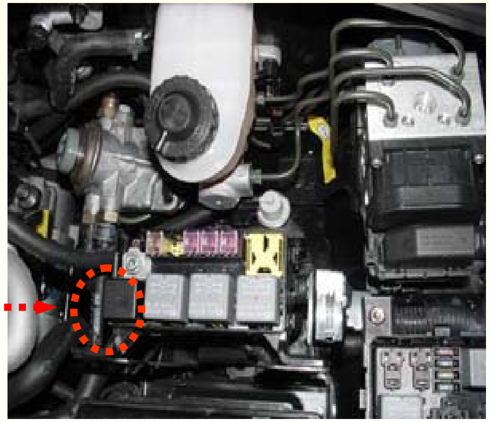
0203 : Injector No. 3 0204 : Injector No. 4

EDC – Sistema de calentadores

■ Descripción :

El sistema de calentadores es responsable de un aranque perfecto cuando el motor está frío y también acorta el periodo de calentamiento, lo que reduce la emisión de gases.

Relé de calentadores



Calentadores

EDC – Sistema de calentadores

- El tiempo de calentamiento depende de la temperatura y de las revoluciones.
- Hay tres modos en el sistema de calentadores ;

① Precalentamiento :

Temp. refrigerante(℃)	-20℃	-10 ℃	20 ℃	50 ℃
Calentamiento (Sec.)	12	8	3	0.7

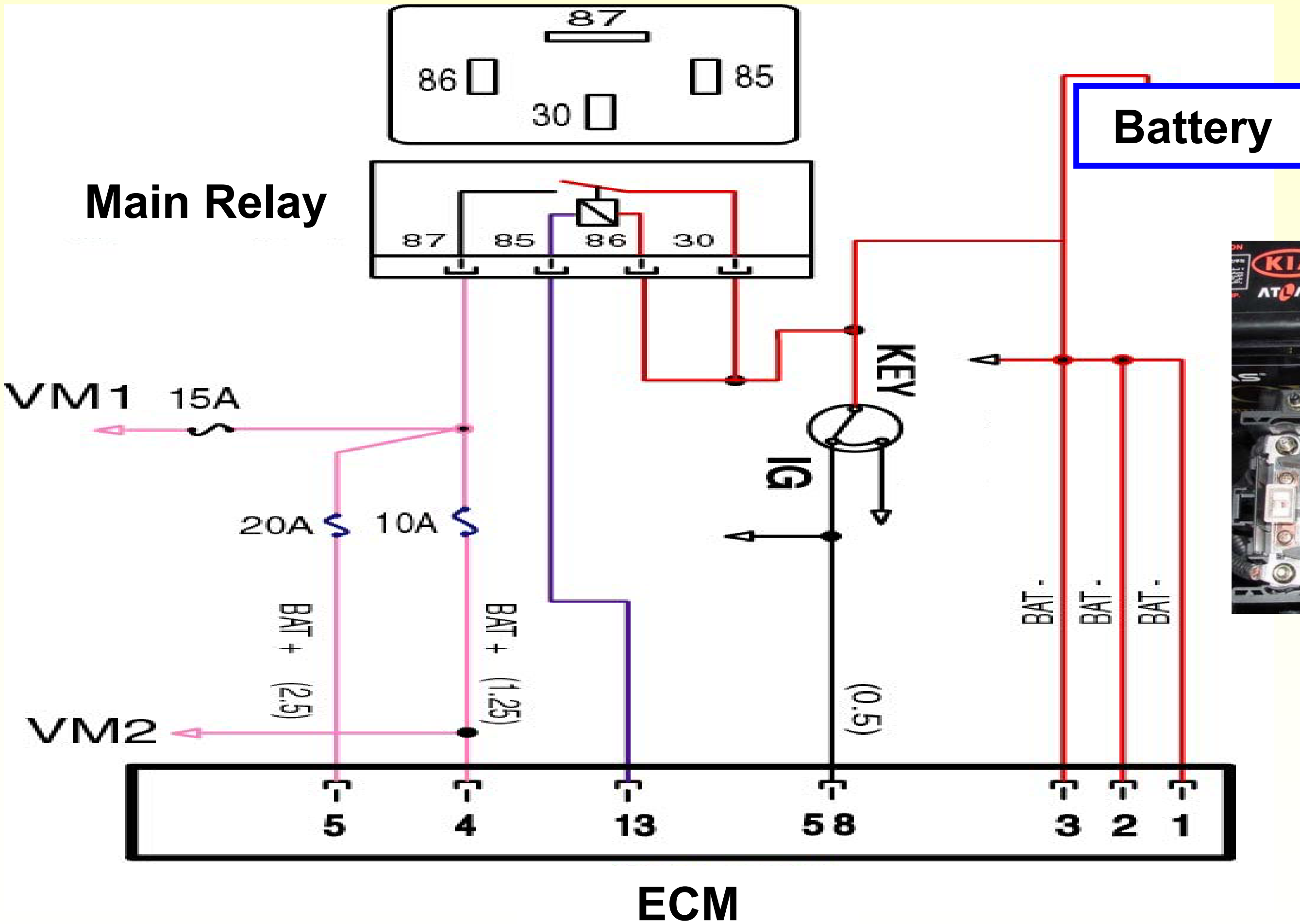
② Durante el aranque : En caso de que el motor no arranque después de tiempo de precalentamiento, si en motor está por debajo de 60º los calentadores se ponen en funcionamiento como max. durante 30 seg. Si antes de pasar los 30 seg. el motor sube más de 60º, se paran los calentadores.

③ Post calentamiento : Si el motor no sube de 2500 rpm y la cantidad de inyección es inferior a 75cc/min.

Coolant Temp.(℃)	-20℃	-10 ℃	20 ℃	40 ℃
Glow time (Sec.)	40	25	10	0

EDC – Relé principal

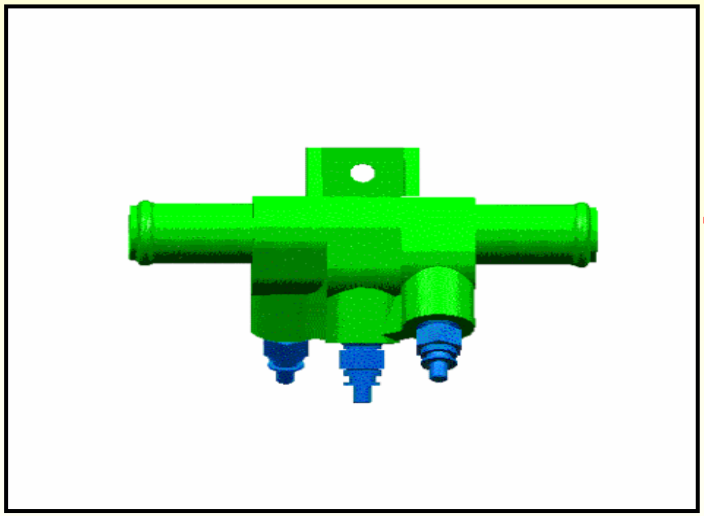
■ Diagrama :



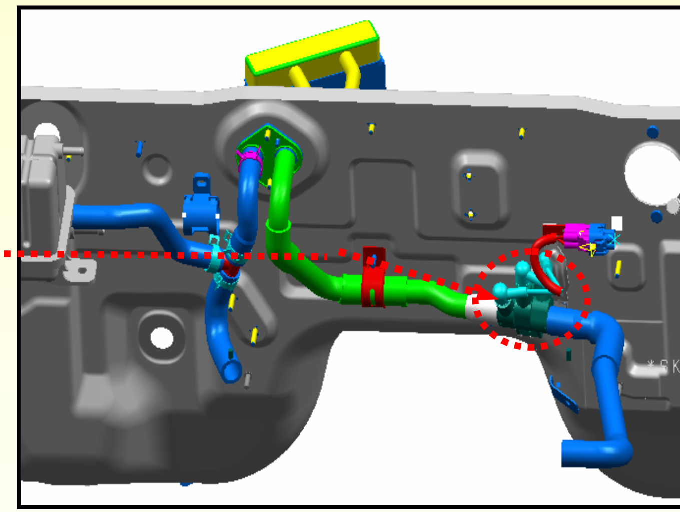
EDC – Relé principal

Code		Detail Description	Symptoms				Check Condition
DTC	**CC**		**Fuel = 0**	**EGR off**	**Fuel Limit**	**MIL On**	
1616	**C004**	Plausibility Error(IG signal comparison)					**IG. On**

EDC – Calentadores del refrigerante



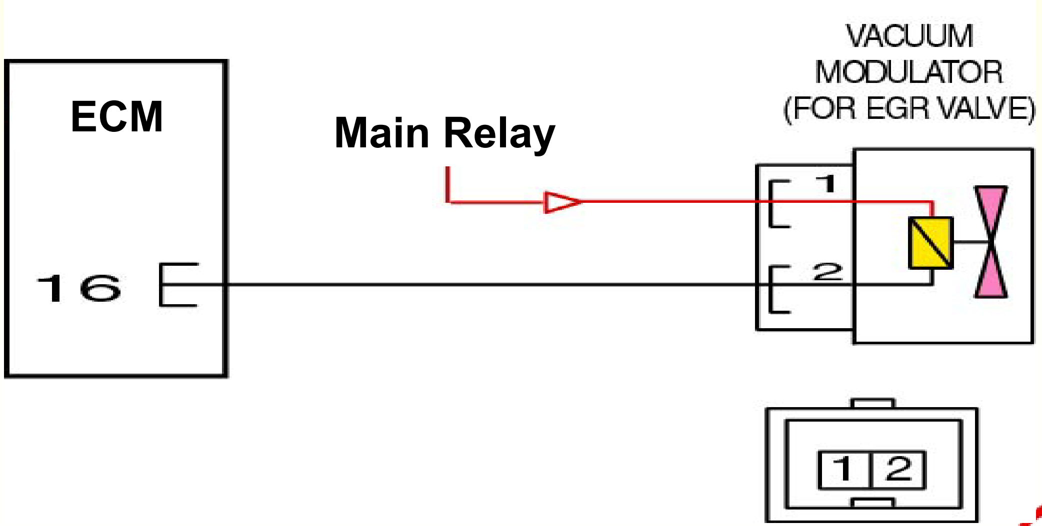
Tres calentadores



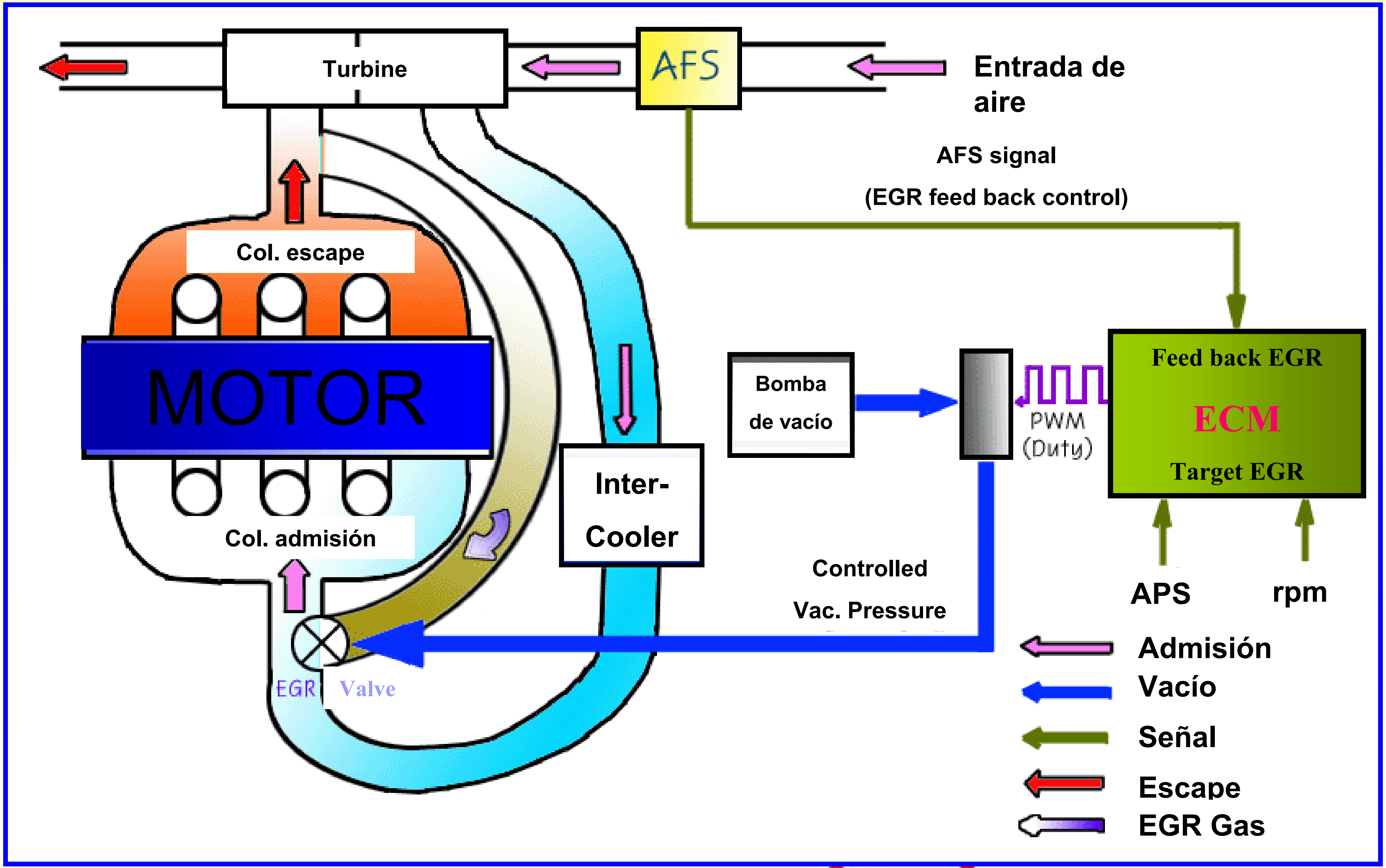
Componentes :

Solenoide

Válvula EGR



- Diagrama :


Turbine
AFS
Entrada de aire
AFS signal
(EGR feed back control)
Col. escape
MOTOR
Col. admisión
Inter-Cooler
Bomba de vacío
PWM (Duty)
Feed back EGR
ECM
Target EGR
Controlled Vac. Pressure
APS
rpm
EGR Valve
Admisión
Vacío
Señal
Escape
EGR Gas

EDC – EGR

Code		Detail Description	Symptoms				Check Condition
DTC	CC		Fuel = 0	EGR off	Fuel Limit	MIL On	
0403	C018	Short circuit to Bat(+)		Y			IG. On
	C019	Short circuit to GND					

Engine

Contents

- Sigma(Σ) Engine Hardware
- Sigma(Σ) Engine Management System

Sigma(Σ) 3.5ℓ Eng. – Engine Concept

■ Sigma(Σ)3.5ℓ Development concept

□ Lay-out

- Σ 3.5 Dohc FF (already installed in Carnival) → FR Design

□ Performance

- Low-middle range torque up --- VIS

□ Emission

- Korean Domestic 2000, LEV, Euro - Ⅲ

□ NVH

- HLA, Beam Bearing Cap, Engine Cover

□ Long Durability

Sigma(Σ) 3.5ℓ Eng. – Engine Concept

Sys.	BL Σ-3.5 FR	Remark
Lubrication	· Oil Level Stability of Up/Downhill at 35 Degree and Fast Turning	
Cooling	· Cooling & Air-Vent Sys. Design for Engine Install(5´incline in fornt side)	
Intake & Exhaust	· Added Vacuum Type VIS and Aerodynamic Port Design for Low-MiddlePerformance · Added MCC and Minimized Exhaust Gas Resistance for LEV	
Accessory	· Optimization of Aux. Drive Belt Lay-out Design	
Moving	· Improved HC EM & Blow-by Gas	

Sigma(Σ) 3.5ℓ Eng. – Main component comparison

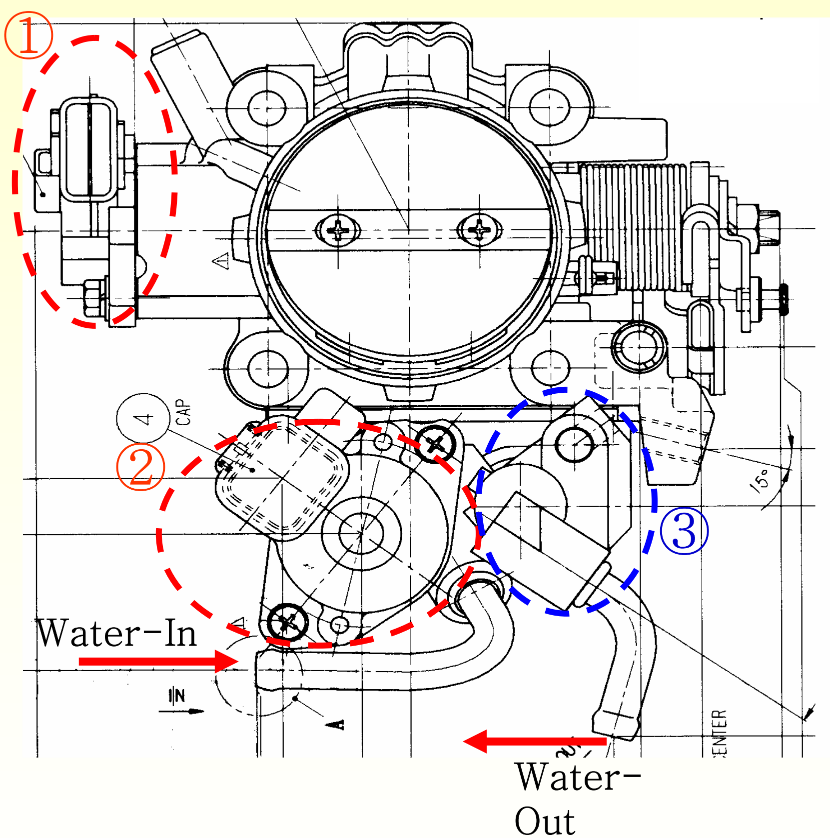
■ Comparison

Part Name	Σ3.5 ENG			
	GQ3.5	BL3.5	MAKER	REMARK
	Part No.	Part No.		
Water Temp Sensor & Heat Gage Unit	39220-38020 39220-38030	←	ELEC. KOREA INSI	
Ignition Coil	27300-39050	27300-39800	DENSO PUNGSONG	- Small different shape - Same performance - Integrated Power_Tr
Ignition Failure Sensor	27370-38000	←	Hyundai Autonet	
Spark Plug	18817-11051(PFR5N-11) 27410-37100(RC10PYPB4)	←	WOOJIN SERIM	- Pt alloy, Gap: 1.0~1.1 - Cu-Ni/Pt, Gap: 1.0~1.1
Air flow sensor	28100-39400 28100-39450	←	BOSCH BOSCH KOREA	- Hot Film Type
Air Temp. Sensor	Integrated in AFS	←	-	
Crank Angle Sensor (CAS)	39310-39010	39310-39800	VDO HALRA	- Hall IC
Cam position Sensor(CPS)	39310-39110	39318-39800	VDO HALRA	- Hall IC
ECU	39110-39600	39110-39420	KEFICO	- GQ : PCU(ECU+TCU) - BL : ECU (separated TCU)
Throttle Body Assy	35100-39610	35100-39600	DEASONG	- Small different shape
Throttle Position Sensor*	incorporated in TH/B	←		- Same Sp - with idle switch

Sigma(Σ) 3.5ℓ Eng. – Main component comparison

Part Name	Σ3.5 ENG			
	GQ3.5	BL3.5	MAKER	REMARK
	Part No.	Part No.		
Idle Speed Actuator*	incorporated in TH/B	←		- Same Sp - Stepping Motor
Fuel injector ass'y	35310-38010	←	KEFICO	
Fuel pressure regulator	35301-39600	35301-39410	INZI	- Same press.control (3.35±0.05Kgf/㎠) - Different shape
Knock sensor	39320-35561	39510-39810	INZI	- Same Spec (resonance-type : 11.0KHz) - Different L/Wire
MAP sensor	39300-38100 39300-38200	←	KEFICO	- 20~106.7KPa abs
O2 sensor (Bank1-Up)	39210-39800	39210-39820	WOOJIN	- FLO Type (+ Heated type) - Different L/Wire
O2 sensor (Bank1-Down)	39210-39650	39210-39550	WOOJIN	- Heated type - Different L/Wire
O2 sensor (Bank2-Up)	39210-39600	39210-39820	WOOJIN	- FLO Type (+ Heated type) - Different L/Wire
O2 sensor (Bank2-Down)	39210-39025	39210-39500	WOOJIN	- Heated type - Different L/Wire
Purge solenoid valve	39460-38650	←	KEFICO	- 60L
Case assy catalyst(MCC)	28530-39675(LH) 28530-39685(RH)	28530-39410		
Converter assy catalyst(UCC)	28950-39671	28950-38610		

■ Throttle Body



1) TPS (Throttle Position Sensor)

- With Idle Switch

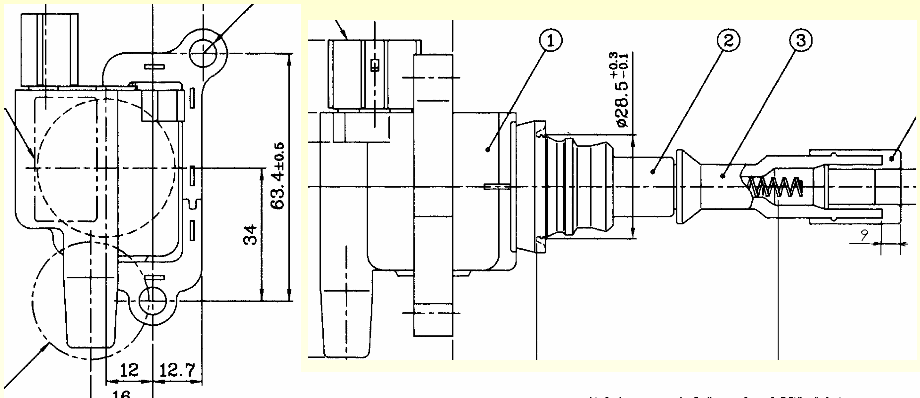
2) Idle Speed Control Motor

- Stepping Motor
- Control Range (0 ~ 120 Step)
- Initial Position : 80 Step
- After IG-Key Off,
  Stop-position is initialized by ECU during power latch time.

