Course Guide

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.01

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

COURSE OVERVIEW

This course is designed to introduce technicians to the newly redesigned, 2004.5 Spectra. Key system and component operations of the Spectra will be covered, including new technology and features that have been added. Upon successful completion of this course, technicians will possess greater in-depth knowledge of key technical systems and components on the 2004.5 Spectra.

COURSE GOAL

After successfully completing this course, the Kia service technician will be able to identify 2004.5 Spectra systems and components, their operations, and how to use this information to successfully service customers' vehicles and repair their concerns the first time, every time.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidate, Senior level, and Senior level candidate service technicians.

ABOUT TRAINING MODULES

Today's complex automotive technology demands that you, the professional Kia service technician, stay up-to-date with the latest service information, special tools, and complex repair procedures. We have adopted a modular training delivery system that breaks down the critical information into logical groupings. First, you will be presented with system theory and operation, then you will be given a chance to practice what you have learned. Finally, we will test what you have learned through a Performance Assessment.

THEORY

A Theory Module explains the subject from basic to complex. This allows you to obtain a working knowledge of a component or system, which is a prerequisite for successful diagnosis and repair.

GUIDED PRACTICE

The Guided Practice Module affords you the opportunity to familiarize yourself with a component or system through hands-on experience. The guided practices are to be supervised and verified by the instructor. These exercises may include: service manuals (on KSIS or in print), accessing kdealer.net, lab, disassembly and reassembly, life vehicle activities, and much more.

PERFORMANCE ASSESSMENT

The Performance Assessment Module provides the opportunity for you to prove that you can perform the subject matter related tasks and procedures. Each technician must successfully complete this module, which is designed to test your cognitive (knowledge) and motor (hands-on) abilities. The module must be completed individually, not as a team.

GETTING THE MOST OUT OF THIS COURSE

These modules are designed to be part of a structured training plan consisting of lecture, interactive classroom discussion, and hands-on shop activities under the direction of a trained Kia instructor. After completing the course modules, your understanding of the material will be verified through the Performance Assessment Module. In the Performance Assessment module, you must pass a written and hands-on evaluation.

COURSE MATERIAL

This 2004.5 Spectra New Model course is comprised of the following modules:

Number	Module Title	Theory	Guided Practice	Performance Assessment	Job Aid
NMLD.01	Course Guide				
NMLD.02	Walkaround	X			
NMLD.03	Walkaround		X		
NMLD.04	Powertrain	X			
NMLD.05	Powertrain		X		
NMLD.06	Driveability	X			
NMLD.07	Driveability		X		
NMLD.08	Brakes	X			
NMLD.09	Brakes		X		
NMLD.10	Heating Ventilation & Air Conditioning	X			
NMLD.11	Heating Ventilation & Air Conditioning		X		
NMLD.12	Supplemental Restraint System	X			
NMLD.13	Supplemental Restraint System		X		
NMLD.14	Body Electrical	X			
NMLD.15	Body Electrical		X		
NMLD.16	Performance Assessment			X	
	Engine Compartment Fuse and Relay				X
	Passenger Compartment Fuse & Relay				X
	Valve Clearance Inspection				X
	Valve Shim Replacement				X

TIME MANAGEMENT

The course and its materials are here for you to learn. Use them and your time in a way that will benefit you when you return to your dealership.

TAKE NOTES

Make drawings, jot down notes, and highlight these materials to help you remember important details. Each module is designed with ample margins for your important notes.

ASK QUESTIONS

If you have a question, **ask the instructor for clarification.** Asking questions is strongly encouraged to help you get the most out of this course.

TEAMWORK

During the hands on activities, you may be working with other Kia technicians. By actively engaging in each activity, you will maximize your learning experience. While in the lab, feel free to ask the instructor questions at any time.

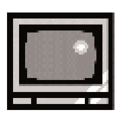
LEARN AT EVERY OPPORTUNITY

Learning in the controlled environment of an authorized Kia Training Center/Facility with the guidance of a trained Kia instructor will maximize your course experience. If you make a mistake, turn it into a learning experience as it will strengthen your ability when you are back at your dealership.

ICONS

Throughout this course, you will come across several icons designed to keep you on track.

The Reference Icons indicates you must refer to additional resources to complete the questions or activities.



The Video Icon indicates there is a media segment corresponding to the module information.

The Activities Icon indicates an activity that supports a critical learning objective. These activities are offered to help you master the material.

The Feedback Icon indicates a progress check meant to provide you with feedback on your understanding of the course material. Based on this information, we recommend you review any areas in which you have not mastered the material.

PERFORMANCE SCORECARD

The scorecard is used to record the scores from Class Participation, Guided Practice Modules, and the final Performance Assessment. The result will be scored as either a Complete or Incomplete.

COURSE ACHIEVEMENT

Guided Practice Coursework

Module 3 - Walkaround	10 points
Module 5 - Powertrain	15 points
Module 7 - Driveability	15 points
Module 9 - Brakes & Antilock Brake System	5 points
Module 11 - Heating, Ventilation & A.C.	5 points
Module 13 - Supplemental Restraint System	5 points
Module 15 - Body Electrical	15 points
Total Possible	70 points

Performance Assessment Module

Written Assessment	10 points
Practical Assessment	20 points
Total Possible	30 points

SCORECARD ROUTING

One copy of the scorecard is yours and one copy is used to update your Kia technical training records. Should you not complete the course, the third copy is forwarded to your Kia District Parts and Service Manager (DPSM).

TIMELINE All times are approximate.

8:00-8:15	Introduction & Course Outline
8:15-8:35	Walkaround Theory
8:35-9:05	Walkaround Tasks
9:05-9:25	Powertrain Theory
9:25-9:55	Powertrain Tasks
9:55-10:10	Morning Break (15 minutes)
10:10-10:30	Driveability Theory
10:30-11:00	Driveability Task
11:00-11:15	Brakes Theory
11:15-11:45	Brakes Tasks
11:45-12:45	Lunch
12:45-1:00	Heating Ventilation & Air Condition Theory
1:00-1:30	Heating Ventilation & Air Condition Tasks
1:30-1:45	Supplemental Restraint System Theory
1:45-2:15	Supplemental Restraint System Tasks
2:15-2:30	Body Electrical Theory
2:30-3:15	Body Electrical Tasks
3:15-3:30	Afternoon Break (15 minutes)
3:30-4:30	Performance Assessment
4:30-5:00	Conclusion

NOTES

NOTES

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WE SUPPORT
VOLUNTARY TECHNICIAN
CERTIFICATION THROUGH

National Institute for
**AUTOMOTIVE
SERVICE
EXCELLENCE**

Kia Motors America, Inc. TT-NMLD204-IL-CG01

Walkaround

2004.5 Spectra Technology

Service Technical Training

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NMLD.02

Theory

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TARGET AUDIENCE

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MODULE GOAL

The goal of this module is to help you become familiar with key features, attributes, and functions on the 2004.5 Spectra that you can apply to Fix It Right First Time (FIRFT).

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify the following with 80% or greater accuracy:

- 2004.5 Spectra key product and technical features and attributes
- Key systems and components that will be covered in theory modules and guided practices for the remainder of this instructor-led course
- Key systems and components, including those requiring consumer interactions for service and repairs

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. At the end of this module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Tools: Hi-Scan Pro

Resources: KSIS

Vehicle: 2004.5 Spectra (LD)

Other: Preferred writing instrument

TIME TO COMPLETE

This module will take approximately 20 minutes.

ACRONYMS

CVVT: Continuously Variable Valve Timing

DAB: Driver Airbag

FIS: Front Impact Sensor

PAB: Passenger Airbag

SIS: Side Impact Sensor

SULEV: Super Ultra-Low-Emission-Vehicles

ULEV: Ultra-Low-Emission-Vehicles

INTRODUCTION

The Spectra is one of Kia's most popular models. The vehicle's extensive features and competitive price only serve to enhance its popularity. The 2005 Spectra has been redesigned and engineered to provide even greater value.

While the new Spectra has retained many of its popular features, important changes made to this new model, as standard equipment or options, include:

- 2.0 liter, Continuously Variable Valve Timing (CVVT) DOHC 16-valve four-cylinder engine
- Tier 2 Bin 4 vehicle, Ultra-Low-Emission Vehicle (ULEV), and Super-Ultra-Low-Emission Vehicle (SULEV) standards
- New optional HVAC air filter for interior air quality
- SRS safety with the addition of occupant present detection system, DAB and PAB dual squibs, FIS and 4 SIS, and front seat location sensor.
- Dash fuse box incorporating the ETACS

PURPOSE

The Spectra is available as a four-door sedan and five-door hatchback. The Spectra sedan comes in two trim levels (LX and EX) and the 5-door is only offered in the SX trim level.

The Spectra continues to be an important vehicle in the Kia line-up. It is positioned above the entry-level Rio to offer customers a vehicle to move up.

APPLICATION

Vehicle	Years
Sephia	1994 - 2000
Spectra (SD)	2000 - 2004
Spectra (LD)	2004.5 - 2005

The 2004 Spectra has been carried over from the 2003 model year. The 2004.5 Spectra LD 4- door will be introduced as mid-year model change. The Spectra 5-door is scheduled to be released in May.

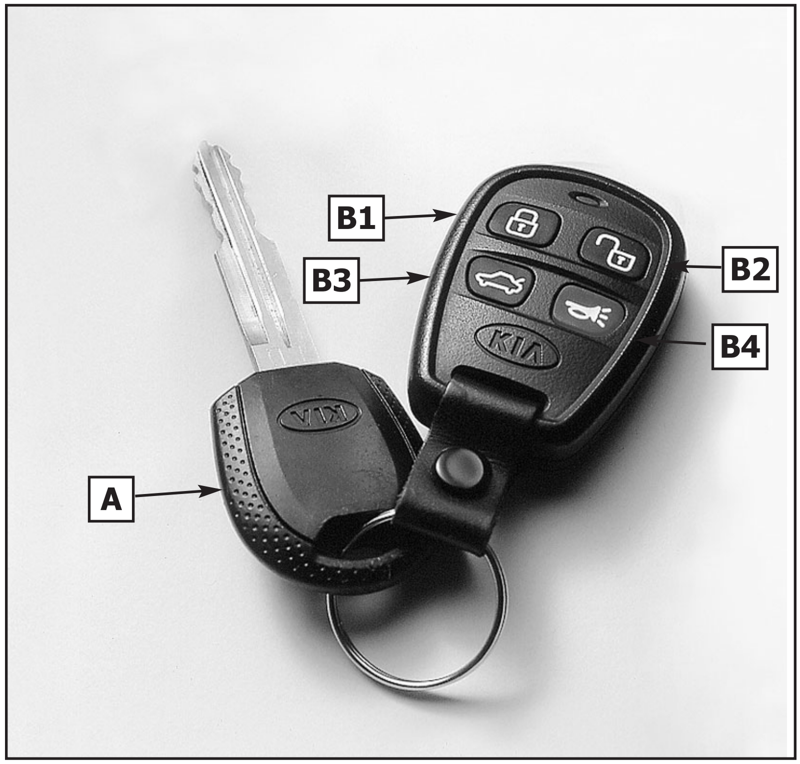
SYSTEMS & COMPONENTS

<table>
<tr><th>Trim Level</th><th>Transmission</th><th>Emissions</th><th>Engine</th><th>VIN</th></tr>
<tr><td rowspan="4">4-door</td><td rowspan="2">M/T</td><td>Tier 2 - Federal</td><td rowspan="6">2.0 Liter
CVVT
DOHC</td><td rowspan="4">KNAFE121-45000001</td></tr>
<tr><td>ULEV - CA</td></tr>
<tr><td rowspan="2">A/T</td><td>Tier 2 - Federal</td></tr>
<tr><td>SULEV - CA</td></tr>
<tr><td rowspan="2">5-door</td><td>M/T</td><td rowspan="2">TBA</td><td rowspan="2">KNAFE161-45000001</td></tr>
<tr><td>A/T</td></tr>
</table>

CA States include: CA, MA, ME, NY, and VT.
Federal States include: All states except CA States.
TBA = To Be Announced

From this point forward, your instructor will walk you around the 2004.5 Spectra and point out different systems, components, and features found in the vehicle. During this time, fill in the boxes that correspond to different items that your instructor is pointing out and take notes to help you become more familiar with the vehicle. After the Walkaround, the guided practice will give you an opportunity to inspect and discover the new Spectra.

ENTRY AT DRIVER DOOR



A. Key operation

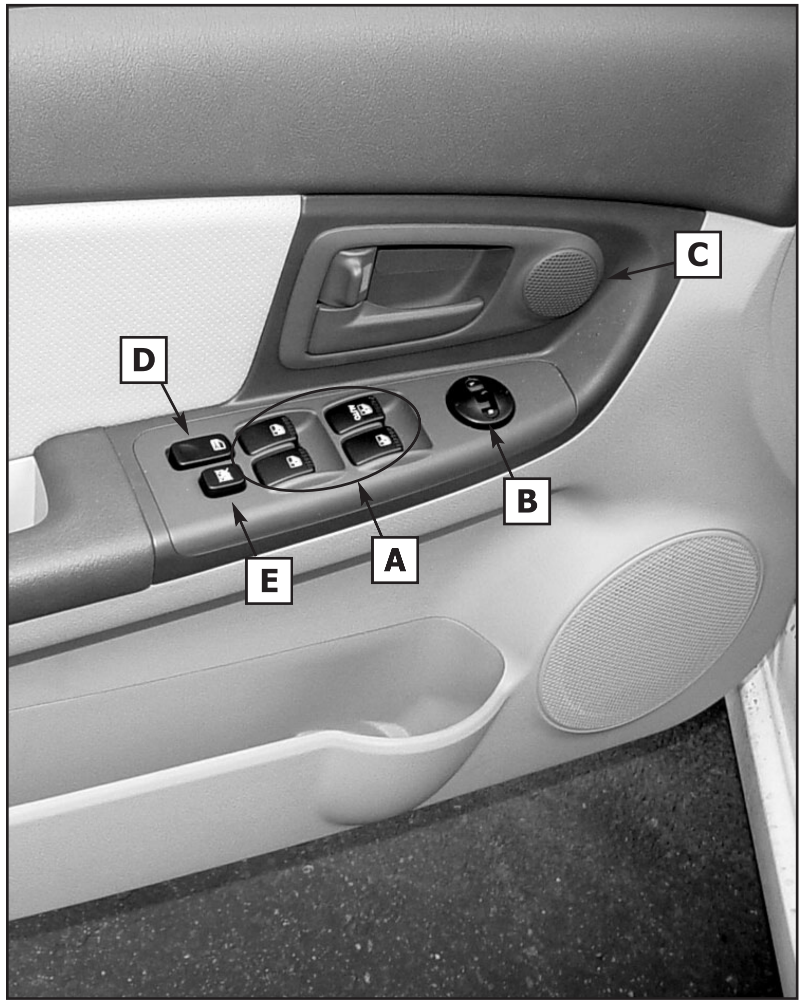
Turn 1x: unlock driver door/lock all doors

Turn 2x: global unlock and lock

B. RKE operation for 4-door Spectra

1. Lock button: press 1x
2. Unlock button: press 1x for driver door and 2x for all doors
3. Trunk lid open button
4. Panic button

DRIVER DOOR PANEL SWITCHES



A. Power windows switches (auto down only for driver power window)

B. Outside mirror remote control for:

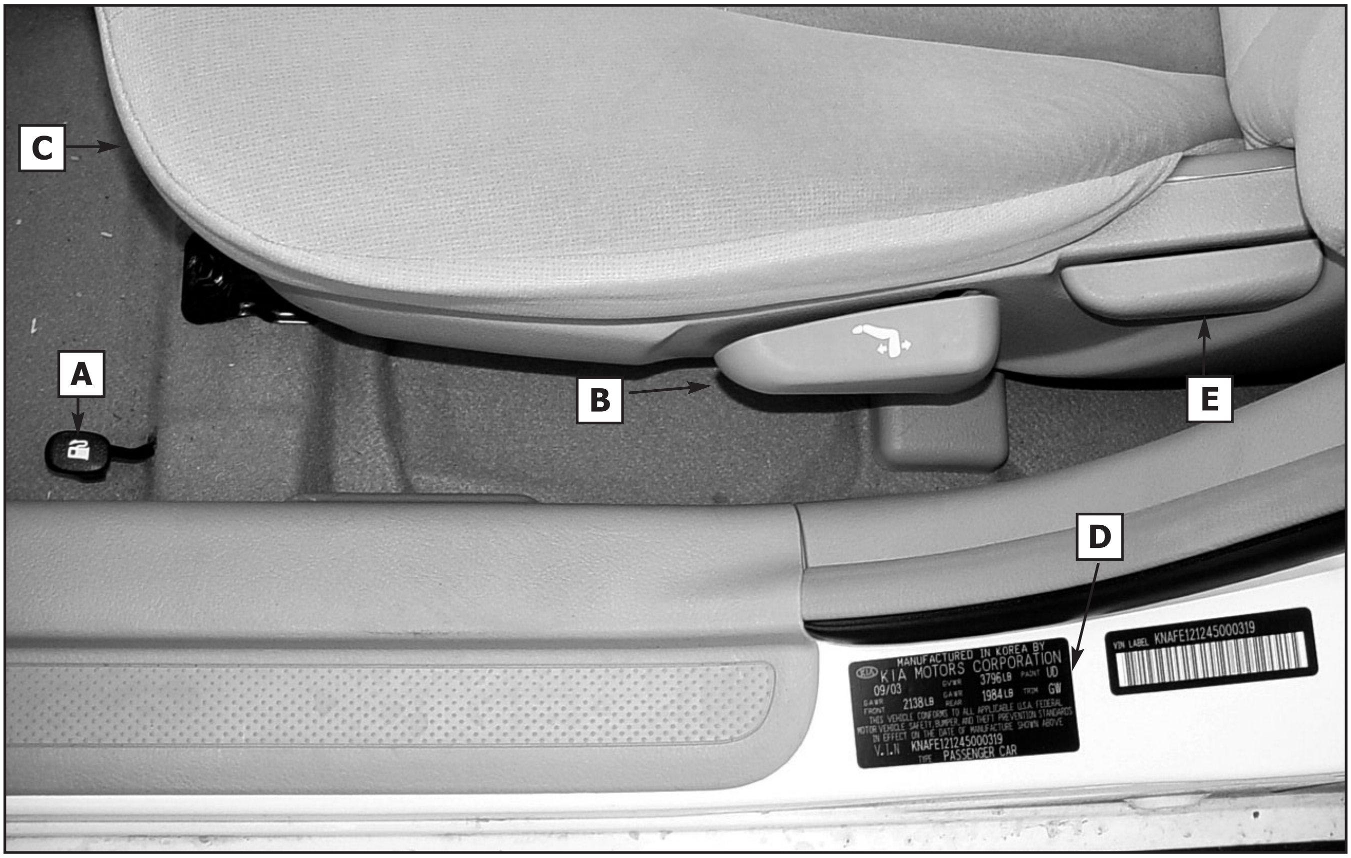
- Right mirror
- Left mirror

C. Speakers with door-mounted tweeter

D. Door open/lock

E. Window lock button

DRIVER SIDE SEAT



A. Fuel filler lid release

B. Driver adjustable seat

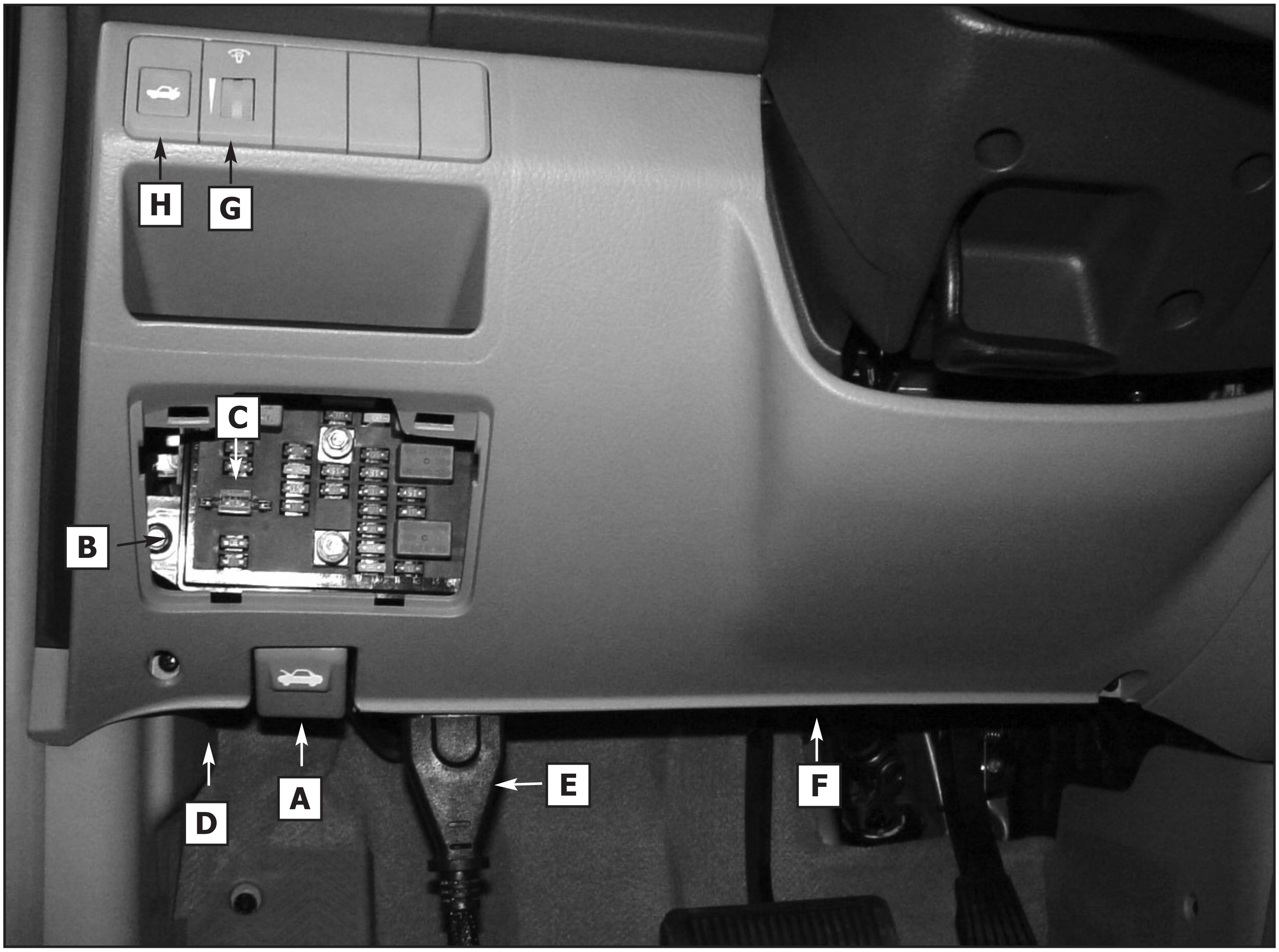
C. Seat track position sensor (under driver seat)

D. Vehicle ID plate

- Date manufactured
- Trim code

E. Driver Seat Back Adjustment

DRIVER SIDE DASH



A. Hood release

B. Dash fuse/relay box & ETACS

C. Power Saver Bar

D. PCM (Siemens) or ECM for M/T (under dash)

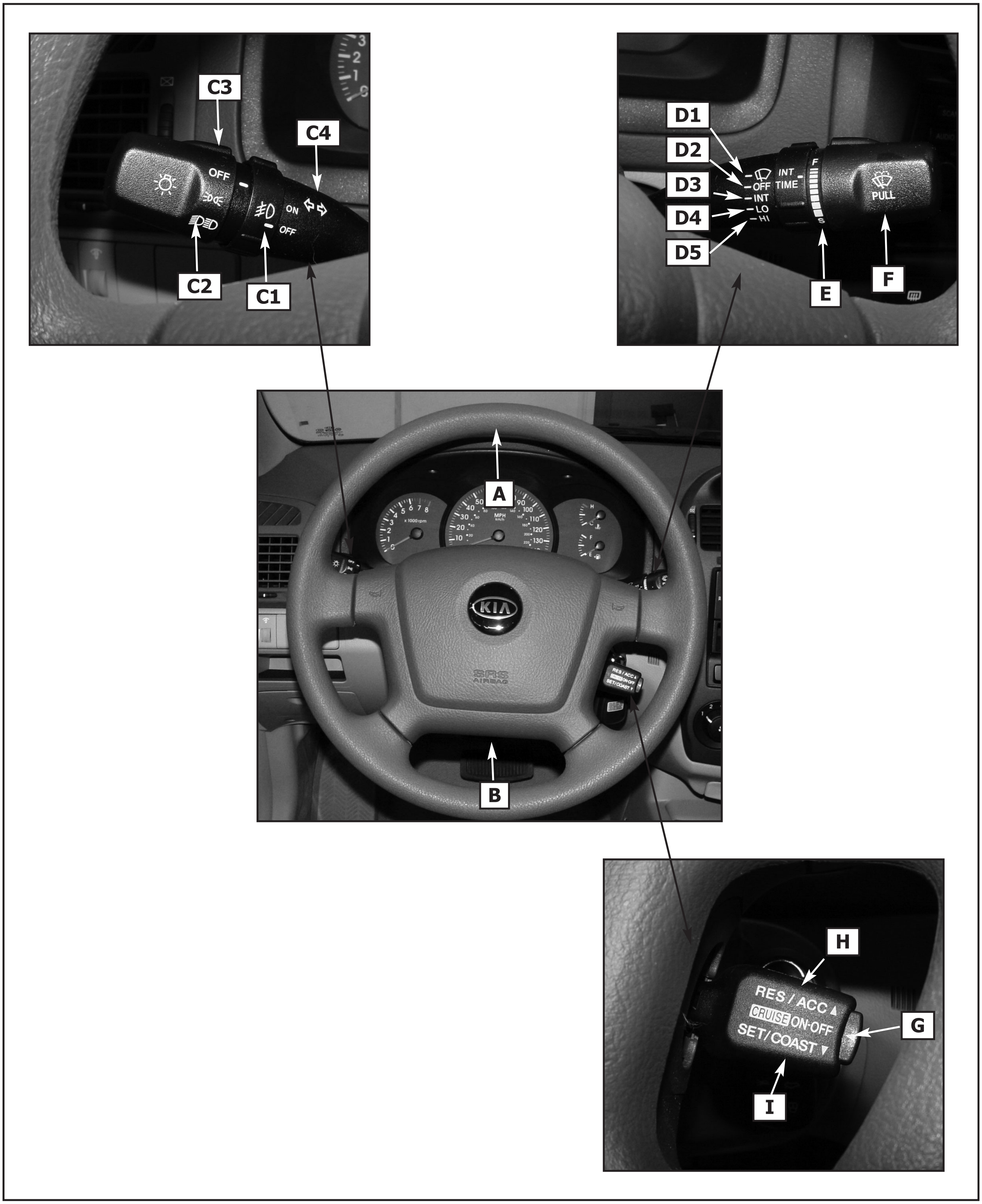
E. 16-pin DLC connector

F. Mechanical shift interlock with cable (brake pedal)

G. Instrument panel lamp dimmer control

H. Electric trunk release

STEERING & HEADLAMP SWITCH



A. Steering wheel

B. Tilt steering column

C. Combination switch
   1. Fog light ON/OFF switch
   2. Headlight ON/OFF switch
   3. Park light ON/OFF switch
   4. High Beams

D. Front Windshield Wipers controls
   1. Mist, hold up until wipers move
   2. OFF
   3. Intermediate
   4. Low speed
   5. High speed

E. Intermediate speed adjustment

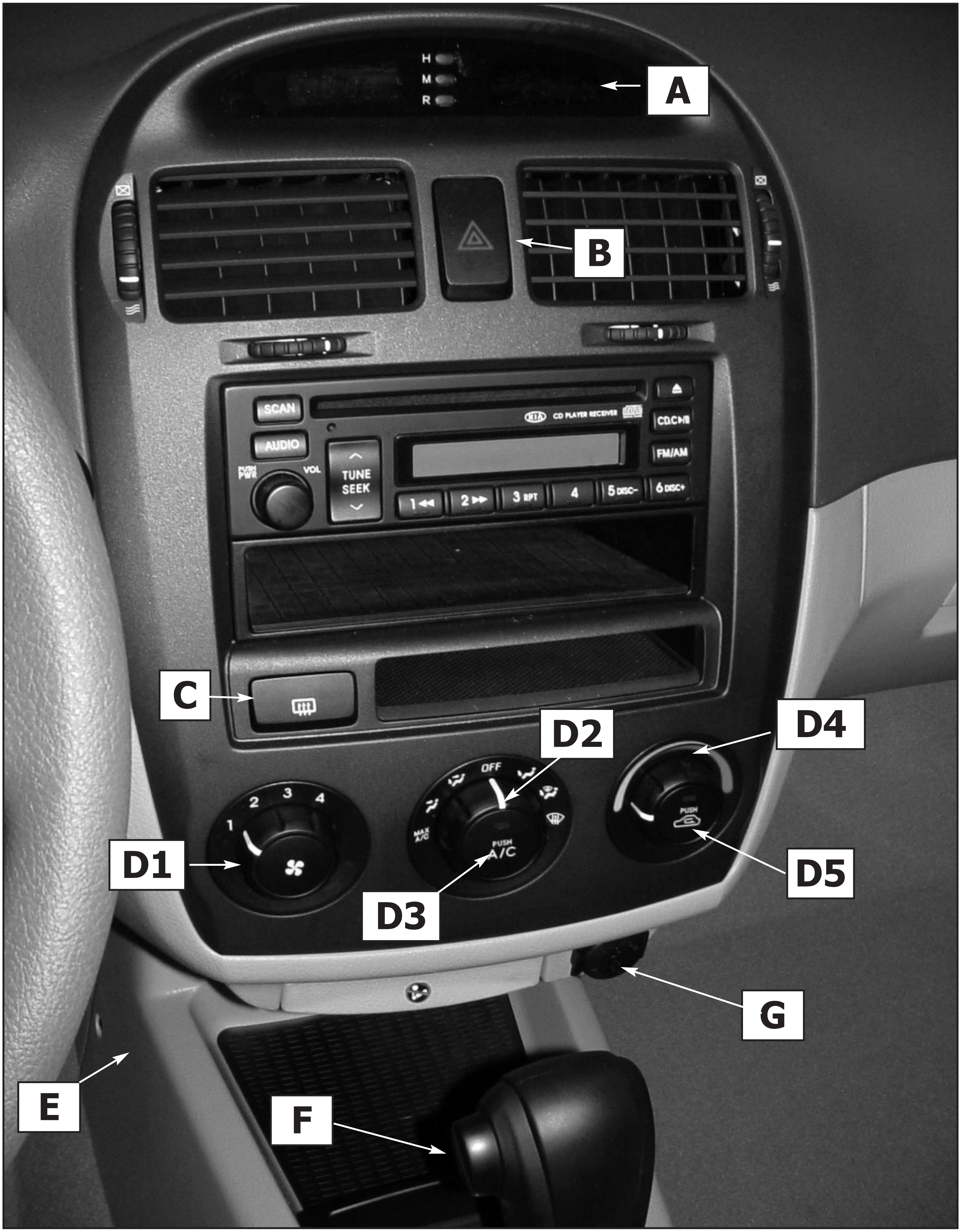
F. Pull lever to wash and auto sweep

G. Cruise Control ON/OFF, push button in middle

H. Resume or Accelerate, move up

I. Set Cruise or Coast down 1mph, move down

CENTER CONSOLE, SHIFTER & A/C SYSTEM



A. SRS Occupant Classification System (OCS) Tell Tale Lamp

B. Hazard Warning Flasher

C. Rear Window DEF and Side Mirror DEF

D. Manual Climate Control System (Actuators are electronic - no cables)

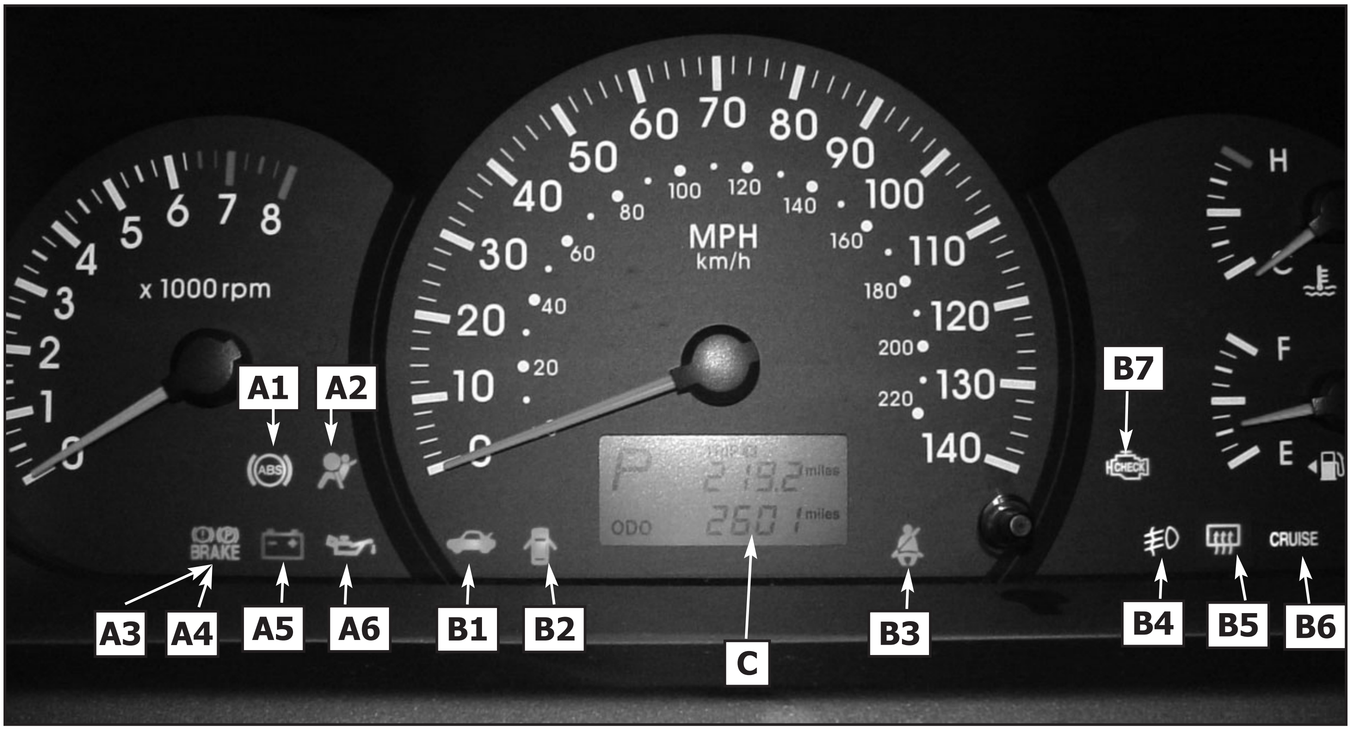
   1. Fan Speed Control Knob
   2. Mode Selection
   3. Air Conditioning button (if equipped)
   4. Temperature control selection
   5. Air Intake Control button

E. DEF or DEF-Floor Mix

F. Automatic Transaxle Shifter
Selector: P / R / N / D=OD on / 3 / 2 / 1

G. Accessory Plug 120 watts

INSTRUMENT PANEL

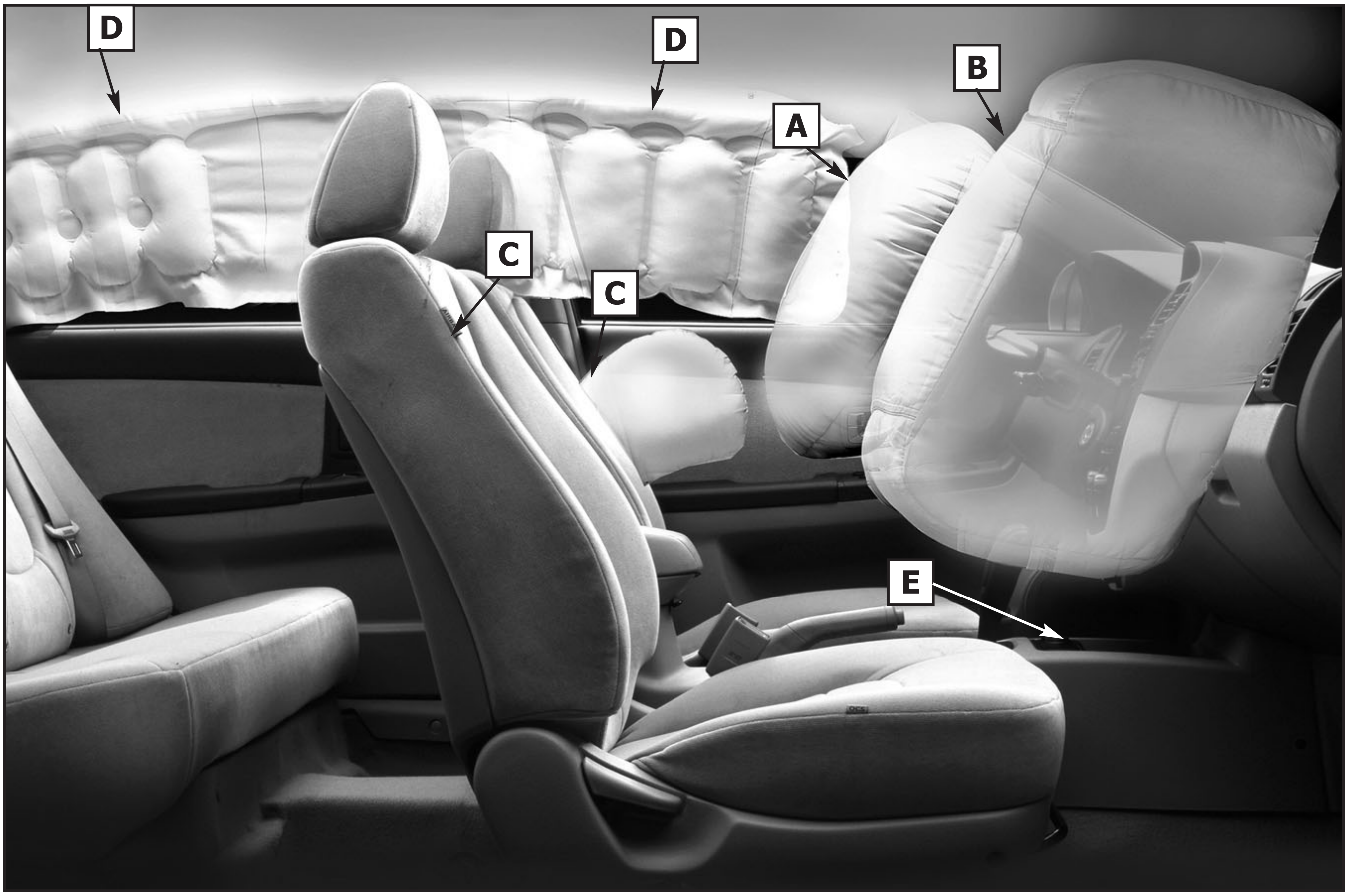


A. Warning lamps
   1. ABS/EBD lamp (if equipped)
   2. SRS lamp
   3. Brake warning lamp
   4. Parking brake and brake fluid warning lamp
   5. Battery lamp
   6. Engine oil pressure warning lamp

B. Indicators
   1. Trunk open
   2. Door open
   3. Seat Belt unbuckled
   4. Front fog lamp ON
   5. R-DEF ON
   6. Cruise ON (if equipped)
   7. Check Engine Light

C. Quartz Crystal Display: Gear selection, Trip, and Odometer

AIRBAGS



A. Driver - dual squib airbag

B. Passenger - dual squib airbag

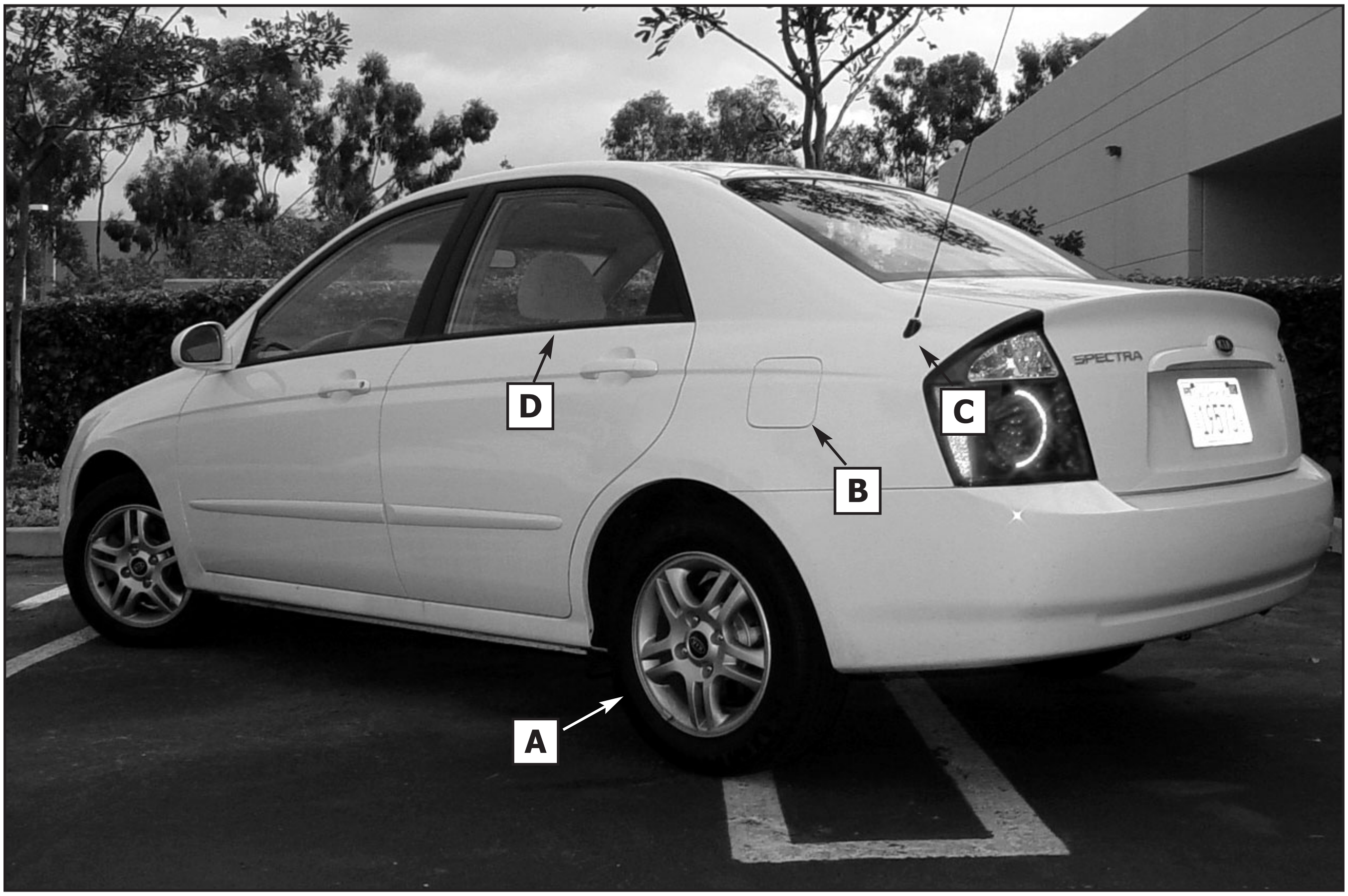
C. Driver and front passenger seats side airbags