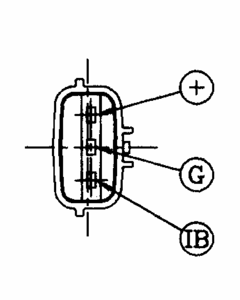
3) Thermo. WAX

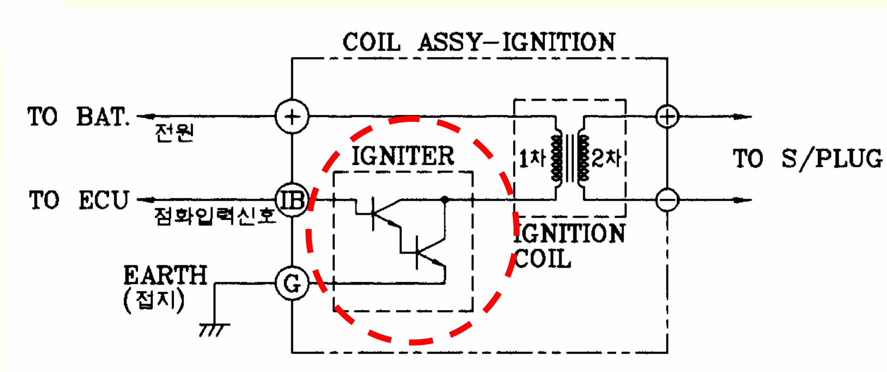
- Operating according to water temp.
- Closed about 60 ℃ (water temp)

■ Ignition coil



- Integrated Power_TR (IGNITOR)
- 2- Cyl. Simultaneous Ignition

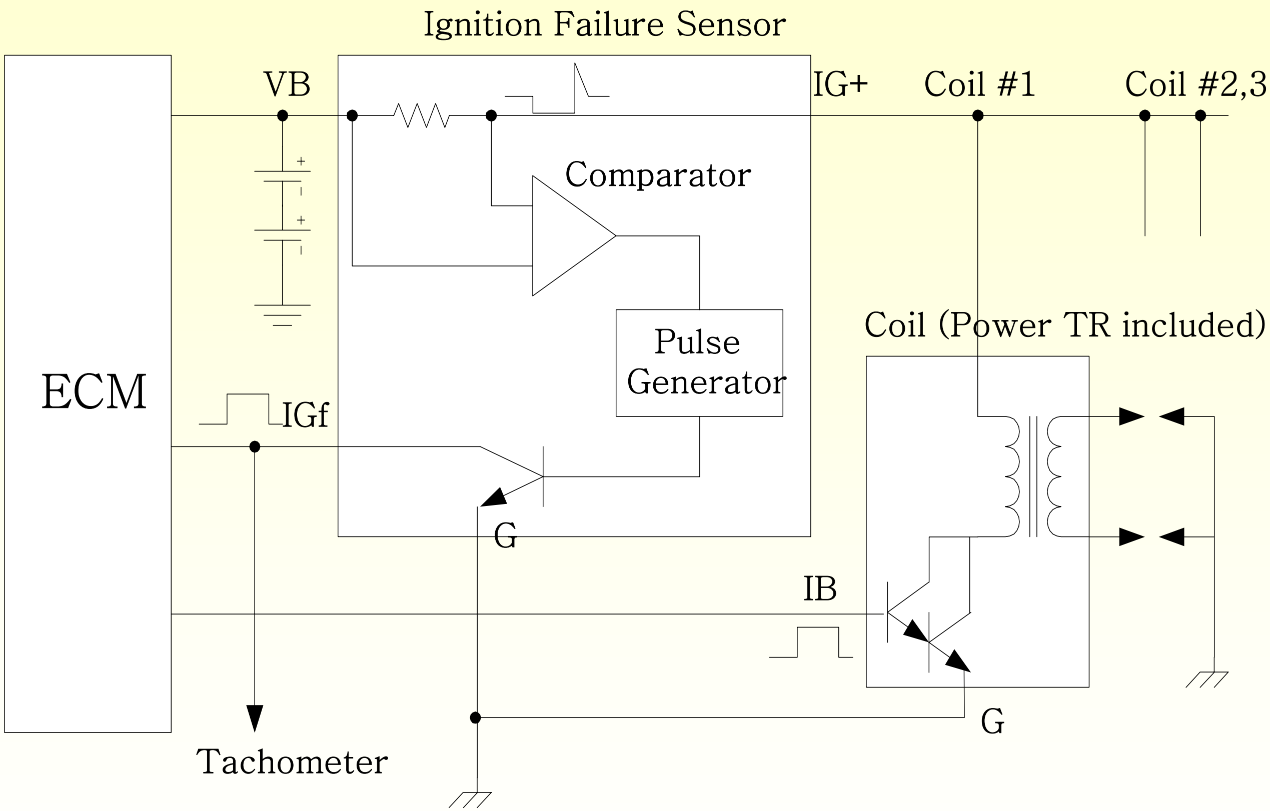


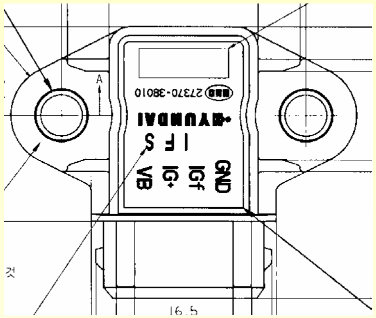


CIRCUIT DIAGRAM

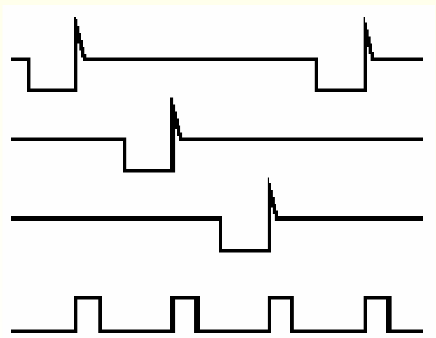
Sigma(Σ) 3.5ℓ Eng. – Main component

■ Ignition failure sensor





IG Coil Primary Circuit Wave form



Ignition Failure Sensor Output

■ Sigma(Σ) Engine

- General

The Delta engine is a compact V6 DOHC engine, light in weight due to the use of aluminum engine parts with high torque output in low and medium speeds. This engine incorporates only one timing belt .This has resulted in a reduction of noise and increase in serviceability.

The Sigma engine is designed and manufactured by Hyundai Motor Company.

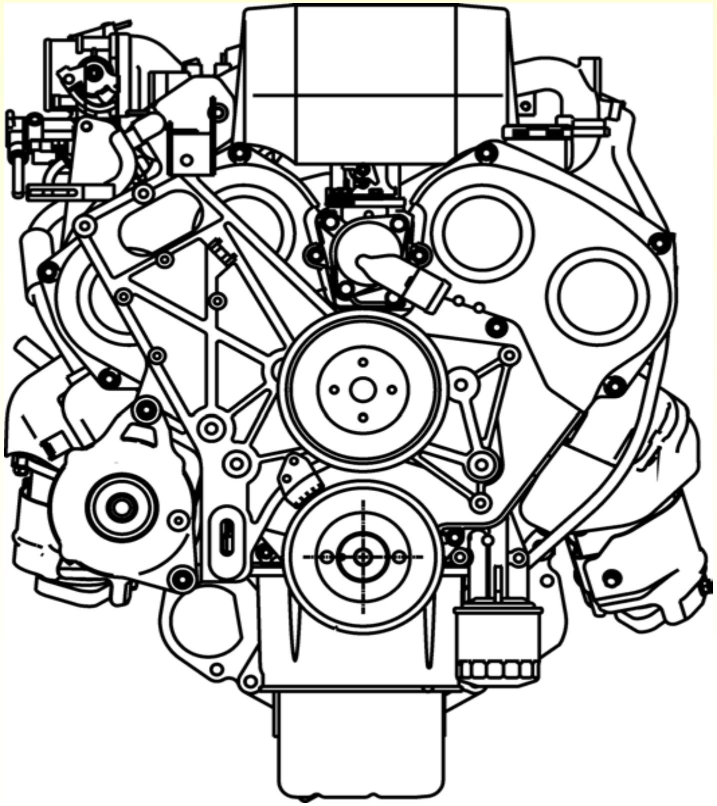
Items	Sigma 3.5L	Items	Sigma 3.5L
Displacement(cc)	3,497	Injector Type	4Hole 2 Spray
Bore X Stroke(mm)	93 X 85.8	Injection Timing	BTDC17.5°
Compression Ratio	10:1	Spark Plug	PFR6.1-11
Firing Order	1-2-3-4-5-6	Spark Plug Gap(mm)	1.0mm
Basic IG. Timing(°)	BTDC10° ± 2°	Oxygen Sensor	ZrO2
Idle RPM	700 ± 100	Coolant Control	Inlet Control
HLA	End Pivot Type	Air Flow Sensor	Hot Film
Fuel Pres.(Kgf/㎠)	3.33 ~ 3.35	EMS	Melco

Sigma(Σ) 3.5ℓ Eng. – Comparison with GQ

Item	GQ Σ-3.5 FF	BL Σ-3.5 FR	Remark
Engine Instl.	**FF**	**FR**	
Engine Code	**G6CU**	←	
Dis. (CC)	**3,497**	←	
B×S (mm)	**93.0 x 85.8**	←	
Compression Ratio	**10.0**	←	
Valve System Type	**DOHC 4 Valve**	←	
Firing Order	**1-2-3-4-5-6**	←	
Aspiration	**NA**	←	
Vis Type	**Electronic**	**Vacuum**	
EGR	**Yes**	**No**	
Eng. Weight (DRY, Kg)	**193.6**	**209.8**	
Eng. Size (LxWxH, mm)	**746×758×733**	**608×658×780**	

■ Sigma(Σ)3.5ℓ-Engine Hardware

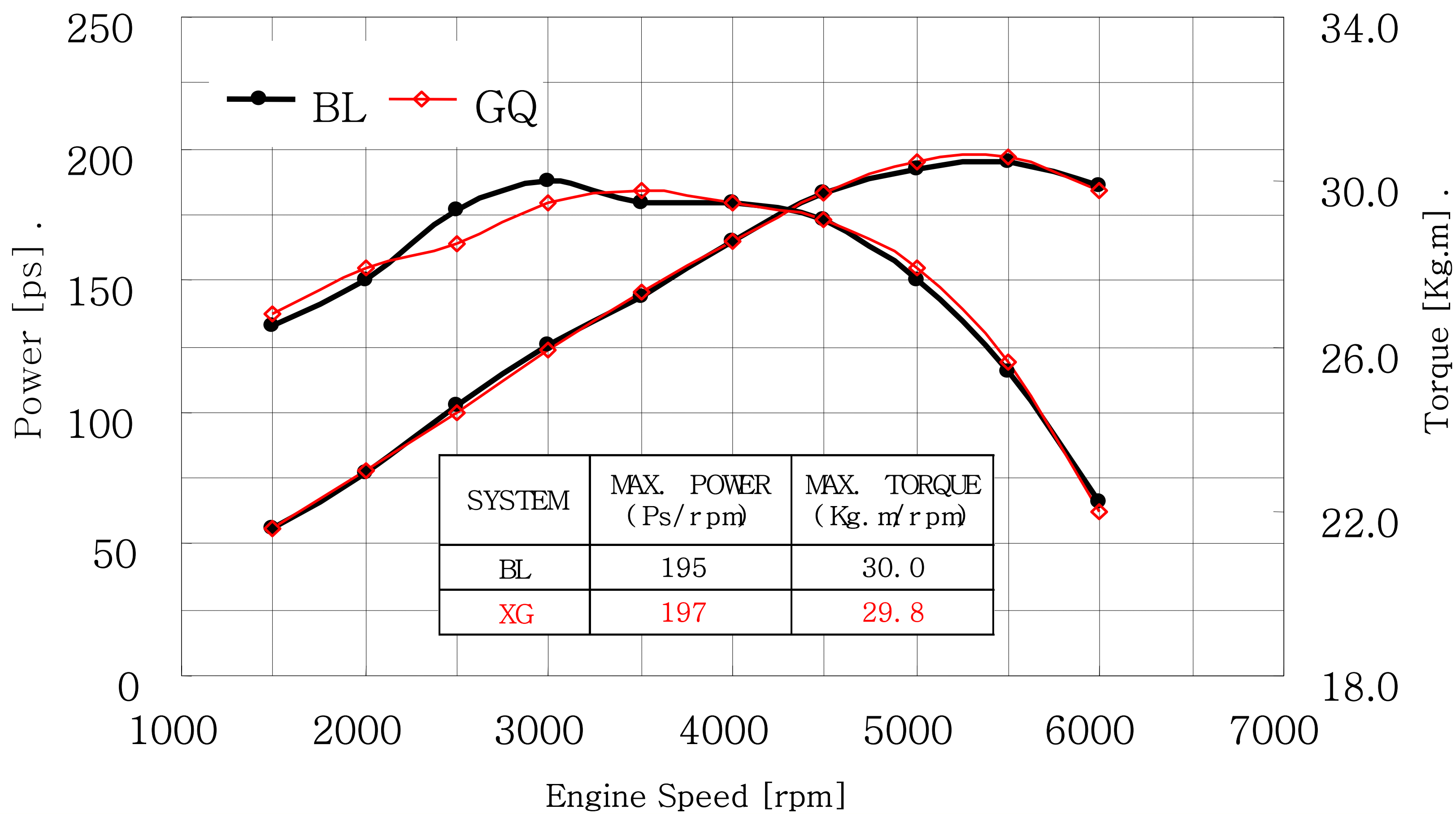
- The sorento is equipped with the Sigma 3.5 Liter Engine with 195 hp @ 5500rpm and torque30 @ 3500rpm. The intake manifold features a variable intake system which extends the torque curve by selecting designated intake runners to improve performance.



The block is made of cast iron. The cylinder heads and upper oil pan are aluminum. Hydraulic Lash Adjusters(HLA) eliminate the need for valve lash adjustments. There are three drive belts on the Sigma 3.5ℓ engine with mechanical tensioners. The timing belt turns all four cam sprockets with an hydraulic timing belt tensioner.

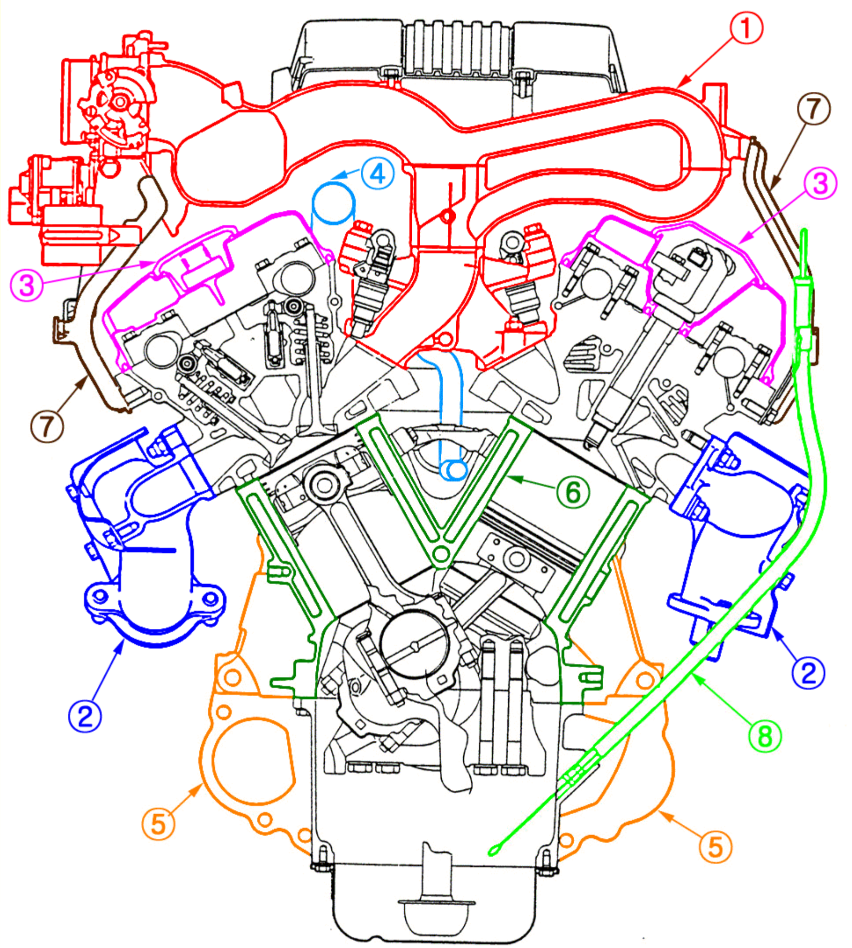
Sigma(Σ) 3.5ℓ Eng.- Performance Curve(WOT)

■ Performance Curve



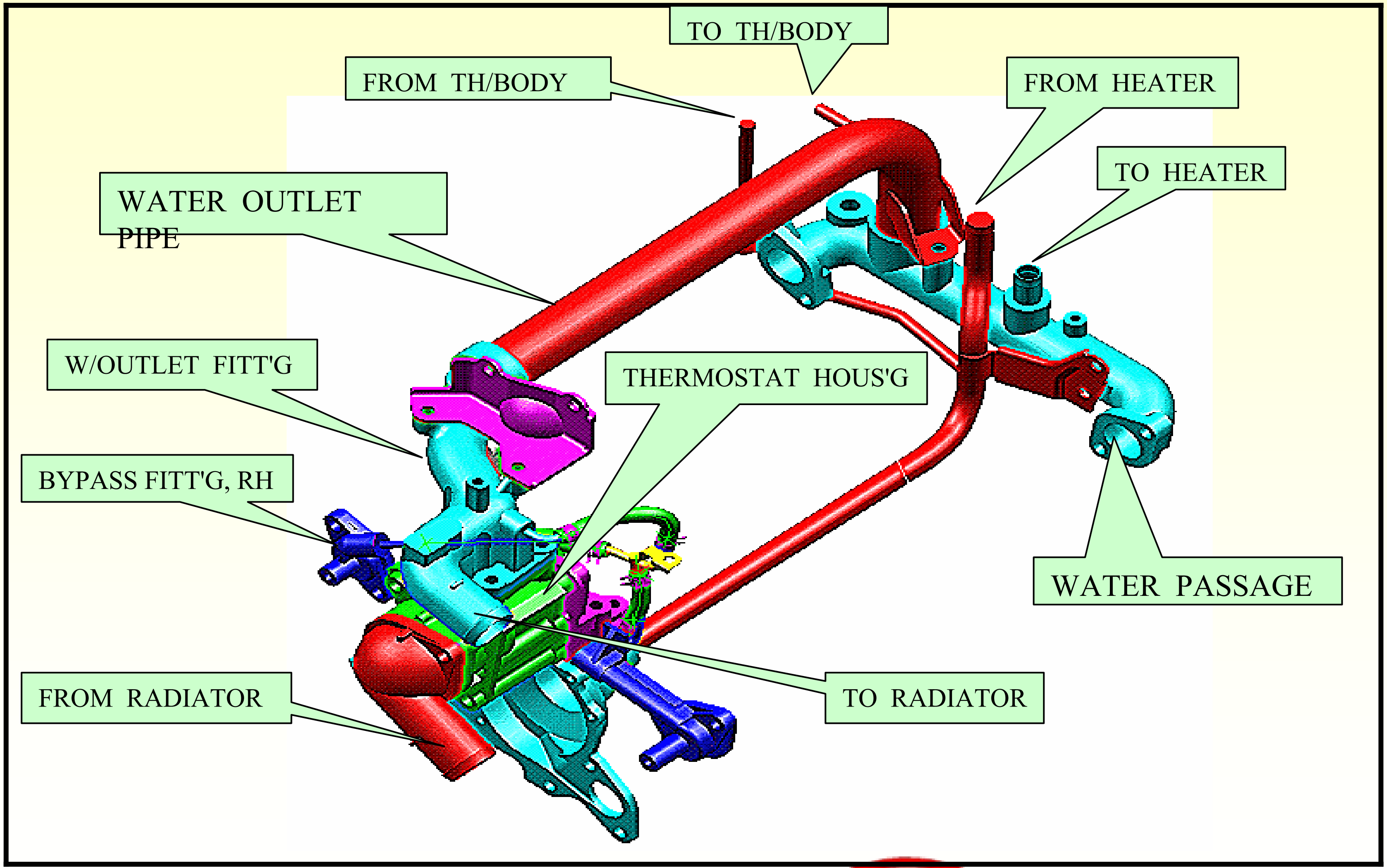
SYSTEM	MAX. POWER (Ps/rpm)	MAX. TORQUE (Kg.m/rpm)
BL	195	30.0
XG	197	29.8

■ Section View



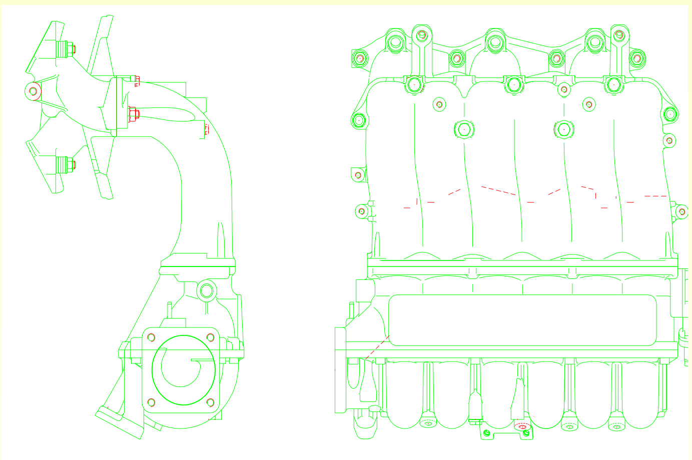
- End Pivot Type HLA
- Dry type liner
- Steel Cylinder block
- AL material Upper oil pan