D. Curtain airbags on each side

E. Airbag system computer (SRSCM) located in center console with:

- One (1) forward sensor
- Two (2) side sensors on each side (4 total)

VEHICLE EXTERIOR



A. Tires

4-door: LS P195/60-R15

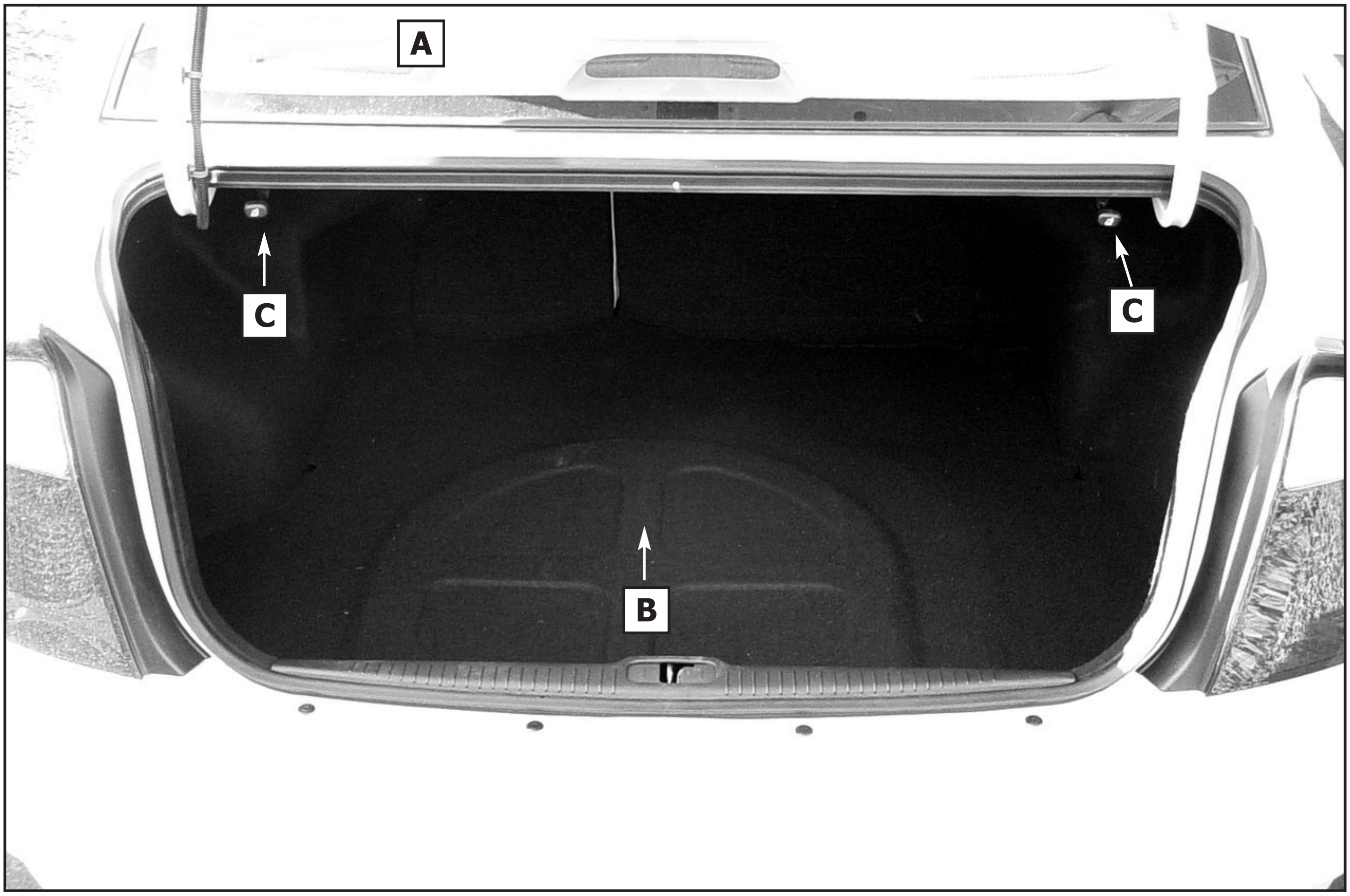
5-door: RS-A P205/50-R16

B. Cable operated Fuel Filler Lid, no trunk release

C. Rod radio antenna

D. Rear windows (opens half way)

TRUNK

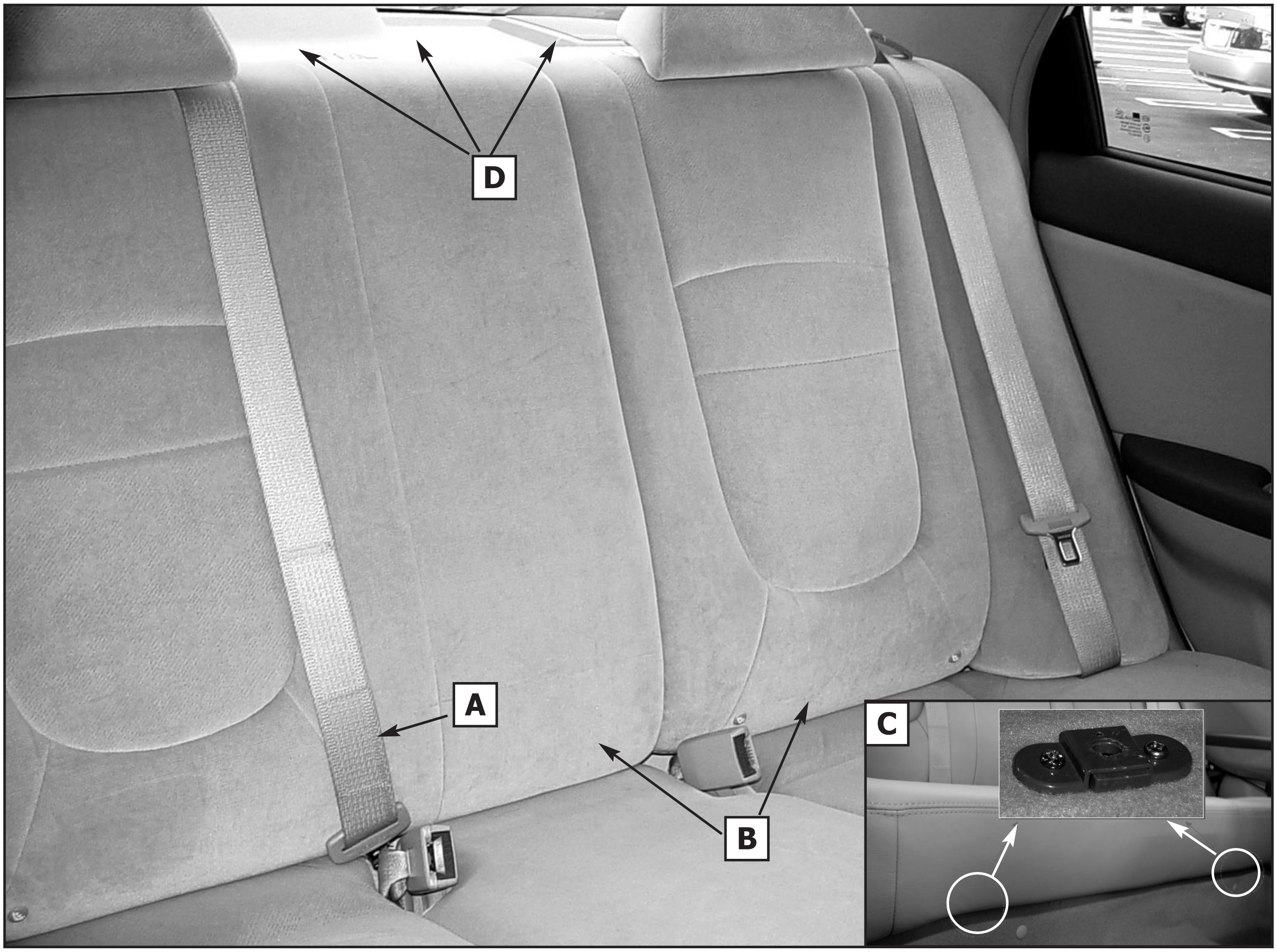


A. Interior trunk release (on interior of trunk lid)

B. Spare tire is temporary use tire

C. Seat back release pull cable releases right and left rear seat to fold down flat into passenger compartment

BACK SEAT



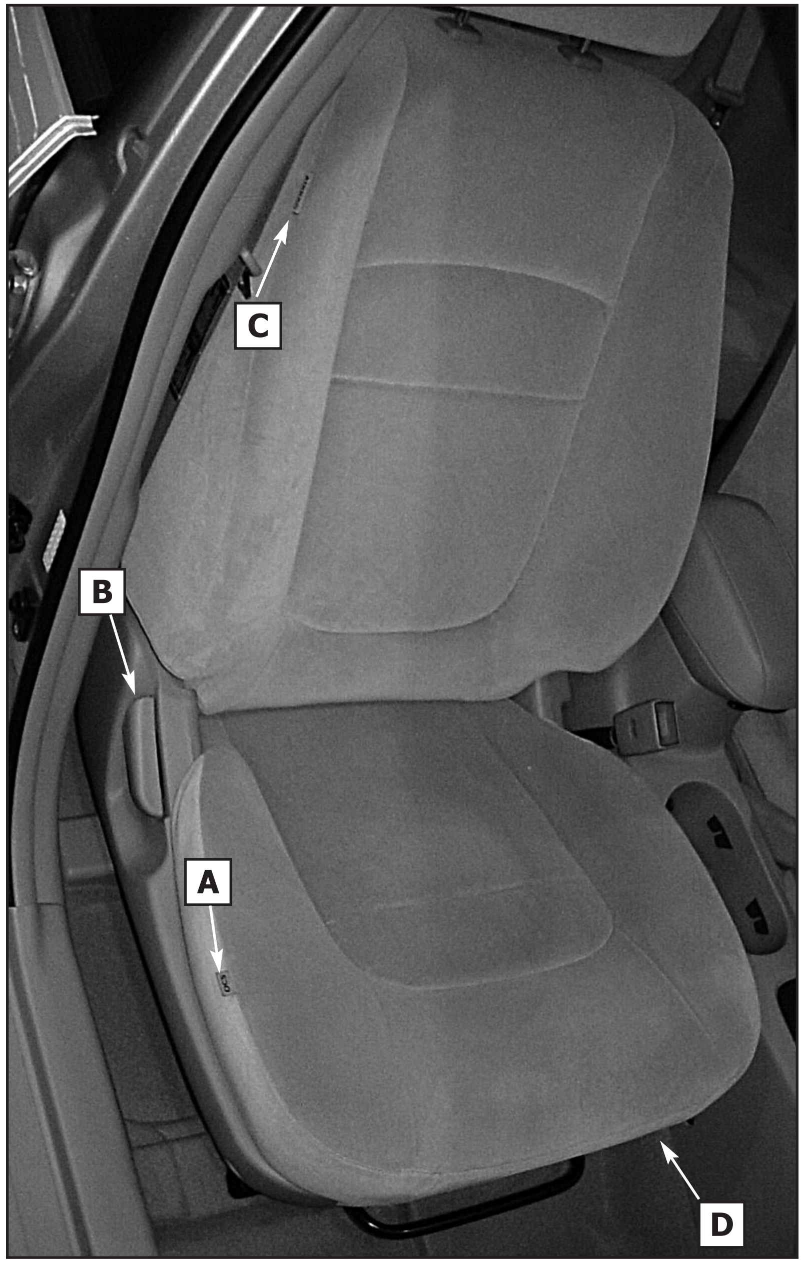
A. Center seat belt is 3-point shoulder and lap belt

B. 60/40 fold down seat

C. Fuel tank access (under seat)

D. Child Car Seat Anchor Points
(arrows point to them but not shown)

FRONT PASSENGER SEAT



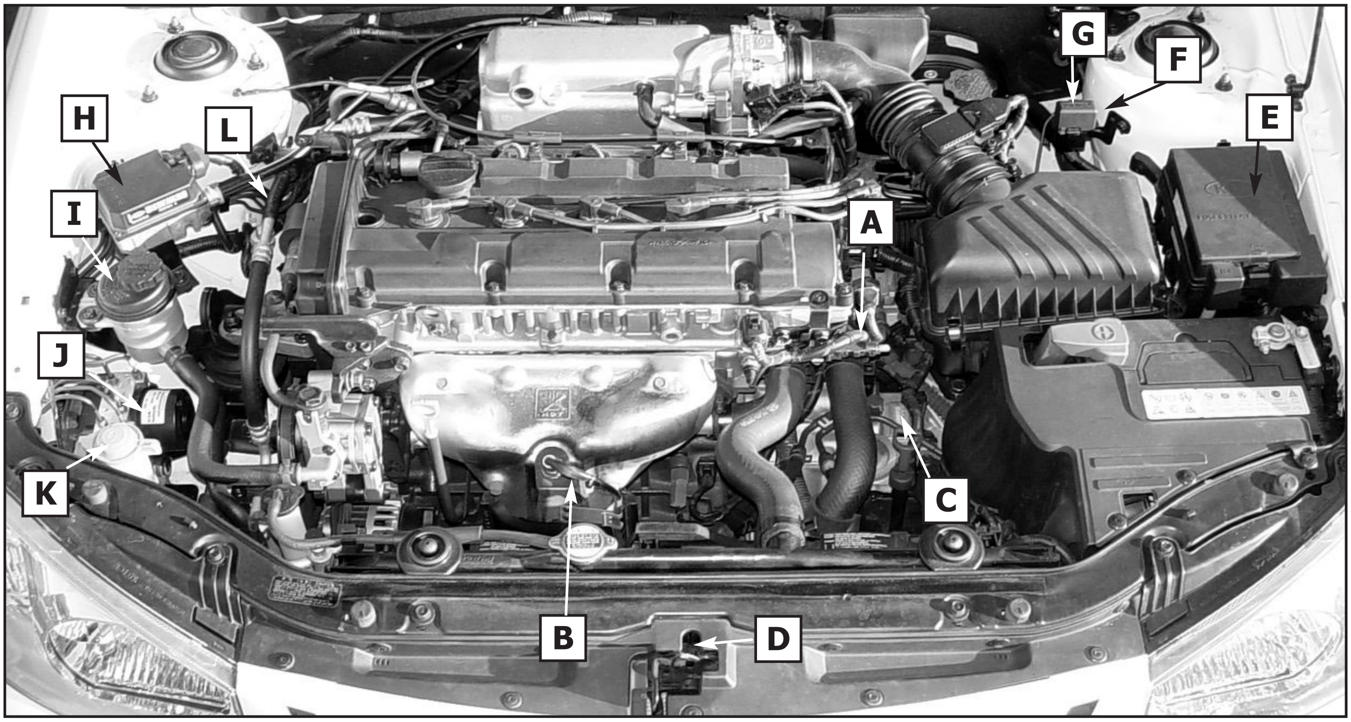
A. Occupant Classification System (OCS) Label

B. Passenger seat adjustments (has only back tilt)

C. Side air bag

D. Seat position sensor (under seat)

UNDER HOOD COMPONENTS



A. Oil pressure valve and oil temperature sensor

B. Front O2 sensor is 5-wire (new for Kia)

C. A/T similar to Optima or M/T new to Kia line-up

D. Location of front impact sensor on SRS

E. Fuse relay box

F. 20-pin connector

G. Fuel shut off switch

H. Cruise control

I. Power steering fluid, full level

J. ABS module is 4-channel system

K. Coolant reservoir

L. 3 drive belts

- A/C
- Power steering and compressor
- Alternator

UNDER HOOD GROUNDS

A. Engine ground

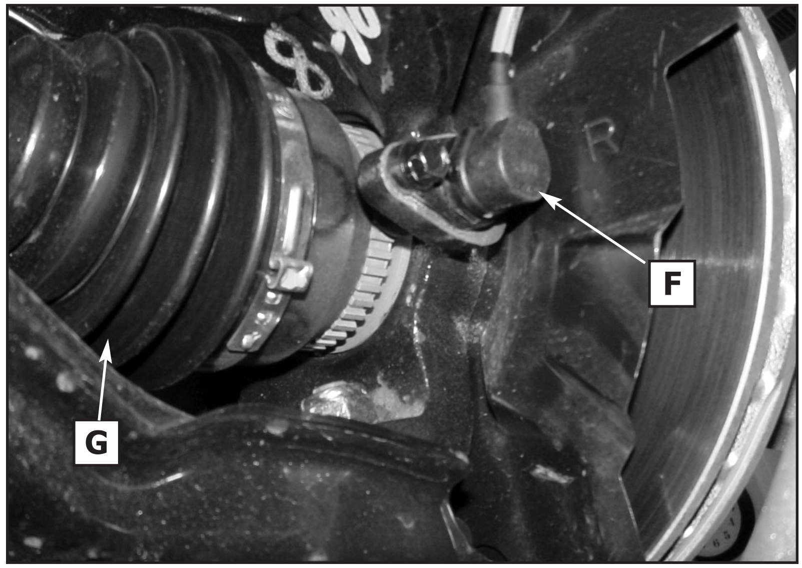
B. Harness-Chassis ground

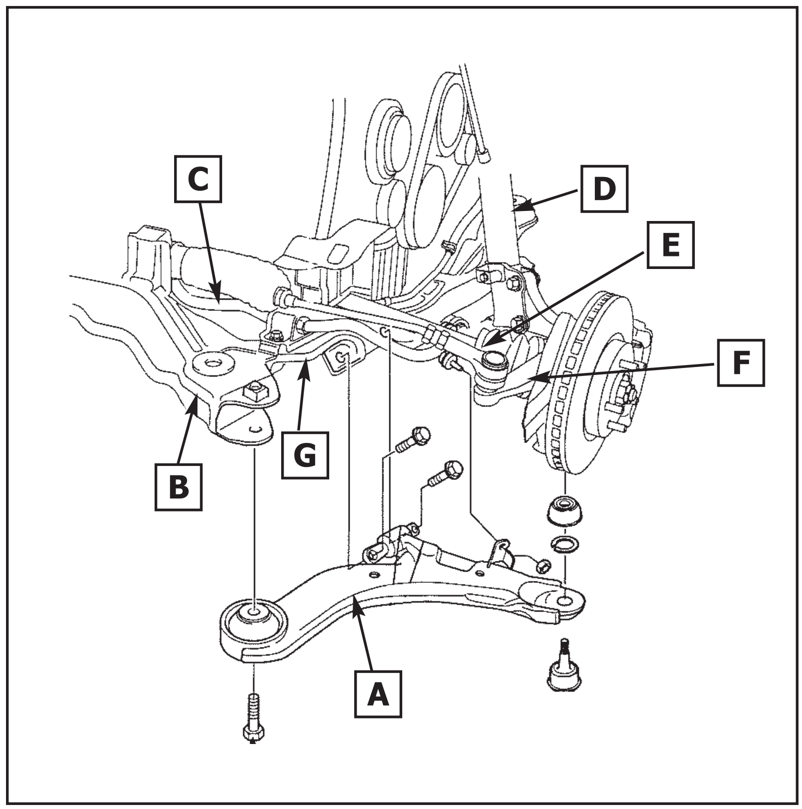
C. Harness-Chassis ground

D. Harness-Chassis ground

E. Battery ground

UNDER VEHICLE - FRONT





A. Lower arm assembly

B. Sub-frame

C. Stabilizer bar

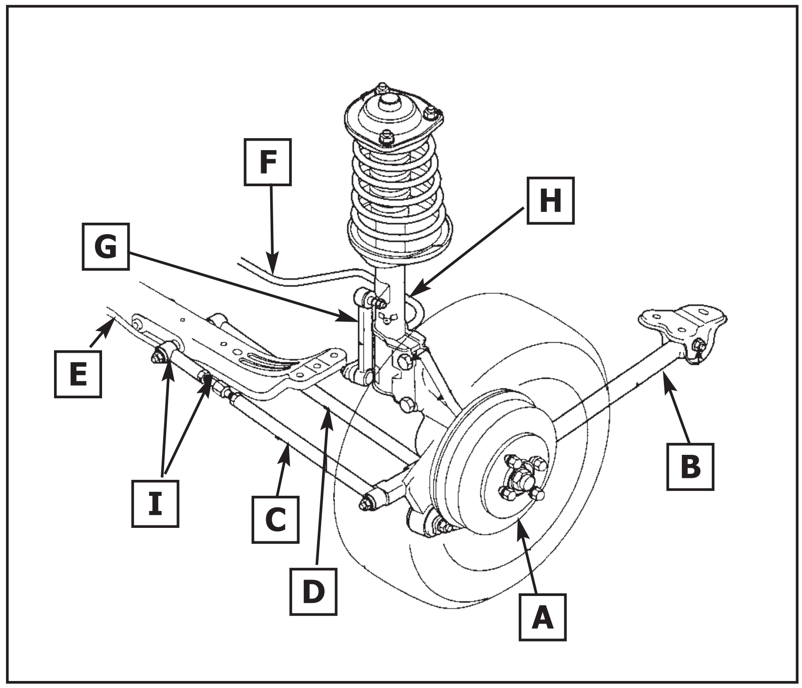
D. Front strut

E. Drive shaft

F. ABS sensor, if equipped

G. Toe adjustment, tie rods

UNDER VEHICLE - REAR SUSPENSION



A. Rear disc brakes (standard on all vehicles)

B. Trailing arm

C. Rear suspension rear arm

D. Rear suspension front arm

E. Rear cross member

F. Rear stabilizer bar

G. Rear stabilizer link

H. Rear Strut assembly

I. Rear Toe Adjustment, tie rod

SUMMARY

Now, you have been thoroughly introduced to the 2004.5 Spectra and its technical systems and components. Additionally, you have learned about features and attributes of the new Spectra.

This will prepare you for the remainder of this course as we look into these systems and components in depth. Remember, the better you understand these systems and components, the more capable you will be in servicing and repairing your customer's Kia vehicles right the first time.

PROGRESS CHECK

1. What features are new on the 2004.5 MY Spectra 4-door?
   A. 2.0 liter CVVT DOHC engine
   B. HVAC optional air filter
   C. Electronic Time Alarm Control System
   D. All of the above

2. Which of the following are key systems to be discussed later?
   A. Full automatic air
   B. CVVT engine
   C. Rear drum brake system
   D. A/T Sportmatic shift

3. What are key systems requiring consumer interactions for service and repair?
   A. CVVT engine
   B. Instrumental panel warning lamps
   C. Both A and B
   D. Neither A or B

4. The following is located inside the trunk.
   A. Seatback release
   B. Fuel tank access door
   C. Fuel filler lid release
   D. All of the above

NOTES:

ANSWER KEY:
1. D 2. B 3. C 4. A

ASE CERTIFIED

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Walkaround

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NMLD.03

Guided Practice

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NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

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When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, the target audience will be given the opportunity to inspect and discover the new Spectra so that you will become more familiar with key features, attributes, and functions on the 2004.5 Spectra.

MODULE OBJECTIVES

The objectives of this guided practice is to apply what you have learned from the Walkaround theory module by:

- Conducting your own walkaround to discover the new Kia Spectra
- Locating and inspecting specific items on the vehicle's
  - Interior
  - Exterior
  - Under Hood
  - Under Vehicle

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- 2004.5 Spectra (LD)
- #2 pencil or preferred writing instrument
- Hi-Scan Pro
- KSIS

TIME TO COMPLETE

This module will take approximately 30 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the specific information you have learned in the Walkaround theory module. Under the supervision of a trained Kia service-training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

TABLE OF CONTENTS

Total Possible Points: 10

EXTERIOR

Total Possible Points: 2

Log on to KSIS and look up the following:

Wheel nuts

- Tightening torque (KSIS): _________ lb ft

Wheel run out spec (KSIS)

- Steel Wheel
  - Radial: ____________
  - Axial: _____________
- Aluminum Wheel
  - Redial: ____________
  - Axial: _____________

On a Spectra, perform the following:

Tire pressure

- Tire pressure specification: _____ PSI Cold
- Temporary tire pressure specification: _____ PSI
- Where did you find tire pressure specifications: ________________________

Remote Keyless Entry (RKE)

What happens when you press the:

- Lock button? _______________
- Unlock button 1X? _______________
- Unlock button 2X? _______________

INTERIOR

Total Possible Points: 3

Inspect and provide answers for the following on the 2004.5 Spectra.

Connect the Hi-Scan Pro, turn on the tool, select LD and select to reprogram an RKE. Write down Hi-Scan Pro menu screens that follow and explain the process.

____

____

____

____

____

What happens to the middle seat belt when you fold down the rear seat?

____

____

____

____

Describe steps taken to access and install an air ventilation filter.

____

____

____

____

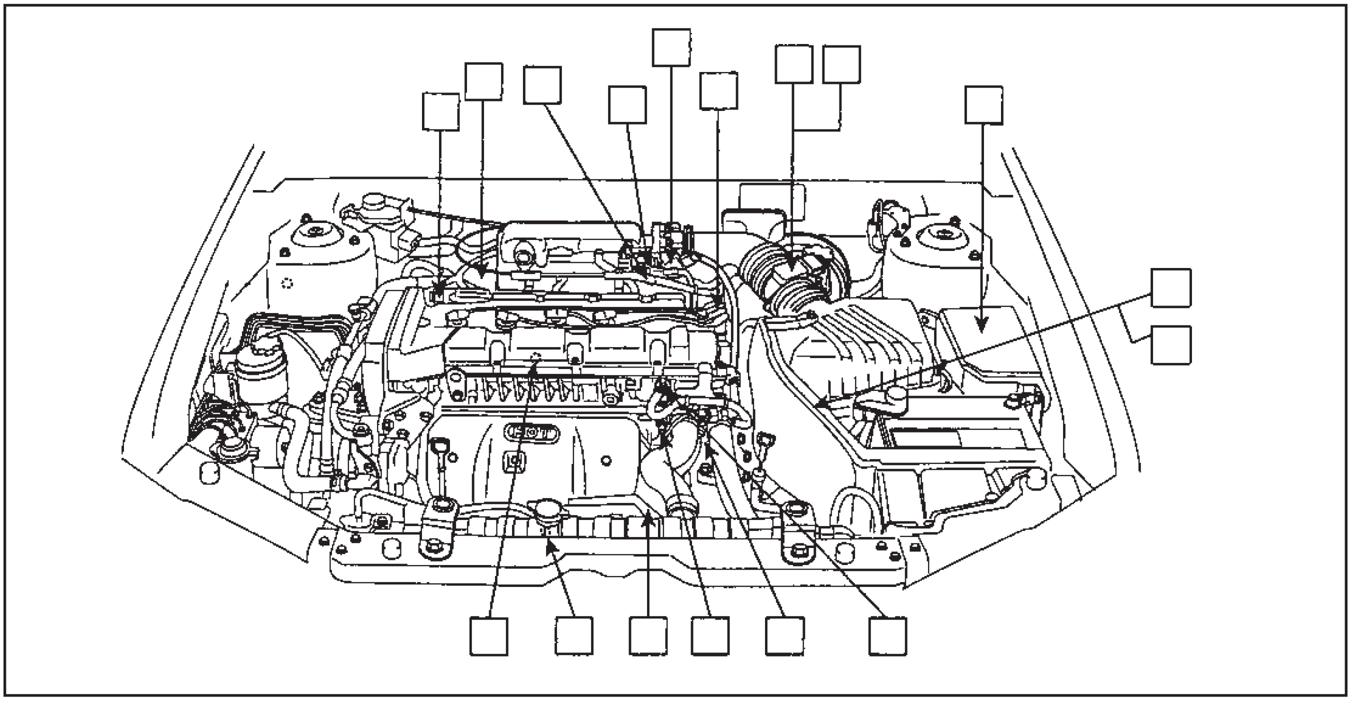
OCS operation:

- Number of pounds needed for front passenger seat sensor to detect passenger in front seat and turn off the telltale lamp: ____________________________
- Length of time before telltale lamp turns OFF once the correct amount of weight is applied: __________

UNDER HOOD

Total Possible Points: 3

Identify and locate items listed below and write the letter corresponding to each item in the box provided.



A. Mass Air Flow (MAF) Sensor
B. Intake Air Temperature (IAT) Sensor
C. Engine Coolant Temperature (ECT) Sensor
D. Throttle Position Sensor (TPS)
E. Camshaft Position Sensor (CMP)
F. Crankshaft Position Sensor (CKP)
G. Heat Oxygen Sensor
H. Injector
I. Idle Speed Actuator (ISA)
J. Vehicle Speed Sensor (VSS)
K. Knock Sensor
L. Oil Control Valve (OCV)
M. Oil Temperature Sensor (OTS)
N. Purge Control Solenoid Valve (PCSV)
O. Control Relay
P. Ignition Coil
Q. Inhibitor Switch

TEST DRIVE

Total Possible Points: 2

This exercise gives you a chance to test drive or ride in the Spectra. Be sure to follow your instructor's assigned road test route and obey traffic laws. Check with your instructor prior to leaving and upon returning.

Connect the Hi-Scan Pro, select data list.

Evaluate, and report on the operation of the following, when and if safe to do:

Automatic Transaxle shifting operation

- Smoothness: ________________________________
- Through all gears: ____________________________
- Under normal acceleration, list the upshift speed:
  - 2nd: ______________________
  - 3rd: ______________________
  - D/OD: ____________________
  - TCC engagement: __________

Manual Transaxle shifting operation (if equipped)

- Smoothness: ________________________________
- Through all gears: ____________________________
- Clutch operation: _____________________________

Cruise Control

- ON/OFF switch: ______________________________
- Pull down to set in coast: ______________________
- Pull up to resume and accelerate: _______________
- Pull back to cancel: __________________________

Steering operation

- Turning/cornering: ____________________________
- Steering wheel position during straight drive:
  ____

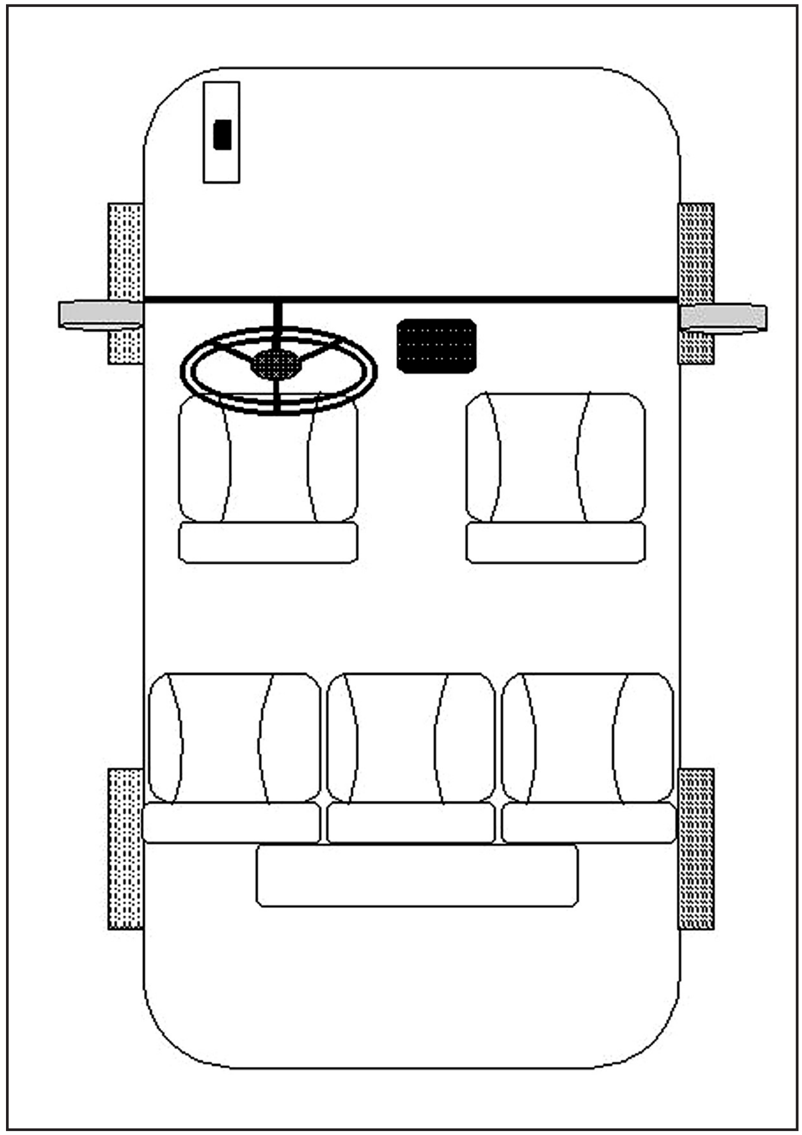
Assure vehicle drives true such as:

- During brake application:
  ____
- List usual tire noise: __________________________

CVVT operations

- Engine noise: ________________________________
- Using the HSP, note the advance and retard during:
    - Idle: ______________________________________
    - Acceleration:_______________________________
    - Deceleration:_______________________________
    - Cruise: ____________________________________

REVIEW



Use the following to make notes and locations.

List key items for discussion in class:

Item:	Discussion:

ASE
CERTIFIED

WE SUPPORT
VOLUNTARY TECHNICIAN
CERTIFICATION THROUGH

National Institute for
**AUTOMOTIVE
SERVICE
EXCELLENCE**

Powertrain

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.04

Theory

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

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When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

The goal of this module is to identify the 2004.5 Spectra Powertrain operation and interworking relationships of its new systems and components

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify the following with 80% or greater accuracy:

- Oil Temperature Sensor (OTS) influence on cold weather oil viscosity
- Continuously Variable Valve Timing (CVVT) benefits compared to fixed-cam engines
- Cam chain timing used on CVVT engine
- Shim style MLA needs to be adjusted periodically during engine reassembly
- Oil Control Valve (OCV) controlled by PCM based on load and RPM
- CVVT in-line oil filter is one of two oil filters used on CVVT engine
- CVVT uses shims to adjust MLA valve clearance

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. In the module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Tools: SST valve adjustment tools, Automatic Transmission Tester with new LD chip and removal tool and MT clutch alignment tool.

Components/Training aids: CVVT head and system, 2.0L CVVT engine

Vehicle: Spectra

Other: Preferred writing instrument

TIME TO COMPLETE

This module will take approximately 20 minutes.

ACRONYMS

ABDC: After Bottom Dead Center

ATDC: After Top Dead Center

ATF: Automatic Transmission Fluid

ATM: Automatic Transmission Module

BBDC: Before Bottom Dead Center

BTDC: Before Top Dead Center

CA: Cam Angle

CAN: Controller Area Network

CKS: Crankshaft Position Sensor

CMP: Camshaft Position Sensor

CVVT: Continuously Variable Valve Timing

EGR: Exhaust Gas Recirculation

HC: Hydrocarbons

HLA: Hydraulic Lash Adjustors

HSP: Hi-Scan Pro

KSIS: Kia Service Information System

MLA: Manual Lash Adjustors

mV: Milli-Volts

NOx: Oxides of Nitrogen

OCV: Oil Control Valve

OTS: Oil Temperature Sensor

RPM: Revolutions per Minute

SAT: Siemens Adaptive TM Control

TDC: Top Dead Center

V: Voltage

INTRODUCTION

The new Kia Spectra is equipped with a Beta 2.0 liter 4 cylinder gasoline powered engine. Beta is a Kia engine family name. The horsepower, compression ratio, bore and stroke were increased from the previous Spectra 1.8L engine. The new cylinder head features a continuously variable valve timing (CVVT) system that improves performance and emissions.

A new 5-speed with overdrive, hydraulically actuated clutch, M5BF2 manual transaxle is standard equipment on the new Spectra. The manual transaxle uses a hydraulically-activated clutch. A four speed with overdrive, F4A42 automatic transaxle is available as an optional feature on all Spectra models and is similar to the one used in the Optima.

PURPOSE

The new Spectra has a more powerful 2.0L Beta engine than previous Spectra vehicles. This engine has a CVVT system designed to burn cleaner and meet higher emission standards than previous models. The CVVT system improves engine performance by varying when the intake valves open and close.

The standard manual transaxle is a 5-speed overdrive unit.

The optional four speed electronic automatic transaxle is PCM controlled based upon various vehicle inputs and driver selected position shifter. Overdrive, or 4th speed operation is automatic when in “D” range; no driver “O/D” ON/OFF selection is available. The A/T self-diagnostic is continuously running during key ON. Depending upon the parameters of the fault found, the MIL will illuminate and the A/T could go into 3rd gear fail-safe mode.

APPLICATION

The following chart compares 2004 1.8L and 2004.5 2.0L Spectra engines and transaxles.

Item:\Vehicle:	2004 Spectra	2004.5 Spectra
Engine Type	Gasoline T8 – 4 cylinders	Gasoline Beta – 4 cylinders
Displacement (cc)	1,793 (1.8L)	1975 (2.0L)
Bore & Stroke (cc)	81.0 X 87.0	82.0 X 93.5
Compression Ratio	9.5:1	10.0:1
Valve System Type	DOHC 4-Valve	DOHC 4-Valve
Compression pressure	193psi @ 300 rpm	218psi @ 250 rpm
Firing Order	1-3-4-2	1-3-4-2
Valve Adjustment	HLA	MLA (Shims)
Valve Clearance (cold)	0 – Maintenance-free	Intake: 0.20mm
		Exhaust: 0.28mm
Valve Timing: Intake Open:	Non-CVVT 10° BTDC	CVVT 11° ATDC to 29° BTDC
Intake Closed:	42° BTDC	59° ABDC to 19° ABDC
CA variance:	Fixed CA	40° CA adjustment
Valve Timing: Exhaust	Open: 50° BBDC	Open:42° BBDC
	Closed 10° ATDC	Closed: 6° ATDC
CVVT System:	No	Yes
Manual Transaxle	T5M	M5BF2
Gear Ratio 1st	3.307	3.615:1
2nd	1.833	2.053:1
3rd	1.310	1.393:1
4th	1.030	1.061:1
5th	0.795	0.837:1
Reverse	3.166	3.250:1
Automatic Trans	F4E-K	F4A42
Gear Ratio 1st	2.800:1	2.842:1
2nd	1.540:1	1.529:1
3rd	1.000:1	1.000:1
4th	0.700:1	0.712:1
Reverse	2.333:1	2.480:1
Shifter	P-R-D-2-1	P-R-D-3-2-1
OD ON/OFF button	Yes	No

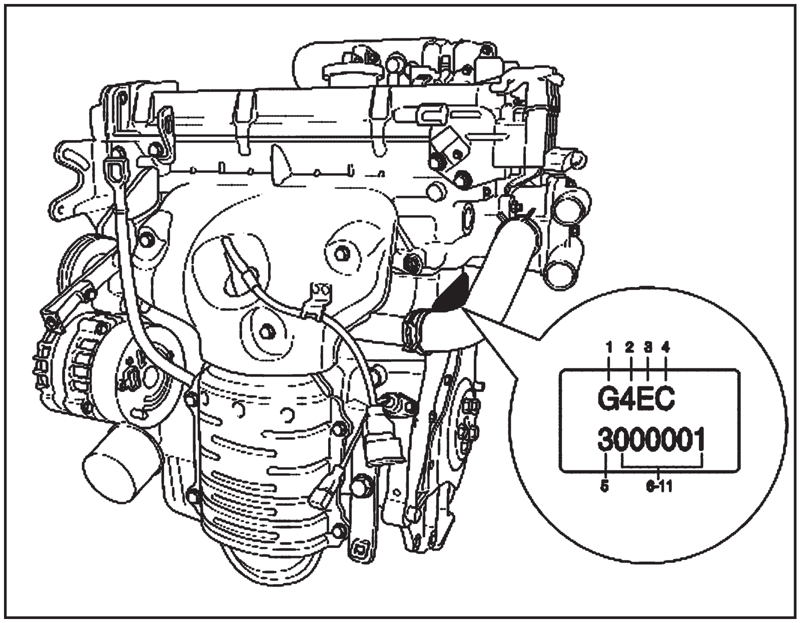
SPECIAL SERVICE TOOLS (SST)

The following new SST's have been released for this module:

- Valve adjustment tools
- Clutch alignment tool (M/T)
- A/T tester LD chip module

SYSTEM OPERATION

The 2004.5 Spectra has a Beta 2.0-liter Continuously Variable Valve Timing (CVVT) gasoline engine. The new engine has larger displacement, more horsepower, solid lifers, and constant variable valve timing compared to the previous Spectra. The Beta engine is considerably larger than the 1.8L engine giving it greater throttle response and improved engine power. The CVVT is controlled by the PCM to provide optional emission reduction.



ENGINE IDENTIFICATION NUMBER

The engine identification (ID) plate location is shown above. To interpret the engine ID plate characters, use the following:

1: G = Gasoline engine

2: 4 = 4 cylinder engine

3: G = Beta engine development order

4: C = 1,975cc engine capacity

5: 4 or 5 = 2004 or 2005 production year

6-11 digits represents the engine production sequence number

The information in this chart shows different 2004 Kia vehicles that use 4 cylinder engines.