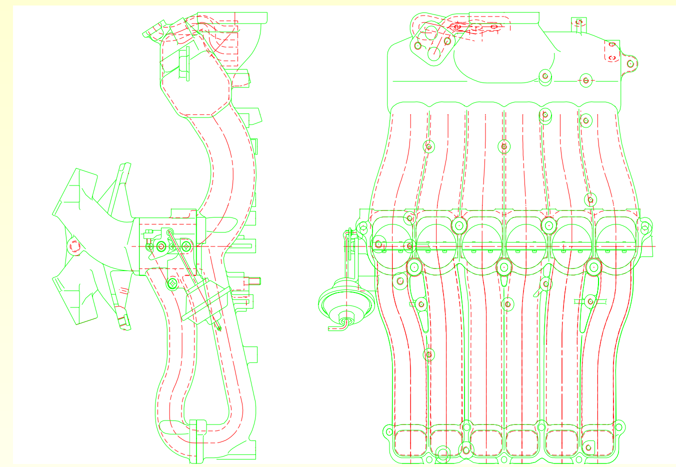
■ Cooling System

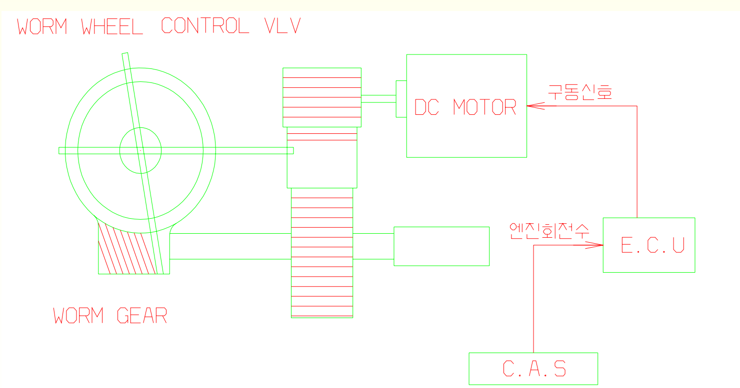


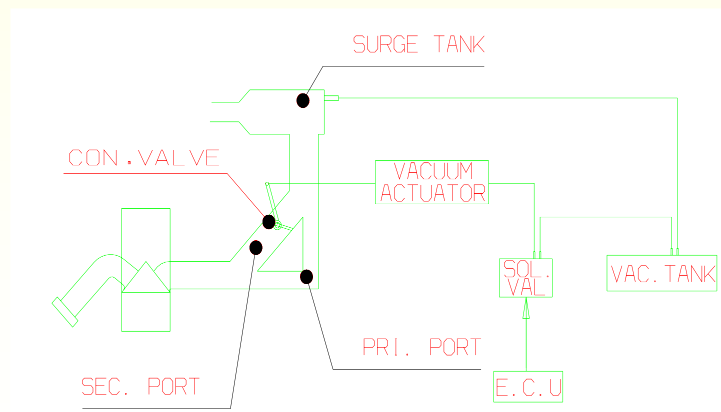
■ Intake System

GQ Σ-3.5 FF	BL Σ-3.5 FR

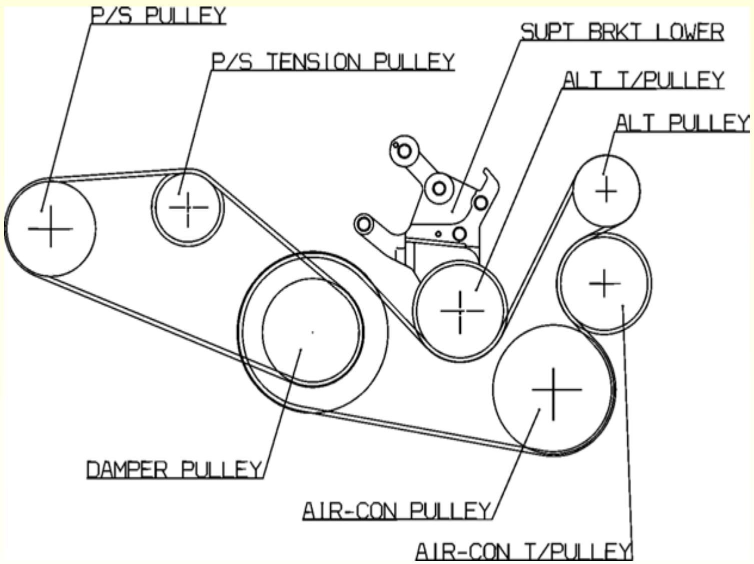
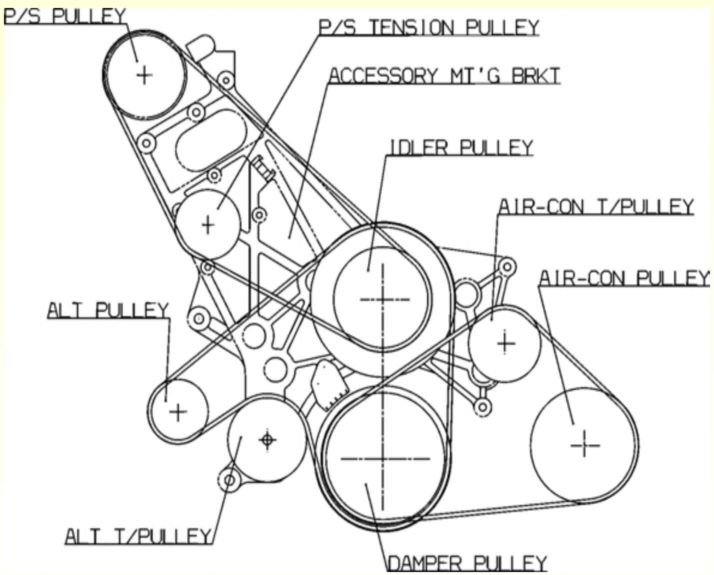








■ Drive Belt

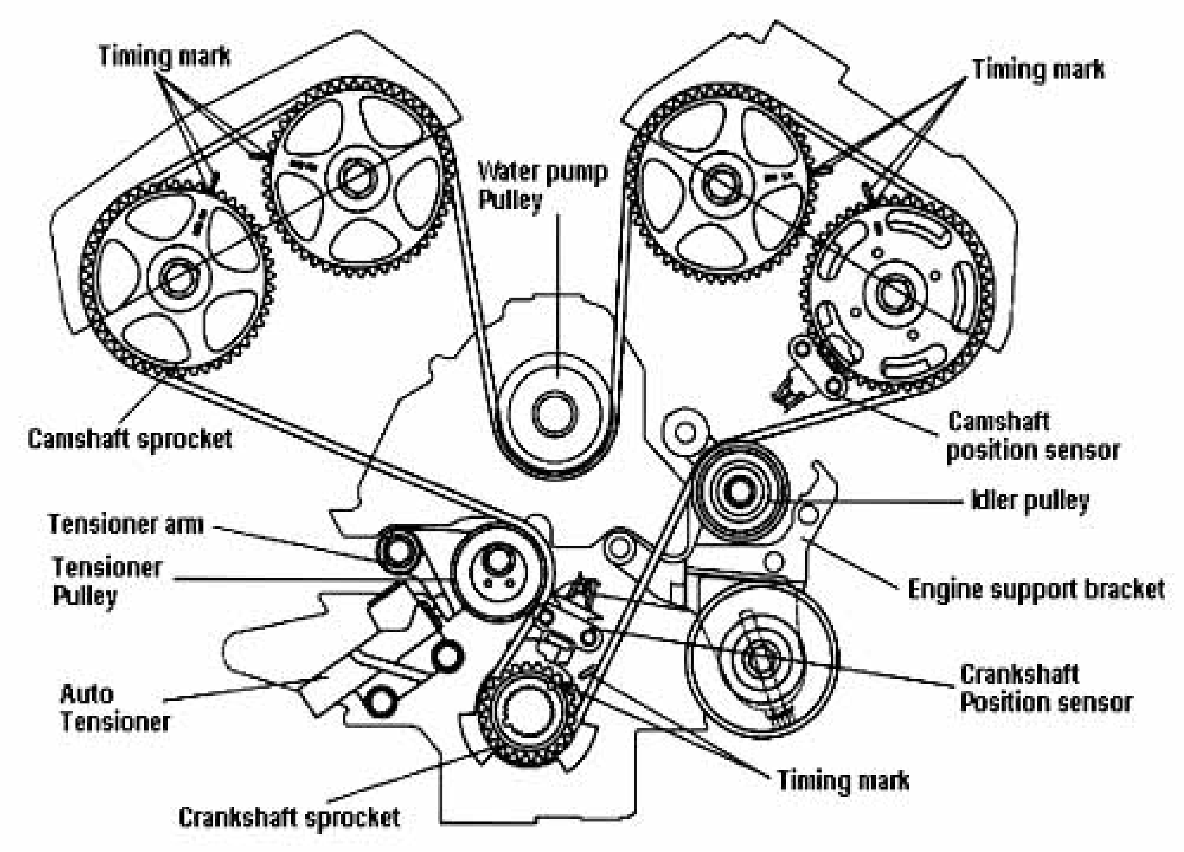
GQ Σ-3.5 FF	BL/HP Σ-3.5 FR
	

-Three mechanical drive belt tension adjuster

■ Timing Belt

- **Hydraulic auto timing belt tensioner :**

One cogged-tooth timing belt, that turns all four camshafts and the water pump.



Sigma(Σ) 3.5ℓ Eng. – Engine Feature

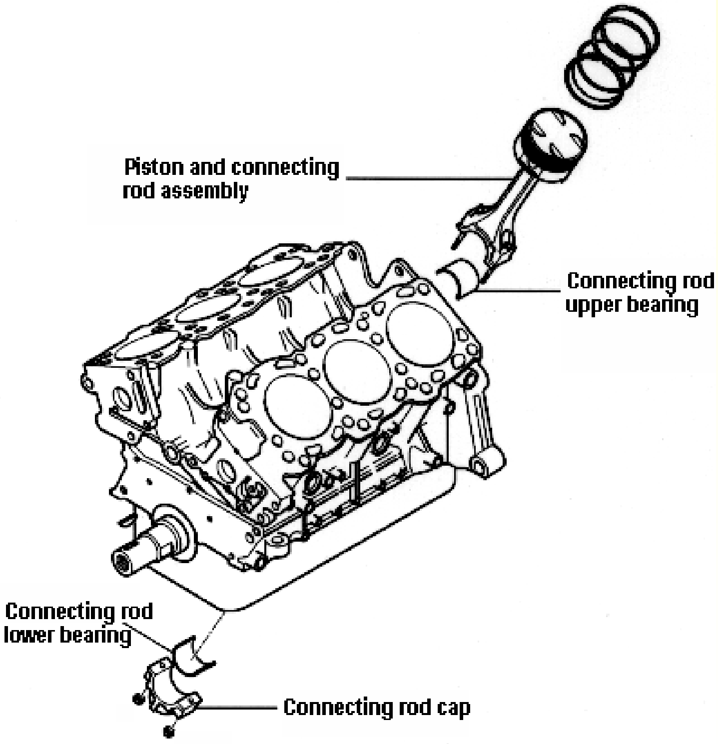
■ Cylinder Block

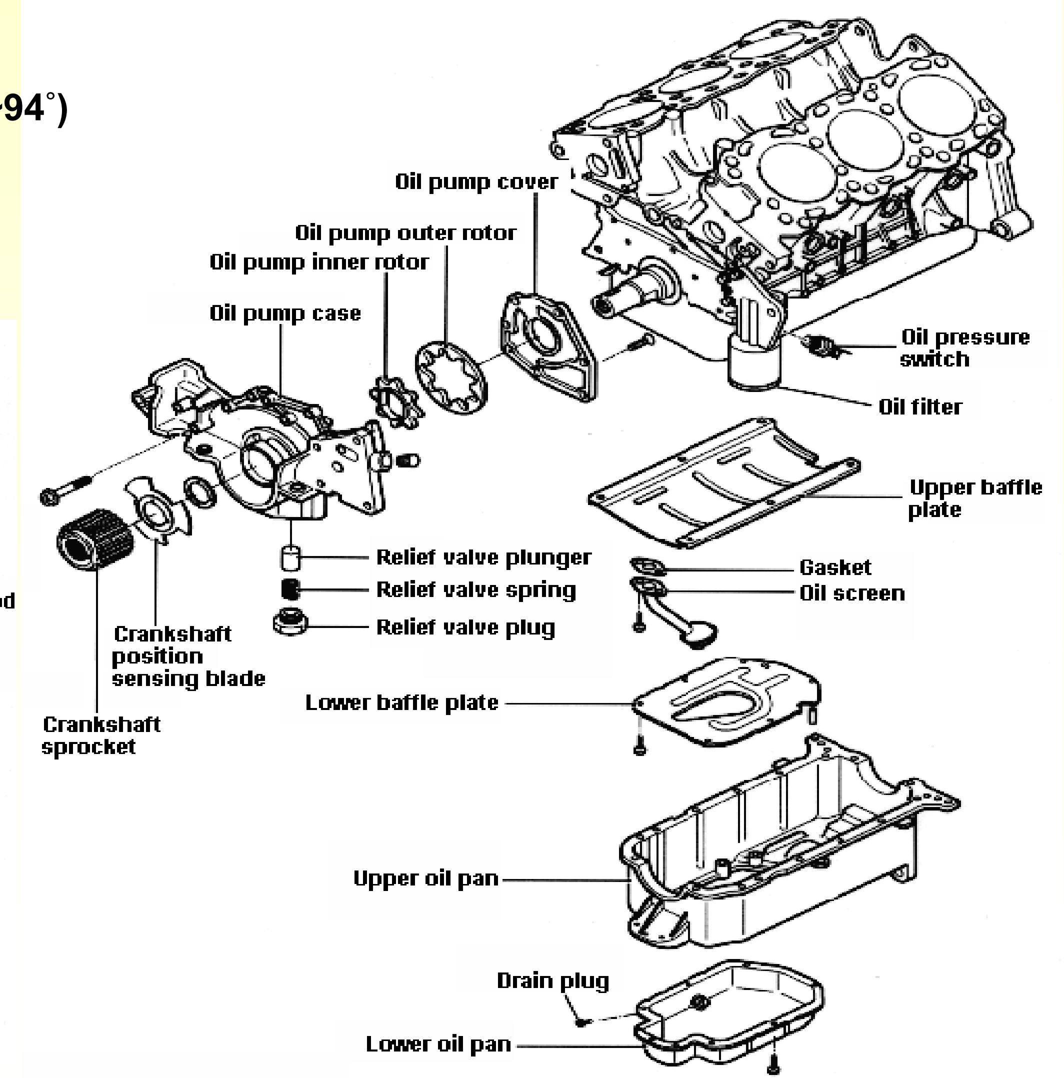
-Torque - Angle Method

Connecting Rod Cap(33~37Nm+90~94˚)

-Torque tightening

Main bearing Cab bolts(70~80Nm)





Sigma(Σ) 3.5ℓ Eng. – Engine Feature

■ Cylinder Head

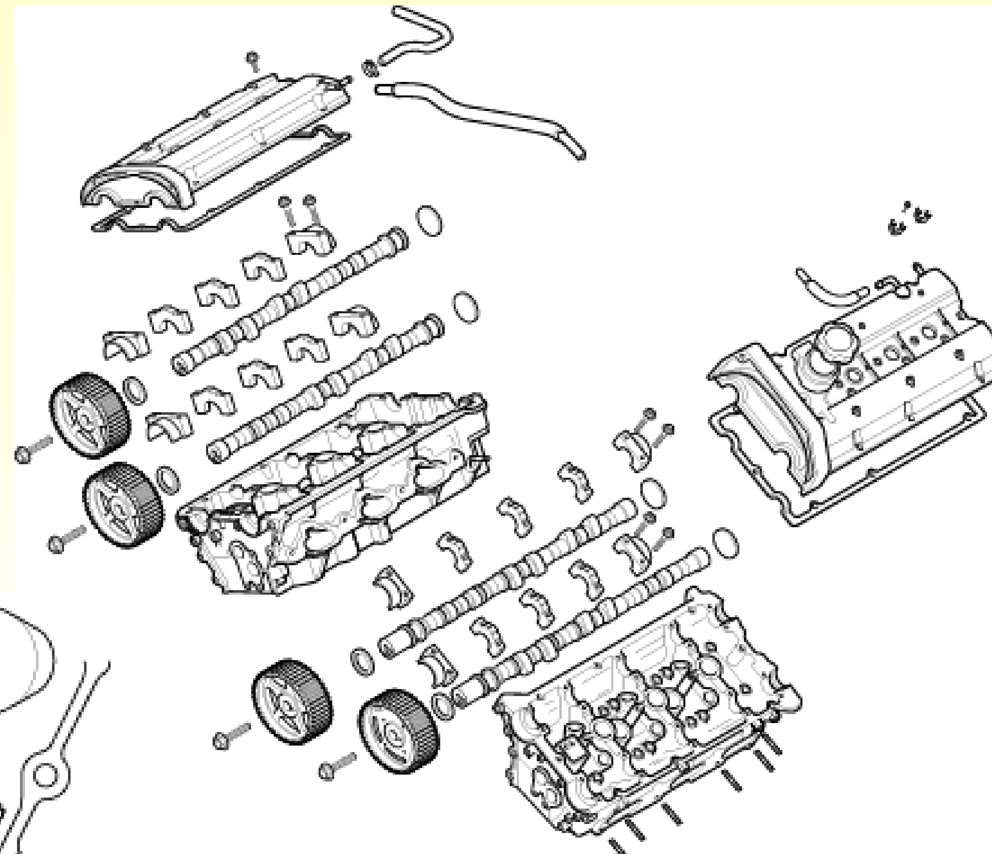
- Torque Tightening

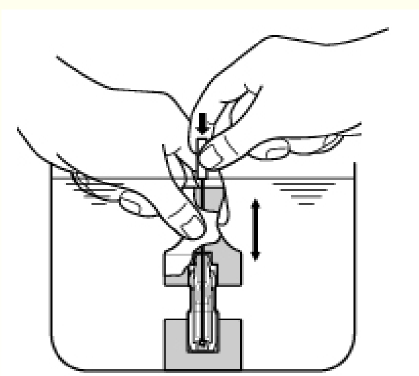
  Cylinder head bolts(105~115Nm)

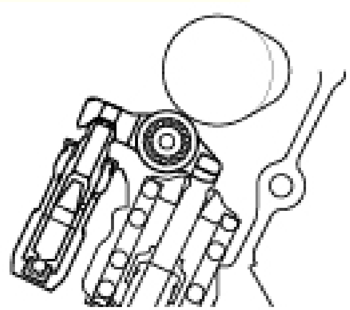
- Hydraulic Lash Adjuster

  End Pivot type HLA

  Air bleeding method



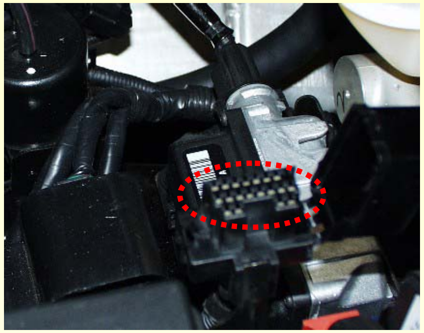


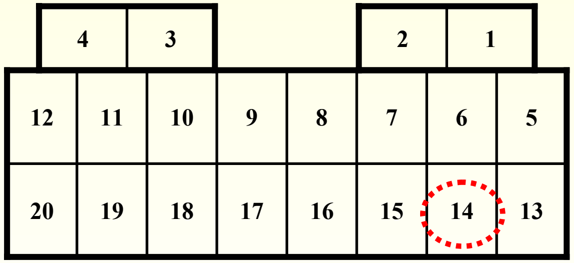


Sigma(Σ) 3.5ℓ Eng. – Ignition Timing Check

■ Checking condition

- Normal Operating Engine Temperature(80~95℃).
- No electrical load
- Neutral of Transaxle
- No operation of Steering wheel





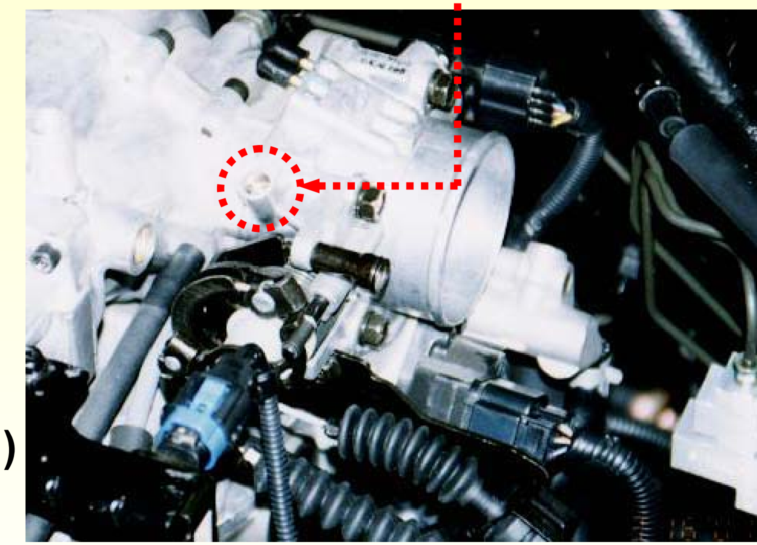
① Ground the No.3 pin(Ignition timing checking terminal) of DLT.

② Check the timing on crankshaft pulley with timing light.

Sigma(Σ) 3.5ℓ Eng. – Idle Speed Adjustment

■ Checking condition

- Normal Operating Engine Temperature(80~95℃).
- No electrical load
- Neutral of Transaxle
- No operation of Steering wheel



① Connect Hi-scan Pro to DLC(L-line Grounded)

② Ground the Ignition timing check terminal.

(To make engine stable, Ignition timing is controlled. ECM goes into Idle speed adjusting mode)

③ Check idle RPM(700±100rpm). If beyond the specification, adjust it through Idle speed adjust screw.