2004 4-Cyl vehicles	Rio	Optima	Spectra	Spectra 2004.5
Engine and type:	1.6L A6	2.4L	1.8L	2.0L Beta
Displacement (cc):	1594	2351	1793	1975
Compression Ratio:	9.5:1	10:01	9.5:1	10:01
Compression Pressure:	184psi	178psi	193psi	206psi
Minimum pressure:				185psi
Difference between cylinders:	<14.2psi	<14psi	<14	<15psi
Valve System:	DOHC 4	DOHC 4	DOHC 4	DOHC 4
Valve Adjustment:	HLA	HLA	HLA	MLA
CVVT System:	No	No	NO	Yes
Firing Order:	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Timing Belt:	Service	Service	Service	Service
Timing Tensioner:	Spring loaded	Hydraulic self contained	Spring loaded	Manual Adjustment
Engine Oil:	See KSIS	See KSIS	KSIS	5w30
Ethylene Glycol Coolant 60% Max:	6.3 Qt	7.7 Qt	6.3 Qt	6.3 Qt
Automatic Transaxle:	F4E-K	F4A42	F4E-K	F4A42
PCM ECM - TCM:	ECM Siemens TCM Bosch	I4 PCM Melco V6 PCM Siemen	ECM & TCM Bosch	PCM Siemen
ATF	SP-III	SP-III	SP-III	SP-III
Manual Transaxle	T5M	M5GF1	T5M	M5BF2
API service GL-4 oil SAE:	75W-90	75W-90	75W-90	75W-90
Clutch Type	Cable	Hydraulic	Hydraulic	Hydraulic

CVVT SYSTEM

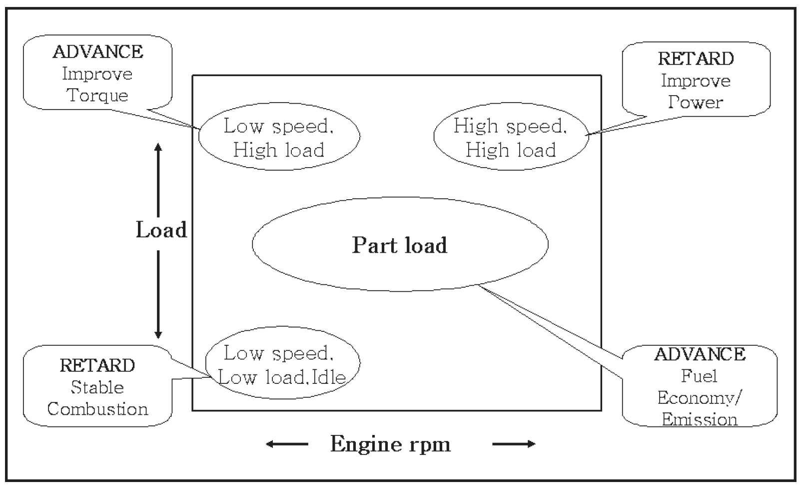
The PCM advances and retards the intake camshaft timing through the CVVT system depending on engine RPM and load.

Advantages to the CVVT system include:

- Improved Fuel Economy
    - Reduced lost A/F mixture loss because of reduced valve overlap

- Reduced emission
  - Reduce NOx through an EGR effect due to optimization of valve overlap
  - Small overlap (Retard) causes increased burning time resulting in reduced HC emission
  - Large overlap (Advance) causes an EGR effect by lowering NOx
- Improved performance
  - Improved volumetric and thermodynamic efficiency by variable valve timing
  - Advanced valve timing at low and middle speed improves volumetric efficiency
  - Retarded valve timing at high speeds improves volumetric efficiency by inertia energy
- Improved idle stability
  - Reduced valve overlap to burn A/F mixture at idle

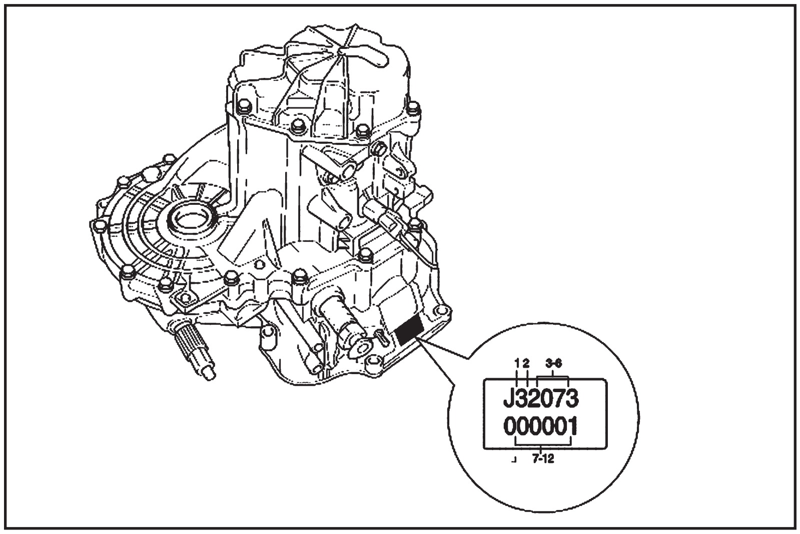
CVVT OPERATING RANGE



The CVVT will retard or advance intake valve timing, based on engine RPM and load. The chart shows the CVVT operating range for different engine loads and RPM. At idle and low load (starting from the lower left corner), the timing is retarded for stable combustion. As load increases (upward on the chart), timing is advanced to improve torque. Timing advances as RPM increases (shown as moving to the right) under partial load for fuel economy and emission. When both RPM and load increase, the CVVT retards timing to improve power. When load and RPM becomes constant, intake valve timing is maintained based on the amount of load and RPM (see chart).

MANUAL TRANSAXLE

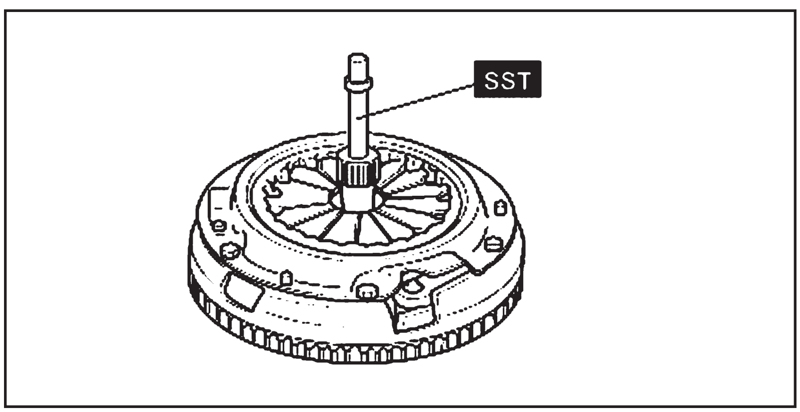
Manual Transaxle (M/T) is standard equipment on the 2004.5 Spectra. This is a new 5 speed with OD to the Kia M/T family.



The manual transaxle identification (ID) plate location is shown above. To interpret the manual transaxle ID plate character, use the following:

1: J = F5BF2 model
2: 4 or 5 = 2004 or 2005 production year
3-4: 20 = Output shaft gear tooth number
5-6: 73 = Differential drive gear tooth number
7-12: Production sequence number

The clutch is a hydraulically activated type. Due to the new shape of the clutch disc and crankshaft pilot bearing, a new clutch disc alignment tool is required. A clutch disc alignment SST has been sent to your dealer.



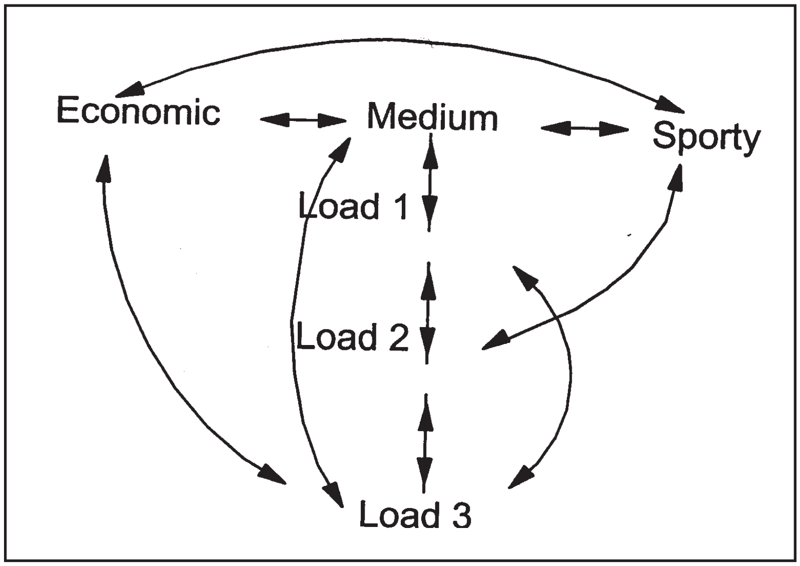
The recommended maintenance under normal driving conditions includes inspecting the oil level every 24,000 miles and replace if the oil is contaminated or dirty. Under severe driving conditions the motor oil recommended replacement is every 60,000 miles.

AUTOMATIC TRANSAXLE CVVT ENGINE

The 2004.5 Spectra offers an optional F4A42 automatic transaxle, which is currently used on the Optima 4 and 6 cylinder vehicles. The new Spectra transaxle differs from the Optima by:

- Not having Sport shift
- Having Siemens PCM

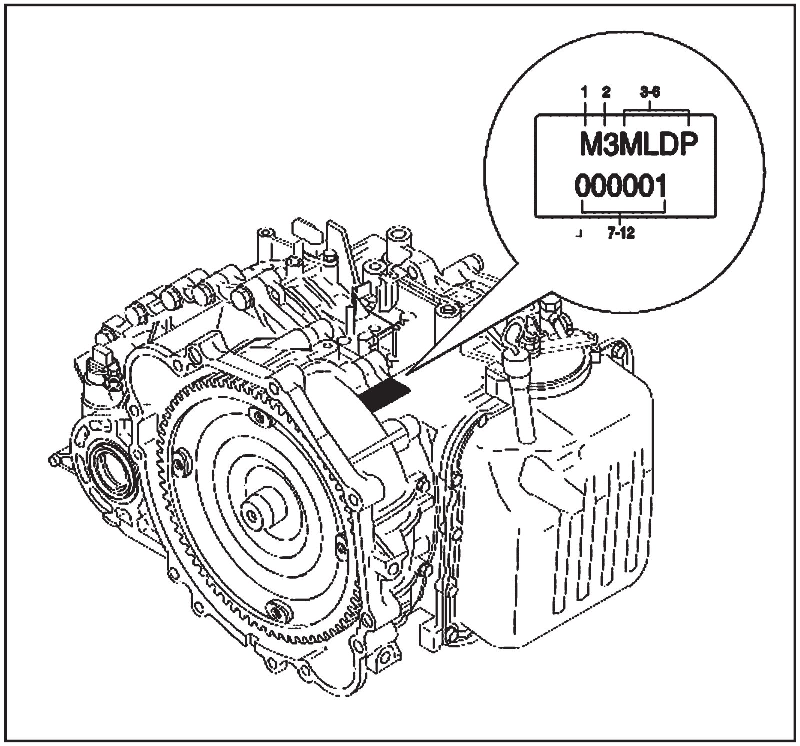
The Siemens system uses an adaptive learning and memory system based on the drivers driving patterns. The PCM software is better equipped to calculate the drivers driving pattern for quicker response and greater customer satisfaction.



The Siemens Adaptive TM control (SAT) has 6 possible shift modes to select from based on operation mode and load. They are illustrated below:

Economic mode is applied by SAT as often as possible. Adaptive shift patterns of medium and sporty modes are activated based on driver's shift pattern and the following load conditions:

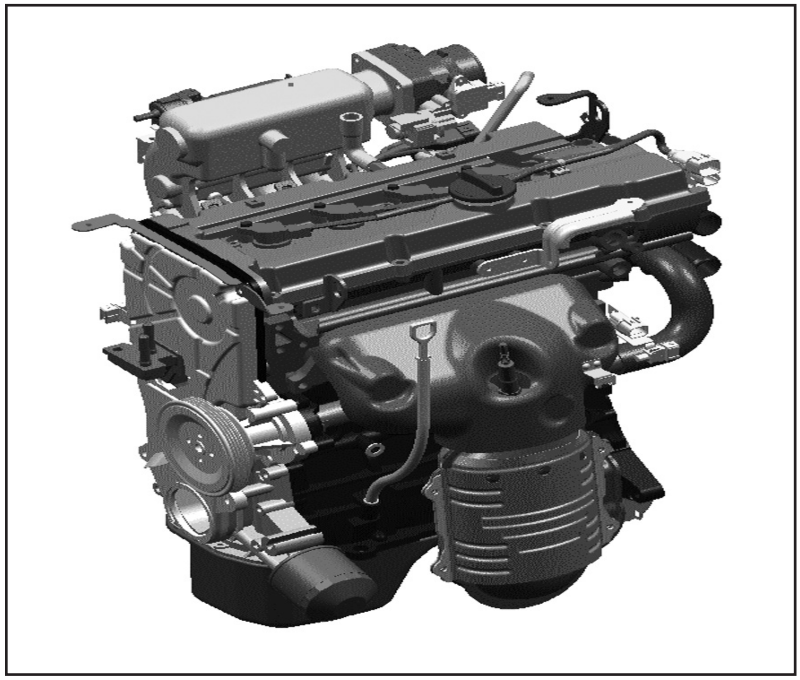
- Load 1 is designed for driving on moderate road gradients
- Load 2 is active while going steeply upwards and
- Load 3 is intended for downhill driving, such as increased engine braking.



The automatic transaxle (A/T) identification number location is shown above. To interpret the A/T ID characters, use the following:

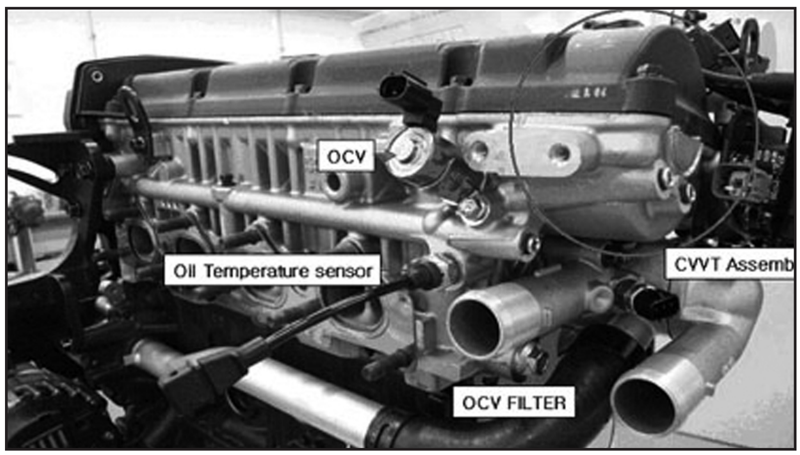
1: M = F4A42-1 model
2: 4 or 5 = 2004 or 2005 production year
3: M = 3.770 gear ratio
4-5: LD = Spectra
6: Spare
7-12: Production sequence number

POWERTRAIN COMPONENT OPERATION



This section will cover Powertrain components and their operations, which are not commonly found on Kia vehicles with 4 cylinder engines.

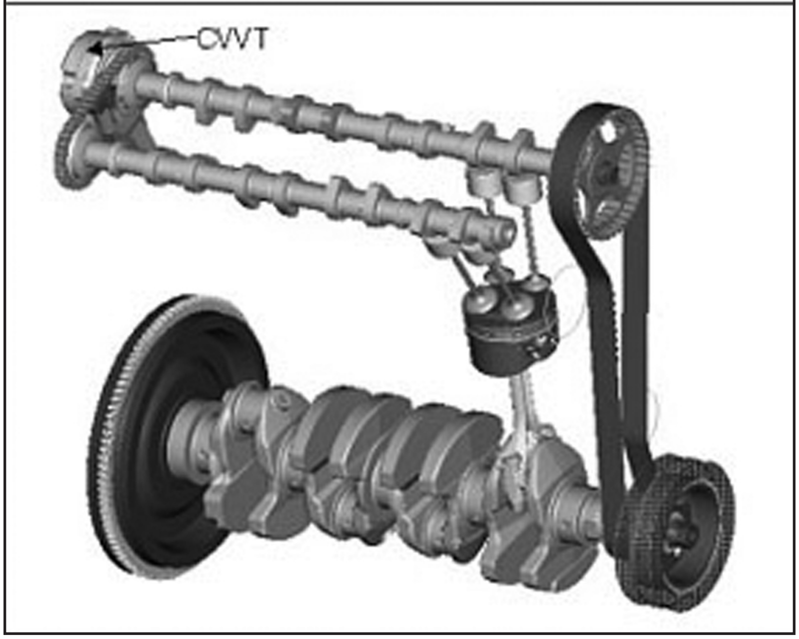
CONTINUOUSLY VARIABLE VALVE TIMING (CVVT) SYSTEM



The CVVT system adds several components to the cylinder head assembly including the:

- Oil Temperature Sensor (OTS)
- Oil Control Valve Filter
- Oil Control Valve (OCV)
- Exhaust camshaft with an oil passage from the rear of the cam shaft journal to the CVVT assembly, which is controlled by the OCV.
- Timing Chain

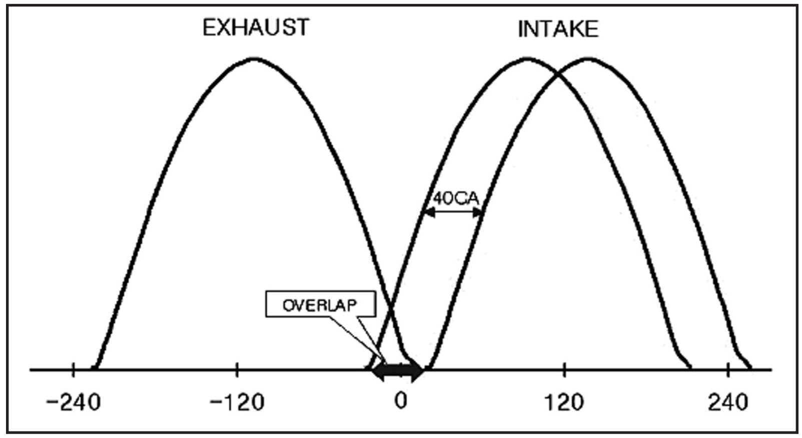
Beta Engine with CVVT



- CVVT assembly on exhaust camshaft

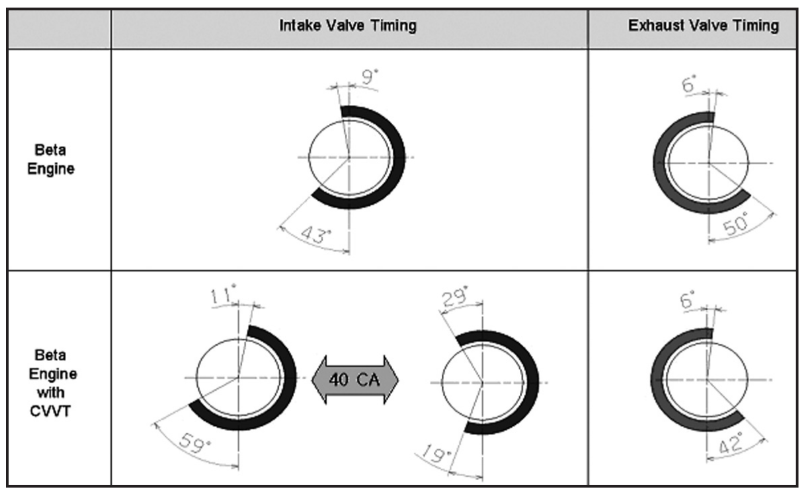
Note: The exhaust camshaft is timing belt driven by the crankshaft through the camshaft pulley located in the front. The intake camshaft is timing chain driven off the rear of the exhaust camshaft through the CVVT assembly, which adjust intake valve timing up to 40 degrees.

CONTINUOUSLY VARIABLE VALVE TIMING (CVVT)



Depending upon engine RPM and load, CVVT system varies the intake valve timing 40 degrees of cam angle, and the intake valve timing is optimized. When the shown intake valve angle “bell” is moved to the right side, the intake is in Full Retard and Full Advance when the “bell” is on the Left Side. The exhaust valve angle remains constant as shown.

CVVT AND NON-CVVT SYSTEM COMPARISON



This chart compares camshaft timing of the 2.0L Beta engine without CVVT (not available on Kia vehicles sold in the U.S.) and with CVVT. At 12 o’clock on the diagram is TDC, while 6 o’clock is BDC of the piston. The camshafts rotate clockwise.

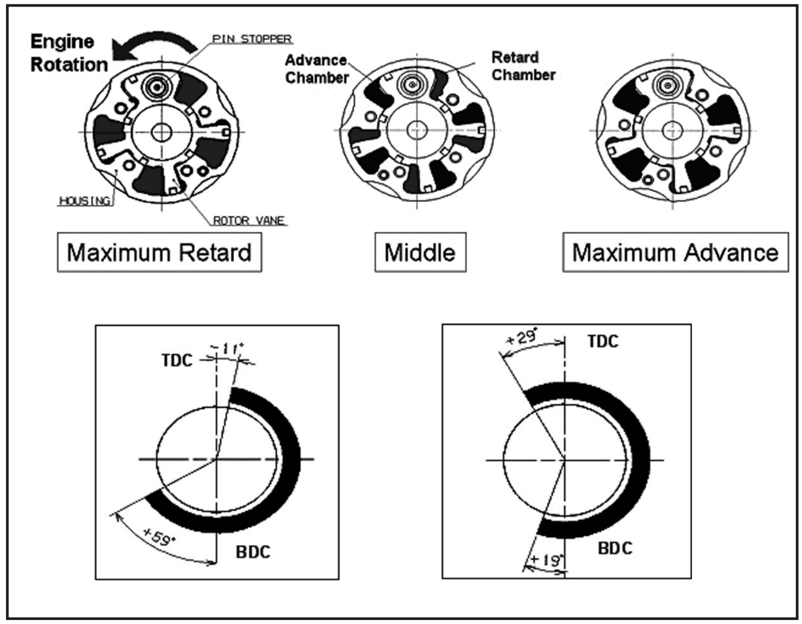
The valve timing does not vary on the exhaust camshafts, which is shown in the right column.

- At 6 o’clock (bottom) the exhaust valve starts to open 50 degrees before BDC (42 degree in CVVT)
- The valve closes at 6 degrees after the piston reaches TDC.

Looking at the intake valve timing on the non-CVVT engine (top), at 12 o'clock (top), it starts to open 9 degrees before the piston reaches TDC and is closed 43 degrees after TDC.

The CVVT engine varies intake valve timing with the opening occuring between 11 degrees ATDC and 29 degrees BTDC, a 40 degree range based on engine load and RPM. It follows then, that the intakevalve closes between 19 and 59 degrees after BDC.

CVVT ASSEMBLY



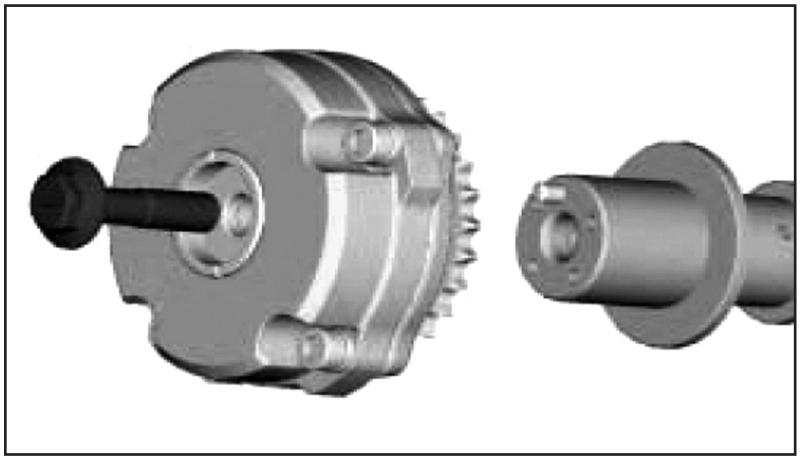
CVVT is a vane type assembly with an operational range of 0 to 40 degrees crank angle (20 degrees camshaft angle or CA). The assembly rotates with the exhaust camshaft at engine speed up to 6000 RPM.

Inside the CVVT assembly, the rotor vane rotates causing a phase difference in the housing and rotor vane to advance or retard intake camshaft timing as shown in the above illustration. The rotor vane is in a fixed position on the housing by a pin stopper when rotated to maximum retard timing. When the Oil Control Valve (OCV) supplies oil to the advance chamber side, the stopper pin is unlocked and the housing will advance (rotate). This will advance the intake camshaft.

The OCV can "Hold" and maintain the oil and the housing will not rotate. When the OCV drains oil from the CVVT assembly, the housing will rotate and retard the intake timing. The CVVT lock pin will re-engage with maximum retard timing.

When the engine is off, the oil is drained from the advance chamber returning the housing to the retarded position and will become fixed in full retard position by the locking pin.

Note: Failsafe is at full retard with the lock pin engaged.

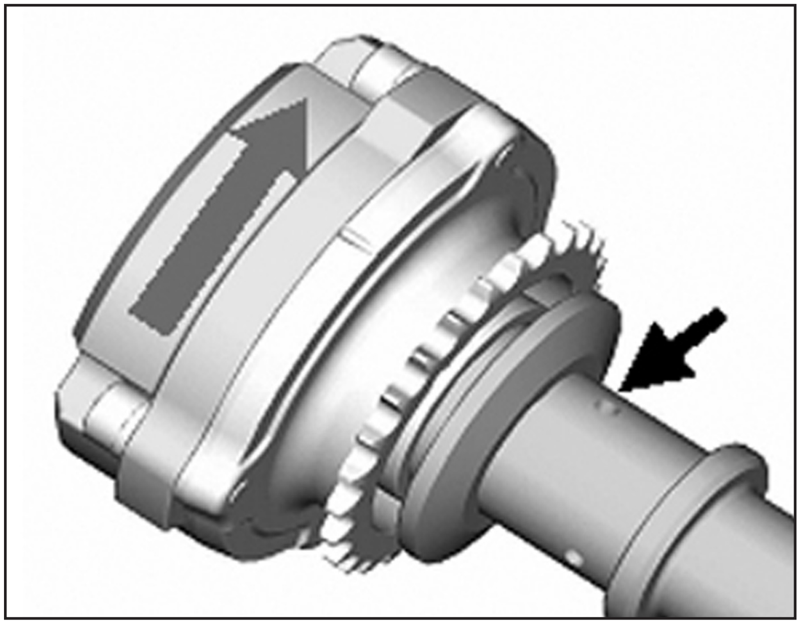


The CVVT assembly is positioned on the camshaft by a location pin and secured with a center bolt. Avoid scratches to the surface of the rotor vane.

Note: Scratches to the rotor vane surface will cause oil leakage resulting in reduced engine performance at low to middle RPMs.

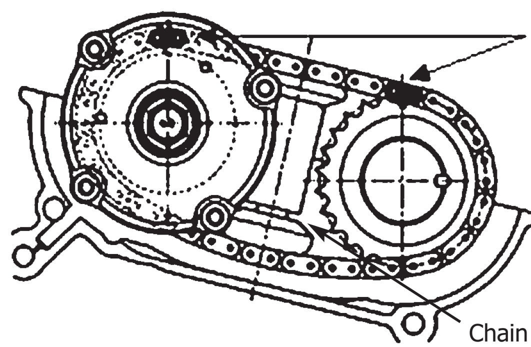
Note: The CVVT assembly is a non-serviceable part. It must be replaced if defective or damaged.

Caution: Refer to KSIS for torque specifications. If under torqued, it will become separated from the camshaft; over torquing could cause it not to operate due to deformation.



The CVVT assembly can be tested with 14 PSI of air. The CVVT should be in the retarded position with the lock pin in place. Plug the OCV passage line holes on the camshaft, except the hole closest to the CVVT assembly. Blow air into the unblocked hole to release the lock pin. Depending upon the air pressure, the assembly should be able to be turned in the direction of advance. When the assembly is turned to the maximum retarded position the pin will relock. Relocking will occur without air pressure.

CVVT TIMING

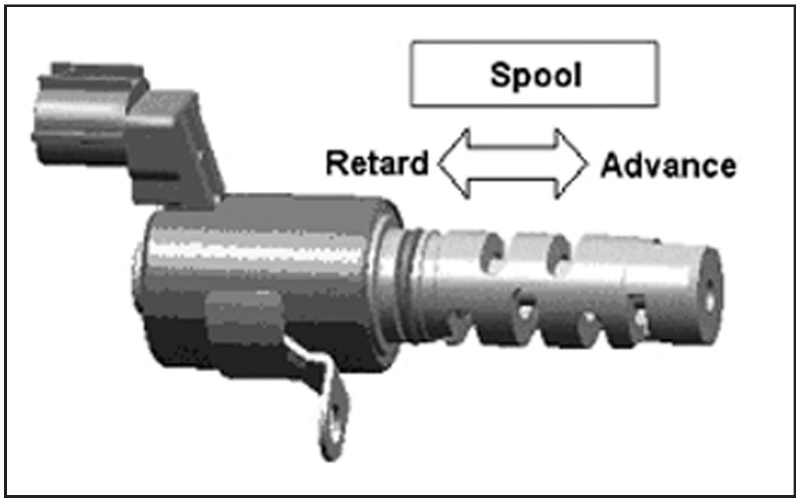


The CVVT assembly is located on the rear of the exhaust camshaft, which is driven by the timing belt.

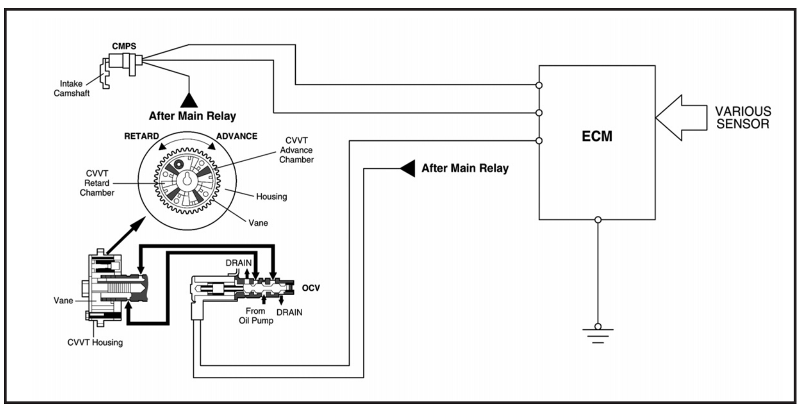
A chain attached to the CVVT housing drives the intake camshaft.

To time the camshafts and chain, place the crankshaft on #1 piston TDC compression, similar to timing belt replacement. The camshafts are timed by aligning each of the 2 brass colored chain links with the dot on each camshaft. Next a chain auto-tensioner is installed between the 2 camshafts to keep chain tension. The auto tension must be compressed with locking pin prior to installation on cylinder head.

OIL CONTROL VALVE (OCV)

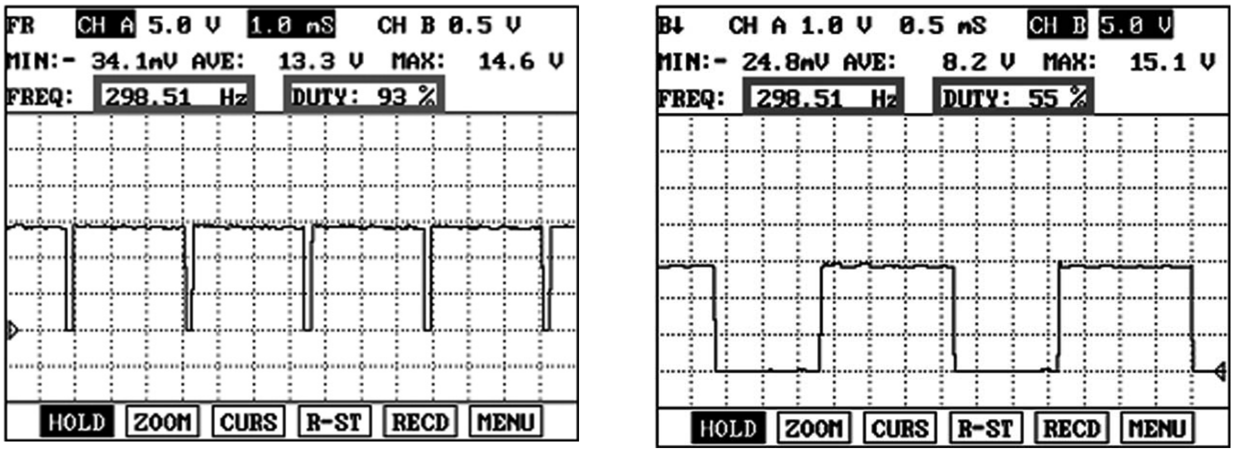


The Oil-flow Control Valve (OCV) is a 12V electromagnetic coil operated spool valve mounted on the cylinder head. The amperage draw of the 7.4 ohm coil is 100 to 1000 mA based upon engine load. The PCM commands the duty cycle using the engine RPM, MAF and oil temperature inputs to determine the engine load.



The OCV receives 12V from the engine compartment main relay and same 15A fuse that power the fuel injectors in the under hood fuse/relay box. The OCV groundside is duty cycled ON by the PCM. The PCM controls the OCV much the same way an A/T solenoid controls a valve through duty cycle.

Note: The OCV operation can be checked through Hi-Scan Pro activation or removed from the cylinder head. Apply B- to pin #2 and briefly contact B+ to pin #1. This will move the spool valve outward. Remove B+ and the spool valve will return to its original position.



The waveforms show an engine at two speeds with the following OCV readings:

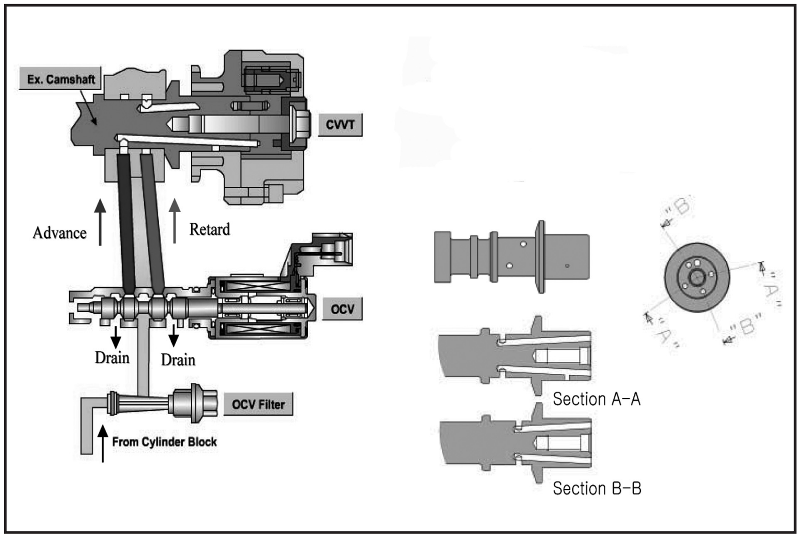
Item:	Idle	2000RPM Load
Min. Voltage:	34 mV Ave.	24 mV Ave
Ave. Voltage:	13.3 V	8.2 V
Max Voltage:	14.6 V	15.1 V
Freq:	298 Hz	298 Hz
Duty Cycle:	93%	55%
Cam Angle:	Retard	Advance

Note: The pattern on the right shows the 0 V trigger point lowered by 1 grad.

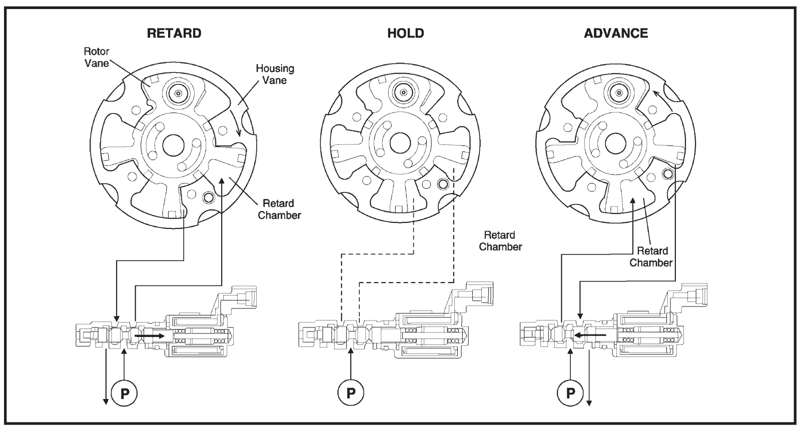
When the OCV was cycled ON, the voltage dropped close to zero volts in each. The average voltage (13.3V & 8.2V) changed due to change in the ON time. Maximum voltage stayed similar (higher due to faster RPM for alternator) at 14.6-15.1V. Frequency should stay the same at 298Hz because the voltage is constant.

The duty cycle changed due to changes in OCV ON time. At idle the valve is cycled ON (ground side) 7% of the time, while at 2000 RPM/Load it is cycled ON (ground side) 45 % of the time.

Note: The OCV default position is with the piston at rest in its normally closed/no flow position similar to a spool valve.



Oil enters the OCV filter from the cylinder block into the cylinder head passage. The oil then enters the OCV in the middle spool. Depending upon where the PCM has commanded the OCV spool valve position, by duty cycle, motor oil will flow to the exhaust camshaft and into the CVVT assembly. The oil pushed the vanes to advance or retard cam angle timing.



Retard When the PCM signals the OCV to retard the Intake valve timing, the solenoid is de-energized the spool valve back. This opens the oil feed line to the retard chamber. It also opens the advance chamber oil line from the CVVT to drain into the oil pan as oil pressure from the retard vane rotates and pushes it out.

Hold With the OCV in a hold CVVT position, the spool valve blocks the oil from entering, draining out of the CVVT.

Advance When the PCM cycles the OCV to advance the Intake valve timing the valve solenoid is energized pushing the spool valve forward. This opens the oil feed line to the advance chamber. It also opens the line to the retard chamber so oil can drain back into the oil pan as oil in the advance chamber pushes it out.

The OCV is a non-service item and is replaced when defective. When the CVVT sticks, the camshafts real position and target position as determined by the PCM is not matched. If it's stuck in the advanced position, engine vibration and stoppage can occur at idle.

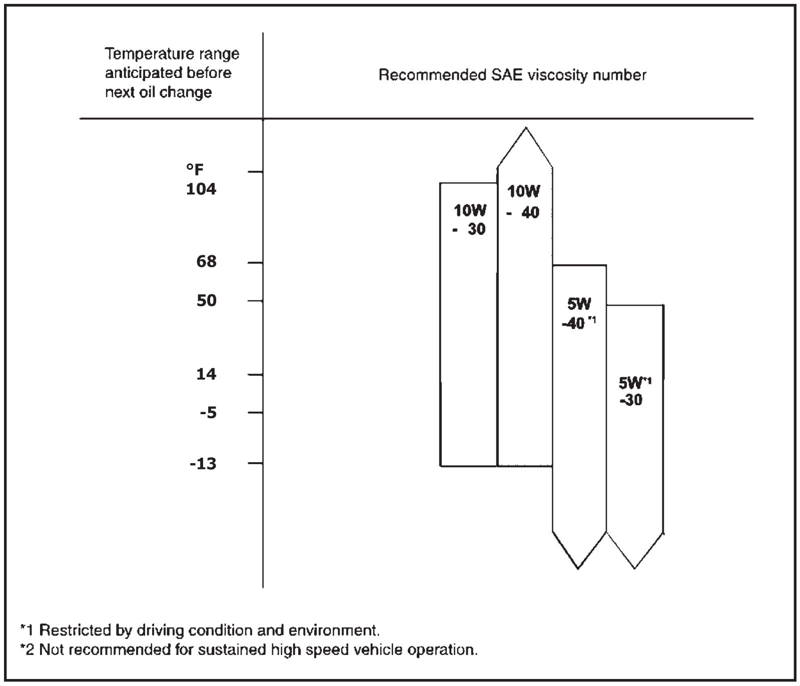
Note: The camshaft position and PCM target position can be observed on the Hi-Scan pro.

Caution: Don't touch the OCV sleeve or use the OCV as an engine handle.

OIL TEMPERATURE SENSOR (OTS)

Oil Temperature Sensor (OTS) is located on the exterior side of the cylinder head in the engine oil passage. The OTS is a 2-wire NTC type resistor sensor. It is a 5-volt feedback sensor that measures the engine oil temperature and provides this information to the PCM. The Oil Control Valve (OCV) control signal is compensated by the PCM depending on the OTS signal.

Engine oil flow is PCM controlled to move the CVVT control valve in order to change valve timing. The PCM uses the oil temperature information to compensate for its control signal to the OCV. The OCV directs oil to move the CVVT unit and changes valve timing.

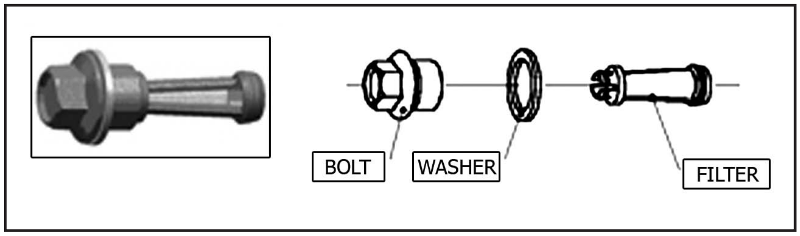


Density of the engine oil changes according to its temperature. Only certain weights of engine oil can be used in a CVVT engine. By using high viscosity oil, the CVVT may not operate in cold conditions.

It's important that only the recommended oil weight (SAE) be used in the CVVT engine.

Oil Weight	2.0L CVVT Spectra	1.8L 2003 Spectra
API SH or above	←	←
SAE 5W30, 5W40	<100 F	RT
SAE 10W30, 10W40	>-10 F	RT
SAE 10W50	NR	RT
SAE 20W40, 20W50	NR	RT
SAE 30	NR	RT
NR = Not Recommended RT = Usable under certain conditions, Refer to KSIS for Range of Temperature		

OIL CONTROL VALVE FILTER



OCV Filter is a screen style located on the side of the cylinder block. It's the primary oil filter for the OCV. If the filter plugs up, the CVVT system will not operate.

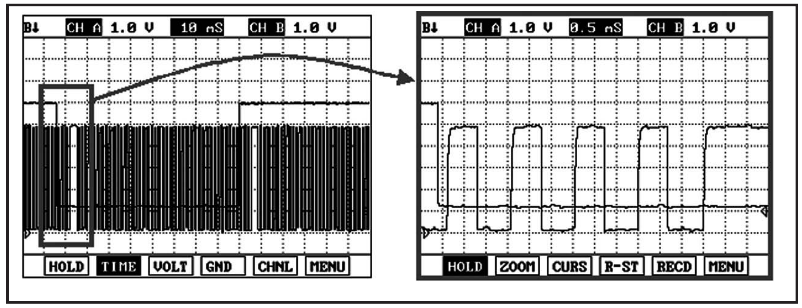
Caution: Clean area around the filter prior to disassembly. Always work in a clean environment due to the filtering size of the screen and replace the washer with a new one.

When the CVVT sticks, the intake camshaft's real position and target position as determined by the PCM don't match, which sets a DTC. If it's stuck in the advanced position, the results will range from poor idle quality to engine stall.

Note: The camshaft position and PCM target position can be observed on the Hi-Scan pro.

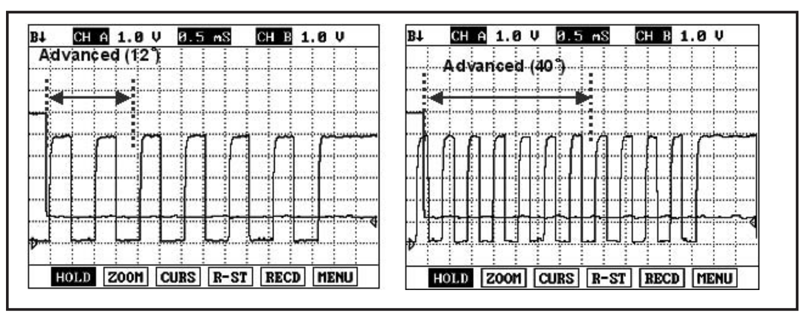
Caution: Replace and work in a clean environment.