Sigma(Σ) 3.5ℓ Eng. – Fuel Filter

■ Location

Fuel Pump Module

Fuel Filter

※ Recommended replacement intervals : 100,000 mile / 10Years

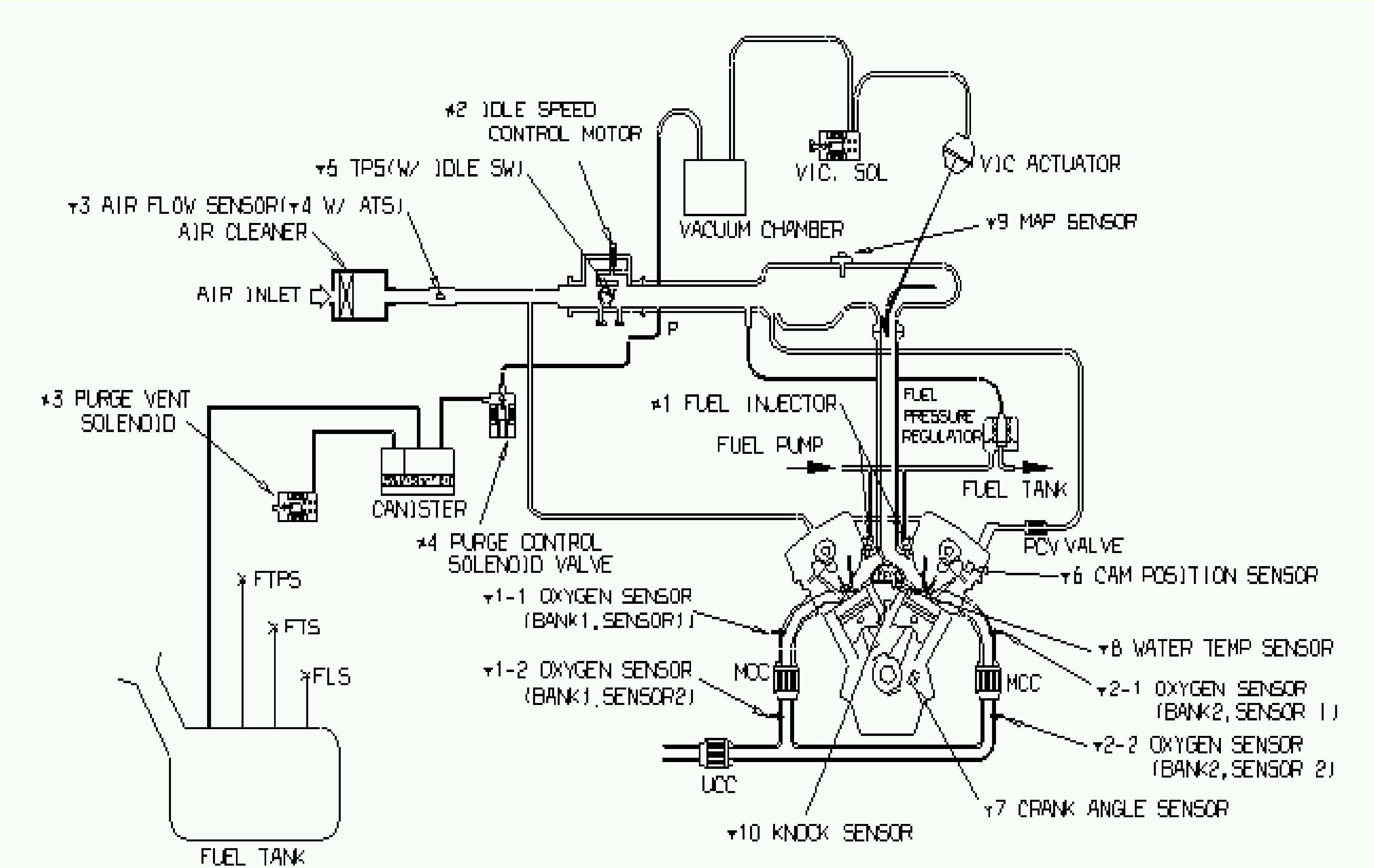
Sigma(Σ)-engine

Engine Management System

Contents

- System Configuration
- System Description
- ECM Input/Output
- OBD2 Functions
- Diagnostic Trouble Code
- ECM Wiring circuit

Sigma(Σ) 3.5ℓ Eng. – System Configuration



Sigma(Σ) 3.5ℓ Eng. – System Configuration

■ General descriptions :

- The Sorento utilizes a Mitsubishi Electronics Company Engine Management System (MELCO). The MELCO system features a single 32 bit Powertrain Control Module (PCM) to control engine management as well as all automatic transaxle functions. Serial communication is used to transmit data between the engine and transaxle sections of the PCM. A sequential Multiport Fuel Injection system (SFI) is incorporated, along with a distributorless ignition system.

- The ignition system of Sorento Sigma 3.5ℓ engine is very similar to previous ignition systems used on Kia vehicles since 1998 with the exception of having an additional coil for the 2 extra cylinders and and ignition failure sensor.

- Engine management system monitoring functions are conducted in compliance with OBD-Ⅱ regulations. An EGR system is not employed in the Sorento.

■ System Description

Engine		V6 3.5L DOHC
Emission Standard		LEV (0.130 NMOG)
Evaporative System		New EVAP/ ORVR
PCM		MELCO
Microprocessor		MH8305F(32bit)
Frequency		32 MHz
Memory Size		512Kbyte
Monitoring Functions	Catalyst	MCC Monitoring
	O2 sensor	Yes
	Misfire	Yes
	Fuel System	Yes
	Evap System	0.02in Leakage Monitoring
	Thermostat	Yes
	Comprehensive Component	Yes

▶ MCC = Manifold Catalytic Converter

Sigma(Σ) 3.5ℓ Eng. – rpm by Load

■ rpm by load

			VEHICLE
			BL3.5 NAS
VEHICLE	IGNITION TIMMING		**BTDC 10° ± 2°**
	P,N RANGE RPM	A/CON OFF	**800 ± 100**
		A/CON ON	**900 ± 100**
	D RANGE RPM	A/CON OFF	**750 ± 100**
		A/CON ON	**750 ± 100**
	OVERRUN F/CUT RPM	P/N	**4000**
		D	**6198**

Sigma(Σ) 3.5ℓ Eng. – ECM Input/Output

■ ECM Input/Output

Input → ECM → Output

Input

- Oxygen Sensor(Bank1, Sensor1)
- Oxygen Sensor(Bank1, Sensor2)
- Oxygen Sensor(Bank2, Sensor1)
- Oxygen Sensor(Bank2, Sensor2)
- Air Flow Sensor
- Air Temp. Sensor
- T.P.S.
- C.M.P
- C.K.P.
- W.T.S
- Manifold Differential Press. Sensor
- Knock Sensor
- Fuel Level Sensor
- Fuel Tank Press. Sensor
- Fuel Temp. Sensor
- Ignition Detect Signal
- Vehicle Speed Sensor
- Power Steering Sensor
- Ignition Switch
- Battery Voltage

Output

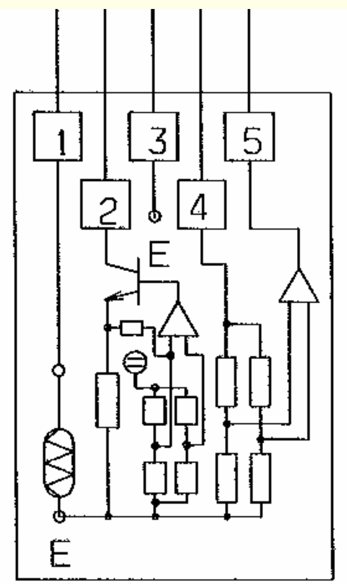
- Ignition
- Injector
- Idle Speed Cont. Motor
- Main Relay Control
- Fuel Pump Control
- Cooling Fan Control
- Diagnosis(OBD)

Sigma(Σ) 3.5ℓ Eng. – ECM Input/Output

■ Mass Air Flow Sensor(MAF)

The air flow sensor installed between the air cleaner assembly and the throttle body assembly integrates Intake Air Temperature Sensor. Air flow sensing part consists of the heater device for keeping the constant relative temperature difference and the sensor device for measuring the air flow rate, and detect the balance of heat loss on hot film as circuit current increment. The ECM can calculate the mass air flow rate to engine, and this is *the most basic and important value for engine control in injection duration and ignition timing calculation*.

Electric Circuit



1: Air Temp. Signal

2: Vb

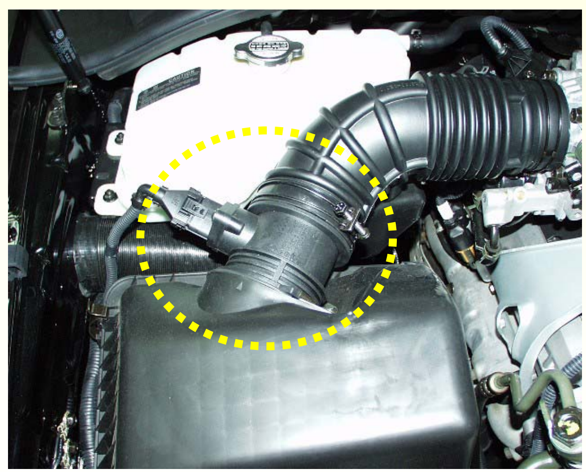
3: GND

4: Vref

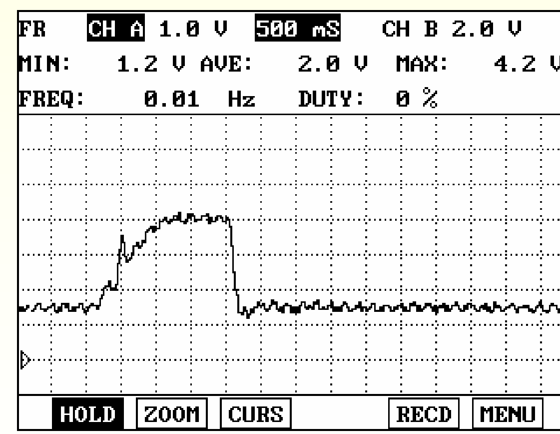
5: Air Flow Signal

-HFM5

Location



Sensor Signal

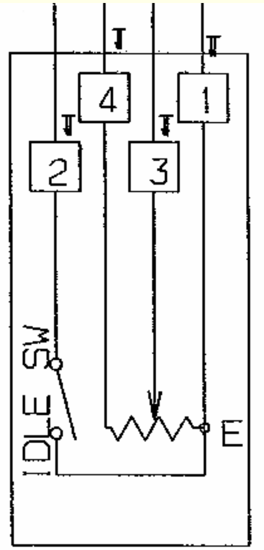


■ Throttle Position Sensor(TPS)

This is a rotary potentiometer having idle switch mounted on throttle body assembly.

This sensor provides throttle angle information to the ECM to be used for the *detection of engine status such as idle, part load, full throttle condition and anti-jerk condition and acceleration fuel enrichment correction.*

Electric Circuit



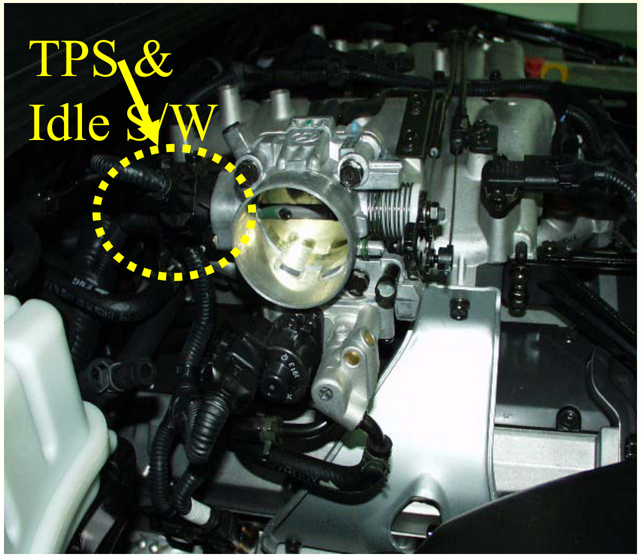
1: GND

2: Idle Sig.

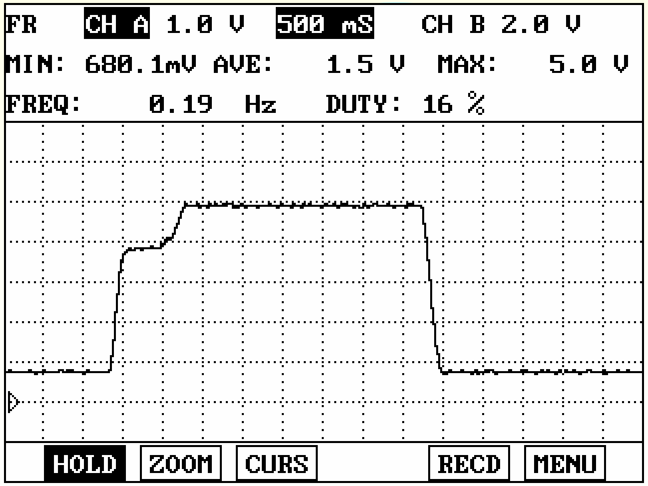
3: TPS Sig.

4: Vref

Location



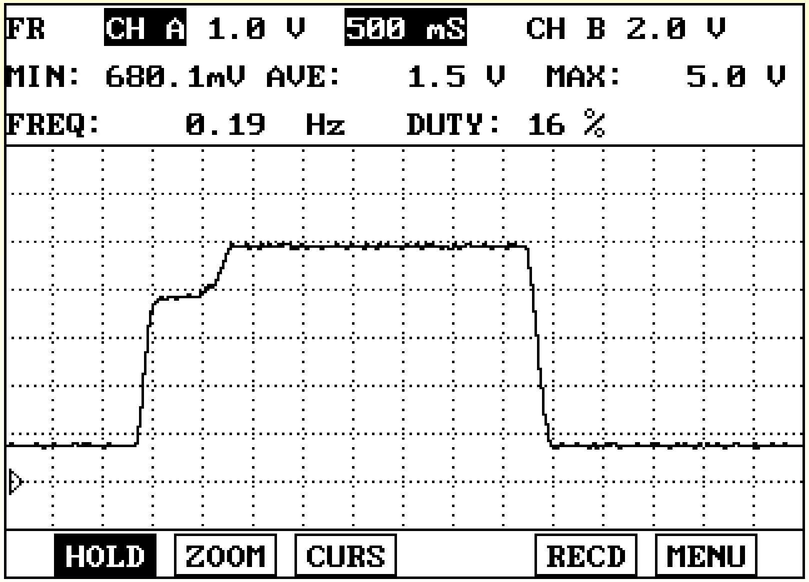
Sensor Signal



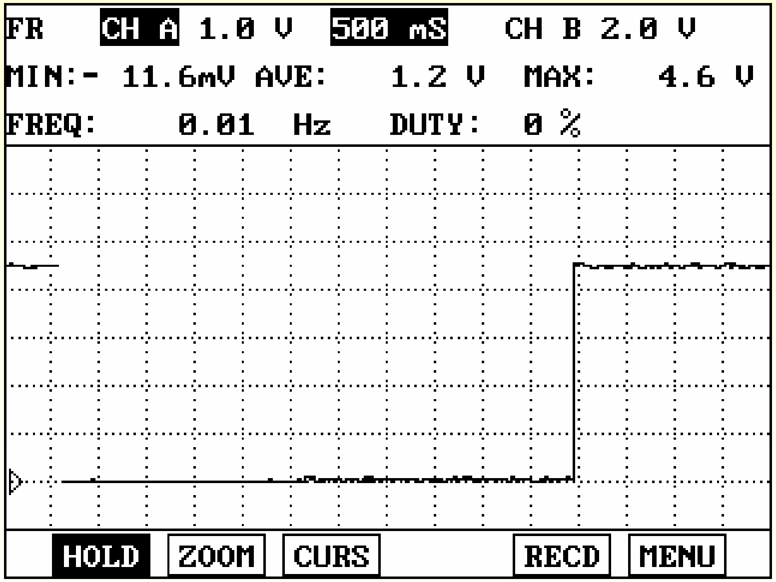
■ Throttle Position Sensor(TPS)

- Sensor Signal

[At idle → fuel cut]



[At idle → running]

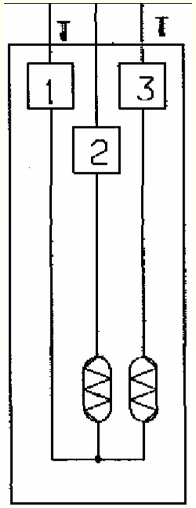


■ Engine Coolant Temperature Sensor (ECT)

The engine coolant temperature sensor integrated heat gauge is installed in the thermostat housing. This sensor having gold coated terminals provides information of coolant temperature to the ECM for controlling ;

- *Injection time and ignition timing during cranking & warm-up & hot condition*
- *ISC Motor to keep nominal idle engine speed*
- *Cooling & condenser fan etc.*

Electric Circuit



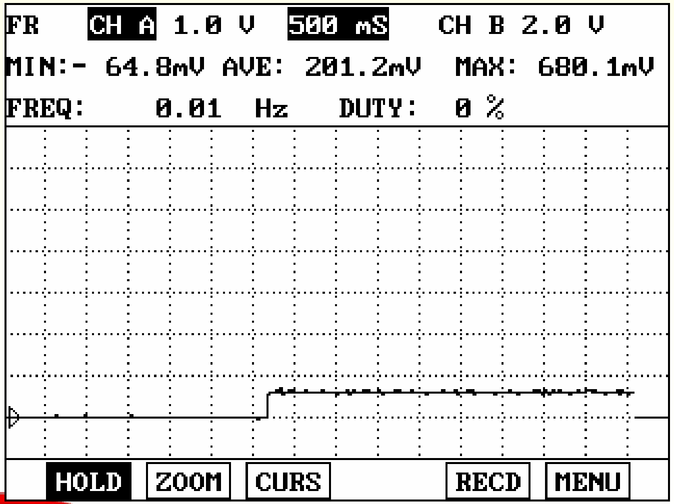
1: GND

2: Heat gauge

3: WTS Sig.

Location

Sensor Signal



■ Heated Oxygen Sensors (HO2S)

There are four O2 sensors in a vehicle, two of them are installed in the upstream and the others are installed downstream of each bank of manifold catalyst.

The O2 sensors is consists of ***Zirconia type*** sensing element and heater. ***The sensing element produces voltage*** according to the richness of exhaust gas, and this voltage to reference in ECM reflect lean or rich status.

For each bank(1/2), ECM can control the fuel injection rate separately with the feedback of each front O2 sensor signals, and the desired air/fuel ratio which provide the best conversion efficiency is achieved.

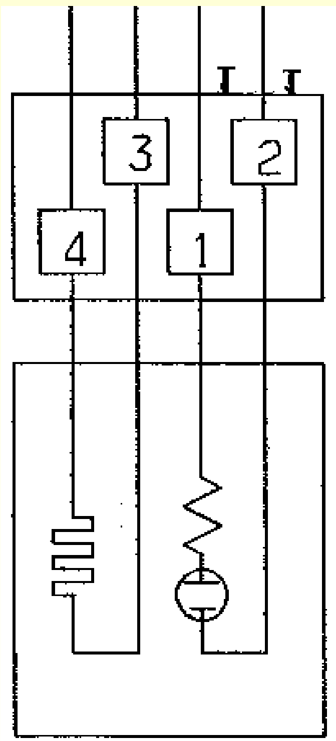
The rear O2 sensors also inform ECM of lean or rich status of exhaust gas existing the closed-coupled catalyst.

The rear O2 sensor signals are used not only for the richness correction to control NOx emission effectively but for the determination of catalyst deterioration factor to monitor the catalyst converter.

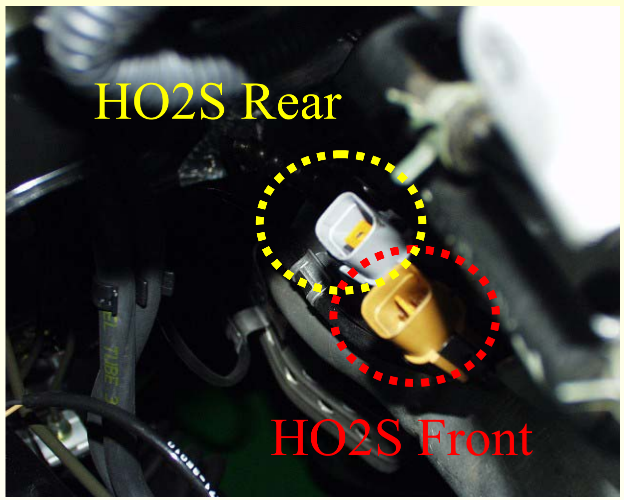
And, the O2 sensor tip temperature is controlled to 750deg.C to get reliable sensor signal output by already programed ***O2 heater control function***.

■ Heated Oxygen Sensors (HO2S)

Electric Circuit



Location



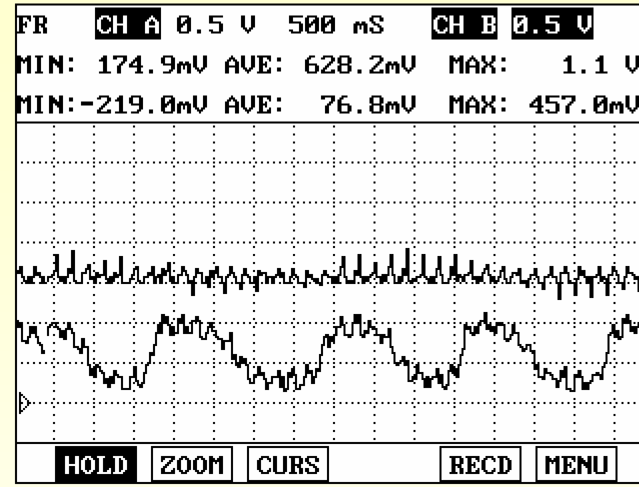
1: Sensor Sig.

2: Sensor GND

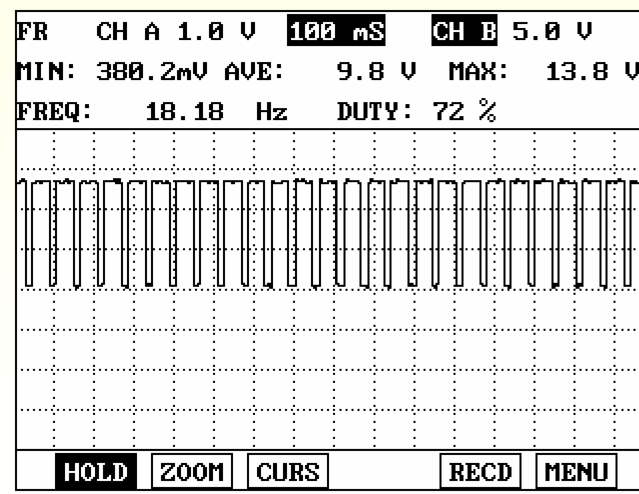
3: Heater Sig.