OCV WAVEFORM



Looking at the waveform on the left, the CKP and CMP waveforms on the HSP can inspect the CVVT operation. Let's review basic engine operation. The waveform of 2-on/off square waves represents the CMP while the waveform of multiple and close together on/off signals represent the CKP. The CMP has 1 signal at TDC per engine revolution while the CKP has 58 + 2 (TDC reference) for 60 signals and turns over twice per engine revolution.

Now lets look closely at a small part of the signal (within the drawn box and moved to the waveform on the right) to discuss the OCV operation. The engine is running at idle condition. On the left side, note the end of the CMP square wave. Moving to the right, there are 4 CKP square waves. The 4 CKP waves mark the 11° of intake cam opening timing at idle with the OCV valve off. The state of cam timing is maximum retarded.



The waveform on the left shows the engine RPM has increased to 1200 RPM. Due to the increased RPM, square waves have become closer together or narrower but still the same height. Also the addition of 2 square waves which represents a 12° advance due to the OCV duty cycling ON. The intake camshaft opening timing is now (11° fix + 12° OCV) 23°.

The waveform on the right shows the CKP waveform even narrower, which indicates higher RPM. The engine is running at +2000 RPM, full load condition and the CVVT system is maximum advanced. There are approximately 6.5 CKP waveforms from the CAM waveform on the left. This time 6° each equals 40° advances.

Note: The math shown is a representation of timing.

CVVT DTC

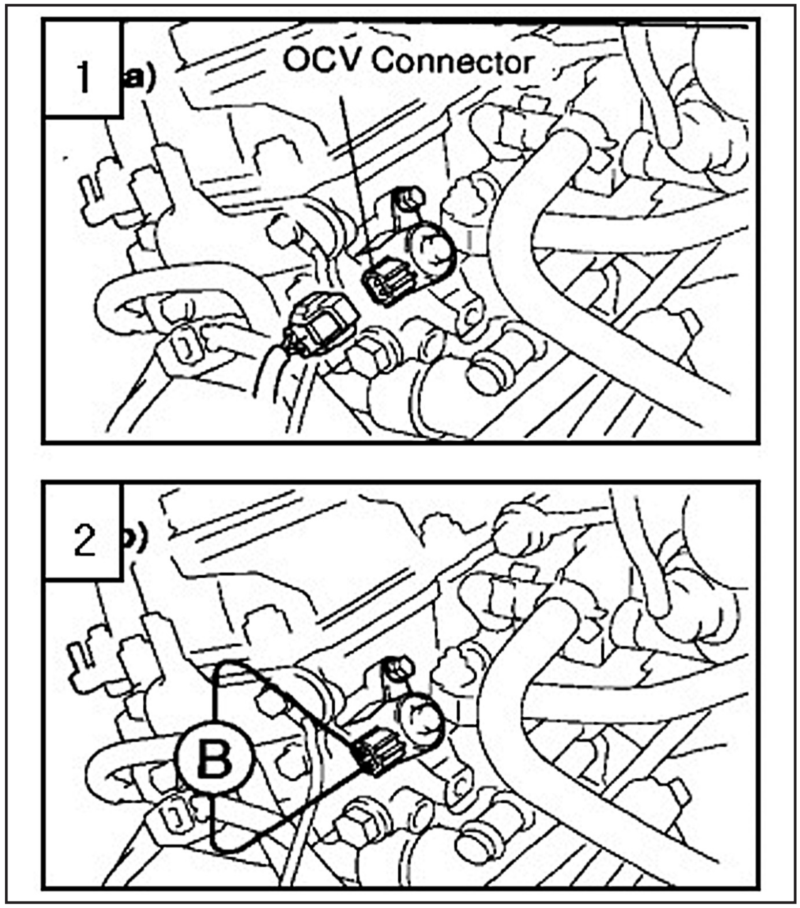
Hi-Scan Pro has an activation test for the OCV.

DTC:	Description:
P0010	Camshaft Position Actuator Circuit
P0075	Intake Valve Control Solenoid Circuit (OCV)
P0076	Intake Valve Control Solenoid Circuit Low
P0077	Intake Valve Control Solenoid Circuit High
P0196	Engine Oil Temperature Sensor Range
P0197	Engine Oil Temperature Sensor Low Input
P0198	Engine Oil Temperature Sensor High Input
P0341	Camshaft Position Sensor Range

There are several new DTC that are related to the CVVT system. Two unique DTCs are:

- Such as DTC P0010 Camshaft Position Actuator Circuit when the camshaft mis-alignment exceed 5° CA from the target position. This can be caused by malfunction of the CVVT assembly due to insufficient oil flow.
- DTC P0341 Camshaft Position Sensor Range indicates that the camshaft position is mis-matched with the crankshaft position when the CVVT is in the fully retarded position and not operating. This can be due to the timing belt or chain off timing or incorrect CMP or CKP sensor signal.

CVVT TROUBLE SHOOTING PROCEDURE



Start the engine and let idle. Test the items shown in the table at idle condition.

	Condition	Test	Remarks
1	Disconnect the OCV connector	Check the engine condition	To check the CVVT position at maximum retard
2	Connect battery voltage to the OCV connector	Check the engine vibration and engine stop at engine idle condition	To check the CVVT movement to advance position

CONDITION TEST REMARKS

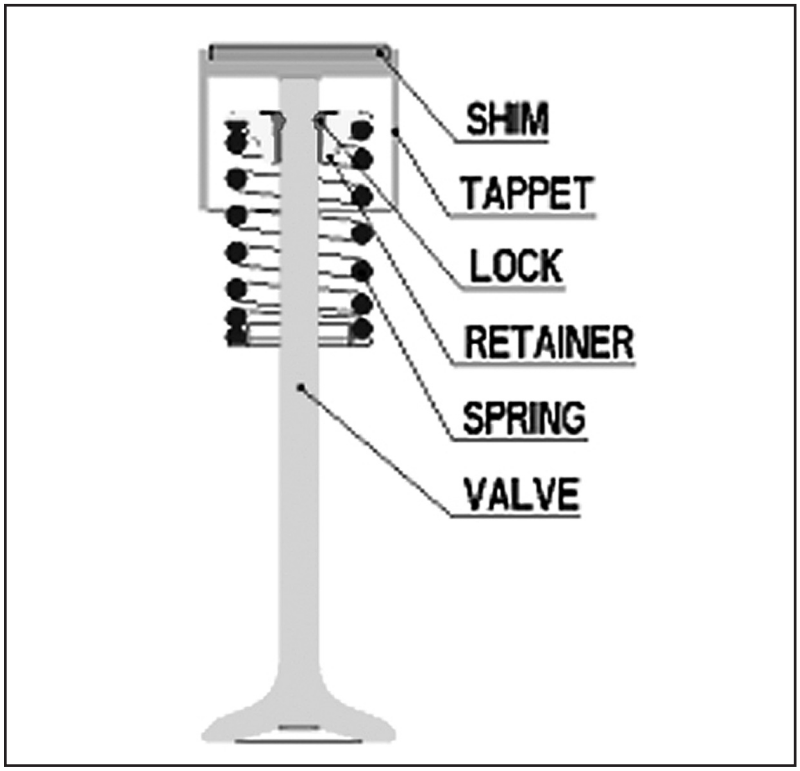
This Checks:

1. This checks CVVT position at maximum retard.
2. Check engine vibration and engine stall at idle. This checks movement to full advance position.

If problems are found during the tests, check each part of in the following order:

Valve Timing → Sensor, ECU Output signal → CVVT ASS'Y → OCV → OCV Filter

VALVE LASH

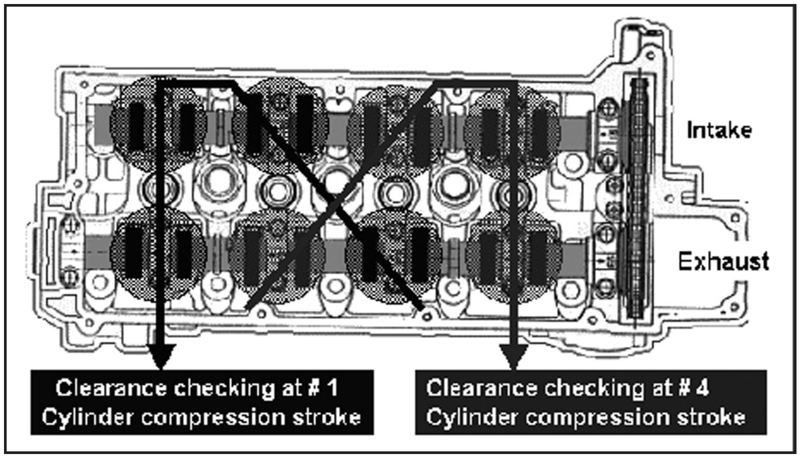


The 2.0L Beta CVVT engine uses a manual lash adjusting (MLA) valve train. The valves are adjusted by changing the size of the shim at the recommend service interval. Vehicle fuel consumption is reduced by using MLA due to reduction of friction:

a. by reduced valve spring tension
b. while the camshaft lobe does not contact with lash adjuster
c. by smooth surface of MLA shim
d. reduced driving force of the oil pump because of less oil flow.

VALVE INSPECTION

Inspect the valve clearance with the crankshaft at TDC and camshaft-timing pulley is aligned with the timing mark on the bearing cap, similar to timing when replacing the timing belt.

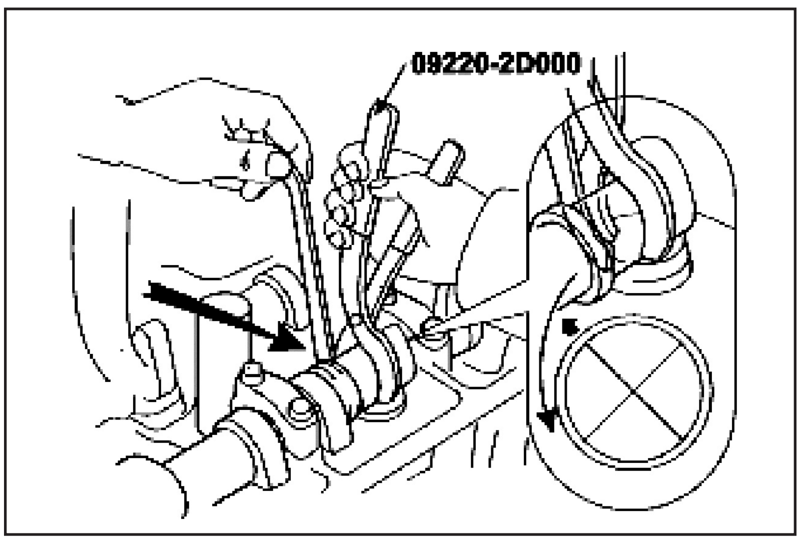


In this position inspect the following valves #1 cylinder intake and exhaust, #2 intake and # 3 exhaust.

Turn the crankshaft pulley one revolution (360°) and check the remaining values: #2 exhaust, #3 intake, #4 exhaust and intake.

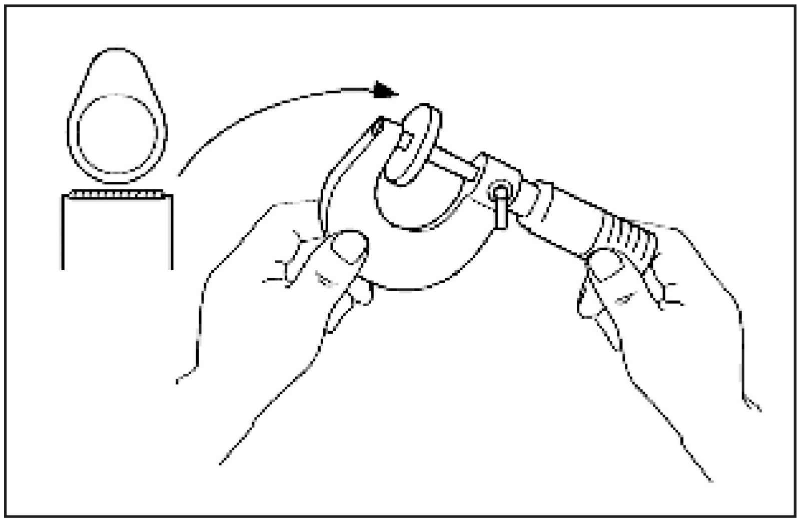
Refer to KSIS for specs with engine cold (68° F).

VALVE ADJUSTMENT



Measure valve clearance first. Record the value for calculations later. Adjust the intake and exhaust clearance with the cam lobe pointing away from the MLA shim.

Using the SST, press down on the valve lifter with the plier and place the stopper between the camshaft and valve lifter. Then remove the SST. Remove the adjusting shim with small screwdriver and magnet.



Measure the thickness of the removed shim using a micrometer. Calculate the thickness of a new shim using the chart listed on KSIS so that the valve clearance comes within the specified value.

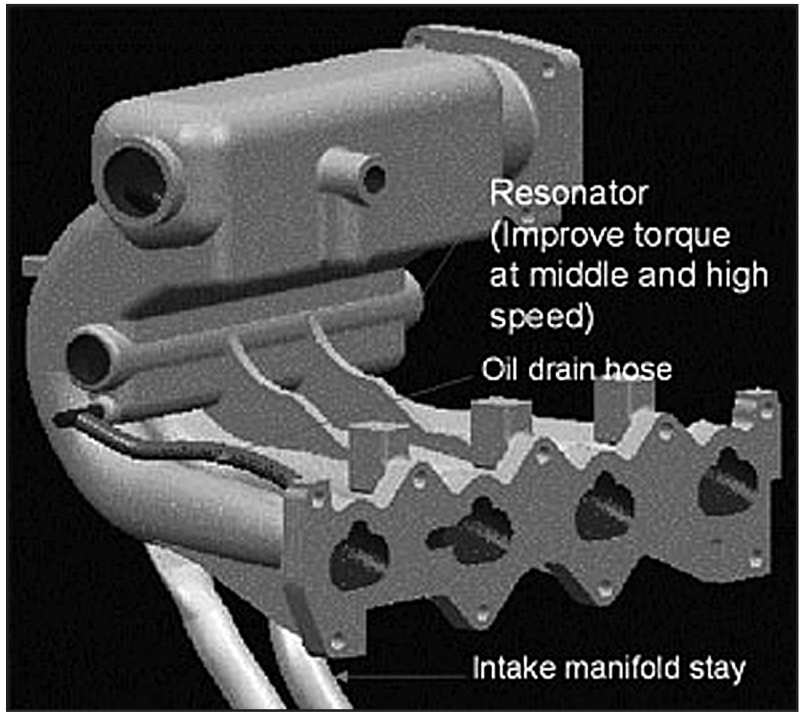
Intake: New shim = Thickness of old shim + measured valve clearance - 0.0079 inches/0.20mm.

Exhaust: New shim = Thickness of old shim + measured valve clearance - 0.0110 inches/0.28mm.

Select a new shim from the chart that is the closest in value. Recheck the valve clearance after installation of new shim. Shim selection chart is available for both intake and exhaust valve clearances. Refer to KSIS for chart.

Note: Shims are available in 20 size increments of 0.016 from 0.079 to 0.1087 inches.

INTAKE MANIFOLD



Intake manifold on the 2.0L Beta engine has a resonator for improved torque at middle and high speeds. Oil from the PCV can collect in the resonator. Oil collected in the resonator drains to the crankcase through the oil drain hose.

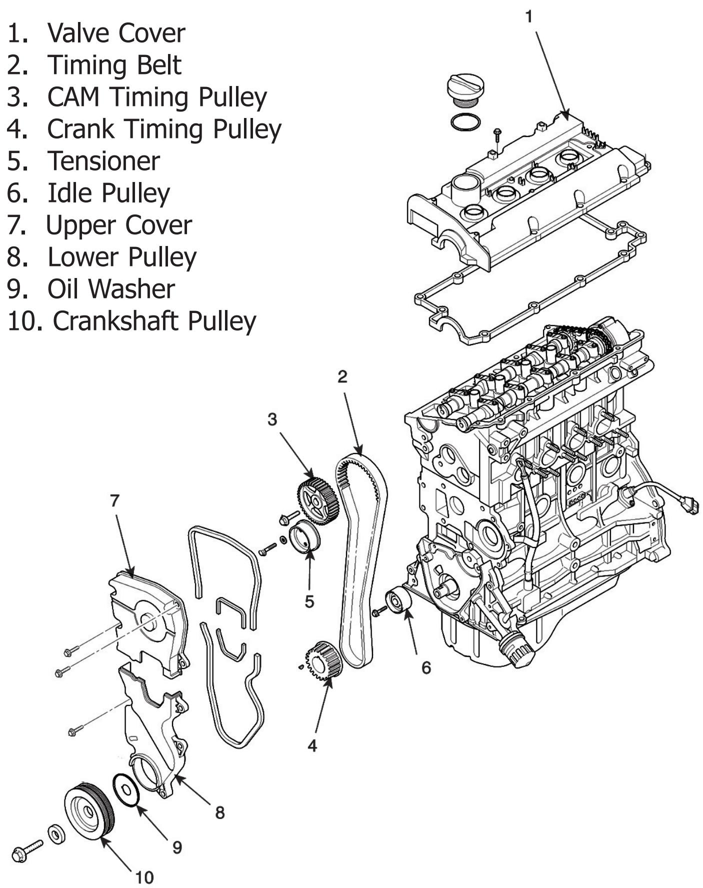
TIMING BELT

The timing belt is serviceable:

Federal & California:	Schedule 1 Normal:	Schedule 2 Severe:
Inspect, service if necessary	30 K miles	20 K miles
Replace (California replacement is only recommended)	60 K miles	40 K miles

The Beta 2.0L engine is interference type. Properly installed and timed timing belts are critical to long engine life. Timing belt tension is manually adjusted. There is no automatic tensioning to take up slack as the belt wears. The belt can be tightened manually if required.

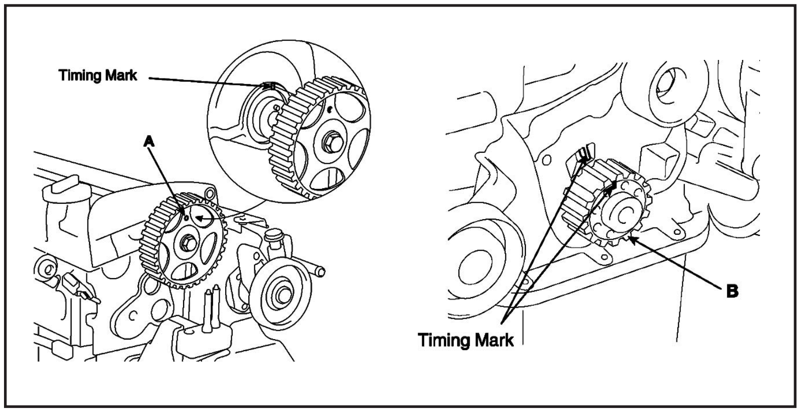
1. Valve Cover
2. Timing Belt
3. CAM Timing Pulley
4. Crank Timing Pulley
5. Tensioner
6. Idle Pulley
7. Upper Cover
8. Lower Pulley
9. Oil Washer
10. Crankshaft Pulley



The front of the CVVT 2.0L engine has a single bolt crankshaft pulley with an ignition timing mark on the timing cover. The timing belt has 1 crankshaft and 1 camshaft sprocket with a tensioner on the left and idler pulley on the right side. If timing belt is being reused, reinstall in the same rotational direction.

Note: Recommend for customer to use new belt when major engine repair is performed.

TIMING BELT TIMING

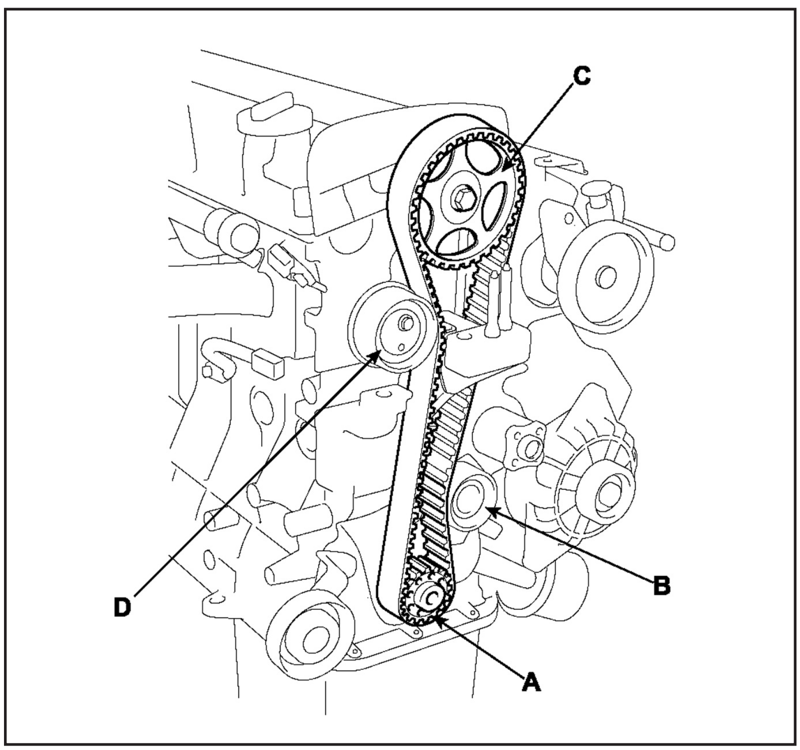


Crankshaft and Camshaft timing

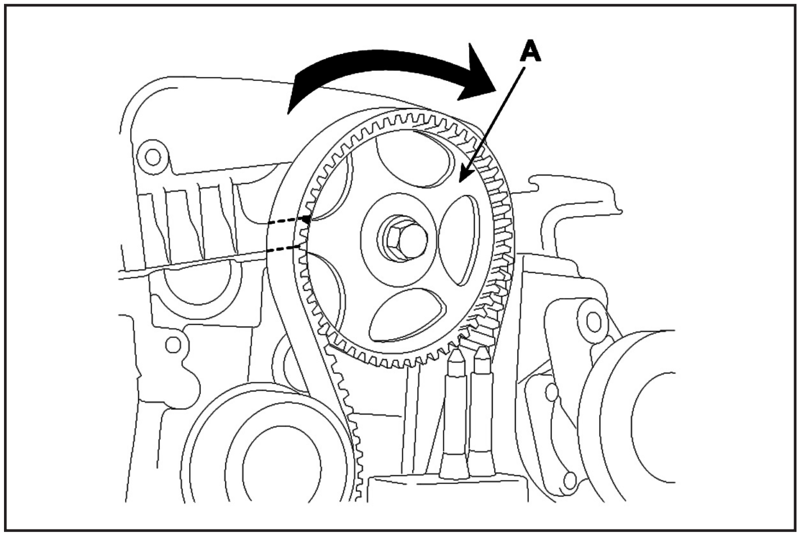
1. Align the timing marks of the camshaft sprocket A and crankshaft sprocket B with the #1 piston placed at TDC compression stroke.

Note: Set crankshaft a few teeth off TDC prior to rotating camshaft so pistons do not hit the valves.

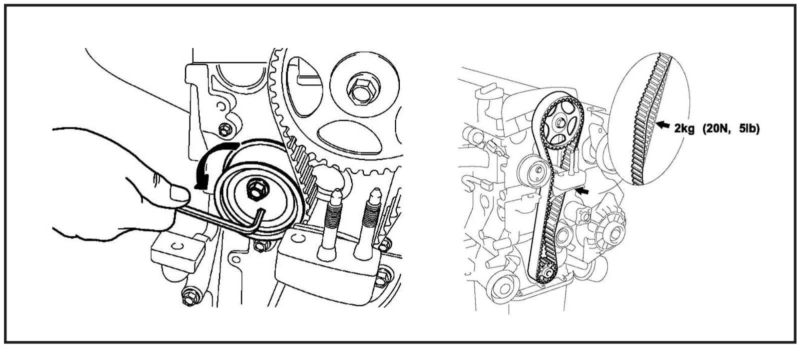
Caution: This is an interference engine. Pistons may bend valves when rotating the crankshaft without camshaft rotation.



2. Install and torque the idle pulley B. Install the belt tensioner D. Install the timing belt on the Crankshaft sprocket A then Idler Pulley B, then Camshaft Sprocket C and finally the timing belt tensioner D.

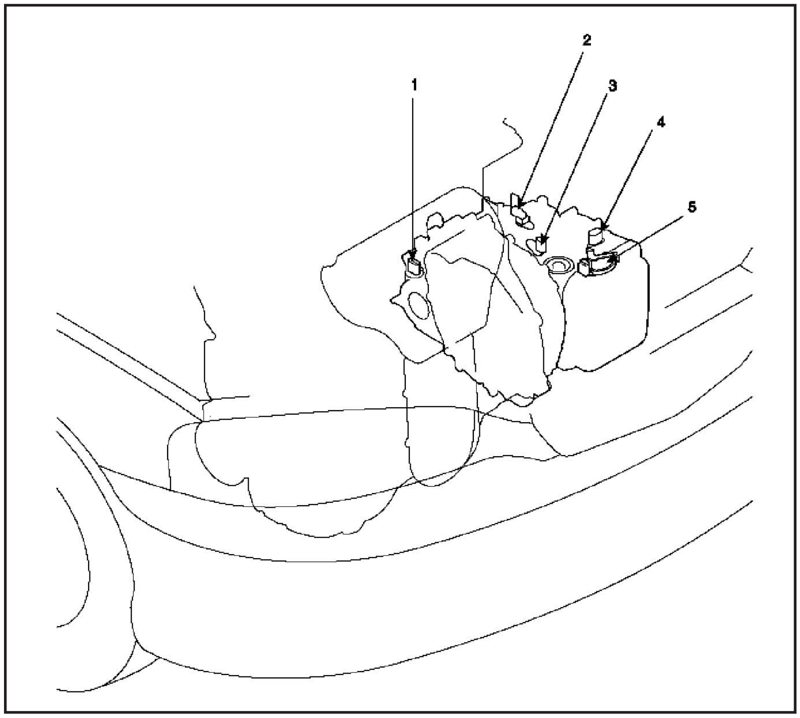


3. Rotate crankshaft in regular clockwise rotation until the camshaft sprockets has moved 2 teeth or 18°.



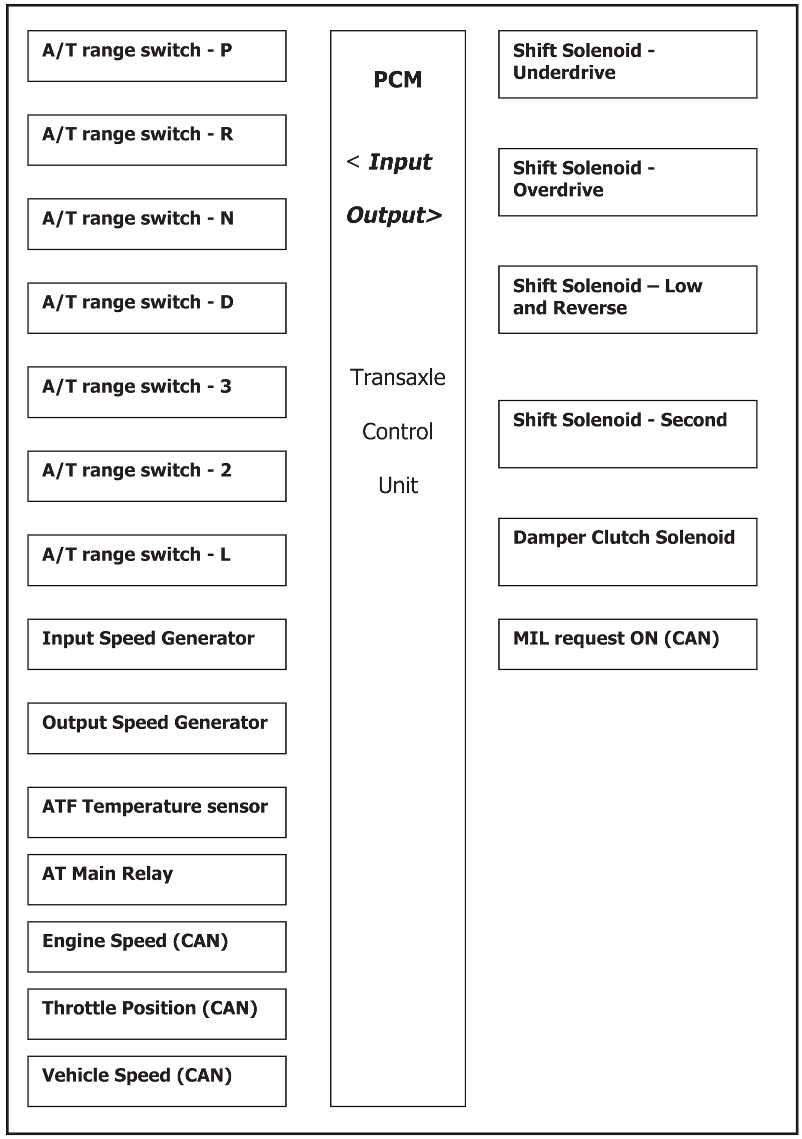
Rotate tensioner using 8mm allen wrench to give tension to the timing belt until tension side can be pushed by hand with approximately 5 lb pressure and belt flexes 1/8 to 1/4 inches (4 to 7mm). Tighten tensioner bolt. Rotate crankshaft two turns and recheck amount of flex and timing marks.

AUTOMATIC TRANSAXLE



The automatic transaxle has: (1) the vehicle speed sensor or VSS, (2) output shaft speed sensor, (3) input shaft speed sensor, (4) solenoid valve connector and (5) transaxle range switch.

The A/T uses 3 clutch sets (underdrive, reverse and overdrive clutch), and 2 sets of brakes (low/reverse and second brake). It has 2 simple planetary gear sets. It has shift modes of P-R-N-D-3-2-L. Brake pedal must be used to release shifter from P.Sliding shifter down from P, it will move directly to 3 passing D range.

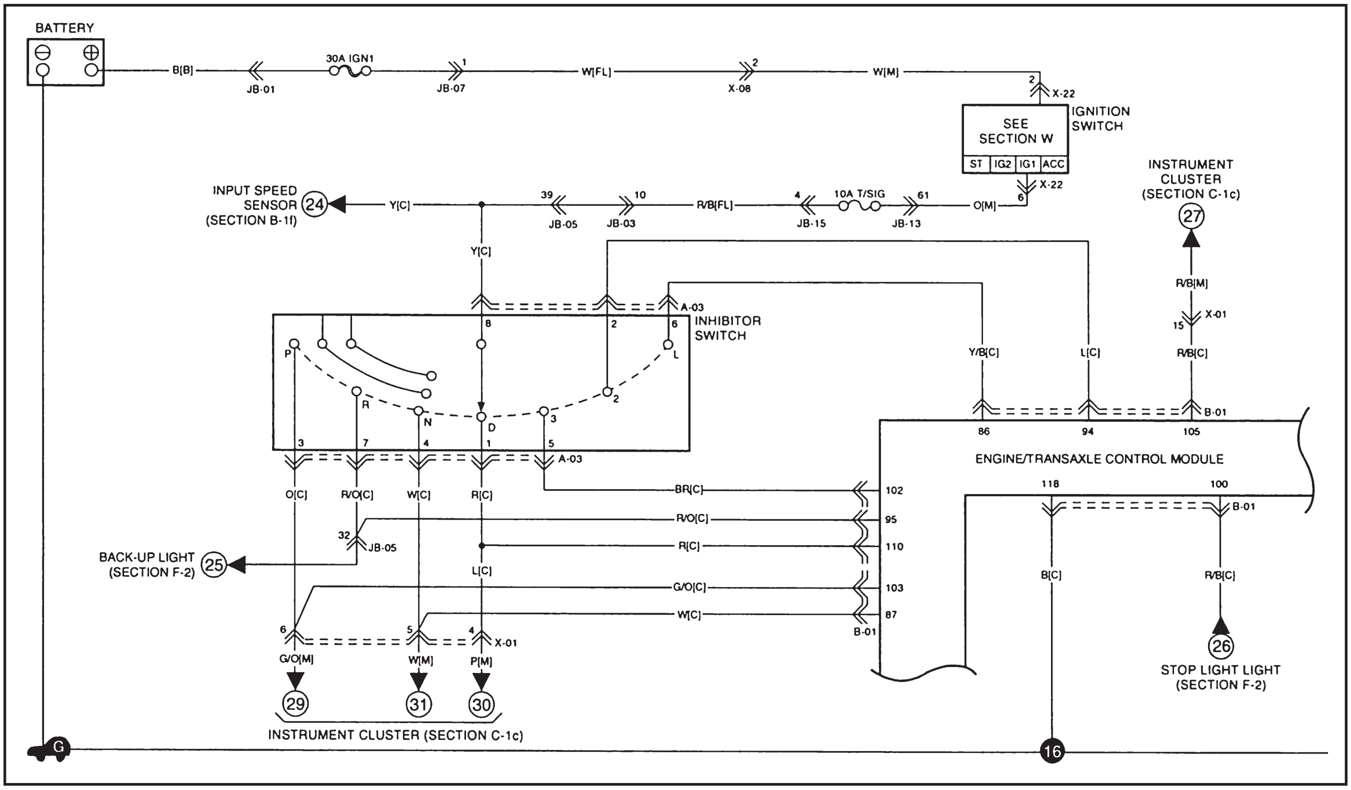


The inputs to the A/T side of the PCM include the driver shifter/range switch, input and output speed sensor, A/T oil temperature, and A/T control relay for shift solenoids A to D.

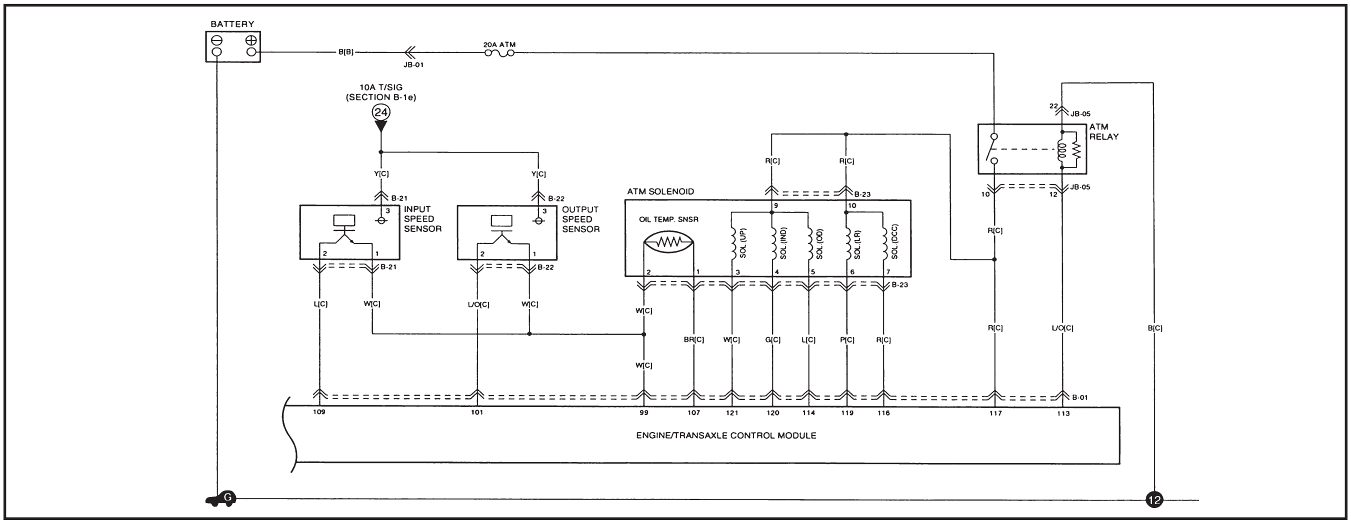
Output controls include the ground side of shift solenoid A, B, C, and D and the TCC solenoid.

When self-diagnostic test fails and a DTC is set, the PCM turns the MIL ONand the A/T goes into failsafe mode.

The 16-pin DLC connector, driver side under IP, provides valuable A/T operational information and diagnostic testing through the Hi-Scan Pro.



The inhibitor switch provides the driver selection to the PCM and IP, including back up lamps. It is powered from the IG1 circuit.



The PCM turns ON the ATM relay when engine is running to provide B+ power to the 5 solenoids. These solenoids are controlled by the PCM on their groundside. The solenoids can be activated by the HSP and resistance checks can be performed on the coils. See KSIS for further information.

A/T Diagnosis work sheet (TSB #3 Transmission Group, June 2003) is used to diagnose transmission and transaxle concerns. It can be downloaded and printed from the service page at Kdealer.net or KSIS.

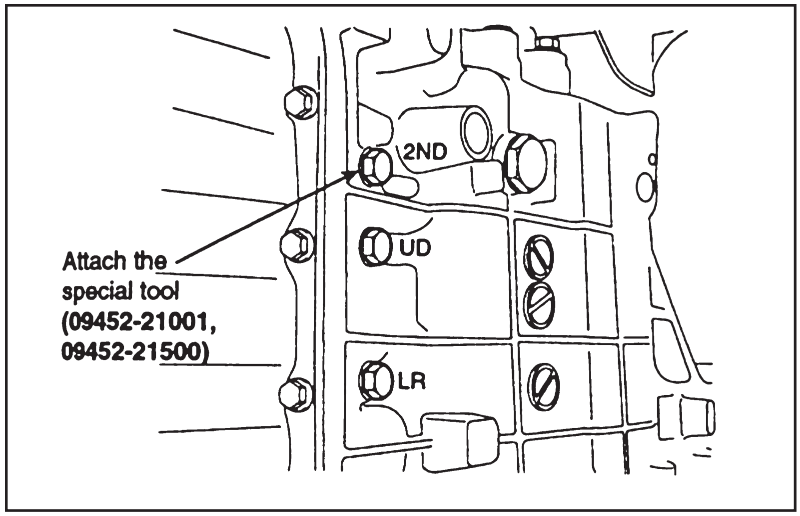
Note: TSB was released before the new Spectra release. The TSB used the 2000-2004 Spectra specifications from a different transmission. Use the Optima L4 P4A42 instructions until the TSB is revised.

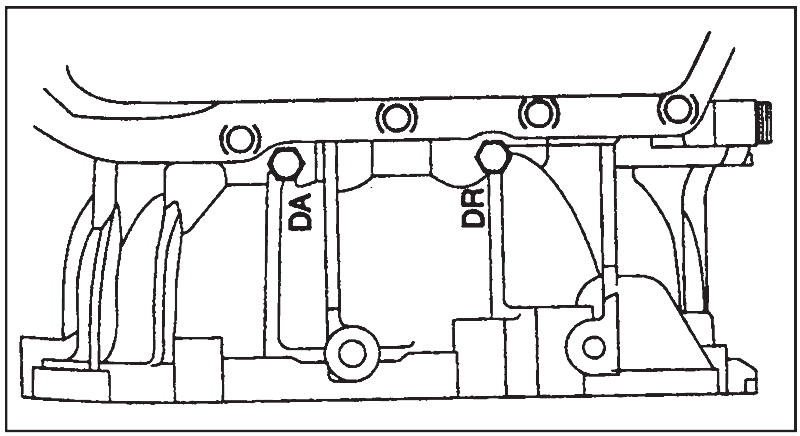
Refer to KSIS for the 2004.5 Spectra specifications.

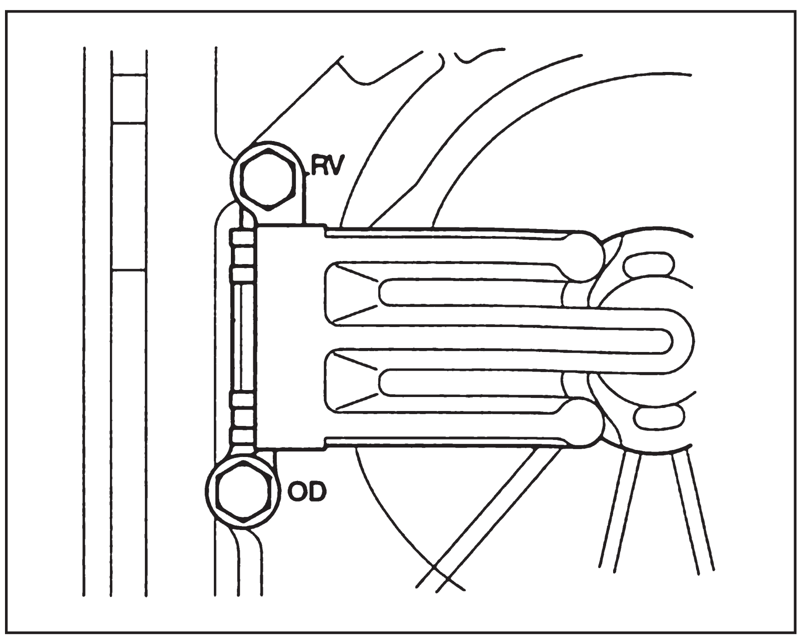
The Hi-Scan Pro is used to read the DTCs. Then follow the diagnostic procedures in KSIS for the code. A maximum of 8 DTCs, in the sequence of occurrence, can be stored in the PCM Random Access memory (RAM). A DTC will not be stored twice; only the most resent will be stored. If the number of DTCs exceeds 8, the oldest code will be erased. The codes should be erased using the HSP, but a battery disconnect will clear all codes. A battery disconnect will also clear the adaptive memory creating short-term shift quality concerns.

If the DTC parameters call for putting the A/T in failsafe mode, the PCM releases the ground on all shift solenoids rendering 3rd gear. Only 3 of these fail-safe codes can be stored in the RAM. Fail-safe is cancelled when the ignition key is turned OFF.

A total of 8 diagnosis codes and 3 fail-safe codes can be memorized in RAM.







Hydraulic pressure test can be performed at each of the ports. Connect the AT pressure gauges to the ports shown in the photos. ATF must be at operating temperature.

Pressure Port		UD	RV	OD	LR	2nd	DR	DA
Shift Selector:	Shift Position:	UD Clutch	Reverse Clutch	OD Clutch	Low & Reverse	2nd Brake	DC Release	DC Apply
P					260- 340		220-360	
R	Rev		1270- 1770		1270- 1770		500-700	
N	Neutral				260- 340		220-360	
D	1st	1010-1050			1010- 1050		500-700	
	2nd	1010- 1050				1010- 1050	500-700	
	3rd	780- 880		780- 880			450-650	750
	4th			780- 880		780-880	450-650	750

Hydraulic Pressure Test with ATF at >176° F and engine RPM at 2,500.

Measure the hydraulic pressure at each port, at each shift position given above, and at 2500 RPM. Check that the measured values are within the standard valve range. If outside the range, refer to the A/T TSB on KSIS.

Pressure given in PSI
Based upon Optima A/T

SUMMARY

The 2004.5 Spectra is equipped with a 2.0-liter Beta engine, which has a Continuous Variable Valve Timing (CVVT) system to improve engine performance and emissions. The CVVT retards or advances intake camshaft timing based on engine RPM and load.