4: Vb

Sensor Signal



FR. Sensor, RE. Sensor

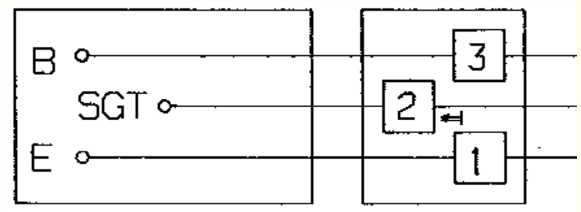


FR. Sensor Heater

■ Crankshaft Position Sensor (CKP)

The crankshaft position sensor detects and counts the tooth on teeth target wheel(3) and provides ECM with the information on the current position of crank angle and cylinder, and also the duration of each tooth and segment. So *injection and ignition could be activated exactly in desired crank angle and current engine speed could be calculated also. The Sigma 3.5ℓ engine will not run if CKP sensor circuit failure conditions exist.* The CKP is located adjacent to the crankshaft pulley (similar to 2.4 Optima).

Electric Circuit



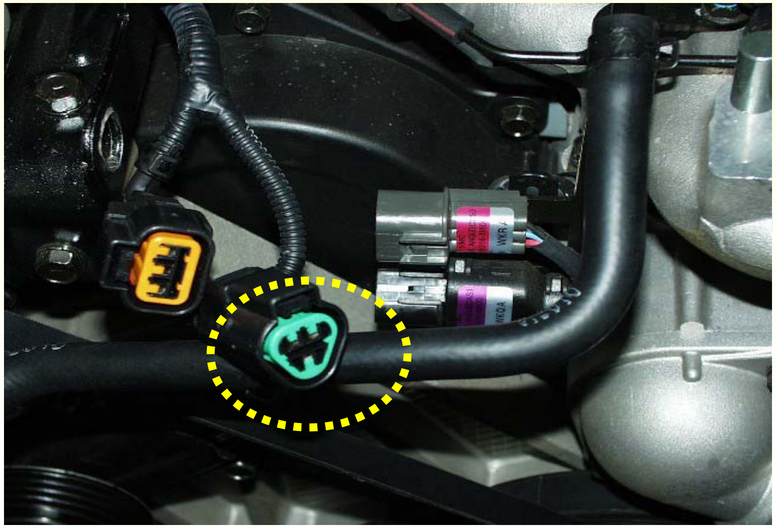
1: GND.

2: Sensor Sig.

3: Vb

-Hall effect type sensor

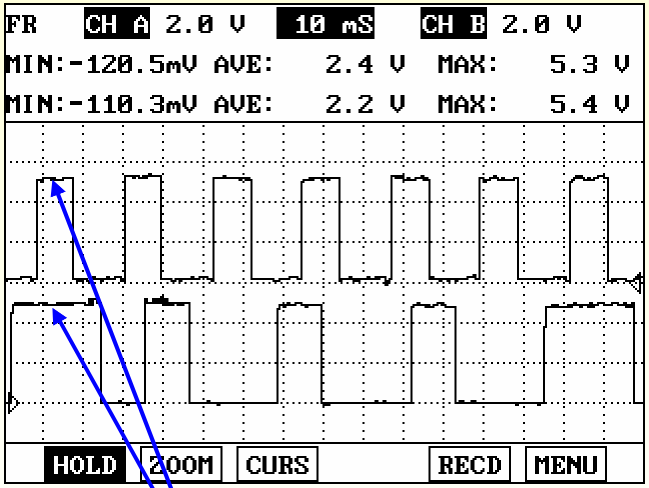
Location



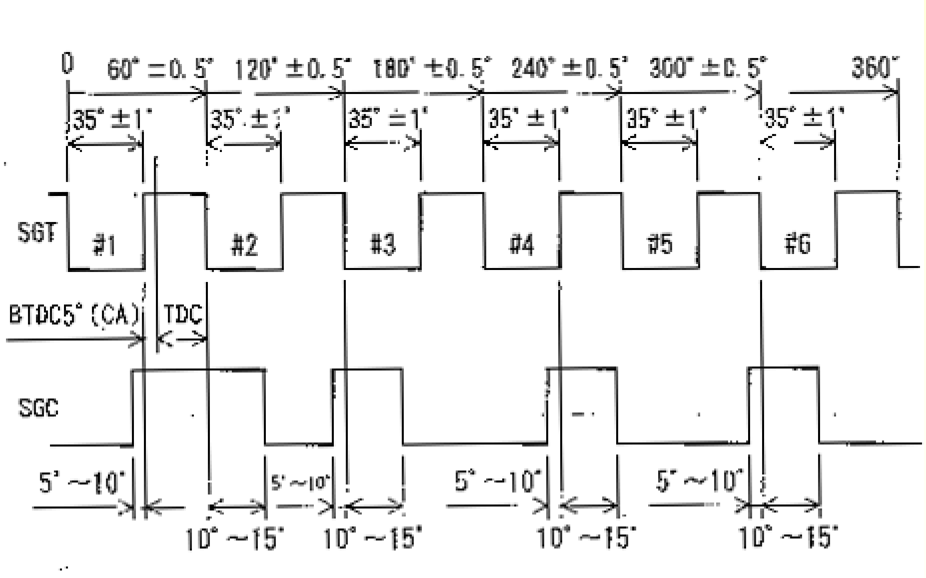
Sigma(Σ) 3.5ℓ Eng. – ECM Input/Output

■ Crankshaft Position Sensor (CKP)

Sensor Signal



Synchronization with CMP

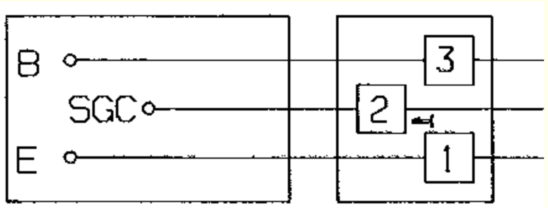


No.1 Cylinder TDC when both signals are at high.

■ Camshaft Position Sensor (CMP)

The Hall effect camshaft position sensor detects the teeth target wheel(Irregular four teeth) and provides ECM with the information on the current position of piston and cylinder, and also the duration of each tooth and segment. So *injection and ignition could be activated exactly in desired TDC of each cylinder.* The CMP is installed near the exhaust camshaft sprocket on the left cylinder bank. The target wheel is on the exhaust camshaft, behind the sprocket.

Electric Circuit



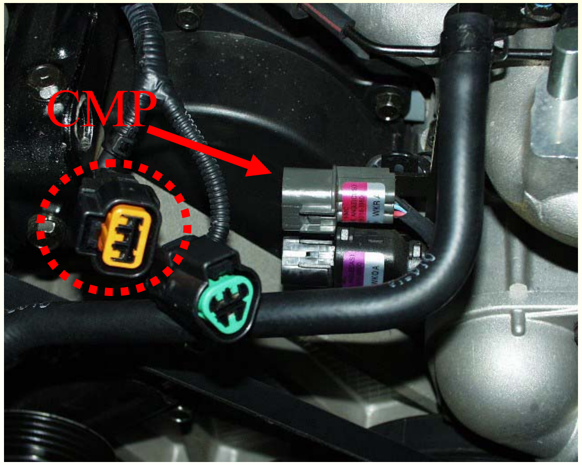
1: GND.

2: Sensor Sig.

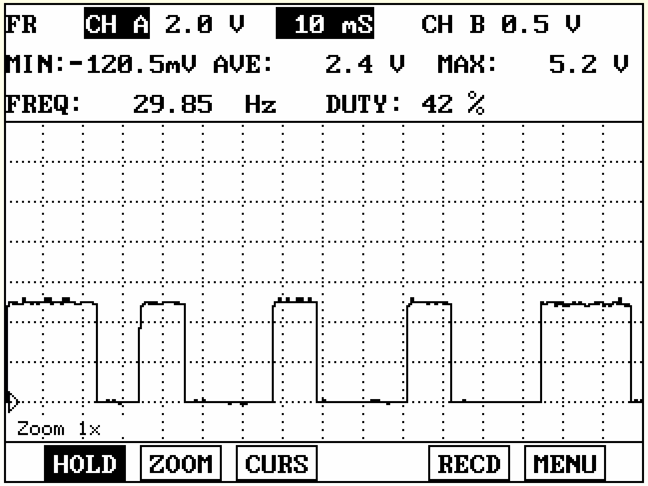
3: Vb

-Hall effect type sensor

Location



Sensor Signal

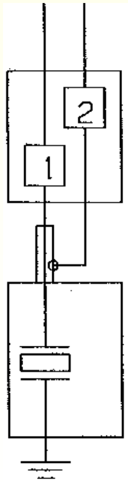


■ Knock Sensor

The knock sensor is installed to detect knock occurrence of each individual cylinders. The knock sensor signal is processed with filtering, signal noise level calculation and final decision of knock by comparing the noise level with calculated noise level threshold.

When knock is detected, ignition timings of corresponding cylinder are retarded by defined value, different engine operating conditions, and advanced again with delay and increment slop.

Electric Circuit

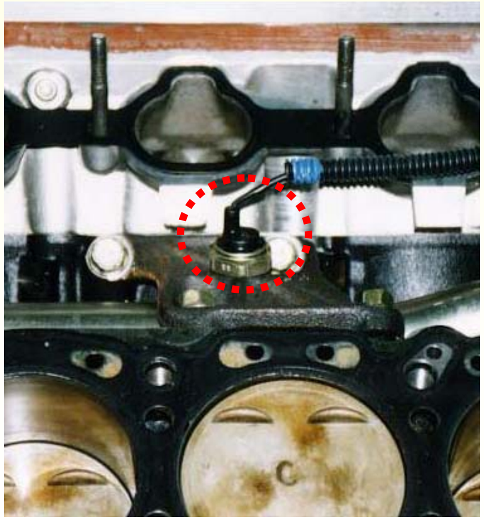


1: Sensor Sig.

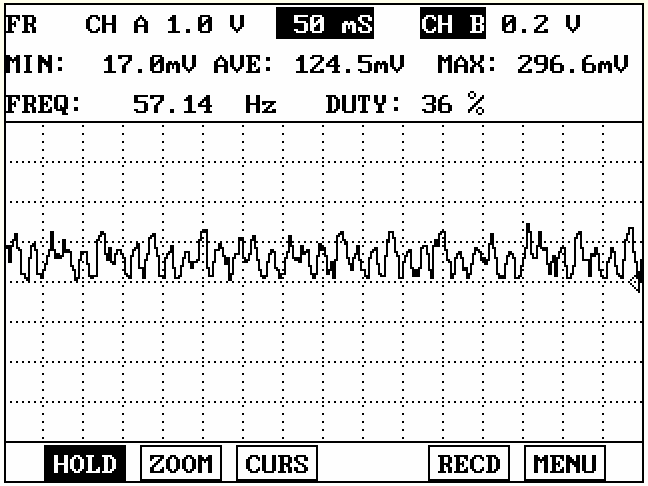
2: Shield GND.

-Piezo type sensor

Location



Sensor Signal

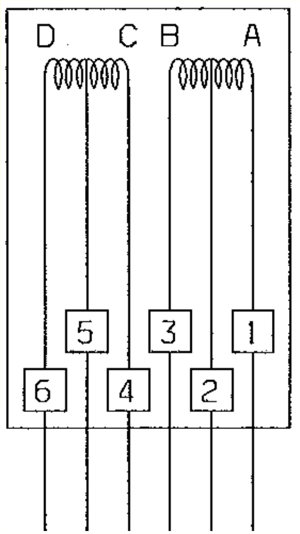


At idle

■ Idle Speed Control Motor (ISC)

Step Motor is installed to control the proper intake air amount to keep nominal idle engine speed and to avoid uncompleted combustion in closed throttle condition.
The ISC Motor opening value is concluded by Engine load(A/C, Fans, Drive, ...), Altitude etc.
ECM sends a signal to each coils of step motor in series to open or close the by-pass passage of throttle body. The idle speed actuator has four coils.

Electric Circuit



1: Control Sig. A

2: Vb.

3: Control Sig. B

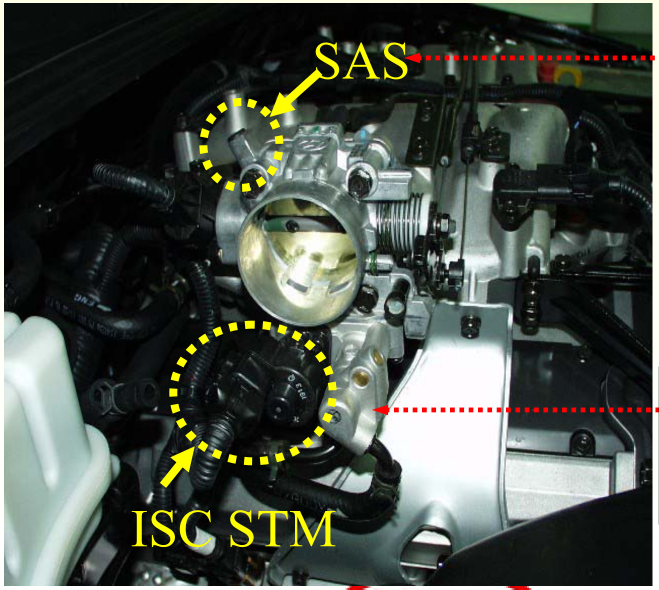
4: Control Sig. C

5: Vb

6: Control Sig. D

-Coil type

Location



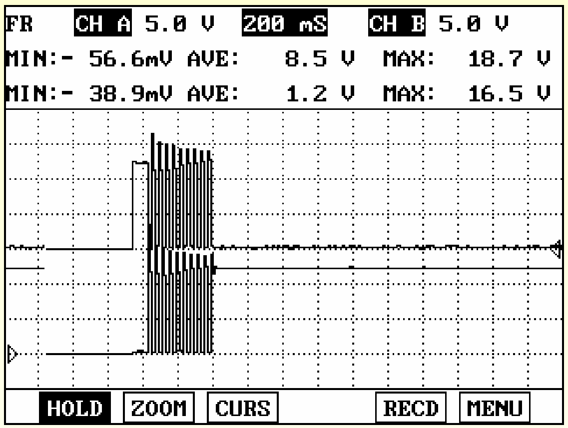
Idle Speed Adjust Screw(SAS)

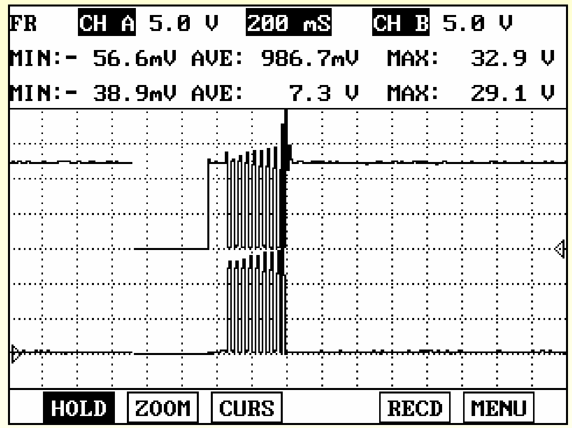
FIAV(Fast Idle Air Valve) for cold condition

Sigma(Σ) 3.5ℓ Eng. – ECM Input/Output

■ Idle Speed Control Motor (ISC)

Output Characteristic

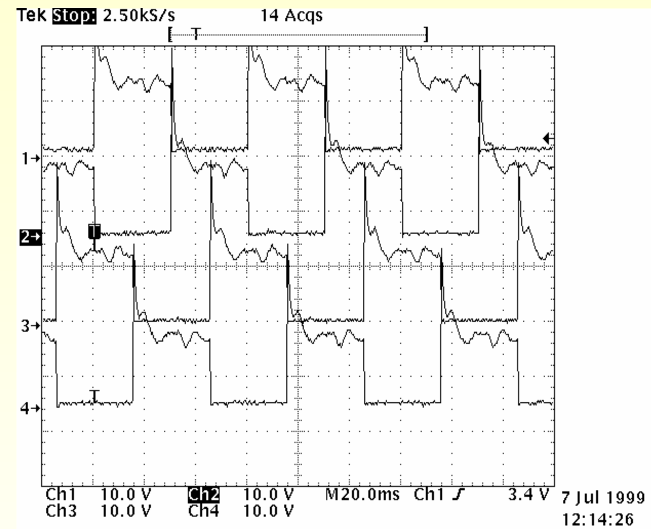




A & B at the moment A/C Off → On

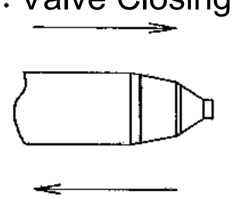
C & D

Details →



Activation Order	A	○			○
	B		○	○	
	C	○	○		
	D			○	○
Valve Moving	a	→			
	b	←			

a : Valve Closing



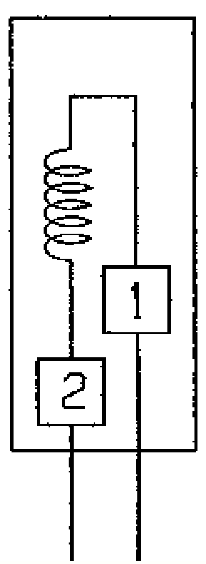
b : Valve Opening

Operation Order

■ Fuel Injectors

The six fuel injectors are sequentially activated by the PCM using ground controlled circuits. Each injector has four individual spray ports. The pulse signal from ECM actuates injector coil to open, thus inject a defined amount of fuel. The start and end of injection is controlled by ECM according to engine operating conditions.

Electric Circuit

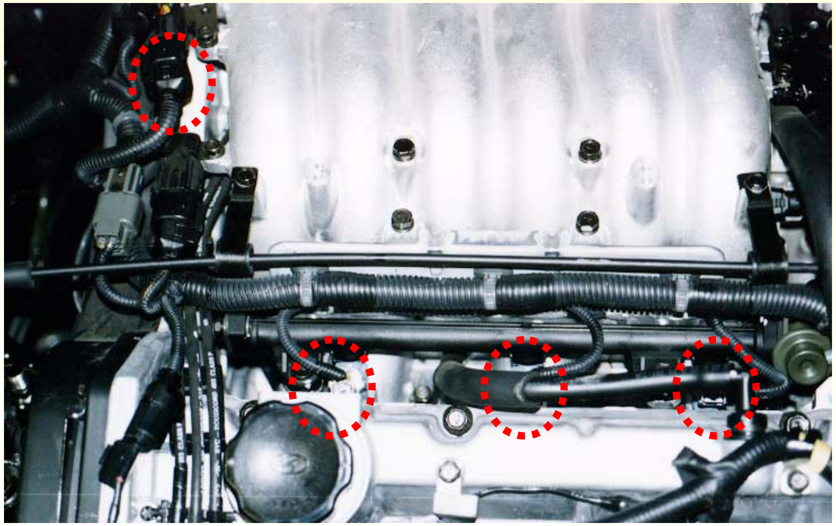


1: Control Sig.

2: Vb.

-Coil type

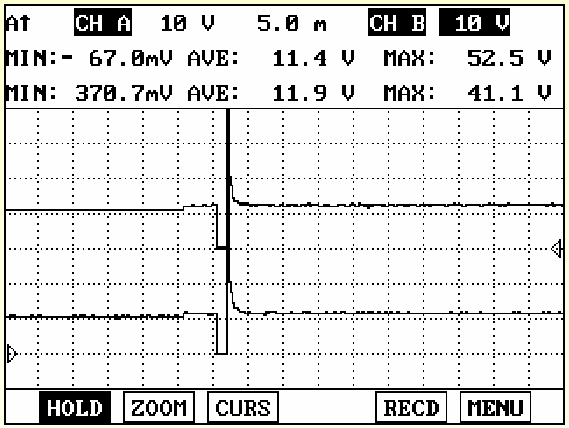
Location

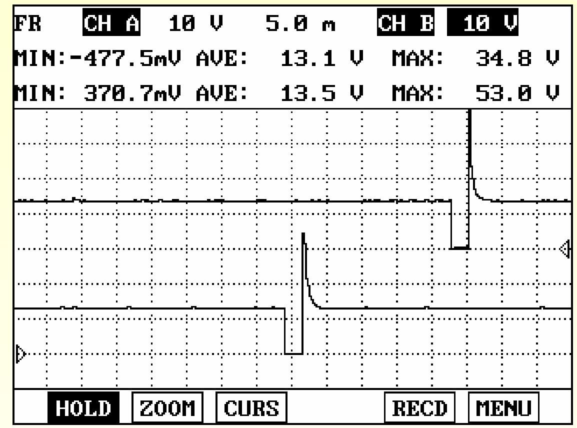


■ Fuel Injectors

Output Characteristic

#1, #2 Cylinder Injection at starting





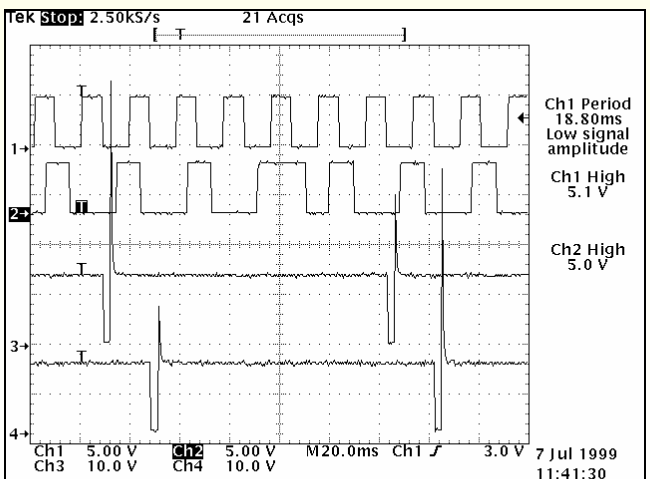
#1, #2 Cylinder Injection at idle

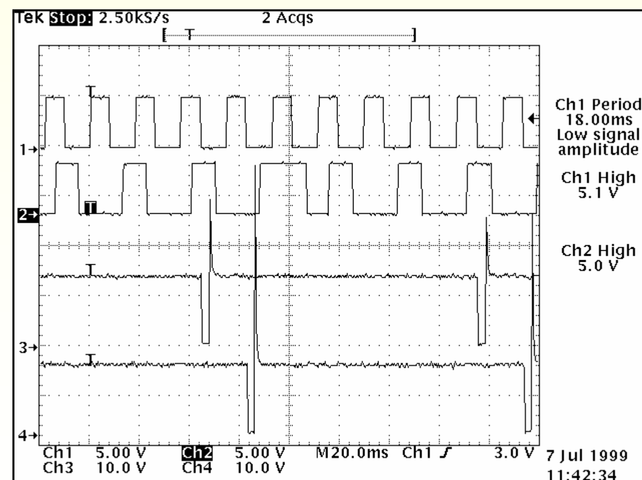
CKP

CMP

#1 Injection

#2 Injection





CKP

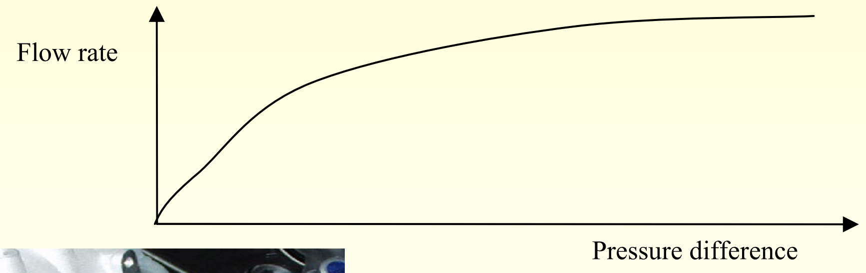
CMP

#3 Injection

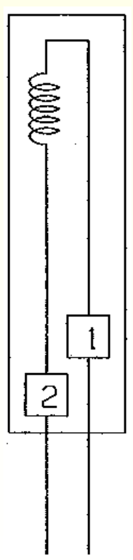
#4 Injection

■ Purge Control Solenoid Valve

20Hz pulse duty signal is sent from ECM to purge accumulated fuel in the canister charcoal. The Purge control valve is open or closed when OBD-II leakage monitoring is performed. The pulse duty to purge the canister is calculated according to engine oper ating condition(Engine speed, Mass air flow)



Electric Circuit

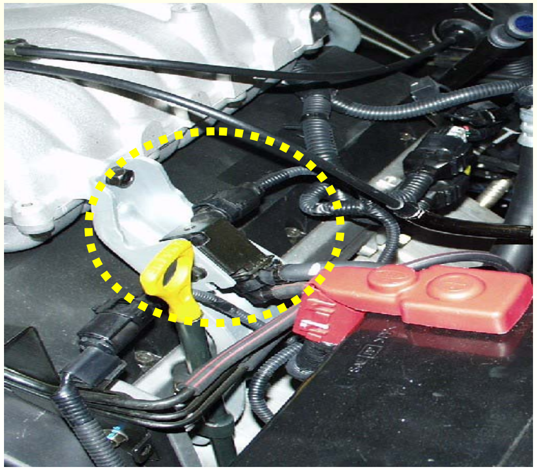


1: Control Sig.