The standard transmission on the new Spectra is the new 5-speed with Overdrive M5BF2 Model Manual Transaxle. It uses a hydraulic actuated clutch.

A 4-speed F4A42 automatic transaxle, with a Siemens PCM, is optional. The Siemens PCM uses an adaptive learning and memory system to tailor shift characteristics on the driver's driving pattern to improve customer satisfaction.

In this module you have learned about the operation of new engine sub systems, their location, and operation of these components. Additionally, we covered the vehicle's manual transaxle and optional automatic transaxle. Finally, you have learned about diagnosis, repair, and adjustment of these components.

PROGRESS CHECK

1. Technician A states that the Spectra 2.0L CVVT engine uses an oil temperature sensor to measure oil density for proper valve timing during cold weather operation. Technician B states that heavier weight oil is used in the CVVT engine to assure variable valve timing is accomplished. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

2. Technician A states the CVVT engine has a better power curve, lower emissions and better fuel economy than a fixed cam timed engine. Technician B states that the CVVT engine has higher compression ratio than the 2004 Spectra, increased displacement and mythical valve lifters. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

3. Technician A states that the CVVT engine uses a timing belt for both intake and exhaust valve operation. Technician B states that the exhaust camshaft is belt driven while the intake camshaft is chain driven. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

4. Technician A states the CVVT engine has Hydraulic lash adjusters that require adjustment. Technician B states that the CVVT engine uses Mechanical lash adjustors that do not require adjustment other than during reassembly. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

5. Technician A states that the PCM controls valve timing through the OCV based on load and RPM. Technician B states that an Oil Control Valve (OCV) and solenoid controls valve timing by varying the timing chain drive length. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

6. The CVVT engine has two oil filters.

   A. True

   B. False

7. Technician A states that the CVVT engine uses shims to adjust the valve lash on its lifters. Technician B states that the CVVT uses tappet adjustment screws to adjust valves. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

NOTES:

NOTES:

NOTES:

ANSWER KEY:
1. A 2. A 3. B 4. D 5. A 6. A 7. A

ASE CERTIFIED

WE SUPPORT
VOLUNTARY TECHNICIAN
CERTIFICATION THROUGH

National Institute for
AUTOMOTIVE SERVICE EXCELLENCE

Powertrain

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.05

Guided Practice

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, you will be given the opportunity to perform engine-related service and diagnostic procedures.

MODULE OBJECTIVES

Objectives of this module are for you to demonstrate your ability to:

- Perform timing belt service and camshaft timing specifications and procedures obtained from KSIS.
- Test the Oil Control Valve (OCT)
- Obtain current data for the Oil Control Valve (OCV) and Continuously Variable Valve Timing (CVVT) system using the Hi-Scan Pro.
- Use KSIS to list valve clearance adjustment steps
- Measure and record Valve clearance For TDC #1.
- Use Special Service Tool to remove shim and measure shim.
- Locate, measure, and record engine ground cable and voltage drop.

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- 2004.5 Spectra
- 2004.5 Spectra (LD) or LD engine
- #2 pencil or preferred writing instrument
- Hi-Scan Pro
- DVOM and appropriate jumper leads
- KSIS with Log/Sign On
- Valve Adjustment Special Service Tool (SST)
- DVOM
- Micrometer and Feeler Gauge (min .0006")

TIME TO COMPLETE

This module will take approximately 30 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the information you have learned in the Powertrain theory module. Under the supervision of a trained Kia service training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

TABLE OF CONTENTS

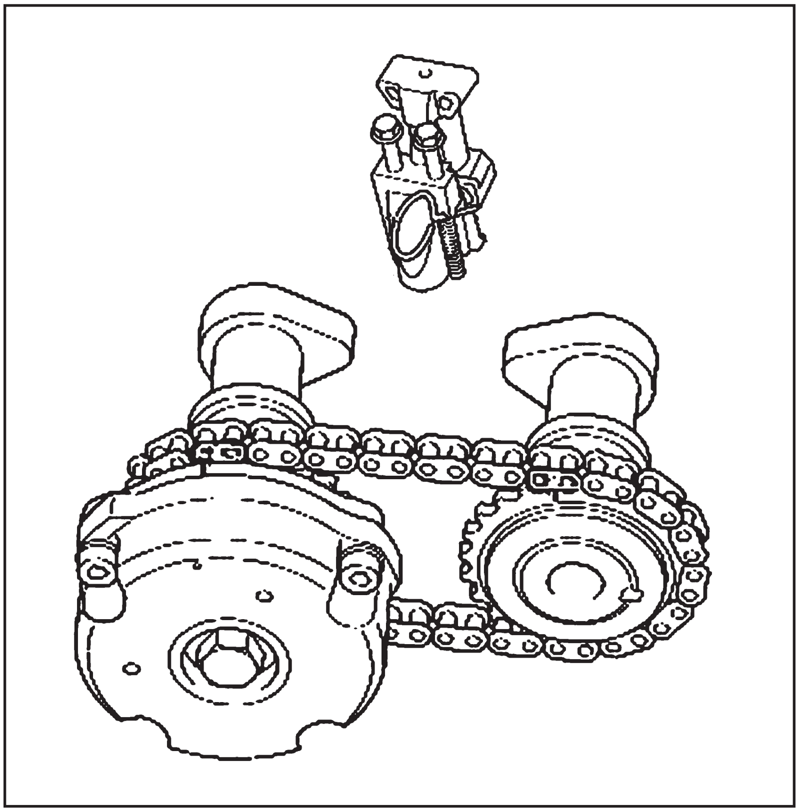
Total Possible Points: 15

TIMING BELT SERVICE AND CAMSHAFT TIMING

Total Possible Points: 3

Enter KSIS using your sign on, and use KSIS or your student guide as resource material to:

CAM SHAFT TIMING



- List Key steps to install and time CVVT intake and exhaust camshafts including the tensioner:

  ____

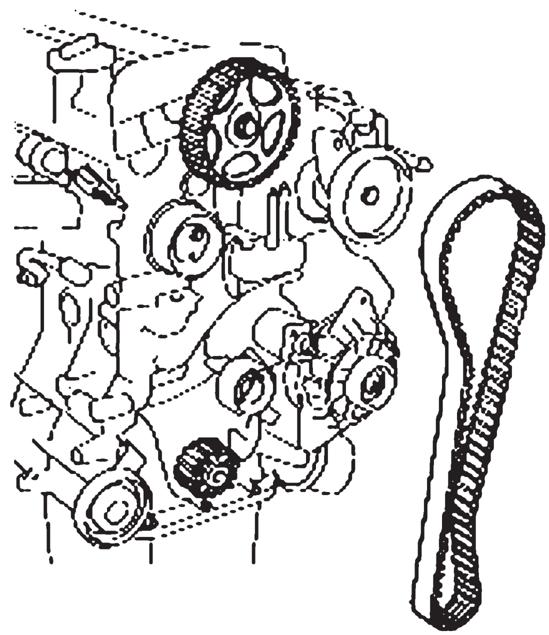
  ____

  ____

  ____

  ____

TIMING BELT SERVICE



- When installing a timing belt, list position of:
- Camshaft Pulley: ______________________________
- Crankshaft pulley: ______________________________

- List order (pulley sequence) in which the belt is installed.

____
____
____
____
____

- List the procedures to adjust the timing belt and lock down the timing belt adjustor:

____

- What is the timing belt deflection specification?

____

- List any other steps that are needed for completion of the timing belt replacement.

____
____
____

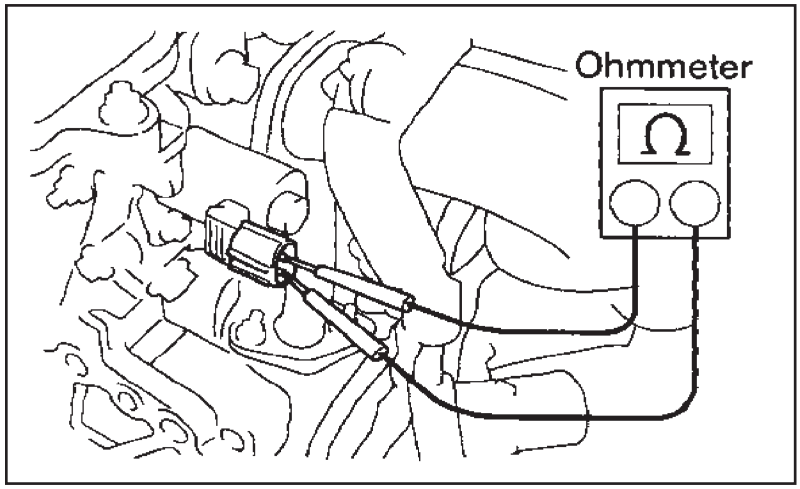
TESTING OCV AND CVVT SYSTEM

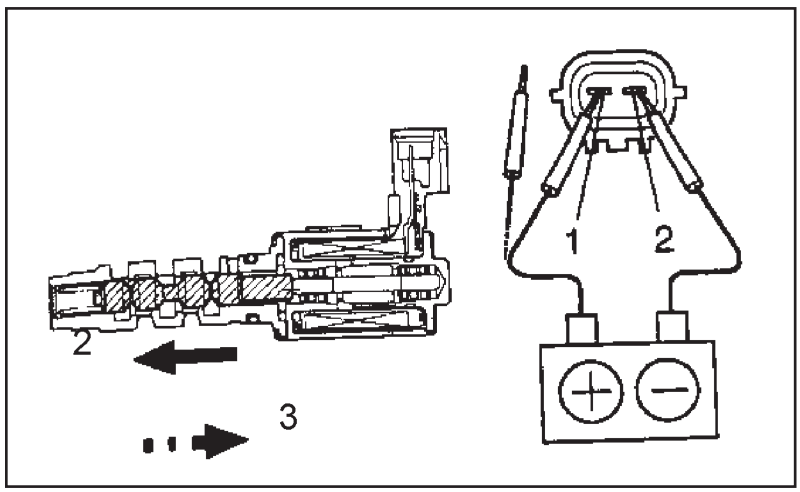
Total Possible Points: 4

Check the Resistance of the Oil Control Valve (OCV)

1. Disconnect OCV connector
2. Measure resistance of OCV
   a. Results: ______________________________
   b. Specification: 6.9-7.9 Ohms @ 68° F

OIL CONTROL VALVE





Check the operation of the OCV if OCV is removed from the cylinder head. If not go to the next test:

1. Connect Battery Voltage
   a. Did Spool move towards #2? ______
2. Disconnect Battery Voltage
   a. Did Spool return (#3)? ___________

CVVT TROUBLESHOOTING PROCEDURE

1. Start the engine, idle speed

Record the operating condition of the engine at idle:

____

2. Perform the tests procedures shown in the chart below at idle speed

Record the operating condition of the engine with the

	Perform:	Test:	
1.	Disconnect the OCV Connector	Check the engine operating condition at idle, record below	Checks the CVVT position at maximum retard
2.	Connect battery Voltage (+/-) to the OCV connector	Check the engine vibration and engine stop at idle condition, record results below	Checks the CVVT movement to advance position

OCV disconnected (maximum retard):

____

Record the operating condition of the engine with battery voltage applied to the OCV (maximum advance):

____

Record below your comparison of the three conditions:

____

Using the Hi-Scan Pro, select current data view for the OCV.

List current data available and it's data for the CVVT system at:

Idle:

____

____

____

____

2000 RPM:

____

____

____

____

ADJUSTING AND MEASURING VALVE CLEARANCE PROCEDURES

Total Possible Points: 5

Below are the valve lash specifications.
Measure Valve Clearance on CVVT engine:

ECT: 68° F

Specification:

Intake: 0.0079”

Exhaust: 0.0110”

Limit:

Intake: 0.0067-0.0091”

Exhaust: 0.0098-0.0122”

1. Using the adjusting shim selection chart (Exhaust), determine the new shim needed so that the valve clearance comes within the specified value, if the:

   Measured valve clearance of: 0.0280”

   Thickness of removed shim: 0.0882”

   New shim thickness: ____________________

   (See shim chart on the next page)

2. Using your 2.0L Valve Inspection and Adjustment sheet, review the key steps to remove a shim. Make any notes below as you perform the procedures:

   ____

   ____

   ____

3. Remove the valve cover.
4. Set #1 cylinder to TDC compression
5. Measure valve clearances for TDC #1 and record your measurements:

   #1 Intake = ______________

   #1 Exhaust = ______________

   #2 Intake = ______________

   #3 Exhaust = ______________

6. Using the valve SST, remove a shim.
7. Measure the removed shim with a micrometer and record the findings: _________________________
8. Re-install the shim and valve cover, if necessary.

Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in) / Measured clearance mm (in)		2.00(0.0787)	2.02(0.0795)	2.04(0.0803)	2.06(0.0811)	2.08(0.0819)	2.10(0.0827)	2.11(0.0831)	2.12(0.0835)	2.13(0.0839)	2.14(0.0843)	2.15(0.0846)	2.16(0.0850)	2.17(0.0854)	2.18(0.0858)	2.19(0.0862)	2.20(0.0866)	2.21(0.0870)	2.22(0.0874)	2.23(0.0878)	2.24(0.0882)	2.25(0.0886)	2.26(0.0890)	2.27(0.0894)	2.28(0.0898)	2.29(0.0902)	2.30(0.0906)	2.31(0.0909)	2.32(0.0913)	2.33(0.0917)	2.34(0.0921)	2.35(0.0925)	2.36(0.0929)	2.37(0.0933)	2.38(0.0937)	2.39(0.0941)	2.40(0.0945)	2.41(0.0949)	2.42(0.0953)	2.43(0.0957)	2.44(0.0961)	2.45(0.0965)	2.46(0.0969)	2.47(0.0972)	2.48(0.0976)	2.49(0.0980)	2.50(0.0984)	2.51(0.0988)	2.52(0.0992)	2.53(0.0996)	2.54(0.1000)	2.56(0.1008)	2.58(0.1016)	2.60(0.1024)	2.62(0.1031)	2.64(0.1039)	2.66(0.1047)	2.68(0.1055)	2.70(0.1063)	2.72(0.1071)	2.74(0.1079)	2.76(0.1087)
0.000-0.020	(0.0000-0.0008)																					1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.021-0.040	(0.0008-0.0016)																			1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	10	10	11	11	12	12	13	13	14
0.041-0.060	(0.0016-0.0024)																	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	11	11	12	12	13	13	14	14
0.061-0.080	(0.0024-0.0031)															1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	11	11	12	12	13	13	14	14	15
0.081-0.100	(0.0032-0.0039)													1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	11	11	12	12	13	13	14	14	15	15
0.101-0.120	(0.0040-0.0047)											1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	12	12	13	13	14	14	15	15	16
0.121-0.140	(0.0048-0.0055)									1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	13	13	14	14	15	15	16	16
0.141-0.160	(0.0056-0.0063)							1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	13	13	14	14	15	15	16	16	17
0.161-0.180	(0.0063-0.0071)						1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	14	14	15	15	16	16	17	17
0.181-0.199	(0.0071-0.0078)					1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	14	14	15	15	16	16	17	17	18
0.200-0.360	(0.0079-0.0142)																																																													
0.361-0.380	(0.0142-0.0150)	3	4	4	5	5	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	18	18	19	19	20	20				
0.381-0.400	(0.0150-0.0157)	4	4	5	5	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	19	19	20	20					
0.401-0.420	(0.0158-0.0165)	4	5	5	6	6	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	19	19	20	20						
0.421-0.440	(0.0166-0.0173)	5	5	6	6	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	20	20							
0.441-0.460	(0.0174-0.0181)	5	6	6	7	7	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	20	20								
0.461-0.480	(0.0181-0.0189)	6	6	7	7	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20									
0.481-0.500	(0.0189-0.0197)	6	7	7	8	8	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20										
0.501-0.520	(0.0197-0.0205)	7	7	8	8	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20											
0.521-0.540	(0.0205-0.0213)	7	8	8	9	9	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20													
0.541-0.560	(0.0213-0.0220)	8	8	9	9	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20															
0.561-0.580	(0.0221-0.0228)	8	9	9	10	10	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																	
0.581-0.600	(0.0229-0.0236)	9	9	10	10	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																			
0.601-0.620	(0.0237-0.0244)	9	10	10	11	11	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																					
0.621-0.640	(0.0244-0.0252)	10	10	11	11	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																							
0.641-0.660	(0.0252-0.0260)	10	11	11	12	12	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																									
0.661-0.680	(0.0260-0.0268)	11	11	12	12	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																											
0.681-0.700	(0.0268-0.0276)	11	12	12	13	13	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																													
0.701-0.720	(0.0276-0.0283)	12	12	13	13	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																															
0.721-0.740	(0.0284-0.0291)	12	13	13	14	14	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																																	
0.741-0.760	(0.0292-0.0299)	13	13	14	14	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																																			
0.761-0.780	(0.0300-0.0307)	13	14	14	15	15	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																																					
0.781-0.800	(0.0307-0.0315)	14	14	15	15	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																																							
0.801-0.820	(0.0315-0.0323)	14	15	15	16	16	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																																									
0.821-0.840	(0.0323-0.0331)	15	15	16	16	17	17	18	18	18	18	19	19	19	19	20	20	20	20																																											
0.841-0.860	(0.0331-0.0339)	15	16	16	17	17	18	18	18	19	19	19	19	20	20	20	20																																													
0.861-0.880	(0.0339-0.0346)	16	16	17	17	18	18	19	19	19	19	20	20	20	20																																															
0.881-0.900	(0.0347-0.0354)	16	17	17	18	18	19	19	19	20	20	20	20																																																	
0.901-0.920	(0.0355-0.0362)	17	17	18	18	19	19	20	20	20	20																																																			
0.921-0.940	(0.0363-0.0370)	17	18	18	19	19	20	20	20																																																					
0.941-0.960	(0.0370-0.0378)	18	18	19	19	20	20																																																							
0.961-0.980	(0.0378-0.0386)	18	19	19	20	20																																																								
0.981-1.000	(0.0386-0.0394)	19	19	20	20																																																									
1.001-1.020	(0.0394-0.0402)	19	20	20																																																										
1.021-1.040	(0.0402-0.0409)	20	20																																																											
1.041-1.060	(0.0410-0.0417)	20																																																												

Exhaust valve chearance (cold) :
0.28 mm (Spec.), 0.20~0.38 mm (Limit)
Example : The 2.24 mm shim is installed, and the measured clearance is 0.450 mm.
Replace the 2.24 mm shim with a new No.11 shim.

New shim thickness mm (in.)

shim No.	Thickness		shim No.	Thickness	
1	2.00	(0.0787)	11	2.40	(0.0945)
2	2.04	(0.0803)	12	2.44	(0.0961)
3	2.08	(0.0819)	13	2.48	(0.0976)
4	2.12	(0.0835)	14	2.52	(0.0992)
5	2.16	(0.0850)	15	2.56	(0.1008)
6	2.20	(0.0866)	16	2.60	(0.1024)
7	2.24	(0.0882)	17	2.64	(0.1039)
8	2.28	(0.0898)	18	2.68	(0.1055)
9	2.32	(0.0913)	19	2.72	(0.1071)
10	2.36	(0.0929)	20	2.76	(0.1087)

HINT : New shims have the thickness in milimeters imprinted on the face

ENGINE GROUND TESTING

Total Possible Points: 3

Locate the primary engine ground cable and record its position:

___

Using a DVOM measure the voltage drop across it with the engine OFF and Key ON. Record the results:

___

Now measure the voltage drop across it with the engine running/ON. Record the results:

___

Return all equipment and clean up the work stations

NOTES:

NOTES:

NOTES:

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National Institute for
**AUTOMOTIVE
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EXCELLENCE**

KIA **Kia Motors America, Inc.** TT-NMLD204-IL-GP05

Driveability

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.06

Theory

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidate, Senior level, and Senior level candidate service technicians.

MODULE GOAL

The goal of this module is to explain 2004.5 Spectra engine management system certified to US and California emission standards

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify the following with 80% or greater accuracy:

- Zero Emissions Evaporative System including at least 3 new components of the system
- Wide Range Linear HO2S output is opposite to typical Zr02 HO2S
- 12-hole Fuel Injectors (SULEV)
- Fuel tank contains ORVR and fuel cap for reduced emission, with new style locking for fuel pump
- Iridium Plugs (SULEV) for use in leaner Air-Fuel mixture
- Front Catalytic Converter (CAT) 900 CPSI (SUEV) for better conversion and durability
- Diagnosis using the Hi-Scan Pro

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. In the module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Tools: Hi-Scan Pro w/LD software program

Components/Training aids:

SST: Various

Parts: B1S1 HO2S, Fuel Injector, SULEV, Spark Plug, Iridium

Vehicle: Spectra

Other: Preferred writing instrument

TIME TO COMPLETE This module will take approximately 20 minutes.

ACRONYMS

AFR: Air-Fuel Ratio

BOB: Break-Out-Box

CPSI: Cells Per Square Inch

ECM: Engine Control Module

HO2S: Heated Oxygen Sensor

PCM: Powertrain Control Module

SST: Special Service Tools

TCM: Transmission (A/T) Control Module

INTRODUCTION

Motor vehicles contribute volatile organic compounds (VOC) and oxides of nitrogen (N0x) to the atmosphere. These substances chemically react to form photochemical oxidant or smog. With stricter emissions standards for motor vehicles, emissions have improved over the years due to such items as higher technology engine management and emission systems.

The 2004.5 Spectra is equipped with a modern Siemens Powertrain Control Module (PCM) for driveability management and emission control when equipped with A/T. The PCM manages the engine and transaxle, monitors related systems and the On-Board Diagnostic (OBDII) system that proactively tests emission related systems and/or components.

The PCM receives input from sensors, processes the input, and controls actuators to maintain an average air/fuel ratio of 14.7:1 (stoichiometric), for the best possible treatment of emissions.

PURPOSE

The 2004.5 Spectra Engine Management System was designed to provide maximum power and fuel economy while meeting minimal exhaust emissions. The EMS has many components and functions, and the one most obvious to the driver is the Malfunction Indicator Lamp (MIL) or Check Engine Lamp (CEL). When the ignition key is first turned ON, the driver should see the MIL illuminates for bulb check. Illumination indicates proper operation before turning OFF. If the lamp does not illuminate or does not turn OFF, the system will need to be inspected.

This indicator lamp is part of the Engine Management System (EMS) that monitors various emission control systems and components. The lamp illuminating while driving or after performing the bulb check indicates that a potential problem has been detected somewhere in the emission control system.

Generally the Spectra will continue to be drivable but this MIL illumination serves as a warning to the driver that the vehicle requires the attention of a Kia technician.

Note: The owner's manual advises the fuel filler cap be tight because the MIL may illuminate.

The Spectra fuel system is designed for the driver to use only unleaded fuel with a minimum Octane Rating of 87 Anti-Knock Index (AKI). The Spectra engine and emission system can accept fuel with maximum of 10% ethanol (grain alcohol) and no methanol (wood alcohol). Using unapproved fuel type, the driver may notice drivability problems that may cause damage.

APPLICATION

The Kia Spectra uses a Siemens engine and automatic transmission management system. The following chart compares several driveability items between the 2003-2004 Spectra and 2004.5 Spectra.

		04.5 MY Spectra	'03-04MY Spectra
Engine		I4 (Beta) 2.0L DOHC	GT 1.8 DOHC
Emission standard		CAL : LEV-2 SULEV(PZEV),	ULEV
		FED : Tier-2 BIN4	(50 state)
Evaporative Emission		CAL : LEV-2 (Zero Evap),	Conventional
		FED : Tier-2 EVAP/ORVR	Evap.
PCM		Siemens EMS 2000	BOSCH
		AT : SIMK43 PCM	ECM
		MT : SIMK43 ECM	TCU
Monitoring Function	Catalyst	WU-TWC monitoring	←
	O2 sensor	Yes	←
	Misfire	Yes (Full range)	←
	Fuel system	Yes	←
	Evap system	0.02 inch	←
	Thermostat	Yes	←
	Comprehensive component	Yes	←
Comparison of Major Component	Upstream O2 sensor	Linear O2 sensor (NTK)	ZrO2 sensor
	Downstream O2 sensor	ZrO2 sensor	ZrO2 sensor
	Injector	FED : EV6 (Bosch)	EV6 (Bosch)
		CAL : 12-hole (Denso)	
	ISA (Flow rate)	ROSA (63m3/h)	EWD3-2 (50m3/h)
	CVVT	Yes	None

SPECIAL SERVICE TOOLS (SST)

The following new SSTs have been released for this vehicle:

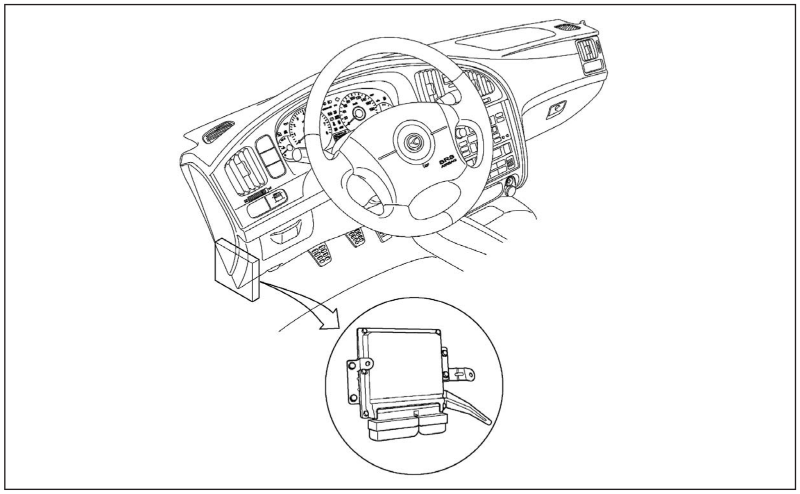
- BOB for PCM (ECM and TCM cable)
- Fuel Pressure Gauge Adapter
- Fuel Pump/Tank Wrench

SYSTEM OPERATION

Inputs (Sensor):	PCM:	Output:
Oxygen Sensors B1S1 B1S2		Ignition Fuel Injectors
MAF/IAT		Idle Speed Actuator
TPS		Main relay control
CKP	Engine Control	Fuel Pump Control
CMP		Cooling fan Control
ECT		MIL
Knock		Canister Purge Control
Tank Pressure Sensor		Canister Close Valve
CVVT Oil Temperature		A/C Relay
FRT RH WSS Valve (non-ABS) ABS (WSS)		CVVT Oil Control
VSS		
	CAN	
Inhibitor Switch		Solenoid UP Solenoid IND
Input Speed Sensor		Solenoid OD
Output Speed Sensor	Automatic	Solenoid LR
	Transaxle	Solenoid DCC
ATF Oil Temperature	Control	
		MIL request AT Relay

The engine management system consists of the Powertrain Control Module (PCM), and numerous inputs and outputs. The PCM has an internal Engine Control Module (ECM) and a Transmission Control Module (TCM). Both modules share inputs, process analog and digital signals, and communicate internally with each other through the Controller Area Network (CAN).

PCM INPUTS/OUTPUTS



The PCM receives inputs from many sensors to detect engine conditions. The PCM processes these inputs to control systems and actuators such as fuel injection, idle speed, ignition timing, fuel pump, A/C compressor clutch relay, fan relay, CVVT, evaporative emission controls, and A/T shifts.

PCM LOCATION

The Siemens PCM is located on the driver's side, under the dash, and has two connectors. One connector for engine management while the other is automatic transaxle. They conduct input from sensors and other electronic components. Based on this information received and software programmed into its processor, the controller outputs signals to the actuators. To perform these functions, the PCM generates a 5V reference signal that's used by several of the engine sensors and controlled actuators as shown in the diagram. Other actuators operate on system voltage. The PCM controls the actuators by switching on the groundside of the circuit.

ECM performs on-board diagnostics (OBD II) to identify when the vehicle may be exceeding federal test procedures (FTP) emission standards. When a system or component exceeds emission threshold or a component operates outside tolerance, a Diagnostic Trouble Code (DTC) will be stored and the MIL may be illuminated. The OBD II software controls all the monitors and interactions, DTC and MIL operation, freeze frame data, and Hi-Scan Tool (HSP) interface.

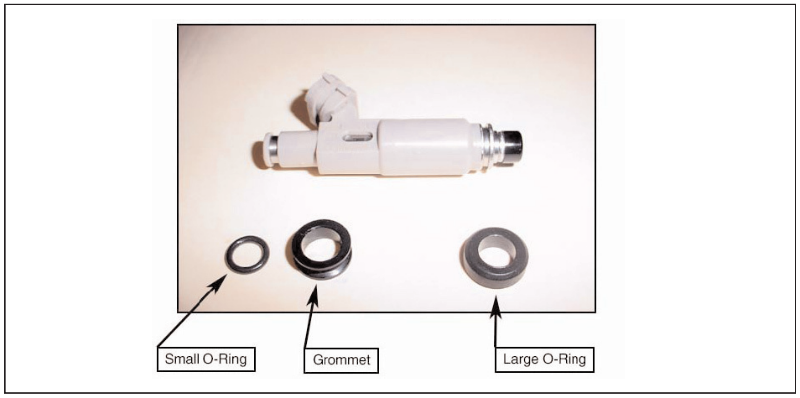
California emission certified 2004.5 Spectra vehicles meet the SULEV emission standard due to significant changes made to exhaust emission and adoption of CVVT and a zero evaporative emission system instead of a conventional evaporative system.

COMPONENT OPERATION

Component:	Function:
Fuel Injector	Changed to 12 multi-hole injector (SULEV)
Secondary Auxiliary Canister	Added a secondary charcoal canister to decrease bleed emissions
Liquid-Vapor Fuel	Changed the location to be built-in the fuel tank with vent valve to decrease vapor leak
Evaporative Hose Access to fuel pump	Changed to have 3-plies. Below rear seat and secured with a twist ring.
Air Flow Sensor	Hot film sensor
Spark Plug	Changed to Iridium (SULEV)
Oxygen Sensor B1S1 Catalyst System	Changed to Linear heated O2 sensor to precisely control the air/fuel mixture in a wide range Change to 900 CPSI (SULEV)

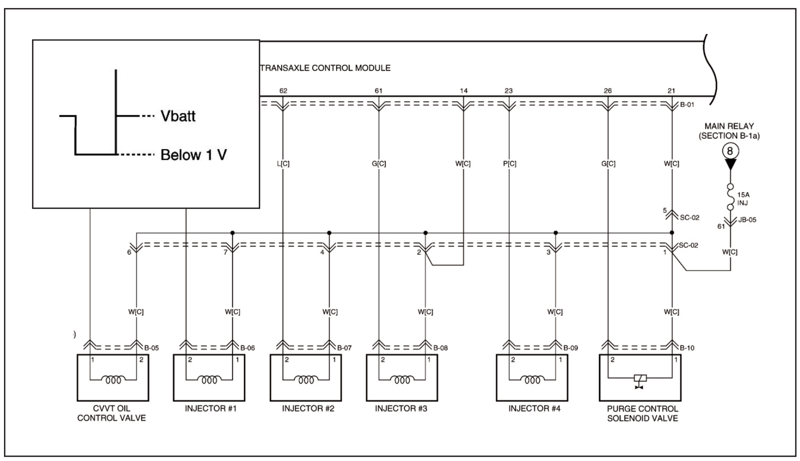
The chart lists driveability related items that changed in the Spectra. Note the changes relating to SULEV emission status. Each of these will be discussed in this module. The CVVT system is part of the Powertrain module.

FUEL INJECTOR

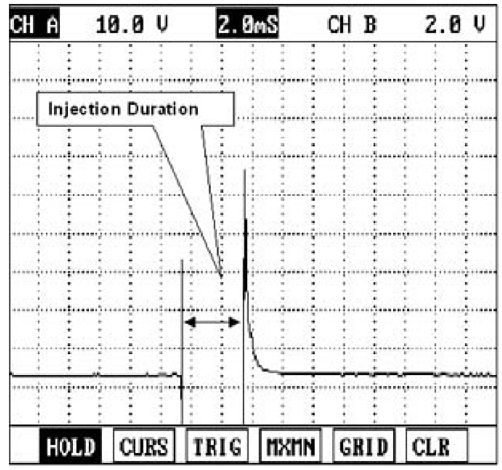


The Federal emission certified engine uses the Bosch EV6 6-hole fuel injector. The CA SULEV emission certified engine uses a new Denso 12-hole fuel injector. The Denso 12-hole injector allows for a more controlled and finer spray pattern. The injectors are high resistance type measuring 14 ohms at 70°F degrees.

Note: Fuel Injector Grommet and O-ring (small and large) should be inspected at 34k and replaced at 64K for SULEV, schedule 2 maintenance. If the injector does not rotate smoothly when installing, check the installation of the new O-ring.

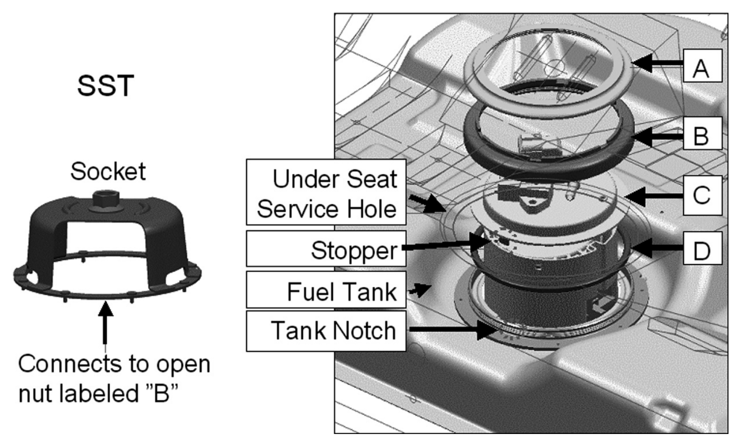


The fuel injector is a solenoid-operated valve controlled by the PCM. The amount of fuel being injected varies by the length of time the injector is held open. The fuel injectors are powered by the main relay through the 15A INJ fuse. The ECM controls the injectors by controlling the groundside of each injector circuit. By varying the amount of time each injector is activated (or grounded), the PCM can control the amount of fuel provided to each cylinder. Normally, the PCM fires the injectors sequentially following the same firing sequence as the ignition system.



When the ECM grounds the injector, the control circuit (system) voltage should theoretically be almost 0V (low). The voltage should peak for a moment when the circuit is opened (inductive spike) allowing the injector to close. The 12-hole SULEV injectors fire twice per crankshaft revolution compared to the 6-hole ULEV injectors that fire once per revolution. When the ECM detects an open or shorted injector, the related DTC will set but the ECM will not engage the limp home function.

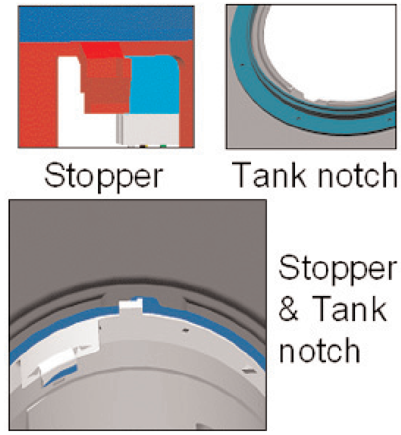
FUEL PUMP



Instead of the typical 8 or 9 screw fasteners to secure the fuel pump assembly into the tank, the 2004.5 Kia Spectra uses a lock ring. The following procedures are used to remove the fuel pump module, which includes the fuel filter:

1. Remove the rubber type seal cover "A."
2. Remove opening nut ring "B" by installing the SST, align the pins on the SST with the holes on the ring, twist with a socket and remove the ring.

3. Turn pump module “C” counter-clockwise until it stops (5o) and take out of the tank.
4. Remove O-ring “D” and inspect.



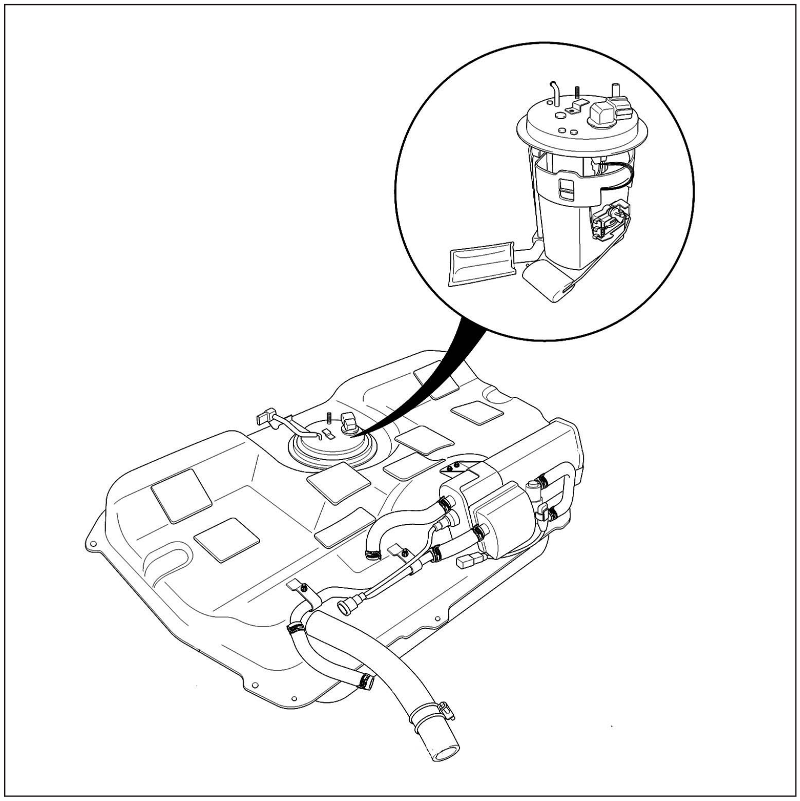
Installation is the reverse of removal:

1. Insert new O-ring into groove in fuel tank.
2. Insert pump module into tank, align stopper with tank notch, then turn the pump module clockwise until it stops.
3. Install opening nut and tighten finger tight. Then, tighten nut ring using the SST.
4. Install seal cover.

The fuel filter is located in the fuel tank attached to the fuel pump. Fuel Filter is a 37,500 miles service item.

Caution: Fuel Tank line is quick disconnect type. Squeezing the connector using fingers only. Hand tools will likely damage the connector.

EVAPORATIVE COMPONENTS



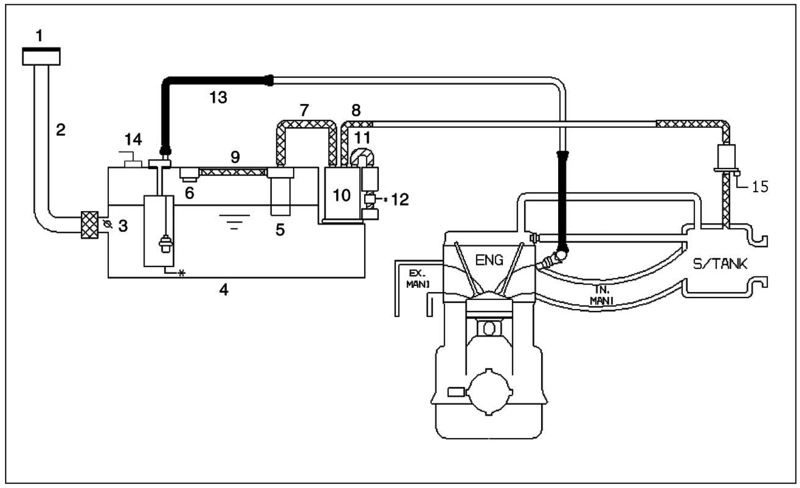
The fuel pump module includes the regulator for the non-return fuel supply, and fuel tank pressure sensor (FTPS). Also added in the tank are: fuel filler line leading to an in-tank one-way check valve at the base of the tank to reduce rollover spillage. Fill vent vapor separator valve to decrease vapor leak, and a new ORVR control valve to reduce fuel vapor emissions during refueling. These have all been moved to inside the tank to decrease hydrocarbon vapor leak.

A new style fuel cap for Kia will be used. This is the return fuel cap, designed to prevent cross threading when installing the cap after refueling. Insert fuel cap into the fuel filler neck and turn 1/4 turn clockwise, then turn until clicks are heard.

A new Auxiliary Canister has been added to decrease bleed emissions and works in conjunction with the evaporative canister; both are located to the rear right side of the fuel tank. A vapor hose runs from the main canister to the auxiliary canister.

The evaporative flexible fuel vapor lines have been changed to a 3-ply design. 3-ply hose must be used when replacing, and the number of hose joints has been reduced — both to reduce HC evaporative emissions.

EVAPORATIVE TESTING

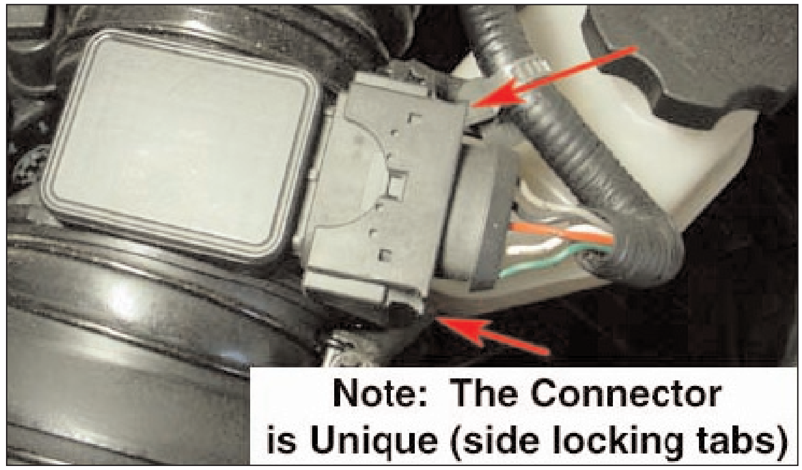


The 2004.5 Spectra fuel and evaporative system is designed with the following components:

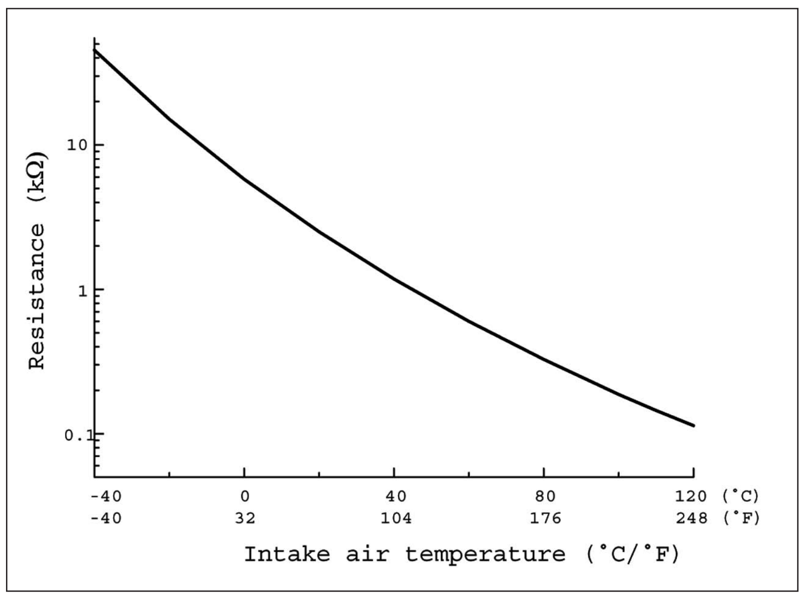
1. Non-threaded fuel cap	7., 8., 9. & 11. 3 ply evap-hose
2. Fuel filler pipe	10. Canister
3. Check valve (CCV)	12. Canister closed valve
4. Fuel Tank	13. Fuel feed line
5. ORVR control valve	14. Fuel tank pressure sensor (FTPS)
6. Vapor line	15. Purge canister solenoid valve (PCSV)

These changes on the SULEV lead to a zero emissions style evaporative emission system. The evaporative emission control monitoring system consists of fuel vapor generation and evacuation leakage check steps. The OBDII system checks if vapor generation due to low fuel temperature is low enough to start monitoring. Then it opens the PCSV to evacuate the evaporative system by ramping up the on or open time in order to maintain the vacuum level. The last check determines if there is a vacuum leak in the system.