2: Vb.

-Coil type

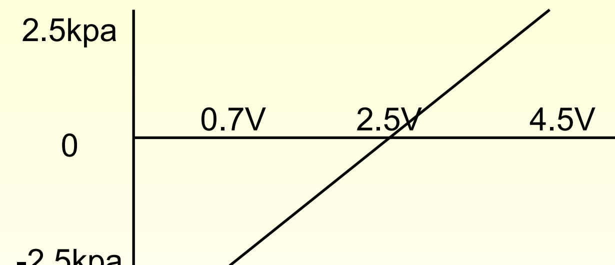
Location



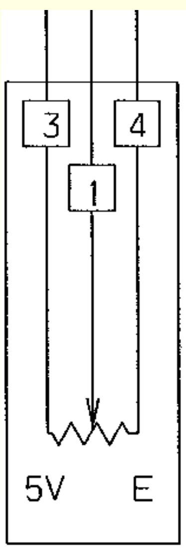
■ Fuel Tank Pressure Sensor (FTPS)

This sensor,installed on the fuel tank, measures the pressure of fuel tank to detect leakage or malfunction of related component during *the leakage monitoring of evaporative emission control system.*

Sensor Characteristic & Signal



Electric Circuit



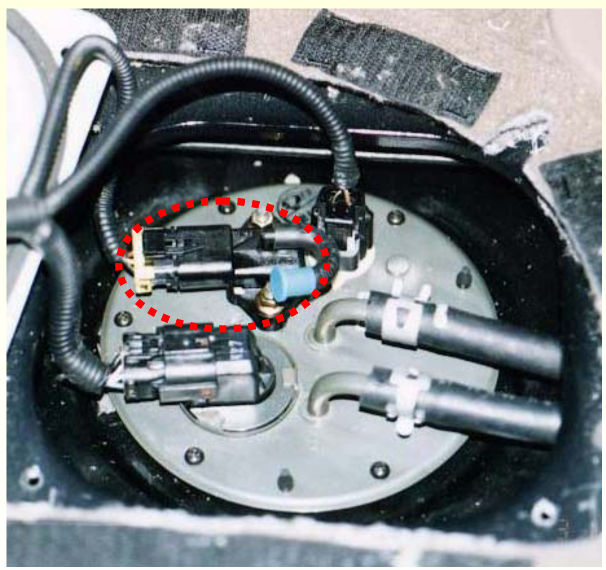
1: Sensor Sig.

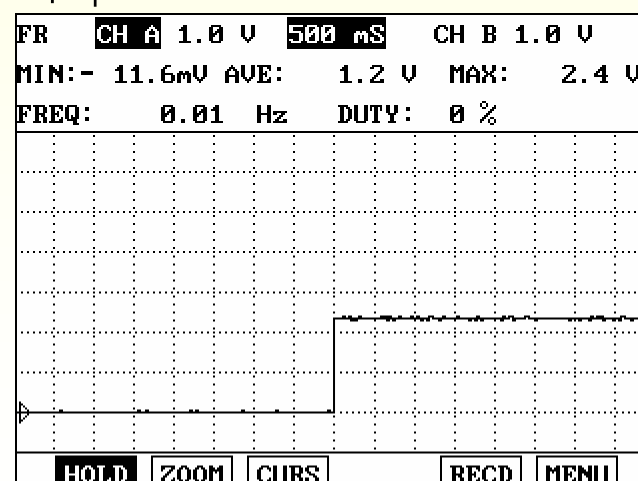
3: Vref.

4: Sensor GND.

-Resistance type with Diaphram

Location





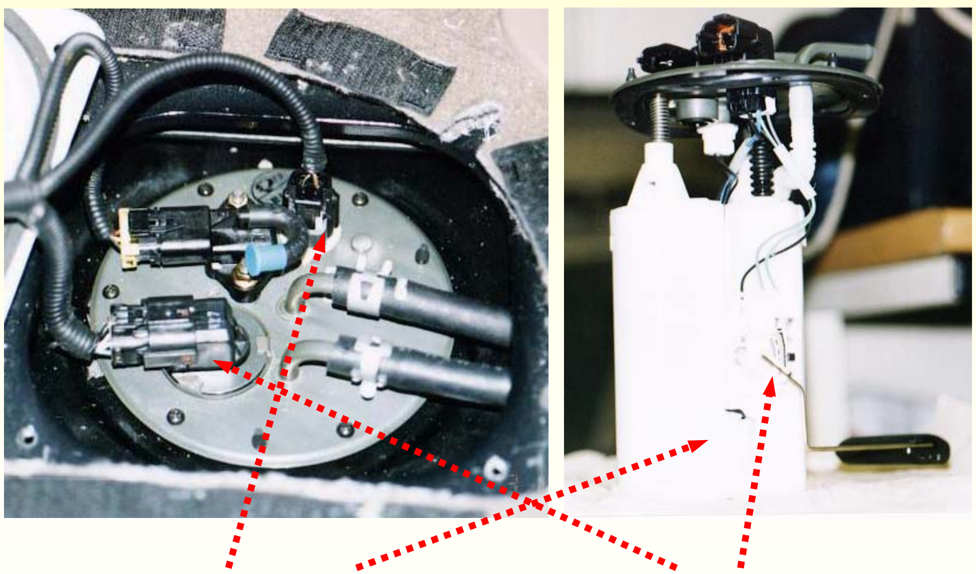
At the moment IG. Off → On

Sigma(Σ) 3.5ℓ Eng. – ECM Input/Output

■ Fuel Level Sensor (FLS), Fuel Temperature Sensor (FTS)

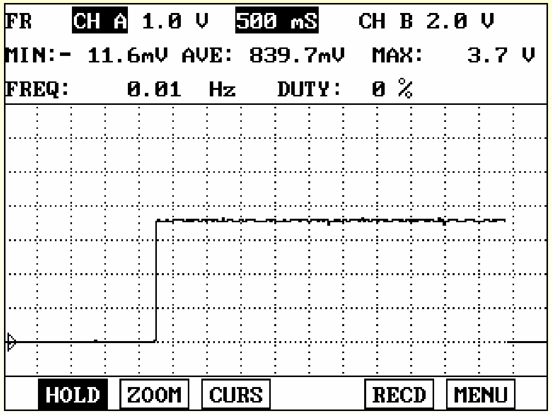
For engine management purposes, the Fuel Level Sensor(FLS) is also used as a supplementary device to assist with evaporative monitoring. The Fuel Temperature Sensor (FTS) is also incorporated for this purpose.

Location

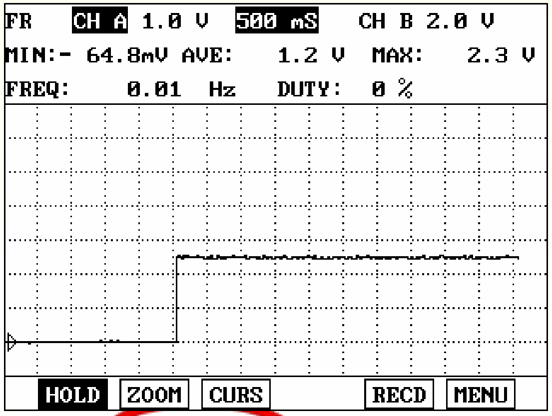


Fuel Temp. Sensor **Fuel Level Sensor**

Sensor Signal



FLS at IG. Off → On

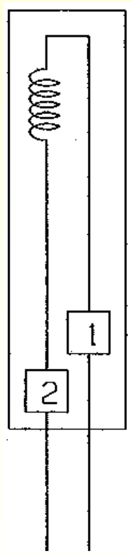


FTS at IG. Off → On

■ Canister Close Solenoid Valve (CCV) – NA only

The Canister Close Solenoid Valve (CCV) is normally open ; the ECM closes the valve to seal the evaporative emissions system for OBD-II leakage monitoring purposes. The CCV is located on the evap canister.

Electric Circuit

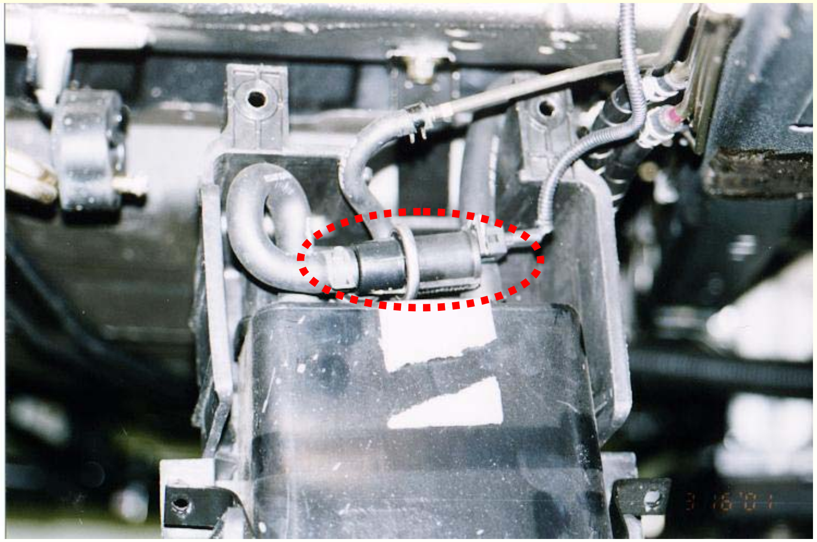


1: Control Sig.

2: Vb.

-Coil type

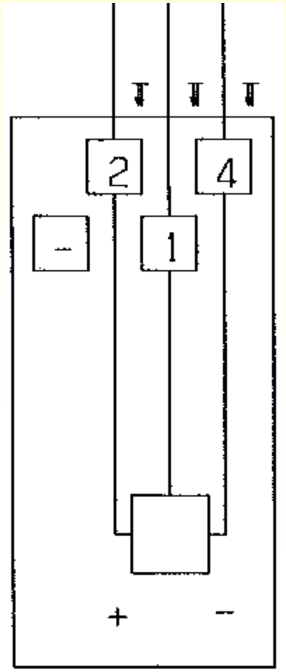
Location



■ Manifold Absolute Pressure Sensor (MAP)

This sensor is installed at intake surge tank to adapt fuel system for the altitude of vehicle(by detecting atmosphere pressure).

Electric Circuit



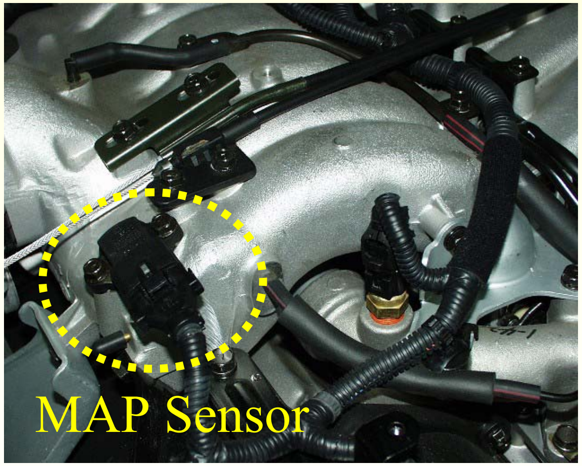
1: Sig.

2: Vref.

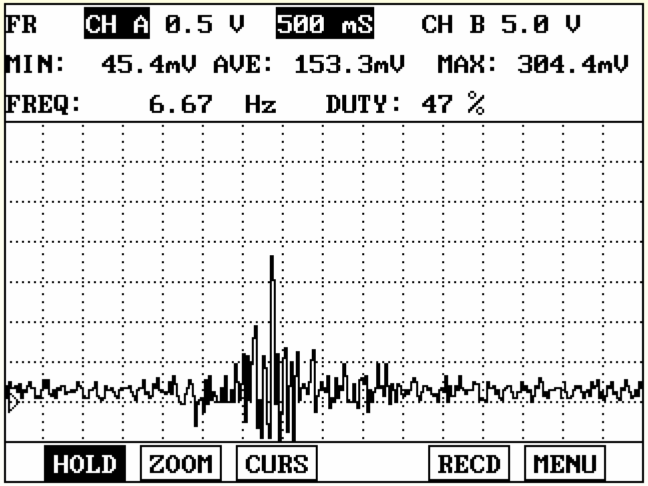
4: GND

-Piezo type sensor

Location



Sensor Signal

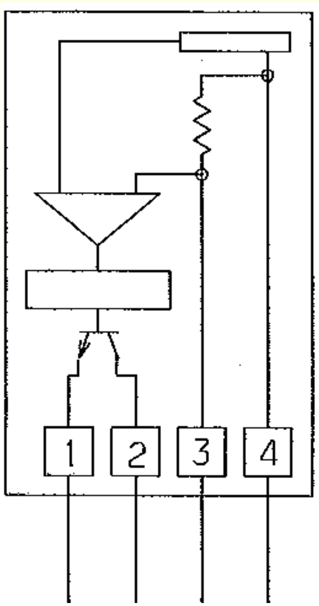


At idle → Acceleration

■ Ignition Failure Sensor

The ignition failure sensor is employed for the purposes of detecting ignition system Malfunctions. The three ignition coil primary circuits are connected through the ignition failure sensor. The ECM monitors the sensor output signal to determine if a failure condition exists. (The tachometer is also supplied with the ignition detect signal.)

Electric Circuit



1: Body GND.

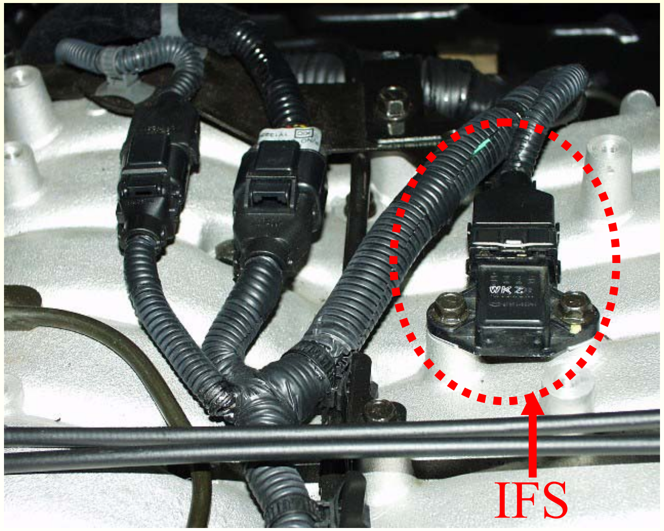
2: Vref.

3: Vb Output

4: Vb Input

-IC type sensor

Location



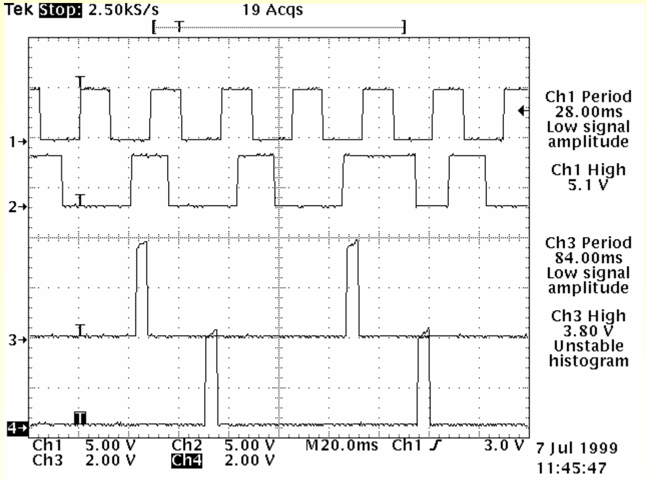
■ Ignition Failure Sensor

CKP

CMP

IG. #1&#4

IG. #2&#5

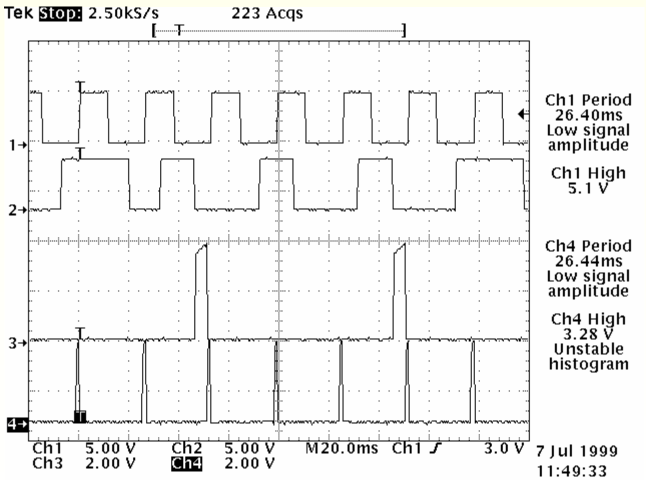


CKP

CMP

IG. #3&#6

IG. Fail. sensor



The signal from IG. Failure Sensor is a kind of monitoring signal for the activation of each primary IG. Coil.

When each primary coil signal falls, the signal of IG. Failure Sensor rises.

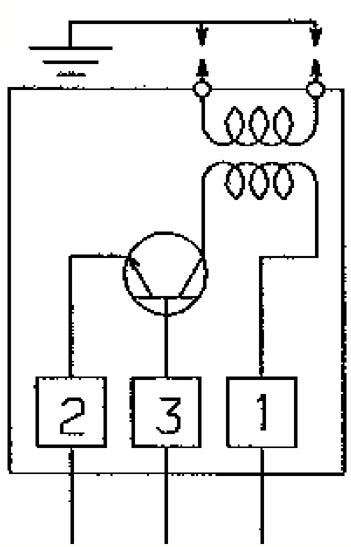
ECM can monitor the primary IG. Coil signal at ECM outside with this signal and compares this signal with the each primary IG. Coil signal of ECM inside.

The frequency of both signal should be same. If there are any difference, ECM regard s it misfire for the cylinder.

■ Ignition Coil

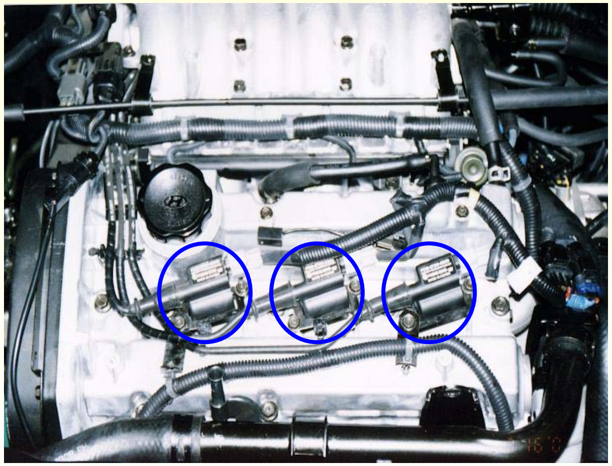
There are three ignition coils-#1/#4, #2/#5 and #3/#6. Each ignition coil is integrated its own power transistor.