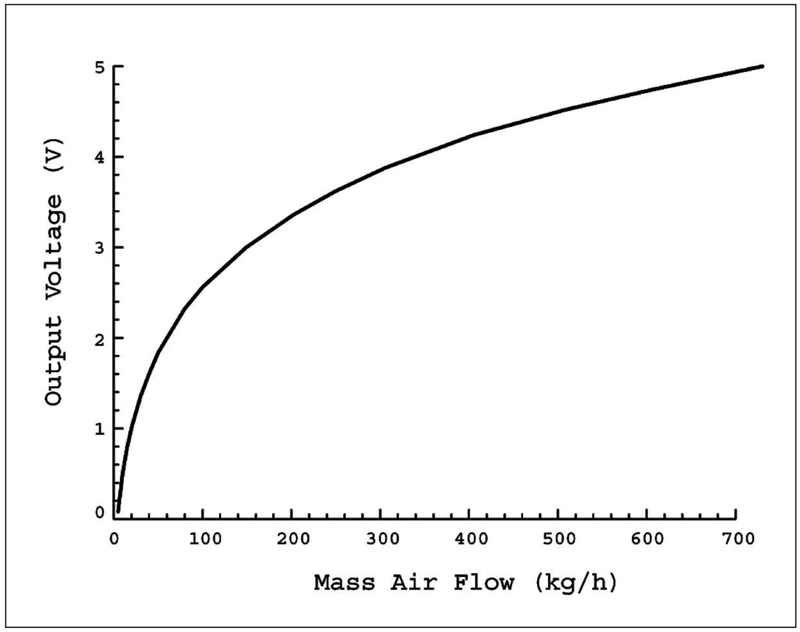
MASS AIR FLOW (MAF) AND INTAKE AIR TEMPERATURE (IAT) SENSORS



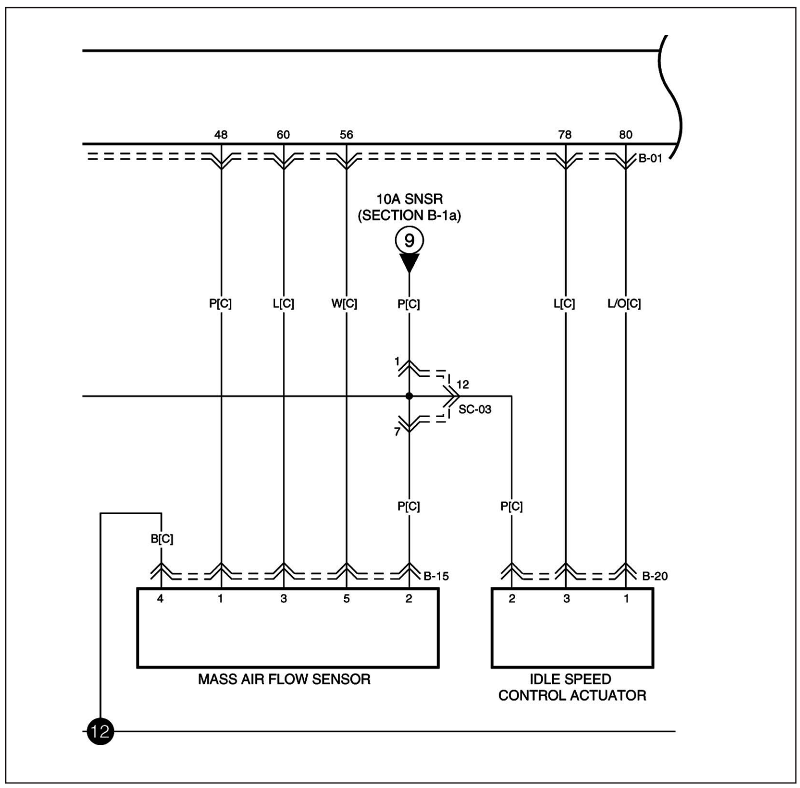
The Mass Air Flow (MAF) sensor is a hot film style sensor. MAF sensors provide more accurate mass airflow information to the ECM for precise engine control. It is located between the air filter box and throttle valve. The MAF connector's side unlocking tabs are new and unique. Press in on both sides at the same time to disconnect.



The Intake Air Temperature Sensor is still a thermistor (NC) built into the MAF sensor assembly. Both MAF and IAT share the same ground.



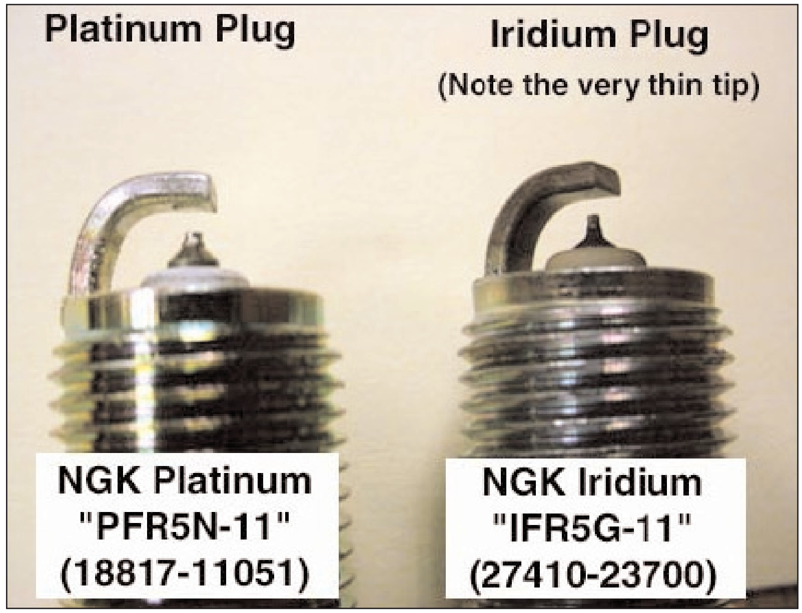
The MAP or air fuel sensor (AFS) feedback signal is based upon the air flowing across the hot wire.



The MAF recieves system voltage supplied by the main relay through the 10A "SNSR" fuse to MAF pin 2. Pin 4 is ground for MAF and IAT. Pin 1 is ECM ground, Pin 3 is MAF signal and Pin 5 is IAT signal.

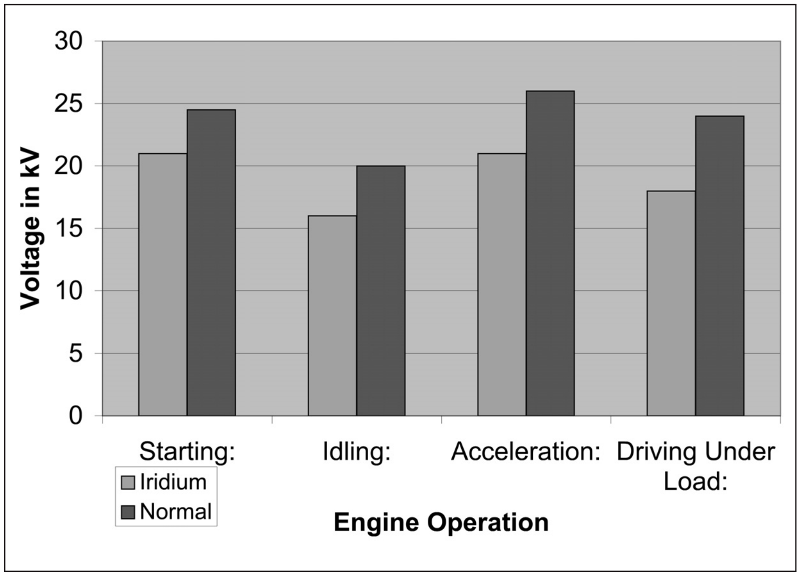
SPARK PLUGS

The SULEV engines use Iridium tip spark plugs. These plugs have more stable ignition during cold starts with a leaner air/fuel mixture, and longer durability. Federal emission vehicles (ULEV) use Platinum Plugs.

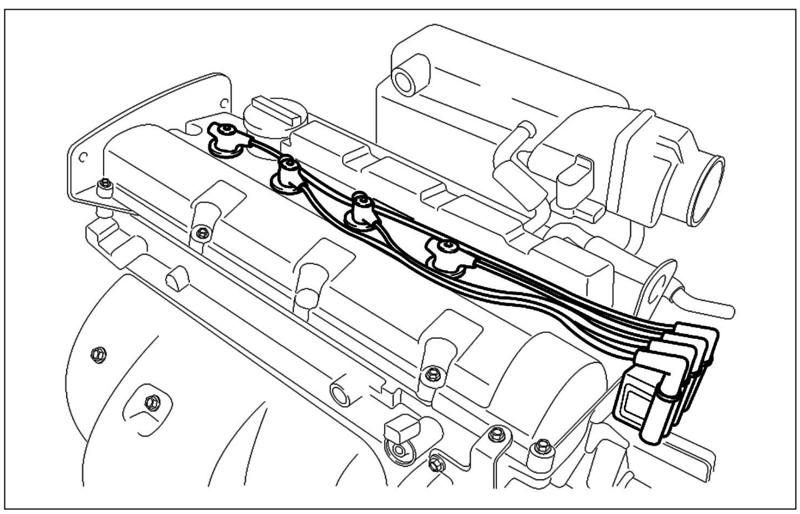


The very thin 1.1mm diameter center electrode tip on the iridium plug is a hard and strong alloy of Iridium and rhodium for increased oxidation wear resistance. This Iridium tip is melted to the nickel base of the plug with a 360-degree laser welding process for a reliable seal. The 0.4mm Iridium alloy tip has a very high melting point. The spark plug has a U-groove tip design that gives the flame a groove to grow in for a more complete combustion even in case of lean air-fuel mixture.

VOLTAGE REQUIREMENT



This chart represents the voltage required by both normal and Iridium power spark plugs to perform 4 engine-operating conditions. In all four cases the Iridium required less voltage. Using Iridium on the surface area of the center electrode causes it to be reduced. A typical platinum plug has a 1.1mm diameter center electrode while an Iridium plug may measure 0.4mm in diameter, decreasing the voltage requirements. The ignition coil also benefits by lower high voltage output demands and cooler operation.



The spark plugs are located on the top of the cylinder head and are accessed by removing the cover and ignition cables, which lead to 2 ignition coils on the right side of the head.

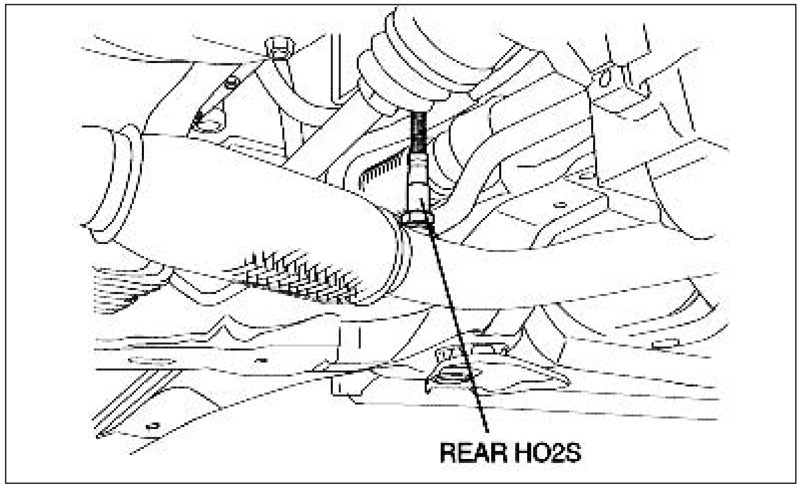
The ignition timing is controlled by the ECM. Ignition system diagnosis includes: checking primary and secondary ignition components (i.e. spark plugs), ignition cables, and coils through visual inspection; and resistance, and scope checks. Measurement specifications are on KSIS.

HO2S

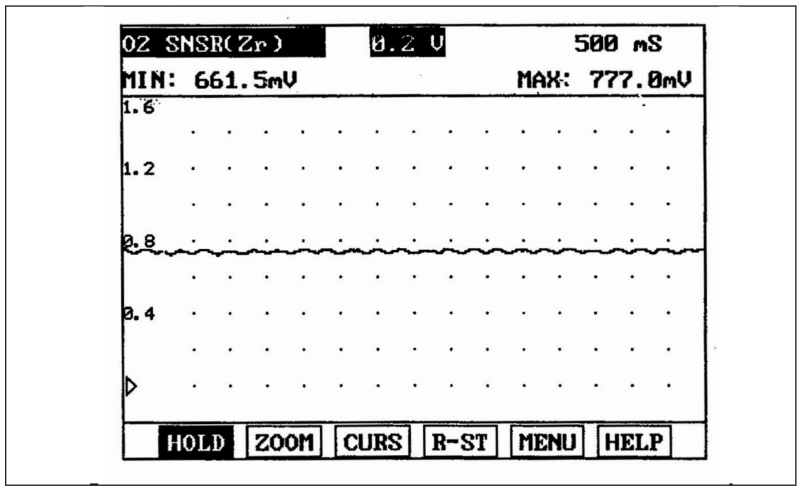
All OBDII vehicles use oxygen sensors for two purposes. Sensor 1 or front sensor provides a feedback signal to the ECM for air-fuel ratio control. Bank 2 or rear sensor is used to check catalytic converter efficiency. Kia vehicles in current production use conventional narrow range Zirconium (Zirconia) Dioxide HO2S that generate a 0 to 1V signal in response to the oxygen level measured in the exhaust stream.

Zirconium Dioxide HO2S is a Narrow Range Oxygen Sensor that does not output a linear response to changes in exhaust oxygen content. Rather, the sensor's voltage output goes sharply higher than .5V when the air-fuel mixture is considered rich and when under .5V is considered lean. Thus every time the voltage crosses over the mid-voltage (.5V), the signal indicates to the PCM a switch from rich to lean or lean to rich depending upon the O2 content in the exhaust.

NARROW RANGE HO2S



The 2004.5 Spectra only uses this type (Zirconia) of HO2S for its sensor 2, or rear sensor. It's mounted after the catalytic converter in the rear exhaust pipe.



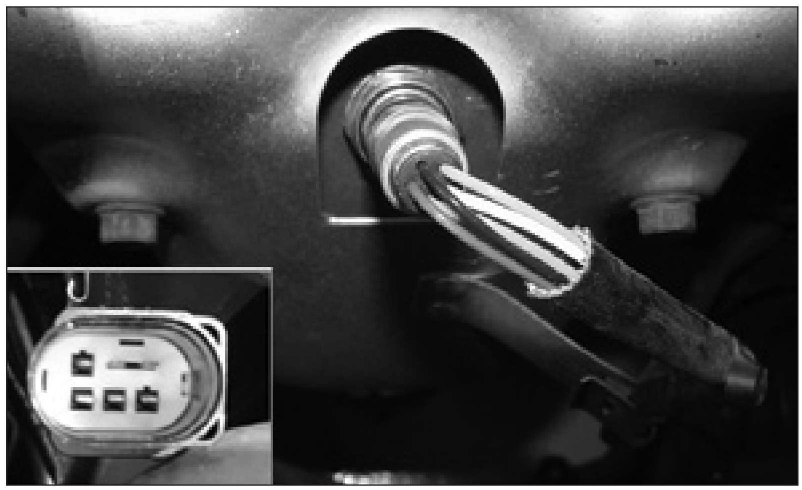
Sensor 2 provides feedback to the PCM estimating the converter's oxygen storage capability and monitoring catalytic converter efficiency. The rear sensor signal will also fluctuate in the 0 to 1V range. Once the catalyst has reached its operating temperature, the sensor's output should change minimally because the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalytic converter.

If the sensor 2 signal fluctuates similar to the front HO2S, it's an indication that the catalytic converter is not at operating temperature or is malfunctioning due to aging, poisoning, or misfiring. A signal graph, such as above, can be obtained using the Hi-Scan Pro. The exhaust should be checked using a 4- or 5- gas analyzer.

Review of a typical Zirconia HO2S:

- Used on most Kia vehicles
- Works essentially like a switch
- Only determines IF the AFR is rich or lean
- Rich condition is a high output voltage (<1V)
- Lean condition is a low output voltage (>0V)
- The voltage signal can be measured and graphed on Hi-Scan Pro.

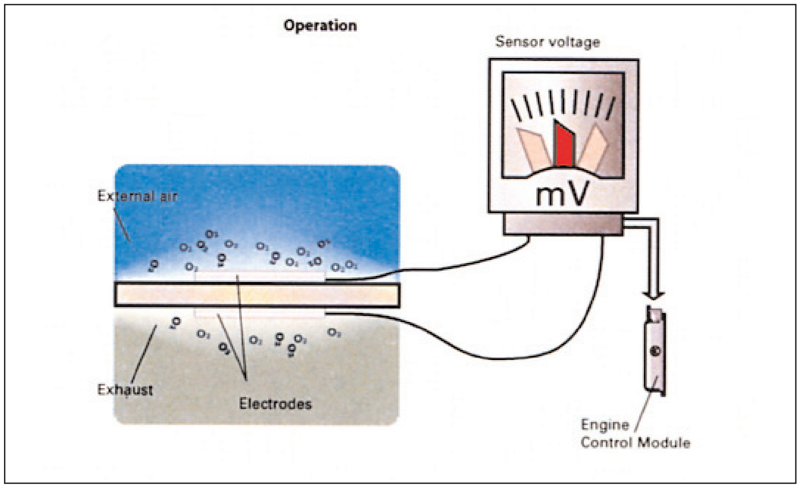
WIDE RANGE HO2S



The Sensor 1, front HO2S, used on the 2004.5 Spectra 2.0L engine is a linear oxygen sensor mounted on the front side (upstream) of the catalytic converter in the exhaust manifold. This the first Wide Range or Broadband sensor used by Kia. It's sometime referred to as a 5-wire HO2S due to the number of wires at the sensor feeding into a 6 pin connector.

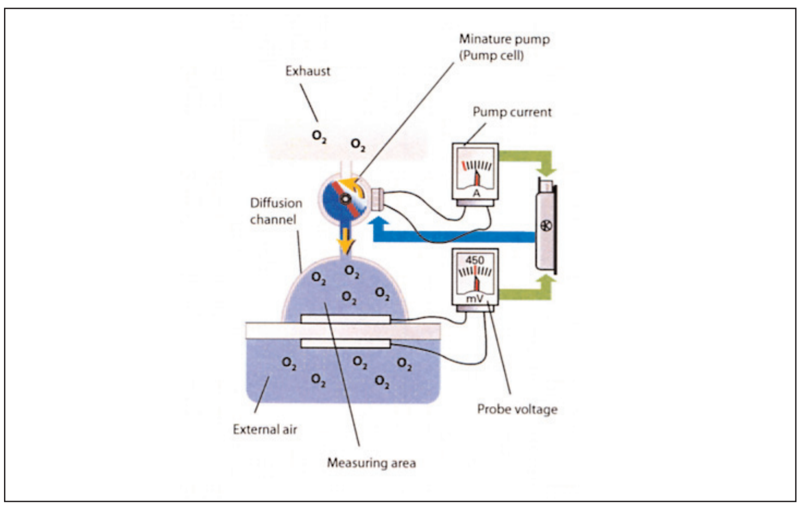
The PCM uses the signal from the wide range HO2S for air-fuel management (control). As the air-fuel (A/F) mixture richens or leans, the change in oxygen content in the exhaust causes the wide range oxygen sensor to modify a PCM-supplied current. This change in current is almost linear and can be used by the PCM to identify the oxygen content and therefore the A/F ratio. Inside the sensor, this current is used to pump exhaust gas across a sensing cell and allows larger range of A/F mixtures.

Typical H02S



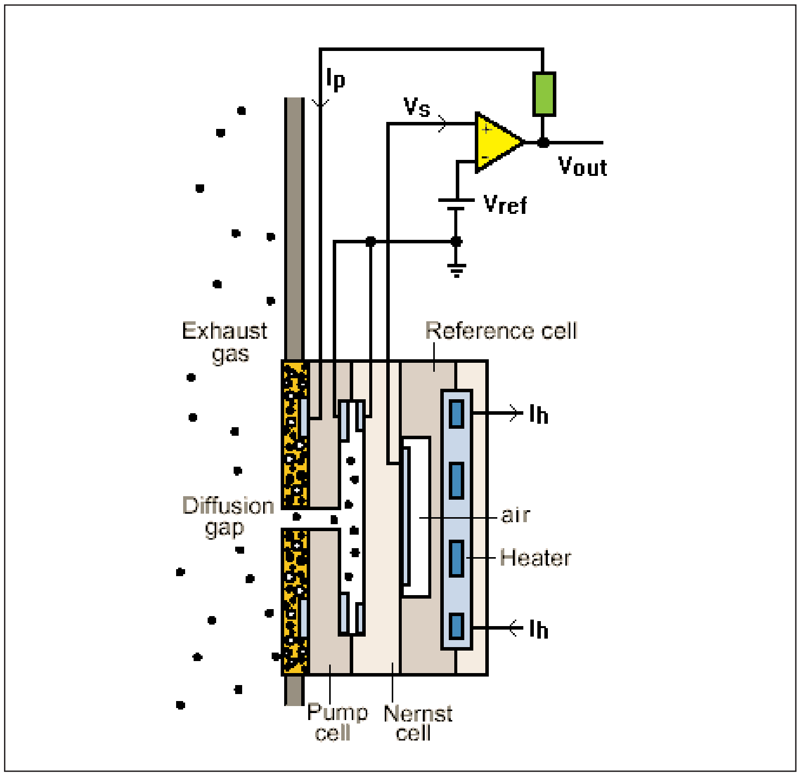
Let's compare the operation of the two HO2S. The key element of the down stream Zirconia oxygen sensor is a ceramic body that is coated on both sides, creating a Nernst Cell. This coating takes over the function of electrodes, where one electrode layer comes into contact with external air and the other with the exhaust. A voltage difference is established between the electrodes by differing concentrations of oxygen in the external air and the exhaust. Low mV is high in oxygen (lean) while closer to 1V is low in oxygen (rich). The PCM evaluates this 0-1V signal to determine the oxygen content of the exhaust.

Wide Range H02S



The Wide Range sensor also produces a voltage difference with the help of two electrodes, which are in contact with external air and the exhaust gases. This sensor differs in that it requires an ECM to function and keep the voltage of the electrodes constant.

This process is carried out by a miniature pump (pump cell), which supplies the electrodes on the exhaust side with enough oxygen to ensure that the voltage between the electrodes remains a constant 450mV. The PCM interprets the current consumption of the pump cell to determine the air-fuel ratio value.

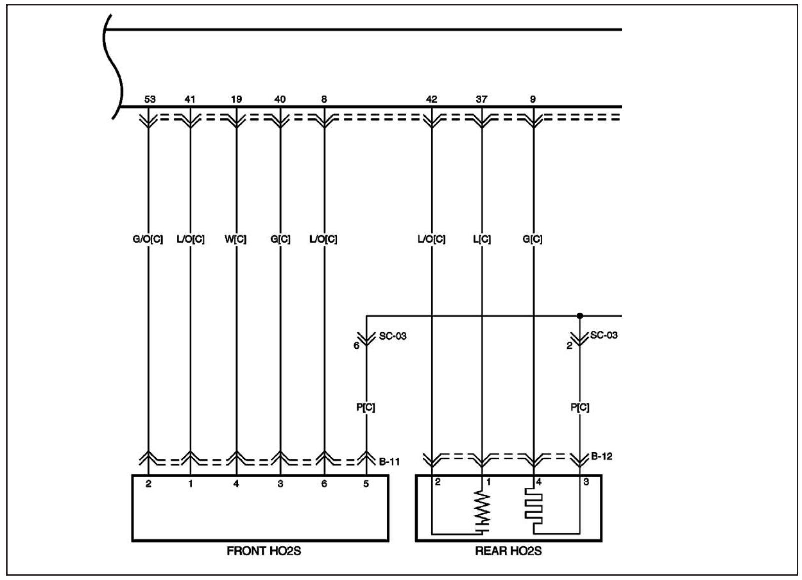


The Wide Range oxygen sensor expands on the principle of the Nernst unit or “oxygen sensor” by being coupled to a pump cell. And it’s through this small slot (gap) in the pump cell that the exhaust gas enters the actual small diffusion-monitoring chamber.

In normal sensor operation, a small sample of the exhaust gas passes through the diffusion gap into the pump cell. This exhaust gas is rich or lean, which is sensed by the reference cell, which produces a voltage “Vs” above or below the PCM’s voltage reference signal (Vref).

A rich exhaust will produce a high “Vs” voltage and the electronics produces a pump current “Ip” in one direction to consume the free fuel. A lean exhaust produces a low “Vs” and the electronics sends the pump current in the opposite direction to consume free oxygen.

When the free oxygen or free fuel has been neutralized, the “Vs” feedback signal goes to about 450mV (same as the “Vref” value). The pump current required to produce this equilibrium is a measure of the air-fuel ratio. The electronics in the unit converts the “Ip” into a “Vout” which is the output of the unit to the PCM.



HO2S HEATER

The heater unit is similar to other HO2S used in Kia vehicle with the exception of a faster light off for quicker response time. The heater unit receives B+ power from the main relay through fuse SNSR 10A to Pin 5. Ground switched by the ECM at pin 6. Then Pin 1 is the VS positive, Pin 2 is “Rc”, Pin 3 is “Rp” and Pin 4 is “Vs/Ip” negative.

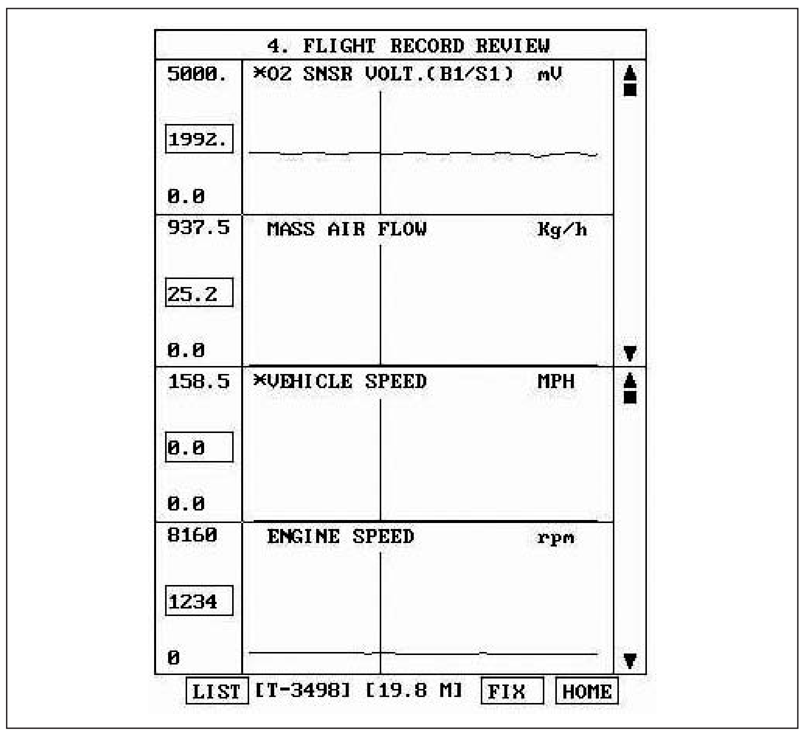
Verifying for DTCs with the Hi-Scan Pro is performed during Diagnostics. If current DTC exists, check for short to ground in the harness by visually inspecting the HO2S and then installing a known good part. Use the Hi-Scan Pro to determine if the DTC is still current.

To review Linear HO2S:

- Indicate HOW rich or lean the AFM is
- This how rich or lean ability is important to more closely control the AFR in order to reduce exhaust emissions or when the engine is operated in a lean condition
- The linear HO2S output signal is a variable current
- The output signal cannot be measured or graphed
- The PCM signal can be used for diagnostic
- Lean mixture is indicated by a High voltage
- Rich mixture is indicated by a Low voltage

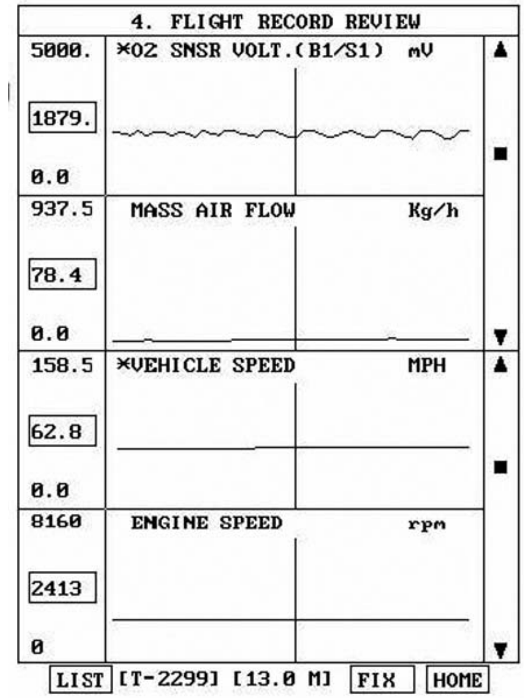
Note: Pin numbers that might be molded onto the connector may not be applicable to the ETM

HO2S ENGINE COLD AT IDLE SIGNAL



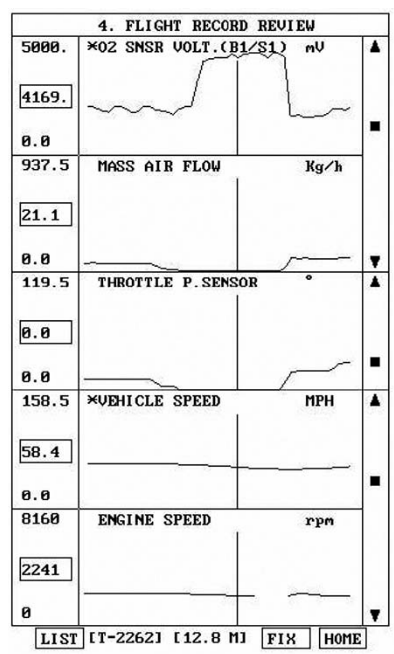
This is a typical linear O2 signal recording with engine cold and at idle, using Hi-Scan Pro flight recording.

HO2S STEADY STATE CRUISING SIGNAL



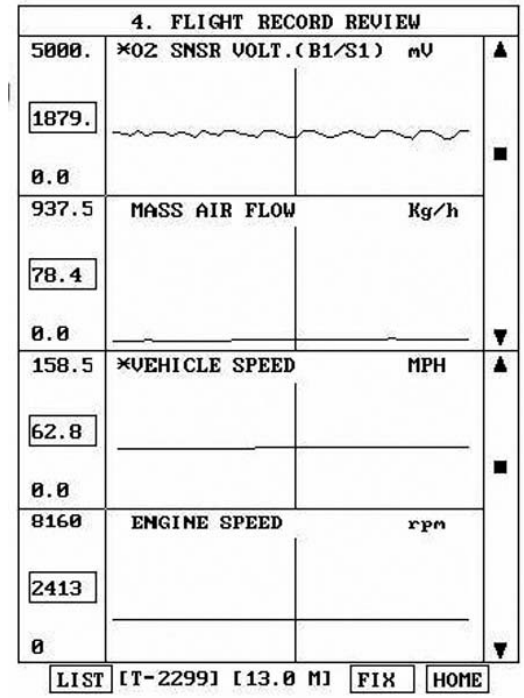
This is a typical Linear O2 signal recording during a Steady Cruising State using Hi-Scan Pro flight recording.

HO2S FUEL-CUT DURING DECELERATION



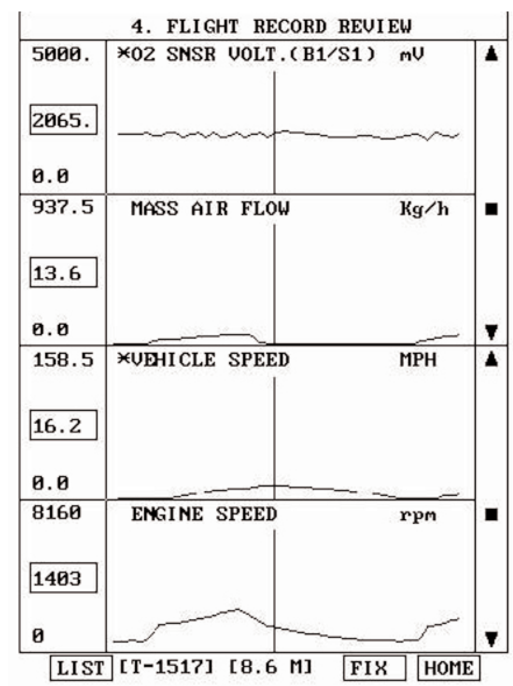
This is a typical linear O2 signal recording of Fuel-Cut During Deceleration, using Hi-Scan Pro flight recording

HO2S STRONG ACCELERATION



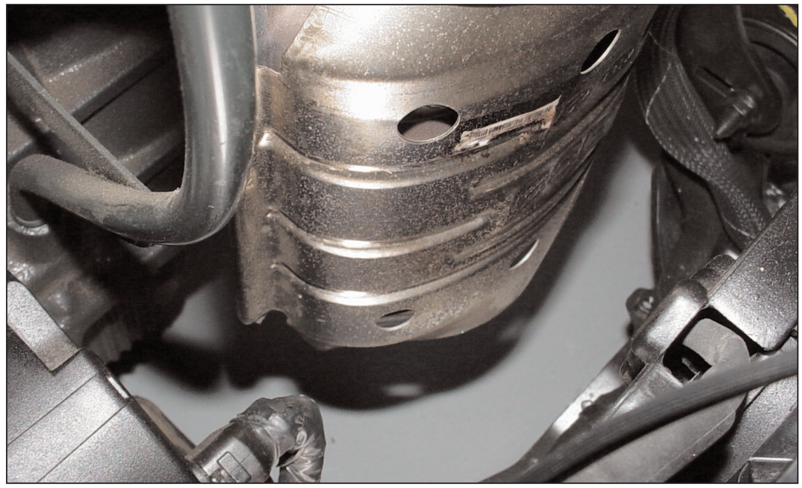
This is a typical linear O2 signal recording during a Strong Acceleration, using Hi-Scan Pro flight recording

HO2S GENTLE ACCELERATION

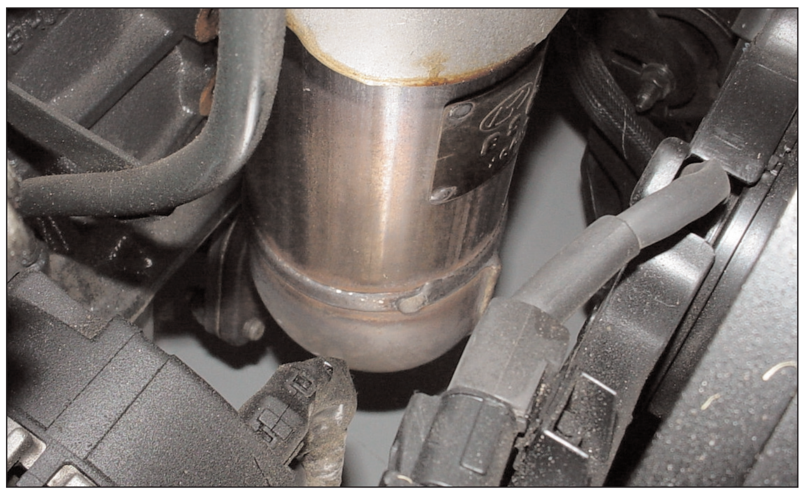


This is a typical linear O2 signal recording during Gentle Acceleration from stop to 16 MPH, using Hi-Scan Pro flight recording.

CATALYTIC CONVERTER

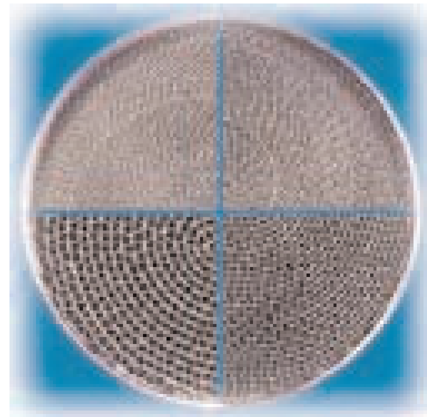


The Federal emission Spectra uses 400 cells per square inch (CPSI) similar to other Kia vehicles. It is located after the exhaust manifold in the engine compartment. Its design is flat in appearance.



The SULEV emission vehicle for CA specification states uses a 900 CPSI catalytic converter that is new to Kia vehicles. It's located in the same place, but its appearance is different being round instead of flat.

SULEV CATALYTIC CONVERTER



This type of CAT has complex internal structures with 800 to 1000 cpsi substrates and wall thickness down to 0.025 mm. This progress in ceramic and metal substrate technology has major benefits. A larger catalyst surface area can be incorporated into a given converter volume, which allows better conversion efficiency and durability. The thin walls reduce thermal capacity and avoid the penalty of increased pressure losses.

Alternatively, the same performance can be incorporated into a smaller converter volume, making the catalyst easier to fit close to the engine, as in the Spectra. The use of additional catalytic converters close to the exhaust manifold reduces the time to warm up at cold start and, therefore, the total emissions. Warm up time has been reduced from as long as one to two minutes to less than 20 seconds.

Improved substrate technology, combined with highly thermally stable catalysts and oxygen storage components, allows the close-coupled catalyst approach to meet the California Low Emission Vehicle (LEV), Ultra Low Emission Vehicle (ULEV) and Super Ultra Low Emission Vehicle (SULEV) regulations.

OBDII SYSTEM READINESS TEST

The OBDII system readiness tests are used by many states in their smog check or inspection/maintenance (I/M) program. If the drive cycle has not been previously completed, showing that the OBDII system is ready to monitor for faults, the vehicle cannot be I/M tested. This prevents a driver with a MIL ON, due to fault detection, from clearing the DTC and getting a smog check performed before the DTC returns.

When the readiness flags are set due to completing the drive cycle, the monitor inspects for faults. When the DTC is cleared, so are the readiness flags. The vehicle must be driven at various road speeds with sufficient rise in engine temperature and various gearshifts to set the flags again. The drive cycle involves:

- Cold start idle to normal engine operating temperature
- Accelerate to 50MPH with a steady cruise for several minutes
- Decelerate to a steady lower MPH cruise for several minutes
- Then, slow to a stop, engine idling.

The readiness flags monitoring includes: catalyst, misfire, fuel system, O2 sensor, evaporative system, engine cooling, A/C, and comprehensive components monitoring.

Diagnosing and repair the DTC with the troubleshooting instructions on KSIS. Then, use some or all of the 4 configured driving patterns (based upon the DTC) to verify the repair: Idle Test mode (comprehensive component), Short Driving Test mode, Long Driving Test mode and Evap. Leakage Test.

Note: not all readiness tests may complete in a single 0drive cycle.

SUMMARY

The 2004.5 Spectra is equipped with an Engine Management System (EMS) to monitor and manage the engine and transaxle and the On-Board Diagnostic II System (OBDII) and a variety of emission control systems and components.

California emission certified Spectra vehicles meet the SULEV emission standard. The Spectra meets the standard due to changes made to the exhaust emission, adoption of Continuous Variable Valve Timing (CVVT), and a zero emission evaporative system instead of a conventional evaporative system.

Federal emission Spectra vehicles use the Bosch EV6 6-hole fuel injector while CA emission vehicles use a new Denso 12-hole fuel injector to achieve SULEV levels. In addition, a new style fuel cap will be used and a new Auxiliary Canister has been added to decrease evaporative bleed emissions and work in conjunction with the evaporative canister.

In this module, we have learned about the 2004.5 Spectra engine Management systems for US and California emission standards, component locations and system operation. Additionally we have learned diagnosis and repairs for the various OBD II sub systems.

PROGRESS CHECK

1. All of the following are true statements about the Spectra zero evap system except:
   - A. New fuel cap
   - B. 3-ply evap hose
   - C. Two Charcoal Canisters are used
   - D. New Double Palladium spark plugs are used

2. Technician A states that the 2004.5 Spectra uses a new wide range oxygen sensor that shows high voltage lean and low voltage rich just opposite typical Zr02 sensors. Technician B states that the 2004.5 Spectra uses a new Trident negative resistive front sensor and a zirconia rear sensor. Who is correct?
   - A. A only
   - B. B only
   - C. Both A and B
   - D. Neither A or B

3. The new 12-hole fuel injectors used on the 2004.5 CA emission certified Spectra vehicles need the grommet and o-ring inspected at 15K and replaced at 30K.
   - A. True
   - B. False?

4. Technician A states that the ORVR Valve is located in the fuel tank to reduce the possibility of fuel vapor leaks. Technician B states that the Evap hoses are constructed of multiple ply hoses to increase flow into the charcoal canister. Who is correct?
   - A. A only
   - B. B only
   - C. Both A and B
   - D. Neither A or B

5. Select the correct type of spark plugs used on the 2004.5 Spectra.
   A. Double palladium
   B. Iridium with grooved side electrode
   C. NGK Copper with platinum center core
   D. Champion extended heat range

6. Select the best reason Spectra with SULEV certification uses a new style three-way catalytic converter.
   A. Internal temperature is 50% of standard catalytic converters
   B. Better conversion rate
   C. Increased CPSI allows for exhaust filtering
   D. All of the above

ANSWER KEY:
1. D 2. A 3. B 4. A 5. B 6. B

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National Institute for
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Driveability

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.07

Guided Practice

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, you will be given the opportunity to perform specific diagnostic procedures on the Spectra engine management system.

MODULE OBJECTIVES

Objectives of this module are for you to demonstrate your ability to:

- Use KSIS to obtain emission specifications and diagnostic trouble code (DTC) information.
- Perform linear sensor heater inspection
- Perform OBDII System Readiness Tests with HSP

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- 2004.5 Spectra (LD) or LD engine
- Vehicle lift
- DVOM with narrow test pins
- #2 pencil or preferred writing instrument
- Hi-Scan Pro (HSP)
- KSIS and Sign/log on

TIME TO COMPLETE

This module will take approximately 30 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the information you have learned in the Driveability theory module. Under the supervision of a trained Kia service-training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

TABLE OF CONTENTS

Total Possible Points: 15

KSIS SPECIFICATIONS AND DTC INFORMATION

Total Possible Points: 4

You will need KSIS to complete this task. If computers are in use, proceed to the next task and complete this one later.

Using KSIS, sign/log on and look up the following specifications and record:

Fuel injector resistance	@ 68degrees F:
Federal:	
SULEV/CA:	

Fuel pump Pressure Regulated:	

HO2S heater resistance:	Value:	Specification:
Front at 70°F		
Front at 500°F		
Rear at 70°F		
Rear at 500°F		

Under Schedule 2 maintenance, SULEV engine, fill in the following:

Item:	Inspection:	Replace:
Spark Plug Cable		
Fuel Injector Insulator		
Cylinder Head Cover Gasket		
Oil Pan Liquid Gasket		
Intake Manifold Gasket		
Thermostat		

Look up DTC P0131 and complete the following:

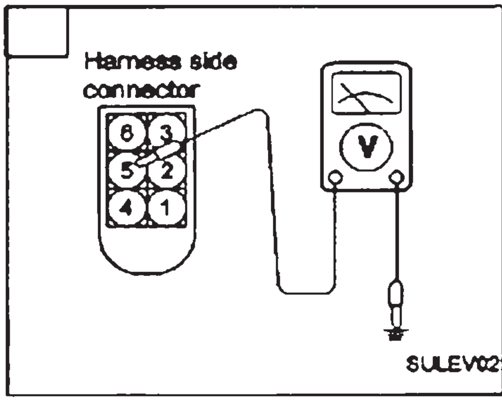
Connection Information

Terminal:	Connected to:	Function:
1		
2		
3		
4		
5		
6		

LINEAR HO2S INSPECTION

Total Possible Points: 3

Linear O2 Sensor Heater Inspection Procedures:



Measure the power supply voltage of the heated circuit.

- Connector : Disconnected
- Ignition SW : ON
- Voltage : Battery voltage

1. Disconnect the Bank 1 Sensor 1 HO2S
2. Measure the voltage to the heater, list results below
   a. Don't probe with test lead, use narrow test pin
   b. Key ON
   c. Red on positive lead, Black on ground
3. Inspect the resistance of the heater of the HO2S
4. List results below:
5. With low resistance reading, what else will affect the readings?

   ____

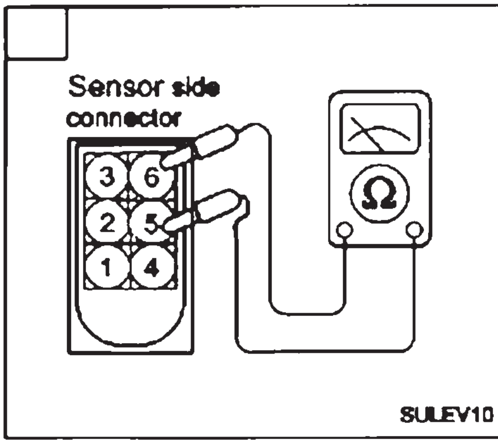
6. List what can be done to get a true reading:

   ____

7. Do not test any other circuits of the HO2S.

Linear B1S1 HO2S	Input Voltage:	Heater Element Resistance:	Heater Specification
			2.42-2.92 Ohms

Note: Numbers on the connector may not match the numbers used in the ETM



Check the sensor heater's internal resistance

- Connector : Disconnected
- Resistance : 2.42 ~ 2.92Ω
  (at 20°C : 68°F)

- Pins 5 & 6

CAUTION: Do not check the sensor's internal circuits with tester except for the internal resistance.

OBDII SYSTEM READINESS TESTS

Total Possible Points: 8

Using a Hi-Scan Pro, clear the OBDII Readiness flags.

Then perform the following four-drive cycle test using a lift: (1) Idle Test mode (comprehensive component), (2) Short Driving Test mode, (3) Long Driving Test mode, and (4) Evap. Leakage Test. Have your instructor inspect and authorize you to begin the actual drive part of the test (#2-4).

The drive cycle involves:

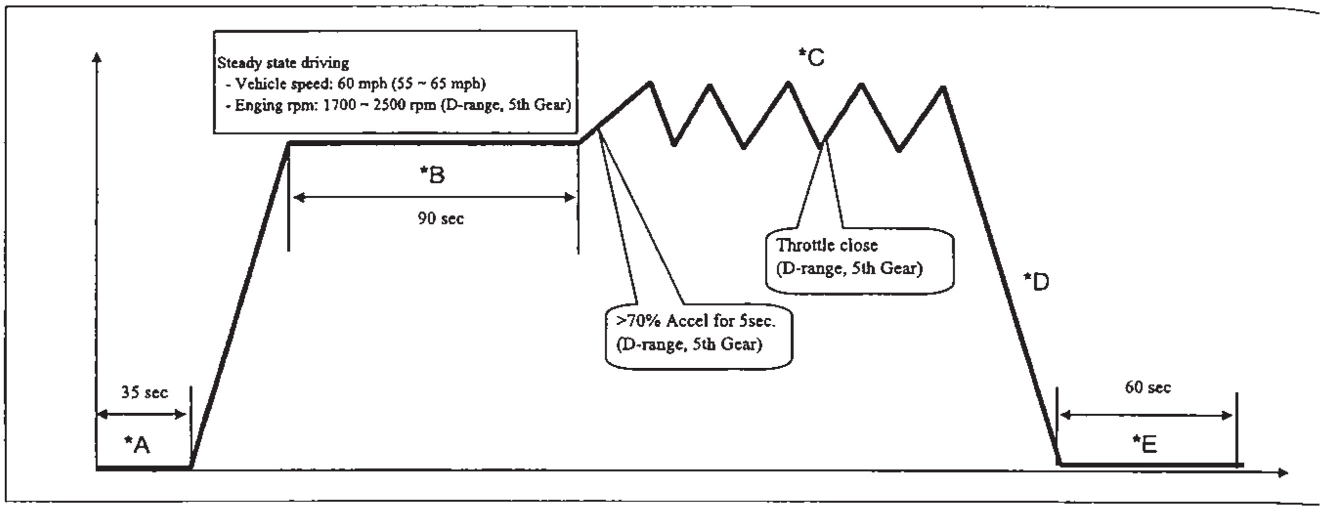
- Cold start with idle to engine operating temperature
- Accelerate to 50MPH with a steady cruise for several minutes
- Decelerate to a steady lower MPH cruise for several minutes
- Then, slow down until stop with an idle.

IDLE TEST

	DTC NO.	Description	DTC NO.	Description
30 Second idle	P0016	Crankshaft Position - Camshaft position correlation	P0335	Crankshaft Position Sensor Circuit
	P0076	Intake Valve Control Solenoid Circuit Low (Bank1)	P0444	Evap. Emission System - Purge Ctrl. Valve Circuit Open
	P0077	Intake Valve Control Solenoid Circuit High (Bank1)	P0445	Evap. Emission System - Purge Ctrl. Valve Circuit Shorted
	P0102	Mass Air Flow Circuit Low Input	P0447	Evap. Emission System - Vent Control Circuit Open
	P0103	Mass Air Flow Circuit high Input	P0448	Evap. Emission System - Vent Control Circuit Shorted
	P0122	Throttle Position Sensor Circuit Low Input	P0449	Evap. Emission System - Vent valve / Solenoid circuit
	P0123	Throttle Position Sensor Circuit High Input	P0452	Evap. Emission System - Pressure Sensor Low Input
	P0197	Engine Oil Temp. Sensor Low Input	P0453	Evap. Emission System - Pressure Sensor High Input
	P0198	Engine Oil Temp. Sensor High Input	P0560	System Voltage
	P0230	Fuel Pump Primary Circuit	P0600	CAN Communication BUS
	P0261	Cylinder 1 - Injector Circuit Low	P0605	Internal Control Module Read Only Memory(ROM) Error
	P0264	Cylinder 2 - Injector Circuit Low	P0606	ECM/PCM Processor (ECM-SELF TEST Failed)
	P0267	Cylinder 3 - Injector Circuit Low	P0650	Malfunction Indicator Lamp(MIL) Control Circuit
	P0270	Cylinder 4 - Injector Circuit Low	P1505	Idle Speed Actuator Signal Low of Coil #1
	P0262	Cylinder 1 - Injector Circuit High	P1506	Idle Speed Actuator Signal High of Coil #1
	P0265	Cylinder 2 - Injector Circuit High	P1507	Idle Speed Actuator Signal Low of Coil #2
	P0268	Cylinder 3 - Injector Circuit High	P1508	Idle Speed Actuator Signal High of Coil #2
	P0271	Cylinder 4 - Injector Circuit High	P1602	CAN Communication BUS with TCU (Timeout)
	P0340	Camshaft Position Sensor Circuit Malfunction (Single Sensor)		
120 Second idle	P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	P0132	O2 Sensor Circuit High Voltage(Bank 1 / Sensor 1)
	P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	P0137	O2 Sensor Circuit Low Voltage (Bank 1 / Sensor 2)
	P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	P0138	O2 Sensor Circuit High Voltage (Bank 1 / Sensor 2)
	P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	P0506	Idle Air Control System - RPM lower than expected
	P0112	Intake Air Temperature Sensor Circuit Low Input	P0507	Idle Air Control System - RPM higher than expected
	P0113	Intake Air Temperature Sensor Circuit High Input	P2237	O2 Sensor Pumping Current Circuit/Open - Bank 1 Sensor 1
	P0117	Engine Coolant Temperature Circuit Low Input	P2243	O2 Sensor Reference Voltage Circuit/Open - Bank 1 Sensor 1
	P0118	Engine Coolant Temperature Circuit High Input	P2626	O2 Sensor Pumping Current Trim Circuit/Open - Bank 1 Sensor 1
	P0131	O2 Sensor Circuit Low Voltage(Bank 1 / Sensor 1)		

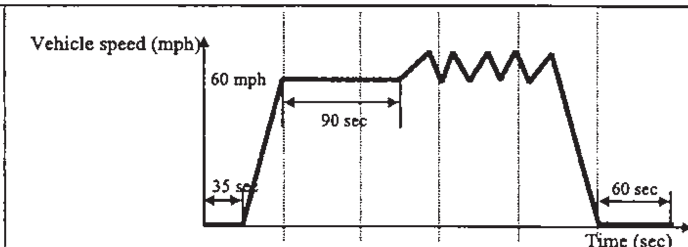
1. Safely rack the Spectra, have instructor inspect.
2. Connect a HSP to the 16-pin DLC
3. List the ECT reading: ________________________
   a. Is the engine coolant cold? _________________
4. Idle Test mode for Comprehensive component: Hi-Scan Pro select the DTC function. Start the engine and idle the engine until at warm up cycle. Idle for the time listed in the left hand column for the specific DTC. Then Check on the Hi-Scan Pro to see if any of the listed DTC have set. Do not turn OFF the engine, unless instructed by your instructor.
5. Has any DTC set? ___________________________
6. List the finish ECT reading: ___________________

SHORT DRIVING TEST



Test Items

Short Driving Test Mode



Short Driving Test Items

Fault code	Description	FAULT DETECTION						REMARK
P0011	"A" Camshaft Position timing over-advanced					●		
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)			●				
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)					●		
P0101	Mass Air Flow Circuit Range/Performance		●					
P0121	Throttle Position Sensor Circuit Range/Performance		●					
P0125	Insufficient Coolant Temperature for Closed Loop Fuel		●					
P0133	O2-Sensor Circuit Slow Response (Bank 1 / Sensor 1)			●				
P0136	O2 Sensor Circuit (Bank 1 / Sensor 2)		●					
P0139	O2 Sensor Circuit Slow Response (Bank 1/ Sensor 2)					●		
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 / Sensor 2)		●					
P0171	System Too Lean (Bank 1)			●				
P0172	System Too Rich (Bank 1)			●				
P0300	Random/Multiple Cylinder Misfire Detected	←	—	—	—	—	→	
P0301	Cylinder 1 - Misfire detected	←	—	—	—	—	→	
P0302	Cylinder 2 - Misfire detected	←	—	—	—	—	→	
P0303	Cylinder 3 - Misfire detected	←	—	—	—	—	→	
P0304	Cylinder 4 - Misfire detected	←	—	—	—	—	→	
P0325	Knock Sensor Circuit	●						
P0420	Catalyst System Efficiency below Threshold (Bank 1)		▬					
P0501	Vehicle Speed Sensor Range/Performance			●				
P0562	System Voltage Low		●					
P0563	System Voltage High		●					
P1166	O2 Sensor System - Lambda Controller at the Limit			●				
P1372	Misfire Detection - Segment Time Acquisition Incorrect					●		
P1529	TCU Request for MIL ON						●	
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1			●				
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1			●				
P2195	O2 Sensor Signal Stuck Lean -Bank 1 Sensor 1			●				
P2196	O2 Sensor Signal Stuck Rich -Bank 1 Sensor 1			●				
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit (Bank1, Sensor1)		●					
P2251	O2 Sensor Reference Ground Circuit/Open - Bank 1				●			
P2270	O2 Sensor Signal Stuck Lean - Bank 1 Sensor 2			●				
P2271	O2 Sensor Signal Stuck Rich - Bank 1 Sensor 2							
P2414	O2 Sensor Exhaust Sample Error - Bank 1 Sensor 1							

1. With a Spectra safely on the lift, shift gears to drive with the engine running. Be sure you have the instructor's approval. Remember to advise others that you are about to run the vehicle.
2. List what a warm up cycle is: ___________________
3. Has this vehicle met the conditions for a warm up cycle? ____________________________________
4. Short Driving Test Mode. Refer to drive cycle map for alpha letters (A-E) labels.

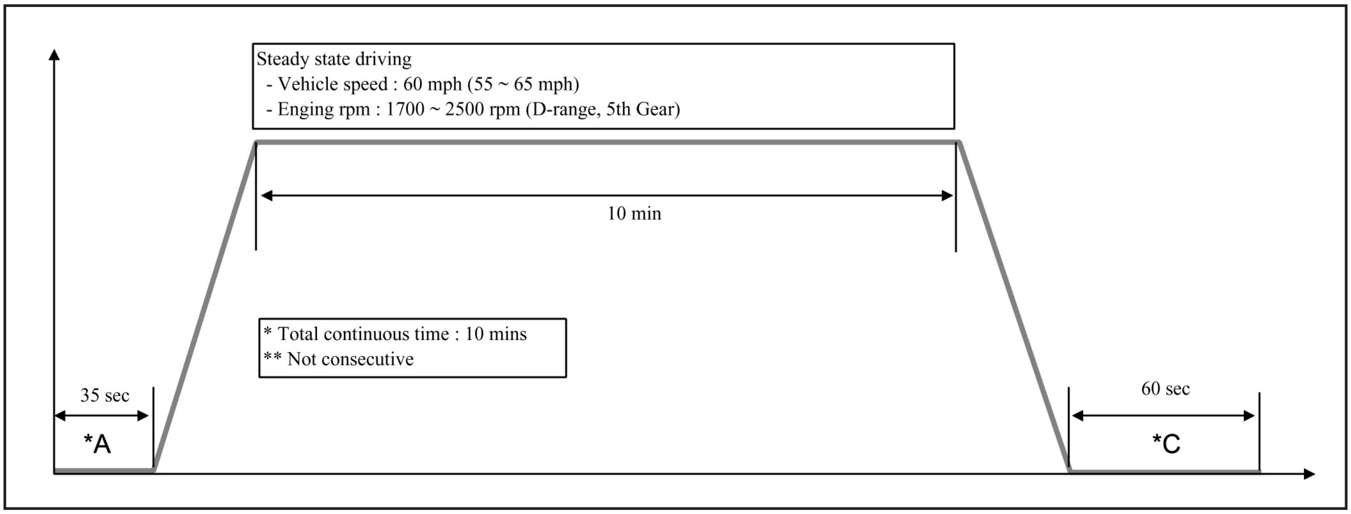
Connect Hi-Scan Pro to 16-pin DLC and select DTC functions. Refer to drive cycle map for alpha letters (A-E) below.

1. Start engine and let idle for 35 seconds (A)
2. Drive vehicle at 55 MPH for <90 Seconds (B)
3. Perform high acceleration (<70% TPS) for 5 seconds and decelerate with closed throttle for 7 seconds, more than five times (C).
4. Then decelerate to stop (D).
5. Idle engine for +30 seconds (E).

Review the test and list your results: _______________

List what the arrows represent on the DTC fault detection chart: _________________________________

LONG DRIVING TEST



Long Driving Test items

DTC NO.	Description	Remarks
P0116	Engine Coolant Temperature Circuit Range/Performance	
P0128	Coolant Thermostat (Coolant Temp. below Thermostat Regulating Temp.)	-10°C (14°F) < coolant temp. at Engine start < 74°C (165.2°F)
P0196	Engine Oil Temp. Sensor Range / Performance	Coolant temp. at Engine start < 40°C (104°F)

1. Long Driving Test mode. Refer to drive cycle map for alpha letters (A-C) labels.
2. Connect Hi-Scan Pro to 16-pin DLC and select DTC functions.
3. Start engine and let idle for 35 seconds (A)
4. Drive vehicle at 55 MPH for <10 minutes (B)
5. Then decrease vehicle speed until it stops (B)
6. Idle engine for over 60 seconds (C)

Did any of the three DTCs that appears: ____________

List how you can conduct these test at your dealership: ______________________________________

HSP EVAP LEAKAGE TEST

Items with Hi-Scan (Pro)'s Evap. Leakage Test

DTC NO.	Description	Remarks
P0441	Evap. Emission System Incorrect Purge Flow	1. Warm-up & connect the Hi-scan pro 2. Idle (No Electric load, P/N-range) 3. Conduct Leakage test using the Hi-scan pro
P0442	Evap. Emission System - Leak detedted (small leak)	
P0451	Evap. Emission System - Pressure Sensor Range / Performance	
P0454	Evap. Emission System - Pressure Sensor Intermittent	
P0455	Evap. Emission System - Leak detected (large leak)	
P0456	Evap. Emission System - Leak detected (very small leak)	

1. Hi-Scan Pro Evaporative Leakage Test. Connect Hi-Scan Pro to 16-pin DLC and select Evap Leakage Test.
2. Start and warm up engine.
3. Idle in P/N with no loads.
4. Conduct Leakage test using the Hi-Scan Pro.

List how this test is different than the Evap test you can currently perform with the Hi-Scan Pro?

____

List the test Results:

____

What are the expected test results for these entire tests?

____

NOTES:

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National Institute for
**AUTOMOTIVE
SERVICE
EXCELLENCE**

Brakes

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.08

Theory

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

The goal of this module is to identify and explain the operation and diagnosis of the 2004.5 Spectra ABS/EBD System.

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify the following with 80% or greater accuracy:

- Antilock Brake System (ABS)/Electronic Brake-Force Distribution (EBD) is optional equipment on the 2004.5 Spectra
- Three tests for ABS/EBD Wheel Speed Sensor (WSS) are air gap, Hi-Scan Pro waveform analysis, and damage/debris on exciter
- Warning lamps
- ABS normal conditions on start up
- ABS/EBD Hydraulic and Electronic Control Unit (HECU)/ABS Control Module (ABSCM) responsibility

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. In the module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Tools: Hi-Scan Pro, new SSTs, DVOM, T-Connectors, KSIS

Components/Training Aids

Other: Preferred writing instrument

TIME TO COMPLETE

This module will take approximately 15 minutes.

ACRONYMS

ABS: Antilock Brake System

ABSCM: Antilock Brake System Control Module

CAN: Controller Area Network

CBS: Conventional Brake System

EBD: Electronic Brake-Force Distribution

HECU: Hydraulic and Electronic control Unit

HPA: High Pressure Accumulator

NC: Normally Closed

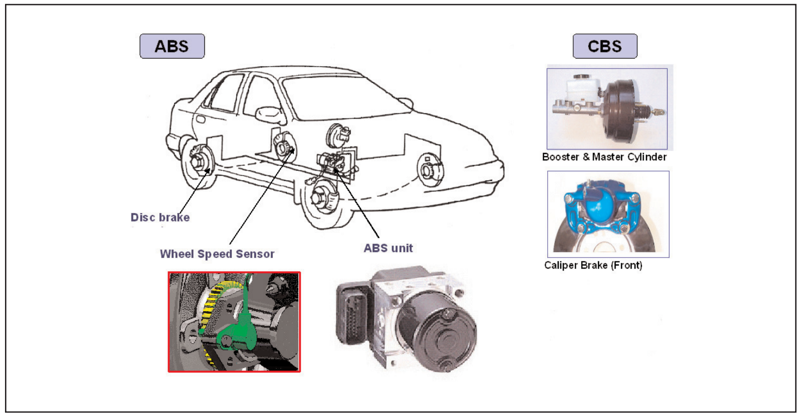
NO: Normally Open

IP: Instrument Panel

LPA: Low Pressure Accumulator

WSS: Wheel Speed Sensor

INTRODUCTION



The 2004.5 Spectra comes standard with a 4-wheel disc Conventional Brake System (CBS) with optional Antilock Brake System (ABS) and Electronic Brake-Force Distribution (EBD).

Brakes are designed to reduce the motion of the vehicle when the driver applies the brake pedal. This produces hydraulic pressure to apply pads against turning rotors, which changes the kinetic energy of the vehicle's movement into heat (friction) energy to slow the vehicle down. The amount of heat created is proportionate to the pressure the driver places on the brake pedal and the speed of the vehicle.

Optional ABS with EBD uses additional electronic and hydraulic components to help prevent wheel lockup and electronically distributes brake pressure between the front and rear brake calipers for optimal rear wheel traction.

PURPOSE

The ABS/EBD system is designed to provide the driver with maximum vehicle control during emergency braking conditions. This operation should be faster and more reliable than the driver. Following is a list of brake related instrument panel lights that the driver should be observing for the ABS/EBD system installed in the 2004.5 Spectra.

1. The brake and ABS indicators are all brake related warning lights on fully equipped Spectra. The driver should occasionally confirm that these warning lights illuminate by turning ON the ignition switch to on, but not start the engine. Any light that does not illuminate should be checked. After starting the engine, the driver should confirm that the warning lights go OFF. Any lights remaining ON indicate a situation that needs attention. The driver can consult the owner's manual for further information.

2. The parking brake fluid level warning light is illuminated when the parking brake is applied with the ignition switch in the ON or START position; it should turn OFF when the parking brake is released. If the light remains ON. It may indicate that the brake fluid level in the reservoir is low. To be safe, the driver should check the level immediately and look for potential brake fluid leaks. Add brake fluid as required and don’t drive vehicle if light remains ON.

3. The Anti-Lock Brake light will illuminate for 3 seconds when the ignition key is turned ON. The light should turn off after 3 seconds as part of the system self-diagnosis procedure to indicate that the ABS is operating normally. The ABS will not operate if the ABS light stays ON. In this instance, CBS will operate and the ABS needs to be inspected.

4. If there is a problem with the ABS and EBD system, both the brake and ABS lights will illuminate at the same time while driving, indicating that the CBS and/or ABS may not be working normally and should be checked.

The Spectra has power-assisted CBS that automatically adjusts with normal usage. The brake pedal requires greater force from the driver if the power-assist loses power such as when the engine is not running and the brakes are repeatedly applied.

The driver will notice a high-pitched warning sound from the front or rear brake pads when they are worn and need to be inspected. This is not associated with a possible normal brake squeal when brakes are first applied in certain driving conditions or climates.

The Spectra's parking brake handle is located in the center console and is cable operated to the rear calipers. The service brake should apply at 6-8 clicks of upward brake handle movement.

The optional ABS continuously senses if the wheels are going to lock during brake application and if so, modulates the hydraulic brake pressure to the wheels. During this ABS event the driver may hear a "tik-tik" sound or sensation in the brake pedal, which is normal.

Note: When descending a long or steep hill, the driver should shift to a lower gear, such as "D" to "3", and avoid continuous application of the brakes to avoid brakes overheating.

APPLICATION

The major difference between the2004 and 2004.5 Spectra is that these newer models have standard rear disc brakes while previous models are equipped with rear drum brakes. In addition, the 2004.5 Spectra 4-door has optional ABS/EBD.

	Sephia	Spectra	2004.5 Spectra 4-Door	2005 Spectra 5-Door
CBS	S	S	S	S
Frt Disc	S	S	S	S
Rr Drum	S	S	N/A	N/A
Rr Disc	O	O	S	S
ABS/EBD	O	O	O	O

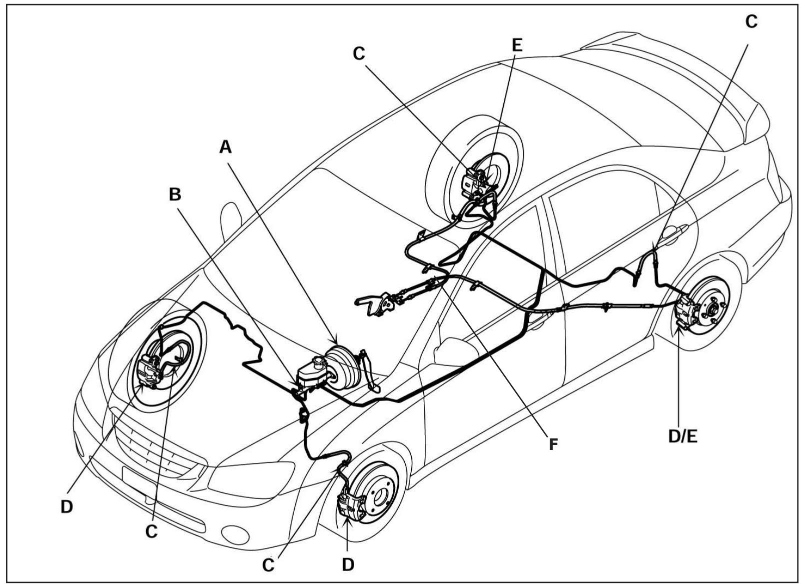
S=Standard, O=Optional, NA= Not Available
CBS: Conventional Brake System
EBD: Electronic Brake-Force Distribution

2004	ABS	EBD	TCS	ESP
2004.5 Spectra	MGH20	Yes	No	No
Sedona	MGH10	Yes	No	No
Rio	Mando FD100	Yes	No	No
Sorento	Bosch5.3	Yes	No	No
Optima	MK20	Yes	No	No
Amanti	MK25	Yes	Yes	Yes

Chart indicates options available on 2004 Kia vehicles.

ABS and EBD are options on most Kia vehicles, and standard on Amanti. TCS and ESP are available as an option only on the 2004 Amanti. The MGH20 ABS/EBD is an option on the 2004.5 Spectra.

CONVENTIONAL BRAKE SYSTEM (CBS) OPERATION



- Dual master cylinder with dual brake-fluid reservoirs (B)
- Brake hoses and steel lines (C)
- Front and rear disc assemblies with pads (D/E)
- Proportioning Valve (B)
- Parking Brake lever (F)

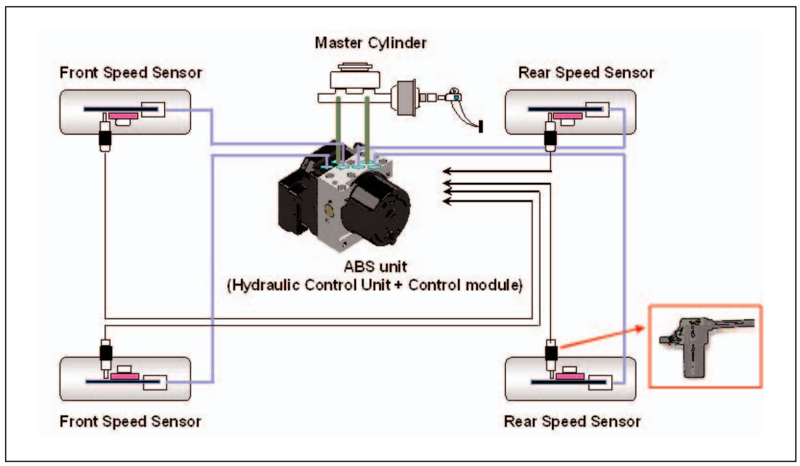
The 2004.5 Kia Spectra Conventional Brake System (CBS) is a hydraulic 4-wheel disc brake system with ventilated brake discs on the front axle and solid brake discs on the rear axle. A brake vacuum booster aids the natural force multiplication of the hydraulic system. The Spectra dual master cylinder utilizes diagonal split brake line configuration. This diagonal split system has one front wheel and the diagonally opposite rear wheel braked in each circuit. The master cylinder has two separate brake reservoirs for fluid storage with a fluid level warning sensor.

Note: Recommended hydraulic fluid for the system is genuine DOT 3 or DOT 4. Don't use DOT 5 hydraulic brake fluid. Fluid leakage from the seals maybe an indication of non-recommended brake fluid. DOT 5 is easily identified by its purple color.

The proportioning valves are a mechanical device mounted under the master cylinder in the diagonal brake system only on the CBS (non-ABS). During braking, these valves regulate pressure to the rear brakes to create balanced braking between the front and rear wheels. The proportioning valves used on the 4-door and 5-door Spectra models are different due to different cut-in pressure and decompression ratio (27:1 and 32:1).

The parking brake holds the parked vehicle when the driver pulls up on the handle, which pulls a cable attached to a lever and cam at each rear brake caliper. By pulling the handle, the cable extends each piston to apply the pads. The parking brake cable needs to be adjusted periodically but the disc pads are self-adjusting.

ANTILOCK BRAKE SYSTEM (ABS)



The ABS is optional and supplements the CBS. The ABS is idle until there is a braking situation that causes impending lock-up of one or more wheels of the vehicle.

The ABS adds the following to the Conventional Brake System:

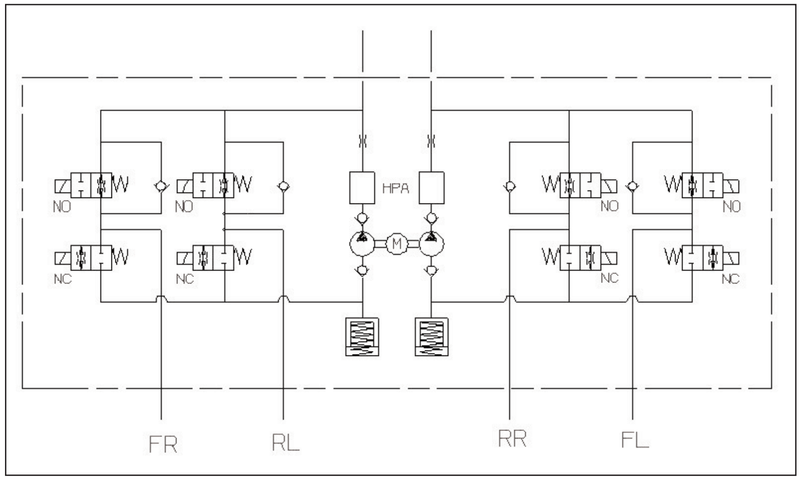
- A Mando MGH-20 integrated hydraulic and electronic control unit (HECU) located in the right front engine compartment
- A passive wheel speed sensor (WSS) at each wheel
- Two 30A fuses in the engine compartment junction box
- An ABS indicator lamp on the IP
- Scan tool communication through the 16-pin under dash connector.

The ABS/EBD system is designed to provide controlled braking power in the longitudinal direction (forward motion) of the vehicle to prevent wheel lock-up during an emergency braking event. This allows the vehicle to maintain maximum braking force, but prevents lock-up of the wheels. This enables the driver to maintain steering control during the emergency braking event.

ABS works by limiting the pressure to any wheel that decelerates too rapidly and slips, allowing maximum stopping force to be applied.

The ABS calculates the difference between the speed of the vehicle and the wheel to determine the slip rate. The slip rate is expressed as a percentage from 100% at wheel lock to 0% when the wheel rotates at the same speed as the vehicle. Generally, slip in the 10-18% range (depending on conditions) is normal; beyond this threshold, it's considered an ABS event.

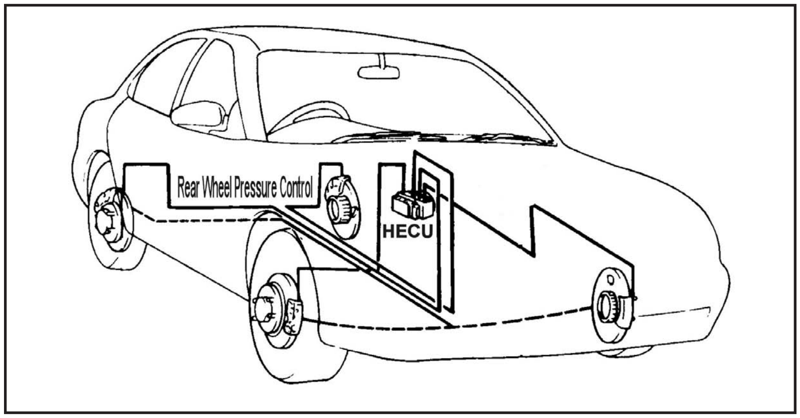
In operation, the wheel speed sensors at each wheel send signals to the HECU. If a wheel speed sensor detects lockup (rapid deceleration) during brake application, the HECU controls the hydraulic pressure to that wheel cylinder.



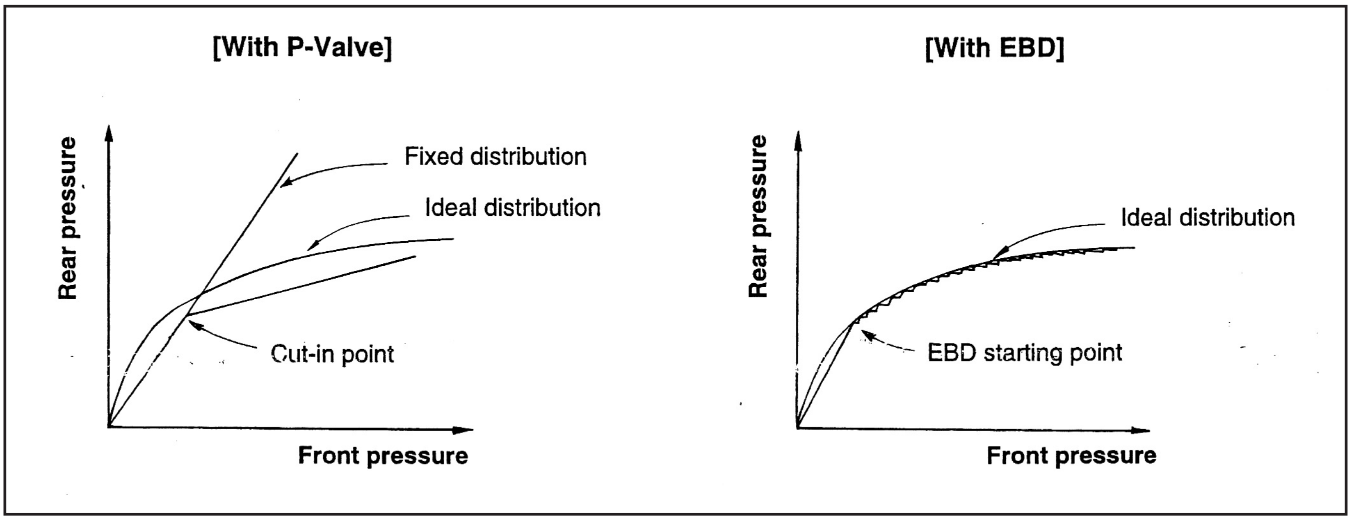
The diagram shows the hydraulic circuit of the HECU. Because Spectra's ABS is a 4-channel system, there is one inlet and dump valve for each wheel caliper. The inlet or isolation solenoid valve is a NO (normally open) valve that connects or isolates (blocks) the hydraulic path between master cylinder and the wheel caliper. The dump valve is a NC (normally closed) valve until the ABSCM allows the hydraulic pressure in that channel to go down (decrease).

The ABS tests itself every time the vehicle is started and every time the brakes are applied by evaluating its own signals. If a defect is detected, the system turns off and turns on the ABS lamp, while leaving normal braking unaffected.

ELECTRONIC BRAKE-FORCE DISTRIBUTION (EBD)



The Electronic Brake-Force Distribution (EBD) system is a sub-system of the ABS. EBD is designed to control rear wheel traction and is included when the ABS option is added to the Spectra. EBD software uses the ABS to control rear wheel slip in the partial braking range. Braking force is controlled electronically, removing the need for the mechanical proportioning valve.

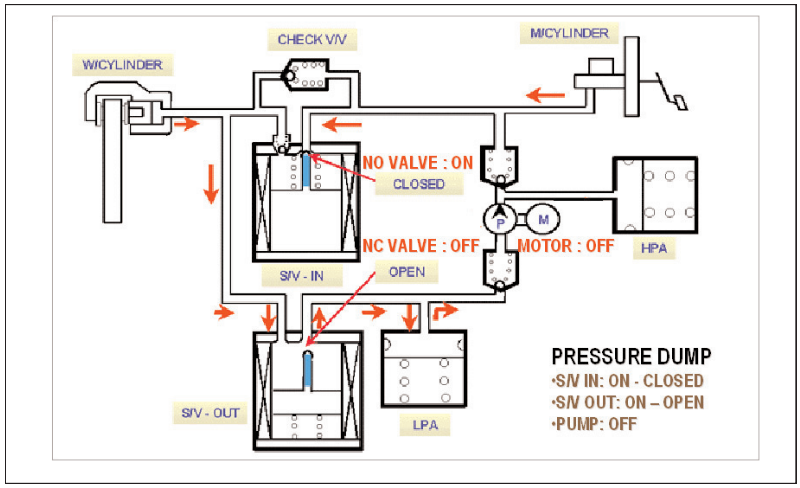


Comparing the proportioning valve distribution to the EBD distribution, the mechanical proportioning valve has limitations. The proportionate valve tries to achieve an ideal brake force distribution to the rear wheels as well as to carry out the flexible brake force distribution proportionate to the vehicle load. EBD calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels through the ABS so as not to exceed that of the front wheels.

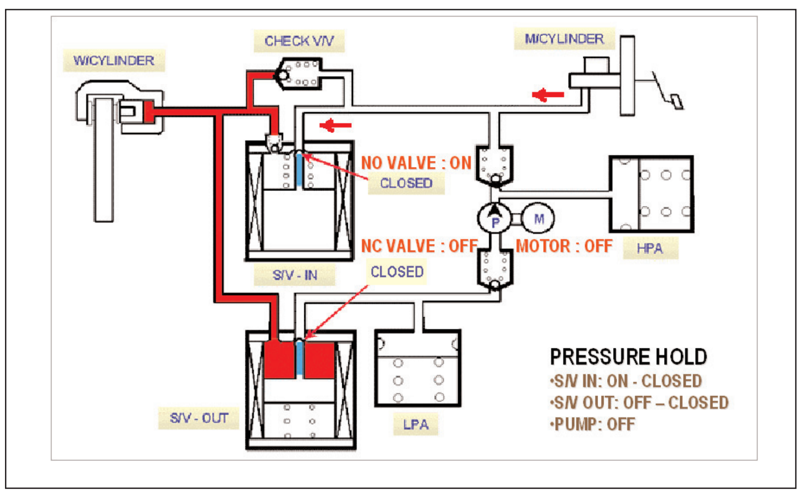
Note: If the EBD fails, the driver may not notice any change. The EBD warning lamp (the parking brake lamp) will illuminate.

EBD OPERATION

The slip of each rear wheel is calculated to determine ABSCM control of the rear wheel brake pressure. During normal braking with no rear wheel slippage, pressure from the master cylinder is passed directly through the valves.

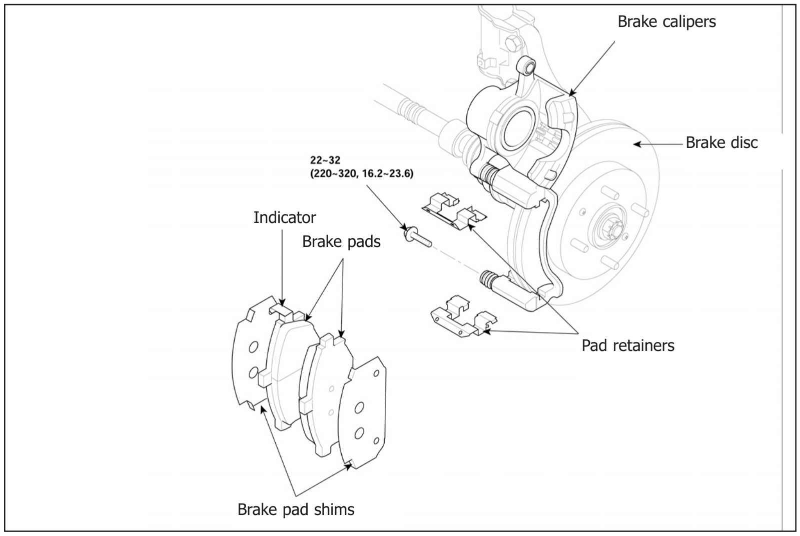


If the rear wheels exceeds predetermined slip rate, the HECU sends a voltage signal to the rear wheel solenoid valves to decrease pressure, which closes the inlet valve(s) and blocks pressure from the master cylinder. At the same time, the outlet valve is opened and brake fluid passes from the wheel cylinder to the reservoir, resulting in a pressure decrease.

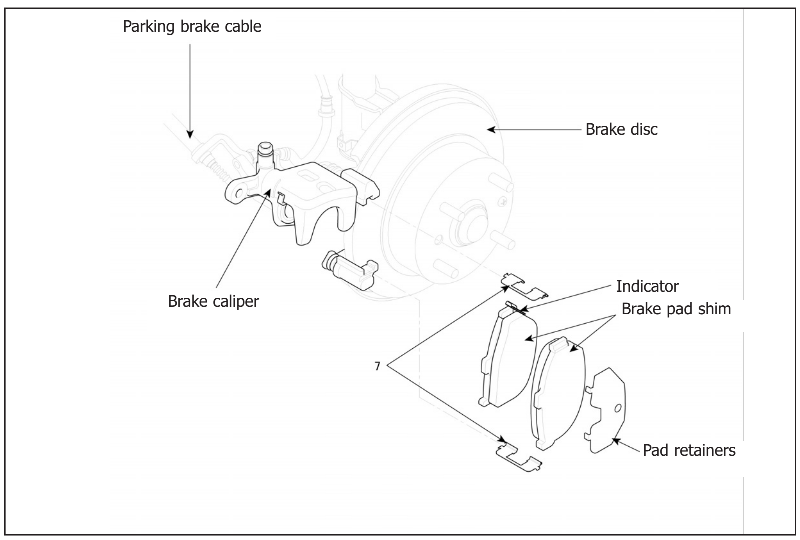


Once wheel cylinder pressure is lowered, the HECU closes the outlet valve and also keeps the inlet valve closed. Pressure in the wheel cylinder is held or maintained. When rear wheel slippage has been suppressed, the HECU cuts voltage to the inlet solenoid, once again allowing fluid under pressure to enter the wheel cylinder.