Electric Circuit

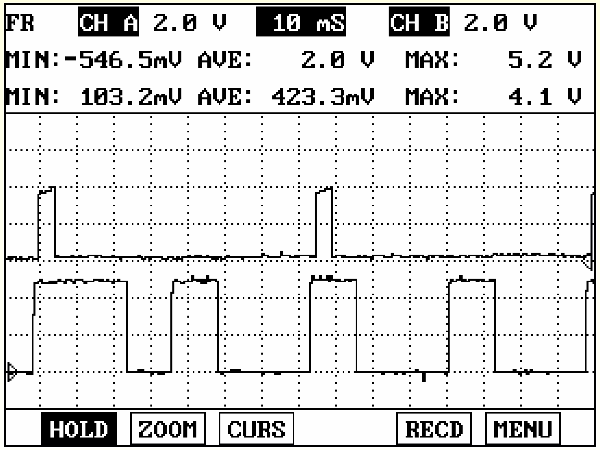


1: Vb.
2: Body GND
3: Signal
-IG. Coil integrated TR

Location



Signal

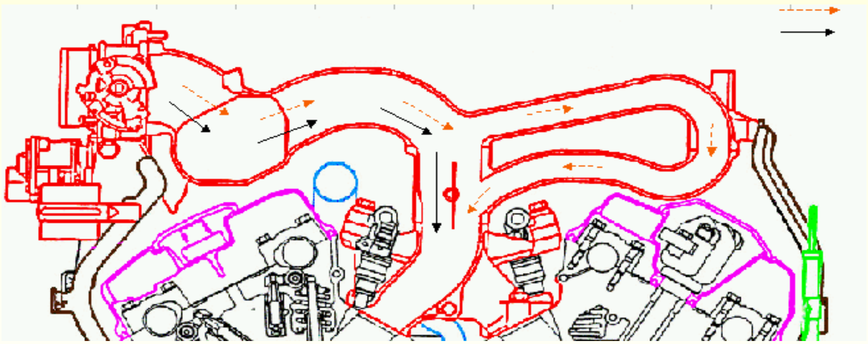


IG.#1&#4 & CMP

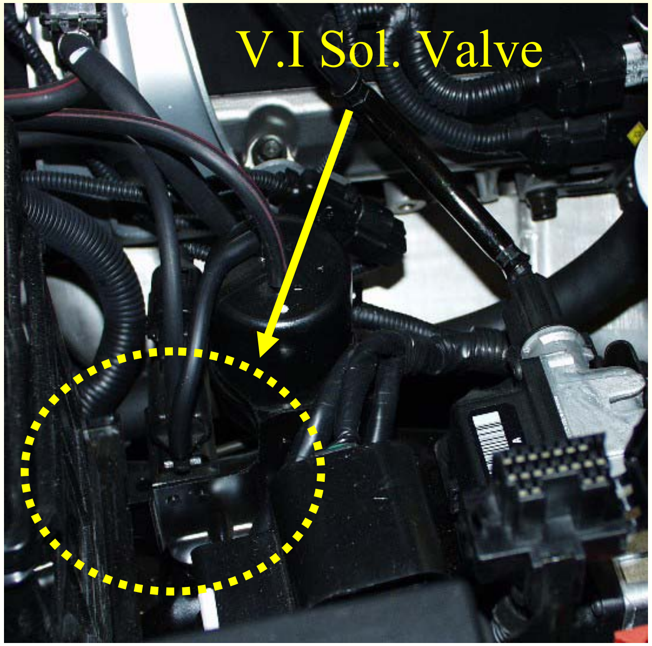
■ Variable Intake Manifold

Low to medium speed torque is boosted through the use of a Variable Intake Manifold. Intake manifold path is variable through the operation of VI vacumn according to the engine RPM. (≒3500rpm, on and off type)

Flow



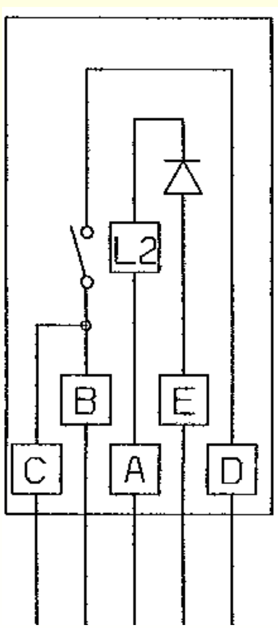
Location



■ Main Relay

The voltage after main relay is used to supply power to the sensors and actuators.
ECM controls the Main Relay and its remains ON at Key off in order to store the adaptation values and fault status to the memory.

Electric Circuit



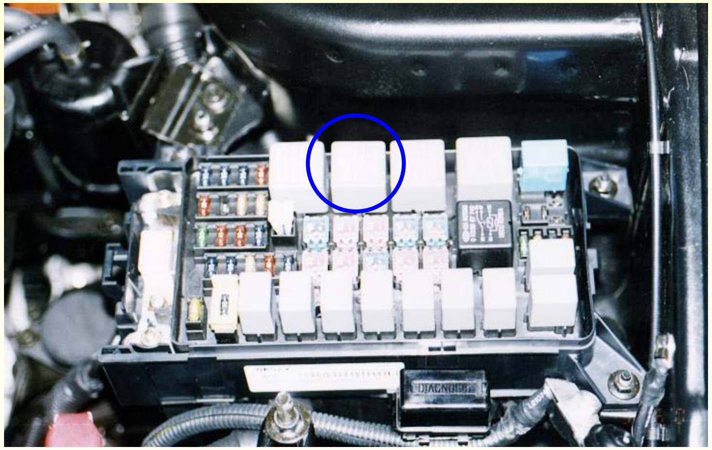
A: Control Sig.

B,C: Output Vb.

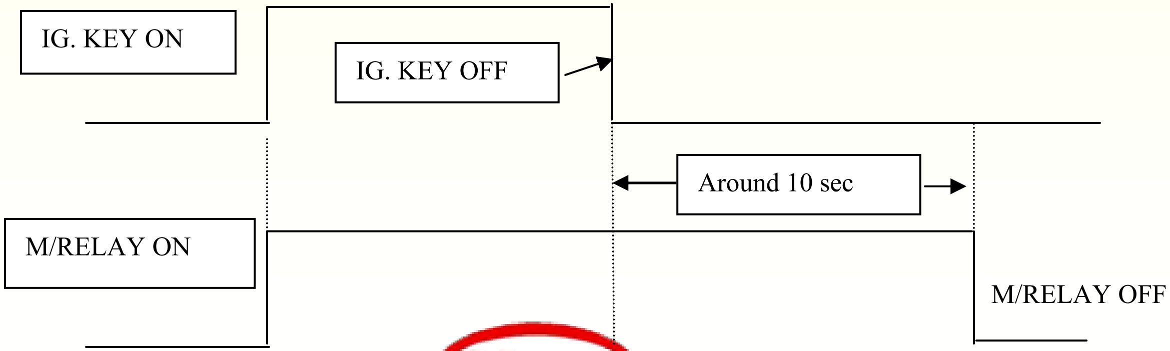
E,D: Input Vb

-Coil type

Location



Output Characteristic



■ Catalyst Efficiency Monitoring

The signal from the O_2 sensor upstream from the monitored catalyst and the associated monitoring oxygen sensor downstream from the catalyst are used to estimate the Oxygen storage capability:

- **If a catalyst has good conversion properties, the oxygen fluctuations upstream from the catalyst, generated by the lambda controller, are smoothed by the Oxygen storage capacity of the catalyst.**
- **If the conversion provided by the catalyst is low due to ageing, poisoning or misfiring, then the fluctuations upstream from the catalyst exist also downstream from the catalyst.**
- **Calculate a frequency ratio of output signals from the front and rear oxygen sensors according to the following equation.**

Rf= Frequency of Rear Oxygen / Frequency of Front Oxygen

if Rf > R0(Threshold value), determine the catalyst malfunction.

■ Misfire Monitoring

Misfire induces a decrease of the engine speed, therefore a variation in the segment period. The misfiring detection is based on the observation of this variation of segment period.
As a result, ECM monitor the fluctuation of crank angular acceleration. If the crank angular acceleration is out of specification, ECM determines misfire on engine.

Main causes of misfiring:

- -injector shut-off
- -fuel pressure problems
- -fuel combustion problems
- -ignition cut-off…

Carb. A error:

- •Check recurrence: 200CKP revolution
- •Target: to avoid cataylist damage

Carb. B error:

- •Check recurrence: 1000CKP revolution
- •Emission decrease

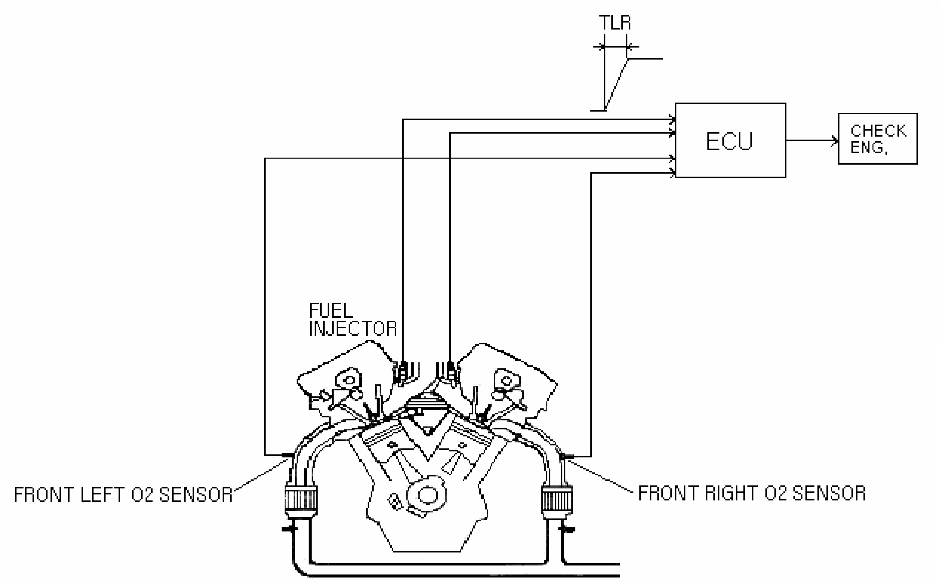
Misfire fade-out conditions:

- •Min. engine rpm
- •Max. engine rpm(6500)
- •Min. engine load(0)
- •Max. air mass gradient
- •Max throttle gradient
- •Max. ignition angle gradient
- •Aircon compressor activation
- •Cylinder shut-off
- •Rough road detection
- •Crankshaft oscilation.
- •Shift change
- •Sudden deceleration

■ O2 Sensor Monitoring

The fluctuation of O2 signal characteristics is significant to perform properly lambda feedback control. And, too slow sensing response of O2 signal can cause the increment of exhaust emission.

- Response time monitoring
Detect the response time (TLR, TRL) of oxygen sensor output signals when air-fuel ratio is changed intentionally from lean to rich (TLR) or rich to lean (TRL) under the hot steady state condition.
If $T_{LR} > T1$ or $T_{RL} > T2$ (T1, T2 : threshold value), determine the oxygen sensor malfunction.

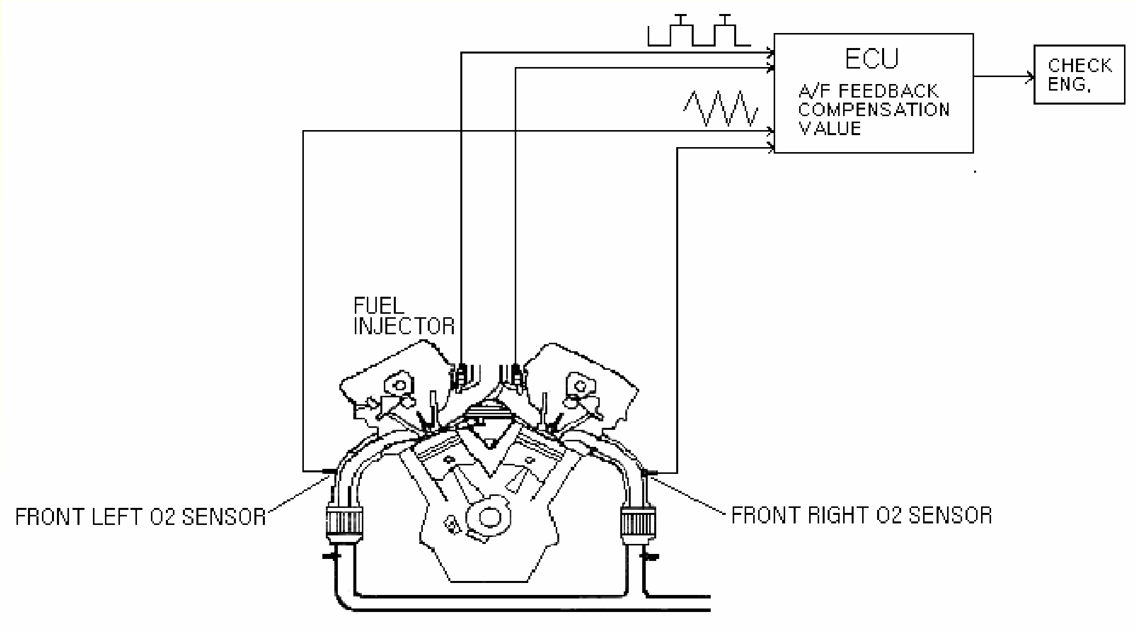


■ Fuel System Monitoring

A/F feedback compensation value (A/F learning value and Integral value of A/F feedback) is monitored. Injection time (T) is conceptually defined as follows ;

$T = TB \times (KLRN + KI + 1.0)$ TB : Base injection time

KI is determined to achieve A/F ratio stoichiometric for short-term trim and KLRN for long-term trim. If KLRN > K0 and KI > K1 or KLRN < K2 and KI < K3(K0, K1, K2, K3 : threshold value), determine the fuel system malfunction.

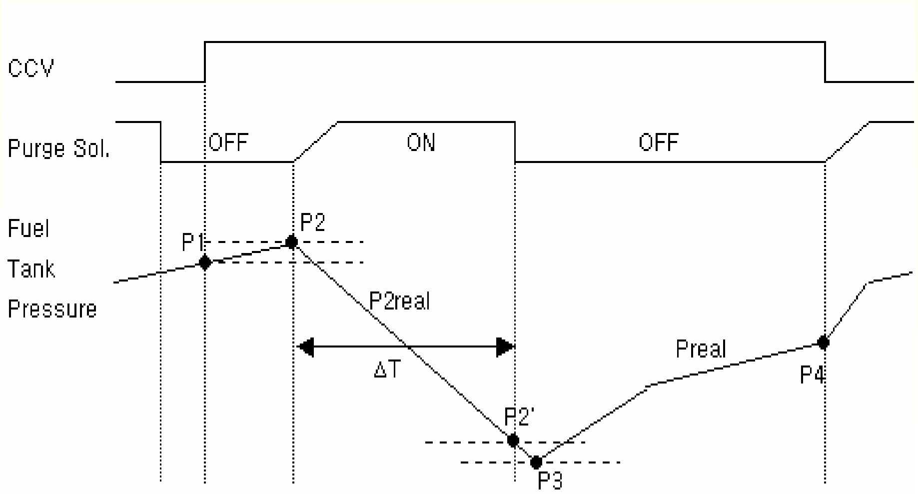


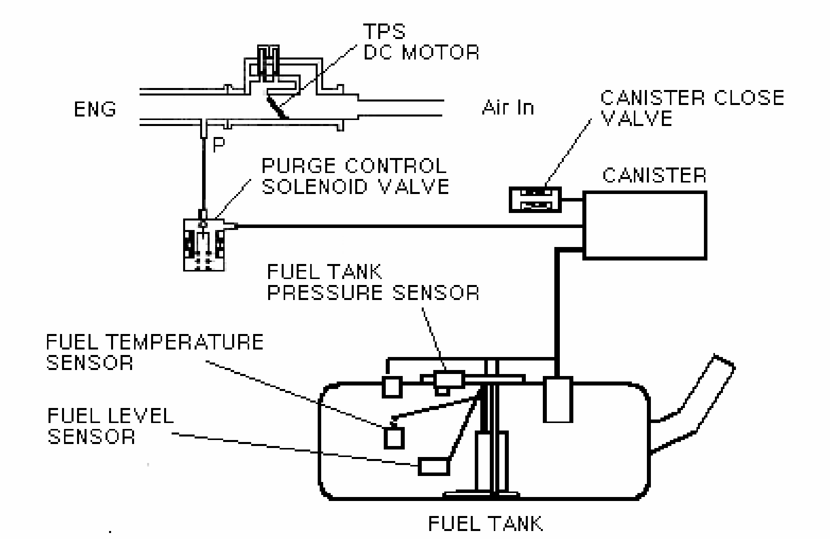
■ Evaporative System Monitoring

At driving condition, the fuel tank pressure gradient and the duration to reach to certain tank pressure are monitored after vacuuming the evaporative system to use the throttle body vacuum through the purge solenoid valve and canister close valve. If the evaporative system has a small leakage such as Φ1mm leakage hole, the pressure gradient will be above a certain threshold map value which consists of ΔP, ΔT.
At idle condition, if the evaporative system has a small leakage such as Φ0.5mm leakage hole, the pressure gradient will be above a certain threshold map value which consists of fuel temperature (FTMP), fuel level(FLVL).

-ΔP ≥ Threshold map value (ΔP, ΔT) or, Threshold map value (FTMP, FLVL)
where, ΔP = (PREAL - P3) - (P2 - P1), ΔT = T(P2') - T(P2)

-P2REAL > Threshold value





■ Thermostat Monitoring

Engine coolant temperature from the sensor voltage is monitored. For thermostat monitoring, three Malfunction criteria (TWTFL_H, TWTFL_M, TWTFL_L) according to intake air flow are reduced per 500msec. Malfunction decision is performed when the counter of malfunction criteria is zero in the case of the engine coolant temperature is over thermostat regulating temperature.

Malfunction Condition

Coolant temperature at start : 5 ~ 60℃
Coolant temperature at start - Intake air temperature at start < 10℃
Intake air temperature at start - Intake air temperature < 5℃
The integrated time of low air flow(TWOAFS) ≤ 200sec
The integrated time of high air flow(TWOAFS_H) ≤ 100sec

Malfunction Criteria

The counter of malfunction criteria(TWTFL_H, TWTFL_M, TWTFL_L) is changed.
intake average air flow(Qave).
Qave > 19.2g/sec ⇒ TWTFL_H
19.2g/sec > Qave > 11.52 g/sec ⇒ TWTFL_M
Qave ≤ 11.52g/sec ⇒ TWTFL_L

COMPONENT SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Catalyst (Bank 1)	P0421	Frequency ratio (Rf) of front and rear oxygen sensor used. Bank 1	FTP emission > 1.75 * emission standard	> 0.801	Closed loop		150sec once per driving cycle	2 Driving cycles
					Load value	25% ~ 70%		
					Engine speed	< 2500rpm		
					Idle switch	off		
					Vehicle speed	> 15KPH		
Catalyst (Bank 2)	P0431	Frequency ratio (Rf) of front and rear oxygen sensor used. Bank 2	FTP emission > 1.75 * emission standard	> 0.801	Closed loop		150sec once per driving cycle	2 Driving cycles
					Load value	25% ~ 70%		
					Engine speed	< 2500rpm		
					Idle switch	off		
					Vehicle speed	> 15KPH		
Misfire	P0300(Multi) P0301(#1 Cyl) P0302(#2 Cyl) P0303(#3 Cyl) P0304(#4 Cyl) P0305(#5 Cyl) P0306(#6 Cyl)	Fluctuation of crank angular acceleration is monitored	FTP emission > 1.5 * emission standard	> 2.2%	Engine speed	500~6250rpm	1000revs. Continuous	2 Driving cycles
					Load value	11% ~ 100%		
			Catalyst temp. > 950?	> 5 ~ 20% within 200revs.	No running on rough road		200 revs. Continuous	
					No shift change			
					No sudden deceleration			
Canister close valve	P0446	Surge voltage is monitored	Surge voltage, Vps	< Vb + 2V	Battery voltage	≥ 10V	Continuous	2 Driving cycles
		Clogging is monitored	Preal	< -200mmAq	FTPS voltage	1.0 V ~ 3.5V		
					Purge Duty	≥ 20%		

Evap. Purge system	P0456	0.02inch leakage of evap. System is monitored	ΔP = (Preal-P3) -(P2-P1)	≥ Threshold value(ΔP, FTMP, FLVL)	Idle switch	on	90sec once per driving cycle	2 Driving cycles
					Fuel temp.	< 45?		
					Vehicle speed	< 10KPH		
	P0442	0.04inch leakage of evap. System is monitored		≥ Threshold value(ΔP, ΔT)	Engine speed	> 1500rpm	50sec once per driving cycle	
					Load value	25 ~ 70%		
					Engine coolant	> 60?		
	P0455	Big leakage (fuel cap missing)	P2real between detecting P2 and detecting P3	> -180mmAq	Intake air temp.	< 70?		
					P/S pressure s/w	off		
					Vehicle speed	≥ 30KPH		
Purge sol. Valve	P0441	Evap. Pressure is monitored	Preal	< -157mmAq	↑	↑		2 Driving cycles
	P0443	Surge voltage is monitored	Surge voltage, Vps	< Vb + 2V	Battery voltage	≥ 10V	Continuous	
Fuel tank pressure sensor	P0453	Output voltage of tank pressure sensor is monitored	Purge Duty	≥ 100% and	Intake air temp.	> 5?	Continuous	2 Driving cycles
			Intake air temperature	< 45? and	Load value	25% ~ 70%		
			Sensor output voltage	> 3.5V	Engine speed	> 1440rpm		
	P0452	Output voltage of tank pressure sensor is monitored	Purge Duty	= 0% and	Vehicle speed	≥ 29.75KPH		
			Sensor output voltage	< 1.0V				
	P0451	(P1=pressure with full tank)	Oscillation between max. & min. voltage	>Mean value+P1 <Mean value-P1	Vehicle speed	< 2.5KPH	90sec Continuous	
					Idle switch	on		
Fuel Level Sensor	P0463	Change in output voltage(ΔVFLS) and output voltage(VFLS) are monitored	ΔVFLS	< 0.039V	Time during vehicle speed ? 0	> 600sec	Continuous	No MIL ON
			and VFLS	> 4.9V				
	P0462			< 1.0V				
	P0460			1.0<VFLS<4.9V				
Fuel temperature sensor	P0181	Output voltage is monitored.	Output voltage, VFTMP	< 0.1V or > 4.6V	Time after start	> 2sec	Continuous	2 Driving cycles
	P0183	Rationality Check	| Fuel temp. at start - water temp. at start |	> 15?	Water temp at start - air temp. at start	< 5?		

Fuel system (Bank 1)	P0171(Too lean)	A/F learning value(KLRN) & integral value of A/F feedback compensation(KI) are monitored	Idle	KLRN	> +12.5%	Closed loop		Continuous	2 Driving cycles
				KI	> +25%				
			Part load	KLRN	> +12.5%				
				KI	> + 15.2%				
	P0172(Too rich)	A/F learning value(KLRN) & integral value of A/F feedback compensation(KI) are monitored	Idle	KLRN	< -12.5%				
				KI	< -30%				
			Part load	KLRN	< -12.5%				
				KI	< -10.9%				
	P0174(Too ean)	A/F learning value(KLRN) & integral value of A/F feedback compensation(KI) are monitored	Idle	KLRN	> +12.5%	Closed loop		Continuous	2 Driving cycles
				KI	> +25%				
			Part load	KLRN	> +12.5%				
				KI	> + 15.2%				
	P0175(Too rich)	A/F learning value(KLRN) & integral value of A/F feedback compensation(KI) are monitored	Idle	KLRN	< -12.5%				
				KI	< -30%				
			Part load	KLRN	< -12.5%				
				KI	< -10.9%				
Oxygen Sensor (Bank 1, front)	P0133	Response time from lean to rich (TLR) & from rich to lean (TRL) are monitored when A/F is intentionally changed.	From lean to rich (TLR)		> 1.1sec	Closed loop		8sec Continuous	2 Driving cycles
						Engine coolant	> 35?		
			From rich to lean (TRL)		> 0.95sec	Load value	25~60%		
						Engine speed	1375~3000rpm		
	P0132	Circuit voltage(Vf) is monitored.	Circuit voltage after applying 5V to sensor		≥ 4.5V	Engine coolant	> 77?	Continuous	2 Driving cycles
						Engine speed	> 1200rpm		
Oxygen Sensor (Bank 1, rear)	P0136	Circuit voltage(Vf) is monitored.	Circuit voltage after applying 5V to sensor		≥ 4.5V	Load value	> 25%		
						Sensor voltage	<0.2V for 180s		
	P0140	Circuit voltage is monitored when A/F is made to be rich 15% during 10sec	Circuit voltage Vf		≥ 0.5V	Engine coolant	> 70?	Continuous	2 Driving cycles
			Circuit voltage Vr		< 0.1V				
	P0139	Rationality Check	Response Rate, TRL		≥ 1sec	Engine coolant	> 82?	3sec Continuous	2 Driving cycles
						Fuel Cut	on		

Oxygen Sensor (Bank 2, front)	P0150	Response time from lean to rich (TLR) & from rich to lean (TRL) are monitored when A/F is intentionally changed.	From lean to rich (TLR)	> 1.1sec	Closed loop		8sec Continuous	2 Driving cycles
					Engine coolant	> 35?		
			From rich to lean (TRL)	> 0.95sec	Load value	25~60%		
					Engine speed	1375~3000rpm		
	P0152	Circuit voltage(Vf) is monitored.	Circuit voltage	≥ 4.5V	Engine coolant	> 77?	Continuous	2 Driving cycles
					Engine speed	> 1200rpm		
Oxygen Sensor (Bank 2, rear)	P0156	Circuit voltage(Vf) is monitored.	Circuit voltage	≥ 4.5V	Load value	> 25%		
	P0160	Circuit voltage is monitored when A/F is made to be rich 15% during 10sec	Circuit voltage Vf	≥ 0.5V	Engine coolant	> 70?	Continuous	2 Driving cycles
			Circuit voltage Vr	< 0.1V				
	P0159	Rationality Check	Response Rate, TRL	≥ 1sec	Engine coolant	> 82?	3sec Continuous	2 Driving cycles
					Fuel Cut	on		
Oxygen Sensor Heater (Bank 1)	P0135(front)	Heater circuit current(AH) is monitored.	Circuit current, AH	< 200mA or	Heater	on	Continuous	2 Driving cycles
	P0141(rear)			≥ 3.5A				
Oxygen Sensor Heater (Bank 2)	P0155(front)	Heater circuit current(AH) is monitored.	Circuit current, AH	< 200mA or	Heater	on	Continuous	2 Driving cycles
	P0161(rear)			≥ 3.5A				
Throttle position sensor	P0122	Output voltage is monitored.	Output voltage, VTPS	< 0.2V or			Continuous	2 Driving cycles
				≥ 2V	Idle switch	on		
	P0123	Output voltage is monitored.	Output voltage, VTPS	> 4.6V	Load value	< 30%		
					Engine speed	< 3000rpm		
	P0121	Rationality Check	Output voltage, VTPS	> Th1(rpm,load)	Engine coolant	> 81?		
				< Th2(rpm,load)				
Cam position sensor	P0340	Change in output voltage (ΔVcam) is monitored.	ΔVcam	0			Continuous	2 Driving cycles
Crank angle sensor	P0335	Change in output voltage (ΔVcrank) is monitored.	ΔVcrank	0	Cranking switch	on	Continuous	2 Driving cycles
		Patterns of the signal combinations of the crank angle sensor signal & cam position sensor signal are monitored every 2sec continuously.						

Sigma(Σ) 3.5ℓ Eng. – Diagnostic Trouble Code

Air flow sensor	P0102	Output voltage is monitored.	Output voltage, VAFS	< 1.055V	Engine speed	> 3000rpm	Continuous	2 Driving cycles
	P0103	Output voltage is monitored.	Output voltage, VAFS	≥ 4.5V	Engine speed	≤ 2000rpm		
					TPS	≤ 2V		
	P0101	Rationality Check	Output voltage, VAFS	0.957V ~ 1.055V	Cranking switch	on		
			ΔVAFS	≤ 0.039V				
			Load value	> Th1(rpm,tps)	Engine coolant	> 81?		
				< Th2(rpm,tps)	Intake air temp.	5 < AT < 45?		
Coolant temperature sensor	P0115	Resistance of sensor(Rcts) is monitored	Resistance, Rcts	< 50Ω or	Time after start	> 60sec	Continuous	2 Driving cycles
				≥ 72kΩ				
	P0125	Time(Tfbi) from engine starting to the reaching engine coolant temp. of F/B on	Tfbi	>300sec@-8?	AFS voltage	> 1.7V	300sec after engine start	2 Driving cycles
				>110sec@20?	Engine coolant	≥ -10?		
				>60sec@82?	Air temperature	≥ -10?		
				>300sec@-8?	AFS voltage	≤ 1.7V		
				>200sec@20?	Engine coolant	≥ -10?		
				>60sec@82?	Air temperature	≥ -10?		
	P0116	Time(Tdf) is monitored (elapsed time under 40? after over 40? once)	Tdf	> 300sec			300sec Continuous	2 Driving cycles
		Temperature shifting is monitored	| Wtmax - Wtmin |	< 1?	Engine speed	> 1500rpm	300sec Continuous	
					Load value	> 25%		
					coolant at start	> 7?		
					Air temperature	< 60?		
Intake air temp. sensor	P0112	Resistance of sensor(Rats) is monitored	Resistance, Rats	< 0.09kΩ	Time after start	> 2sec	Continuous	2 Driving cycles
	P0113		Resistance, Rats	≥ 50kΩ				
Idle speed control	P0506	Real engine speed & target engine speed are monitored.	Real engine speed	< Target-100rpm	ISC Feedback	on	Continuous	2 Driving cycles
	P0507			> Target+200rpm	Engine coolant	≥ 77?		

KIA MOTORS

Sigma(Σ) 3.5ℓ Eng. – Diagnostic Trouble Code

Idle switch	P0510	Condition of idle switch is monitored.	Idle switch is not made "on" for at least once during 1 driving cycle		Engine speed	< 812rpm	Continuous	2 Driving cycles
Fuel injector	P0201	Surge voltage(Vinj) at injector drive is monitored.	Surge voltage, Vinj	< Vb + 2V Vb : Battery V	Engine speed	< 1000rpm	Continuous	2 Driving cycles
	P0202							
	P0203							
	P0204				TPS voltage	< 1.16V		
	P0205							
	P0206							
Air fuel ratio feedback (Bank 1)	P0134	O2 sensor staying time(TFB2) below or under the reference voltage to decide rich/lean is monitored.	Time, TFB2	> 15sec			15sec Continuous	2 Driving cycle
					Engine coolant	> 70?		
					Engine speed	1400~3000rpm		
					Load value	25% ~ 62%		
Air fuel ratio feedback (Bank 2)	P0154	O2 sensor staying time(TFB2) below or under the reference voltage to decide rich/lean is monitored.	Time, TFB2	> 15sec			15sec Continuous	2 Driving cycle
					Engine coolant	> 70?		
					Engine speed	1400~3000rpm		
					Load value	25% ~ 62%		
Power steering pressure switch	P1521	Signal of power steering pressure switch is monitored.	P/S pressure switch signal	on	Engine speed	> 2500rpm	Continuous	No MIL ON
					Load value	> 55%		
					Engine coolant	> 20?		
Manifold absolute pressure sensor	P0106	Output voltage(Vmap) is monitored.	Output voltage, Vmap	< 0.1V or > 4.6V	Engine coolant	> 45?	Continuous	2 Driving cycles
					Intake air temp.	> 5?		
					Load value	30% ~ 55%		
	P0108			> 4.2V	Load value	< 30%		
	P0107			< 1.8V	Load value	> 70%		
Knock sensor	P0325	Signal at current segment is compared to previous one.	Amount of change	< 0.06V	Time after start	> 2sec	Continuous	No MIL ON
					Engine speed	≥ 2500rpm		
					Load value	≥ 30%		

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Sigma(Σ) 3.5ℓ Eng. – Diagnostic Trouble Code

Thermostat	P0128	After given time (function or mass air flow, vehicle speed, engine speed) has elapsed, engine coolant temperature is monitored.	Engine coolant temperature after given time has elapsed.	< 77?	Engine coolant at start	5? ~ 60?	10~30min. depending on mass air flow, vehicle speed, engine speed	2 Driving cycles
					Intake air temp. decrease after start	< 5?		
					Engine coolant at start - intake air temp. at start	< 10?		
Battery backup line	P0560	VB backup voltage is monitored.	VB backup voltage	< 2V	Battery voltage	≥ 10V	Continuous	1 Driving cycle
					Duration	10sec		
Ignition coil	P0350	Current through ignition coil is monitored.	No current of 1 or 2 IG coil group at the 3 IG coil group	During 48 ignitions	Engine speed	< 4000rpm	Continuous	2 Driving cycle
Ignition failure sensor	P0320	Current through ignition coil is monitored.	No current at the 3 IG coil group	During 32 ignitions	Engine speed	< 4000rpm	Continuous	No MIL ON

Sirius2-Engine

Contents

- General Description
- Engine Feature
- Timing Belt
- Engine Tightening Torque
- ECM Overview
- ECM Input/Output

■ Sirius2 Engine

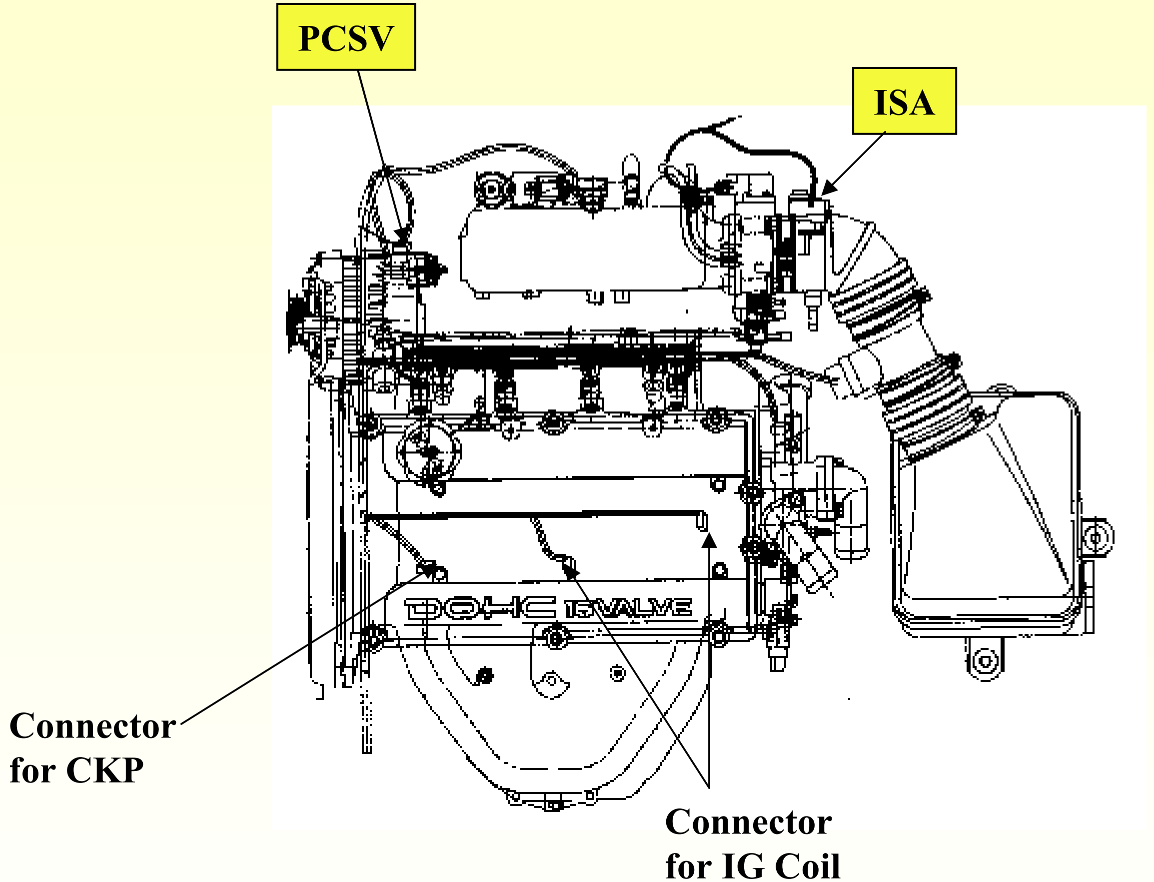
The Sirius2 engine is In-line 4 Cylinder DOHC engine adopted aluminium oil pan, inlet type cooling system, DLI type ignition coil integrated Power Transistor, and a ignition failure sensor added to detect ignition problems to increase serviceability.

Also, hall type CKP and CMP sensors are installed. This engine incorporates only one timing belt.

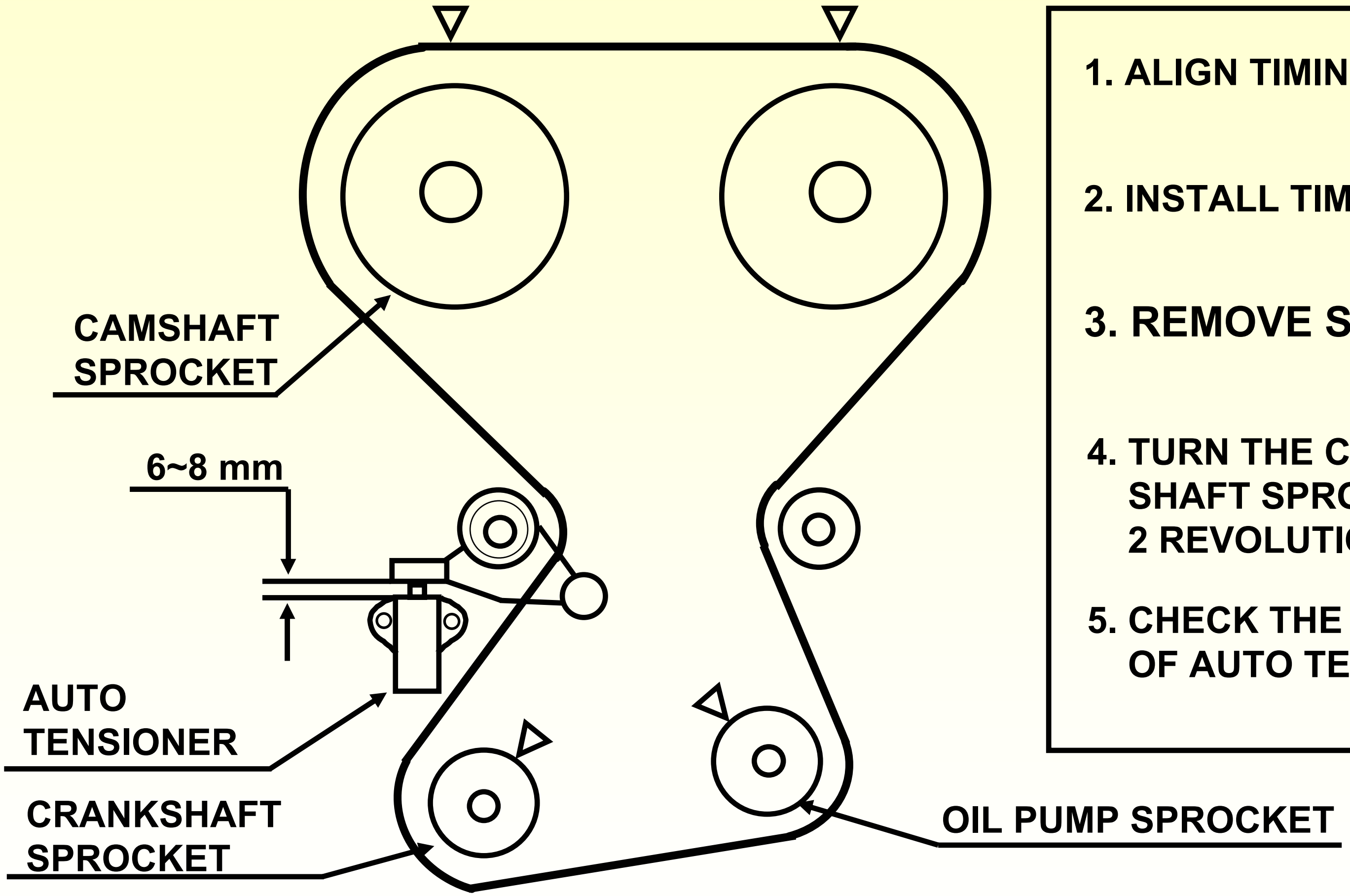
The Sirius2 engine is designed by Mitsubishi Motor company and manufactured by Hyundai Motor Company.

Item	Sirius Ⅱ 2.4 DOHC
Capacity(cc)	2351
Engine type	In line 4 cylinder MPI DOHC
Bore × Stroke	86.5 × 100
Compression ratio	10:01
Max. Power(PS/RPM)	140/5500
Max. Torque(Kgm/RPM)	20.2/3000
Ignition Timing	BTDC 5° ± 2°
Idle RPM	800± 50RPM
Valve Clearance	0(HLA)
Fuel Pressure(Kg/㎠)	3.06
Ignition Order	1→3→4→2

■ Top View


PCSV
ISA
DOHC 16VALVE
Connector for CKP
Connector for IG Coil

■ Timing Belt



1. ALIGN TIMING MARKS
2. INSTALL TIMING BELT
3. REMOVE SET'G PIN
4. TURN THE CRANK-SHAFT SPROCKET 2 REVOLUTION
5. CHECK THE CLEARANCE OF AUTO TENSIONER

■ Tightening Torque

CAMSHAFT BEARING CAP: 19~21Nm

CONNECTING ROD BEARING CAP BOLT: 18~22Nm + 90~94°

MAIN BEARING CAP BOLT: 25Nm + 90~94°

CYLINDER HEAD BOLT:

OVERHAUL WITHOUT REPLACE:

20N.m + 90~94°+ 90~94°

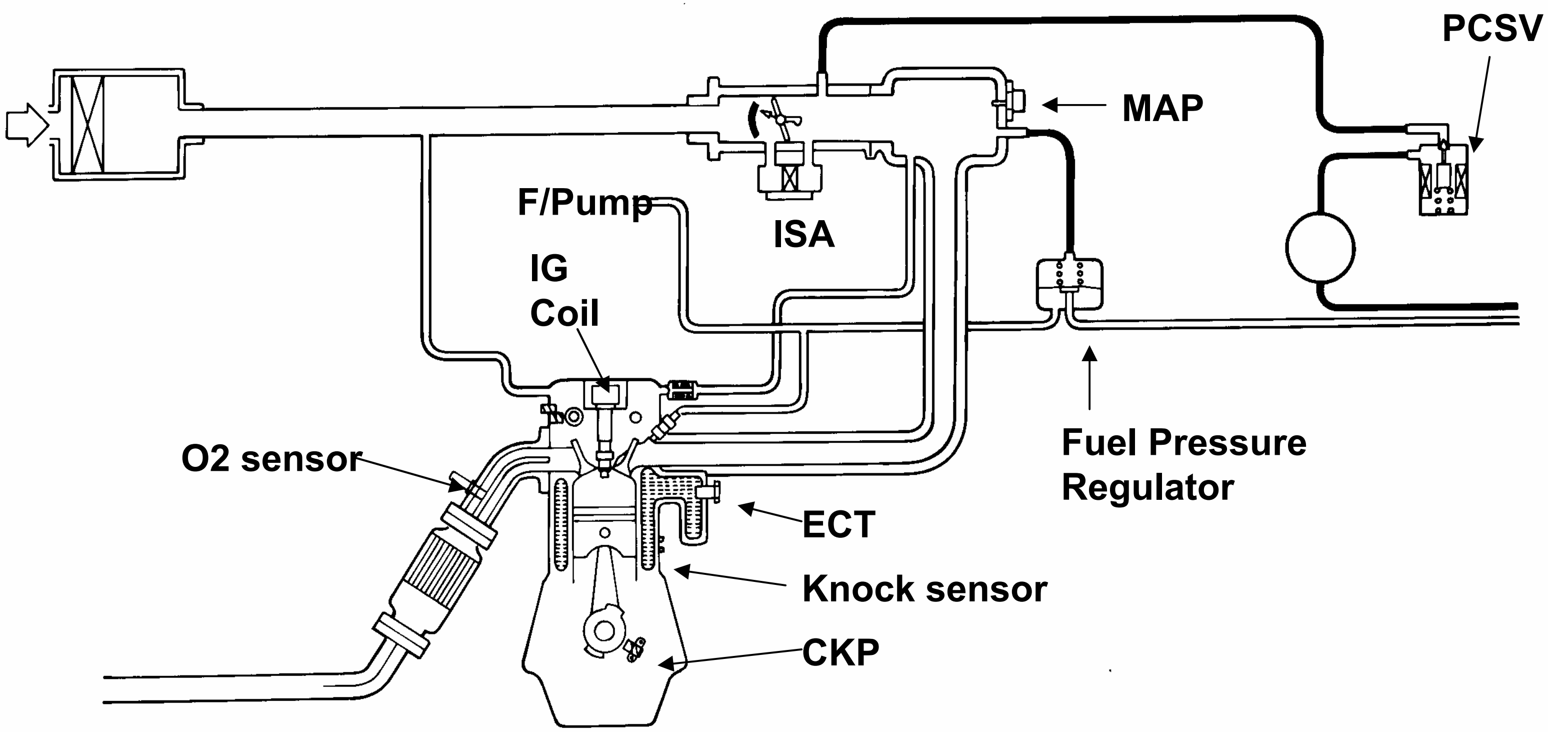
REPLACE GASKET:

80N.m, LOOSE, 20N.m + 90~94°+ 90~94°

REPLACE HEAD BOLT:

20N.m + 180~184°, LOOSE, 20N.m + 90~94°+ 90~94°

■ ECM Overview



Sirius Ⅱ 2.4ℓ Eng. – ECM Input/Output

■ ECM Input/Output