COMPONENT OPERATION DISK BRAKES

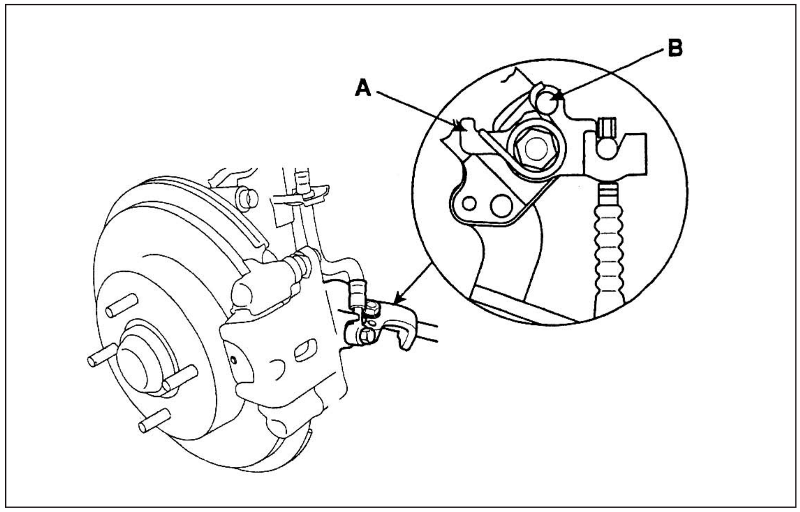


The front disc brakes have floating type calipers with ventilated rotors. The brake pads have wear indicators and can be visually inspected with out removal of the caliper. The disc brake caliper assembly is mounted to the steering knuckles.

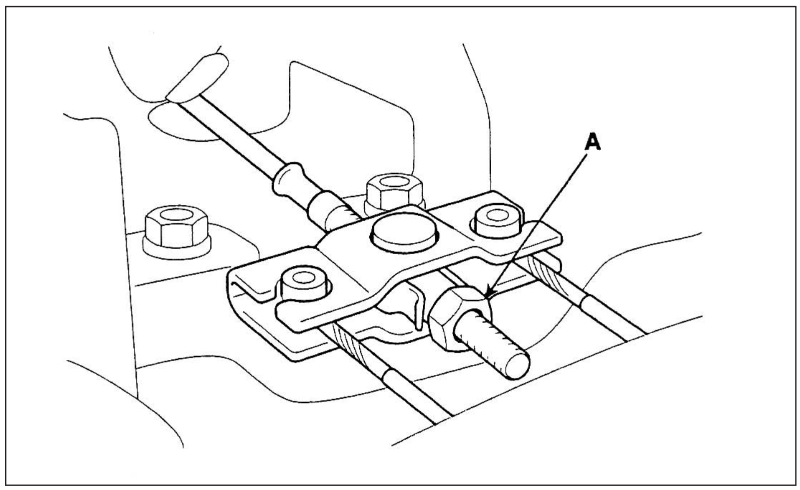


Rear brakes are also floating type calipers with solid rotors. Inspection is the same as front brake disc.

PARKING BRAKE

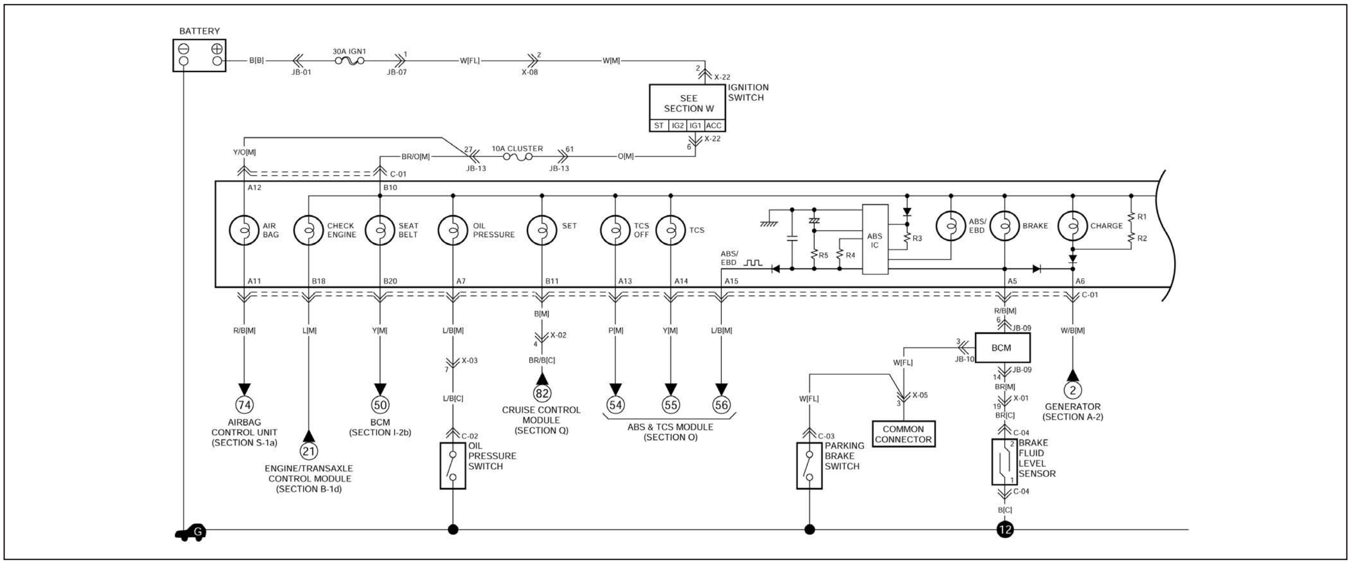


The parking brake is V-type cable that mechanically actuates the rear wheel pads against the rotors.



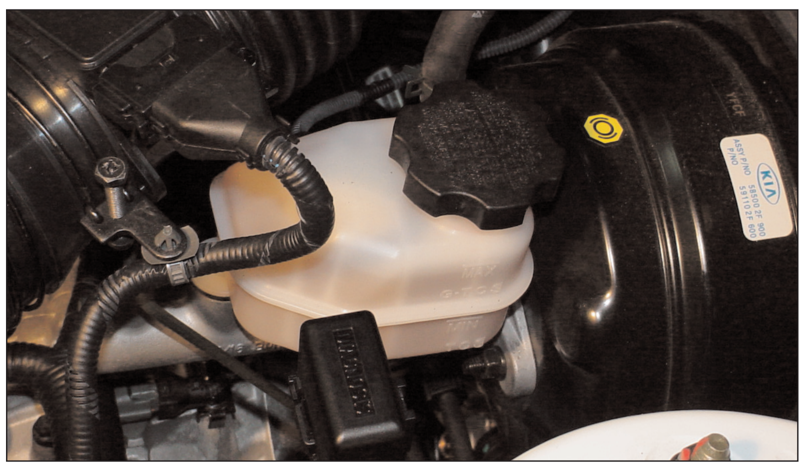
Typical parking brake set is 8 clicks of the parking brake pawl and is adjusted at A. The same brake pads are used as the rear brakes, not a shoe in the hat type of design.

BRAKE WARNING LAMPS

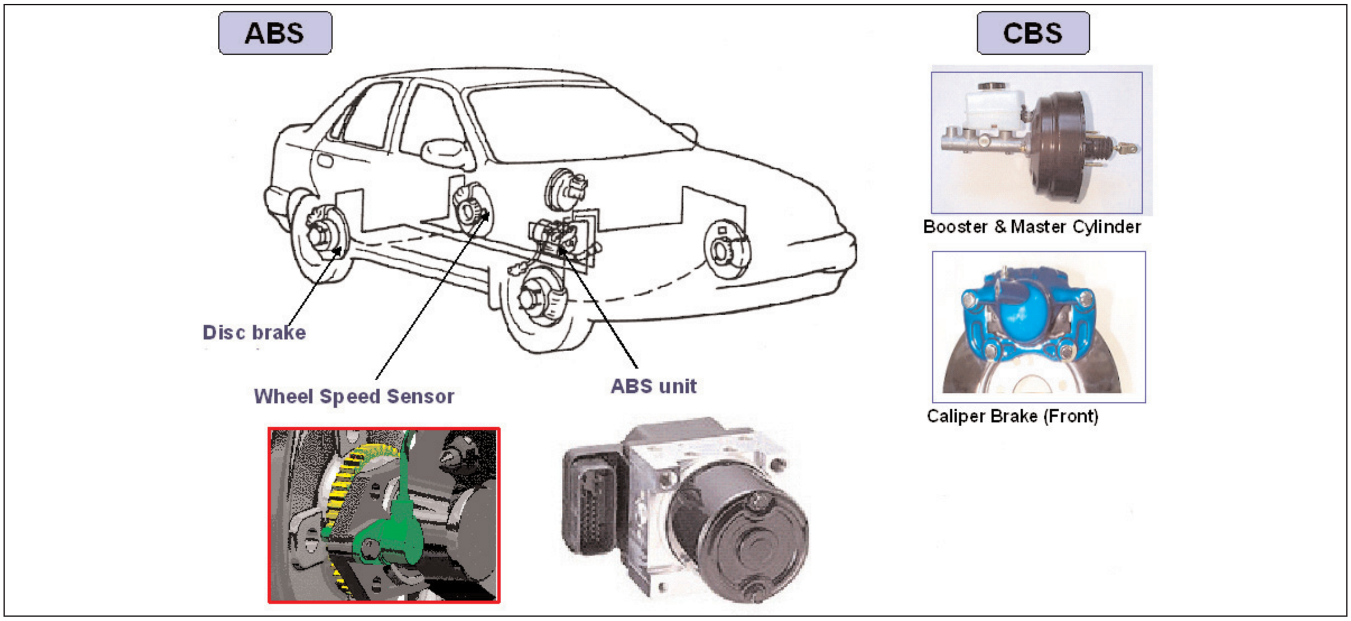


The brake fluid level sensor in the brake fluid reservoir is a normally open (NO) switch that is closed when emerged in fluid. Signal is sent to the ETACS, which illuminates the brake lamp when fluid exposes the switch (low fluid). The parking brake switch is a NO switch that is closed when the parking brake is applied at +1 clicks. The ABSCM controls the ABS/EBD lamps.

MASTER CYLINDER



The master cylinder is mounted on the brake booster in the engine compartment. When the output rod of the booster applies pressure directly to the piston of the master cylinder, the two chambers of the master cylinder supply hydraulic pressure to their respective diagonally split wheel circuit.



ANTILOCK BRAKE SYSTEM

Spectra ABS is a 4-channel system with a MGH-20 HECU. The system houses an inlet valve and outlet valve for each wheel. The pump and valve assembly are similar to other Kia models' ABS/EBD systems.

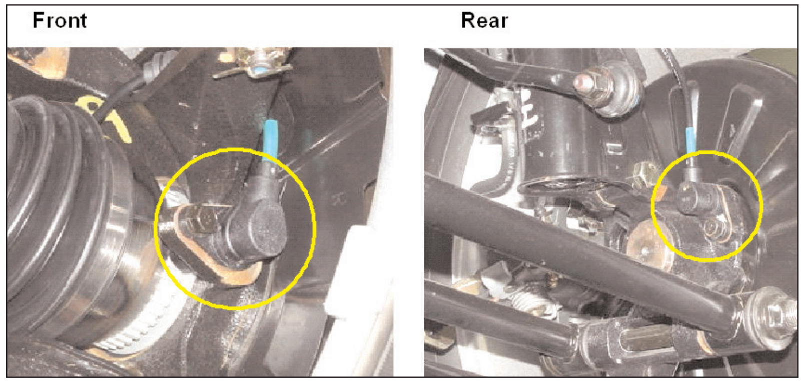
The HECU has a min/max operating range of 9.7 to 18 volts with a normal operating range of 12-14 volt range through the two 30A fuses. When voltage above 16V is detected, the HECU shuts down the ABS, and turns the ABS lamp ON until system voltage returns to normal.

The Hydraulic and Electronic Control Unit (HECU) controls the Anti-Lock Braking System (ABS). This HECU has the following functions:

- Input signal from the wheel speed sensors attached to each wheel
- Control of braking force and traction force
- Failsafe function
- Self diagnosis function
    - Interface with the Hi-Scan Pro
- Apply and release inlet and outlet valves for each wheel.

HYDRAULIC AND ELECTRONIC CONTROL UNIT (HECU) COMPONENT OPERATION

The HECU is energized when the ignition key is turned ON. After completing the initialization phase, the HECU is ready for operation. In normal operating condition, the HECU is ready (within specified limits, i.e. voltage and temperature) to process the signals sent by various sensors and switches.



The ABS system uses four passive wheel speed sensors (WSS) to measure wheel speed. The wheel signals are an analog signal that is converted to square wave by the signal conditioning circuit within the HECU. The signals from the wheels sensors are compared to the remaining WSS to determine if there is any slip, or traction loss. After processing inputs, the HECU actuates the inlet and outlet solenoids according to software control algorithms.

ABS SELF-DIAGNOSIS

Self diagnosis can be classified into two categories:

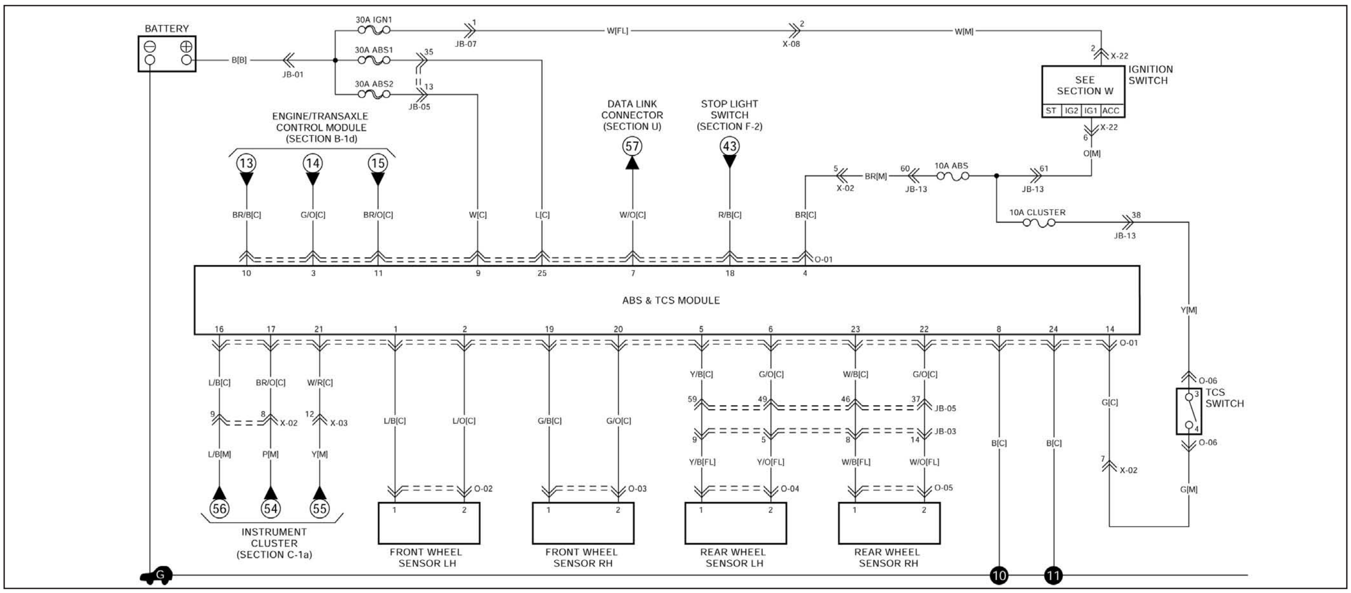
- Initial diagnosis: performed right after the engine starts.
- Regular diagnosis: performed continuously after the initial diagnosis until the ignition switch is turned OFF.

When a problem is detected by self-diagnosis, the system turns:

- The solenoid valve OFF
- The pump motor OFF
- The ABS indicator light ON

ABS/EBD Diagnostic Trouble Codes (DTCS)

1. If the CPU cannot be activated or the CPU fails, the ABS indicator light comes on, but the DTC is not memorized.
2. When the same DTC is detected more than once, the later one is written over the old one. Therefore, when the same problem is detected repeatedly, it is memorized as one DTC.
3. The DTCs are indicated in the order they occur.
4. The DTCs are memorized in the EEPROM (nonvolatile memory) and cannot be canceled by disconnecting the battery. Most DTCs must be cleared with the Hi-Scan Pro.



The ABS control module is located on the HECU, and receives operational power from the 10A ABS fuse. Two-30A fuses supply B+ power for pump and solenoid operation. The inputs include the 4 WSS and brake lamp ON switch. Outputs include the HSP serial data line, CAN bus, and Instrument Cluster.

WSS MONITORING

Each of the four WSSs is monitored constantly once vehicle speed exceeds 1.25 mph (2 km/h). Any condition that causes an out of specification reading for a wheel sensor will be detected by the HECU and cause a DTC.

WSS FAILSAFE

Sensor Failure Outside the ABS Control Cycle

1. Only one wheel failure
   - Only the ABS is inhibited
   - The ABS warning lamp is activated and the EBD warning lamp is not activated.
2. More than two wheels failure
   - Systems down.
   - Both the ABS and EBD function are inhibited and ABS and EBD warning lamps are activated
   - In this failure, the valve relay and all solenoids are prevented from being switched on.

Sensor Failure Inside the ABS Control Cycle

1. One front wheel failure
   - Inhibit the ABS control of the failed-wheel and maintain the ABS control of normal wheels
   - After the controller completes the ABS control, the ABS function is inhibited. The ABS warning lamp is activated and the EBD warning lamp is not activated.
2. One rear wheel failure
   - Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased
   - After the controller completes the ABS control, only the ABS function is inhibited
   - The ABS warning lamp is activated and the EBD warning lamp is not activated.
3. More than two wheels failure
   - System down
   - Both the ABS and the EBD functions are inhibited
   - EBD warning lamps are activated
   - In this failure, the valve relay and all solenoids are prevented from being switched on.

WSS DTC Detecting Conditions

DTC failure conditions detected by the WSS include:

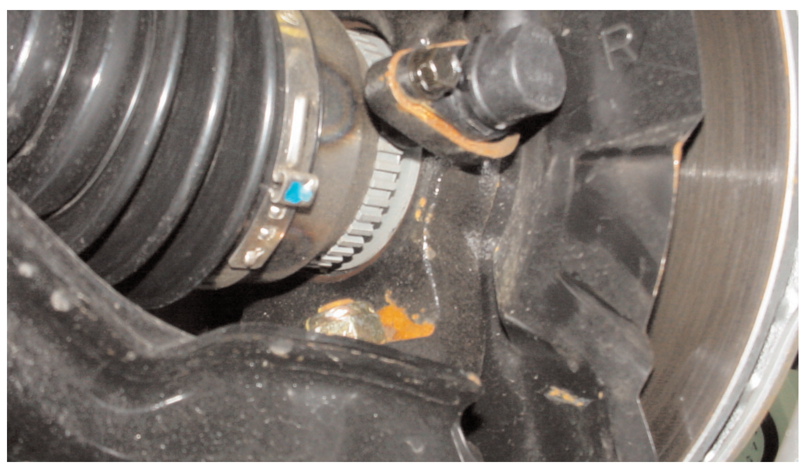
- When the wheel velocity is less than 5 MPH due to an open or short in the wire
- Faulty wheel speed sensor
- Faulty HECU.

The WSS detects a “Speed Jump” condition by monitoring when velocity of each wheel exceeds 1.25 MPH more than other wheels and counts the number of wheel accelerations or decelerations within a specific speed and time period. The ABSCM will recognize the related fault.

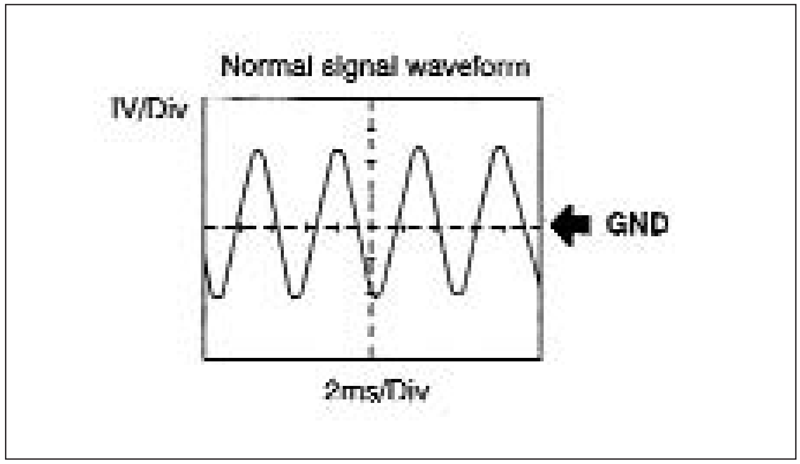
The WSS is also used by the ABSCM to detect: a condition for a damaged exciter due to improper installation of wheel speed sensor, an open or short in the wire, faulty wheel speed sensor, faulty rotor or wheel bearing, or a faulty HECU.

When the ABSCM detects a condition for large air-gap between the WSS and exciter, it may be due to improper installation of the WSS.

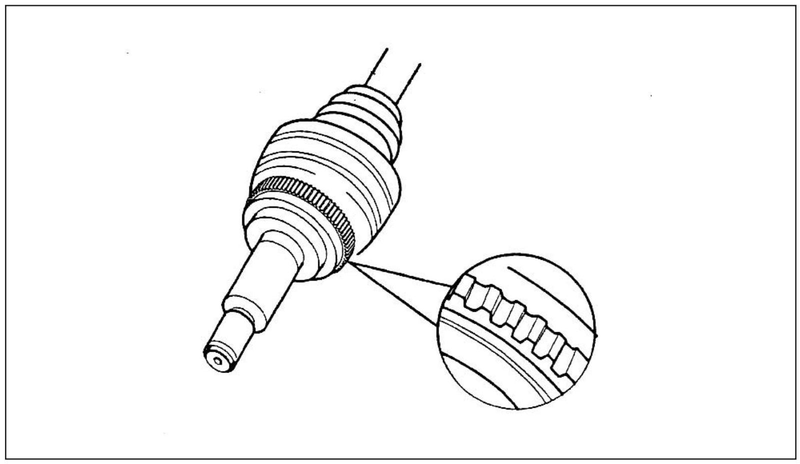
WSS Inspection Procedures



1. Air gap between the WSS and the rotor is critical.

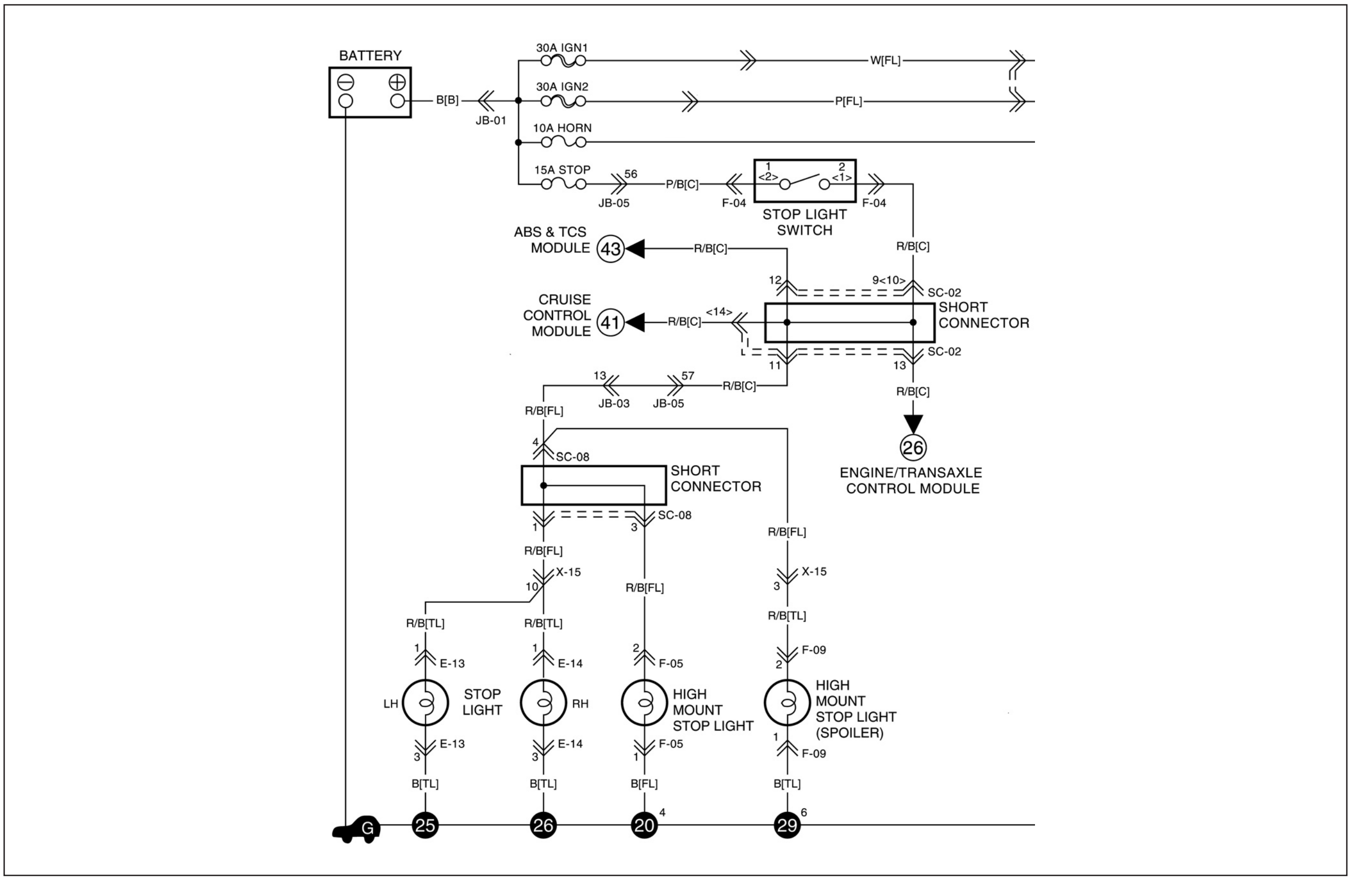


2. Check waveform signal on Hi-Scan Pro.



3. Check the exciter teeth for foreign objects or damaged teeth.

BRAKE LAMP SWITCH



The brake lamp switch is an adjustable normally closed (NC) switch located on the brake pedal assembly. With the brake pedal at its normal resting position (brakes OFF) the switch is pushed to an open position. With brakes applied, the switch is released and closes, affecting the brake lamp and notifying the cruise control system and ABSCM of a braking event.

SYSTEM DIAGNOSTICS & TROUBLESHOOTING

The following are normal ABS operations and checks.

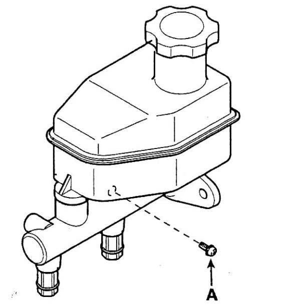
Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. The sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to brake application and release (Thump: suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Pedal kick back	Pedal kick back is normal operation.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirement listed in "Comment" are met.	

Note: This table lists symptoms supported by comments to help technicians diagnose and properly resolve these problems. Be sure to review comments listed on KSIS under diagnostics by symptoms.

FAILSAFE FUNCTION

1. Only the ABS function is inhibited:
   - The ABS warning lamp is activated and EBD warning lamp is not activated
2. Motor error during the ABS control cycle:
   - Inhibit the ABS control of front wheels
   - Allow ABS control of the rear wheels
   - ABS warning lamp is switched ON at the end of ABS control.

BRAKE SYSTEM BLEEDING



The KSIS procedure should be followed to ensure adequate bleeding of air and filling of the CBS and ABS.

Brake fluid bleeding for the Spectra diagonally split system is conducted in the following order:

- Rear Right
- Front Left
- Rear Left
- Front Right.

The Hi-Scan Pro is used for air bleeding the ABS unit; the motor and valves are energized.

Note:

- ***Always use genuine Kia DOT 3 or DOT 4 brake fluid. Using non-genuine Kia DOT 3 or DOT 4 brake fluid can cause corrosion and decrease the life of the system.***
- ***Do not reuse drained fluid***
- ***Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.***
- ***Spilling brake fluid on the vehicle may damage the paint; if brake fluid contacts the paint, wash it off immediately.***
- ***The Master cylinder reservoir must be at the MAX (upper) level mark at the start of bleeding procedure. Check fluid level after bleeding each brake caliper and add fluid as required.***
- ***Observe the ABS motor duty cycle when operating with the Hi-Scan Pro.***

SUMMARY

In this module, you have learned about the Conventional Brake System (CBS) that comes standard with the 2004.5 Spectra, which has front and rear disc brakes. Antilock Brake System (ABS) with Electronic Brake-Force Distribution (EBD) are optional. The Spectra ABS with EBD (if equipped) uses additional electronic and hydraulic components to help prevent wheel lockup and enable the driver to maintain steering control during an emergency braking event.

We have also covered brake system components, their location and functionality, how they operate, and methods to diagnose them. Being familiar with these systems and components will help you become more efficient in diagnosing and repairing customer braking concerns.

PROGRESS CHECK

1. Technician A states that a Spectra equipped with ABS also will have CBS as part of the option. Technician B states that a Spectra equipped with ABS will also have EBD as part of the option. Who is Correct?

   A. A only

   B. B only

   C. Both a and B

   D. Neither A or B

2. The 2004.5 Spectra uses Active wheel speed sensors.

   A. True

   B. False?

3. Technician A states that four wheel disc brake systems come only with the ABS option. Technician B states that all 2004.5 Spectra comes with four wheel disc brakes. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

4. Technician A states the proportioning valve in a Spectra has malfunctioned and he must replace the HECU. Technician B states the proportioning valve may be replaced as a separate part. Who is correct?
   A. A only
   B. B only
   C. Both A and B
   D. Neither A or B
5. Technician A states that ABS works in the latitude direction of the vehicle. Technician B states that the ABS does not correct for under steer. Who is correct?
   A. A only
   B. B only
   C. Both A and B
   D. Neither A or B
6. ABS/EBD diagnostic trouble codes stored in EEPROM can only be erased by:
   A. Repairing the concern
   B. Clearing hard codes with the Hi-Scan Pro
   C. Canceled by disconnecting, then reconnecting the battery
   D. None of the above

NOTES:

ANSWER KEY:
1. B 2. B 3. B 4. B 5. B 6. B

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National Institute for
AUTOMOTIVE SERVICE EXCELLENCE

Brakes

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.09

Guided Practice

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, you will be given the opportunity to practice performing braking service and diagnostic procedures.

MODULE OBJECTIVES

Objectives of this module are for you to demonstrate your ability to:

- Diagnose Wheel Speed Sensor (WSS) DTC.
- Perform ABS valve cycling for brake bleeding of air.

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- 2004.5 Spectra (LD) (Task 1)
- 2004.5 Spectra (LD) with ABS (Task 1 and 2)
- #2 pencil or preferred writing instrument
- Hi-Scan Pro (HSP)
- DVOM and T-Connector
- KSIS and sign/log on

TIME TO COMPLETE

This module will take approximately 30 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the information you have learned in the Brake theory module. Under the supervision of a trained Kia service-training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

TABLE OF CONTENTS

Total Possible Points: 5

WHEEL SPEED SENSOR DIAGNOSTICS

Total Possible Points: 3

1. Sign on to KSIS, search and list the resistance specification for the WSS. List in chart below.
2. Go to a Spectra to measure WSS output voltage and resistance:

Why do all Spectra vehicles have a FR WSS? ________

____

1. Raise the vehicle
2. Disconnect the HECU harness connector
3. Measure the WSS resistance from the sensor side connector, enter results in the chart below
4. Rotate the wheel to be measured approximately 1 rotation per second and check the output voltage signal while spinning the wheel and record below.

WSS	FRT LF	FRT RIGHT	RR LEFT	RR Right
Specs:				
Ohms:				
mV:				

Is the voltage AC or DC: ______________________

Explain why: ________________________________

BRAKE BLEEDING

Total Possible Points: 2

On Spectra with ABS, perform the following part of activating the ABSCM during a brake bleed.

1. Plug in Hi-Scan Pro to 16-pin DLC
2. Using a Hi-Scan Pro, select the brake bleeding procedure to ensure adequate bleeding of air.
3. Do not open the brake bleed valves.
4. Select and enter through the bleeding steps on the Hi-Scan Pro.
5. List procedure and screens: ____________________
6. ____
7. ____
8. ____
9. ____
10. List findings: ______________________________

____

____

____

____

NOTES:

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EXCELLENCE

Heating, Ventilation, and Air Conditioning (HVAC)

2004.5 Spectra Technology

KIA

Service Technical Training

Student Guide

NMLD.10

Theory

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

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When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

The goal of this module is to identify the heating, ventilation, and air conditioning (HVAC) systems and applications and for you to be able to diagnose electrical controls of these systems.

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify or perform the following with 80% or greater accuracy:

- HVAC system operations and components
- Cooling fan operation
- Service HVAC systems and components including:
  - Blower speed
  - Door actuation
  - Fan operation
  - Filter replacement
  - Belt adjustment

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. In the module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Parts: Air filter

Resource: KSIS

Tools: DVOM

Components/Training Aids:

Vehicle: Spectra

Other: Preferred writing instrument

TIME TO COMPLETE

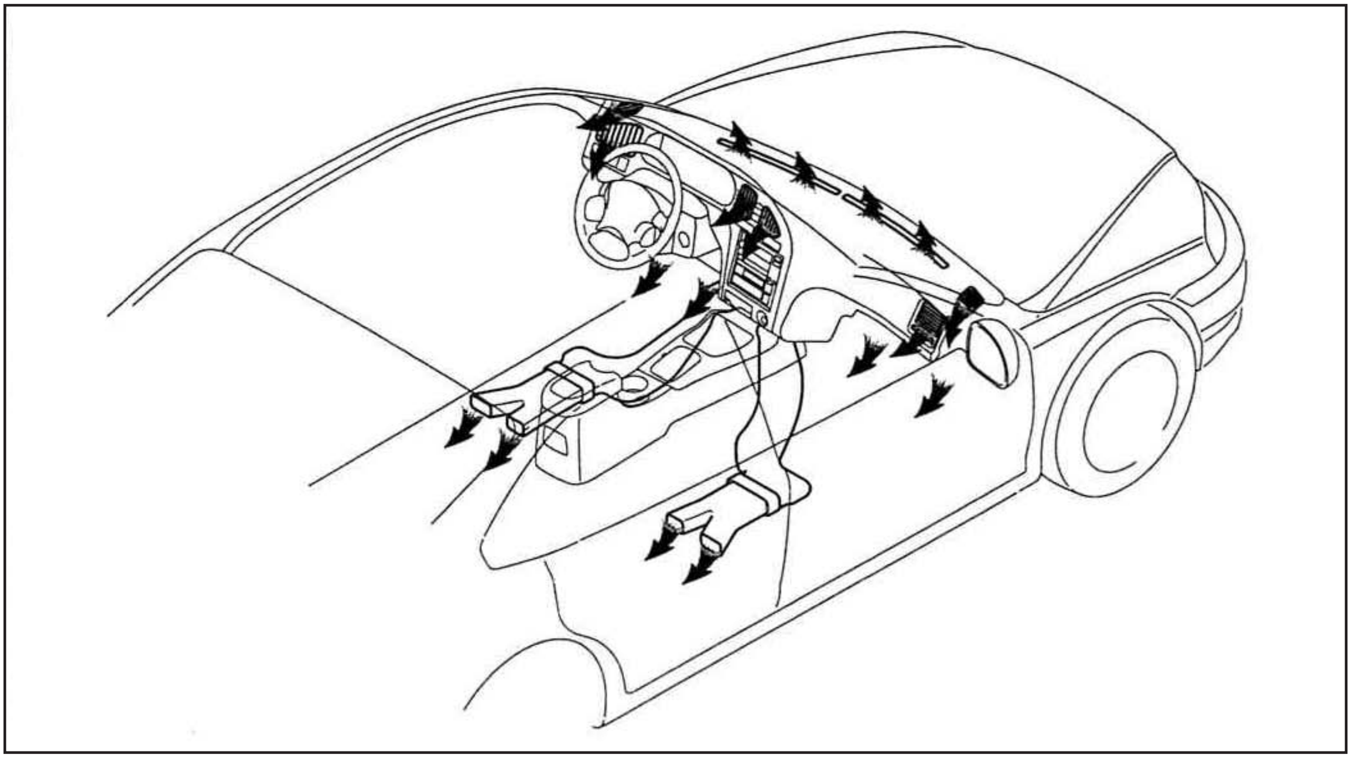
This module will take approximately 15 minutes.

ACRONYMS

A/C: Air Conditioning

HVAC: Heating Ventilation Air Conditioning

INTRODUCTION



The Spectra heating, ventilation, and air conditioning (HVAC) system provides interior temperature comfort to the driver and passengers.

The new Spectra is equipped with a heating and ventilation system. A manual climate control air conditioning (A/C) system is an option on the Spectra 4-door LX trim level, and standard equipment on the EX trim level and the 5-door model.

The HVAC control system requires the driver or passenger to manually set the air intake, blower speed, directional mode, and temperature. The A/C compressor ON/OFF state is controlled by the PCM for automatic transaxle vehicles and ECM for manual transaxle vehicles, based on occupant's request and drivetrain operating conditions.

PURPOSE

The Spectra HVAC is a manually selected control system that allows occupants to control the climate in the interior compartment. Occupants can manually control the:

- Intake of fresh air or recirculation of interior air
- Air flow direction of the ventilation system including: vent, floor, mix, and defrost
- Temperature by adjusting for cool to warm air
- Fan speeds (4) from LOW to HIGH
- A/C system, if equipped.

APPLICATION

The Spectra is Kia's second vehicle in the United States to use an air filter in the blower motor assembly to filter intake air for improved air quality in the passenger compartment. The Spectra is equipped with a receiver/drier that attaches to the condenser.

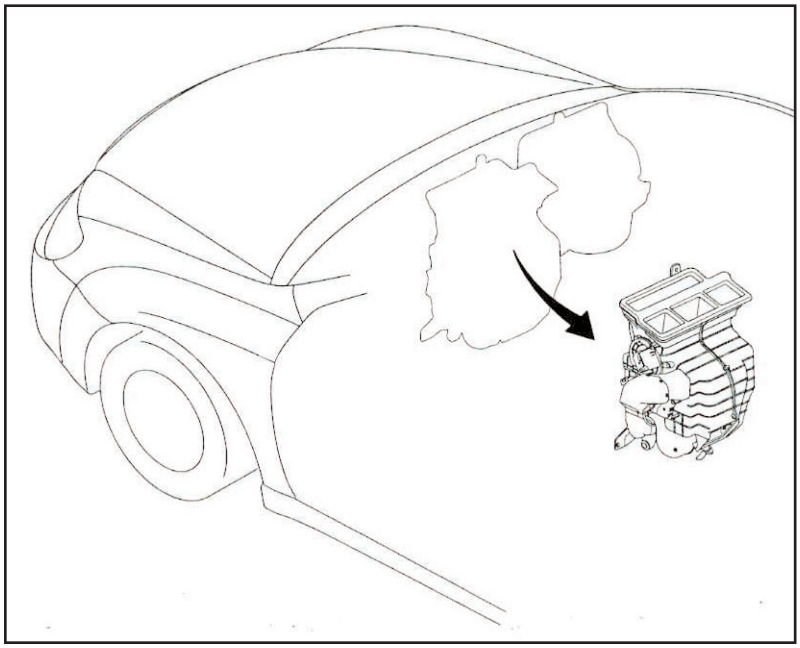
Vehicles	Trim Level	Model Year	A/C	Air Filter
Spectra	LX	2004.5	O	O
	EX	2004.5	S	S
	5-Dr	2005	S	S
Spectra	Base/GS	2000-2003	O	—
	LS	2000-2003	S	—
	5-Dr GS	2000-2003	O	—
	5-Dr GSX	2000-2003	S	—
Sephia	Base	1994-2000	O	—
	GS	1994-2000	O	—
	LS	1994-2000	O	—

HEATING, VENTILATION, AIR CONDITIONING (HVAC) SYSTEM SYSTEM OPERATION

Spectra is equipped with a manually selected climate control system that includes the following:

- Heating system
- Ventilation system
- Air Conditioning system (if equipped)

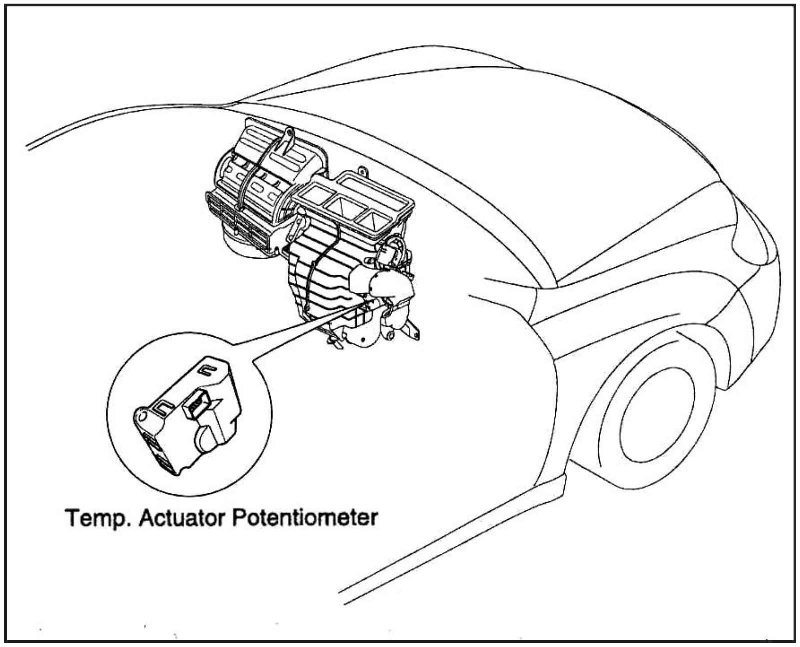
HEATING SYSTEM



The heating system operates with engine coolant continuously flowing through the heater core tubes and transferring heat to the core fins. Heat is then exchanged with incoming air selected to flow over the fins to warm the air.

The occupant manually selects a desired temperature setting that determines the position of the temperature mix door to regulate how much air flow is permitted to pass through the heater core. The remaining ambient air bypasses the heater core and enters the ventilation system. The total airflow mix, blending warm and ambient air, is sent to the passenger compartment through the ventilation system.

VENTILATION SYSTEM

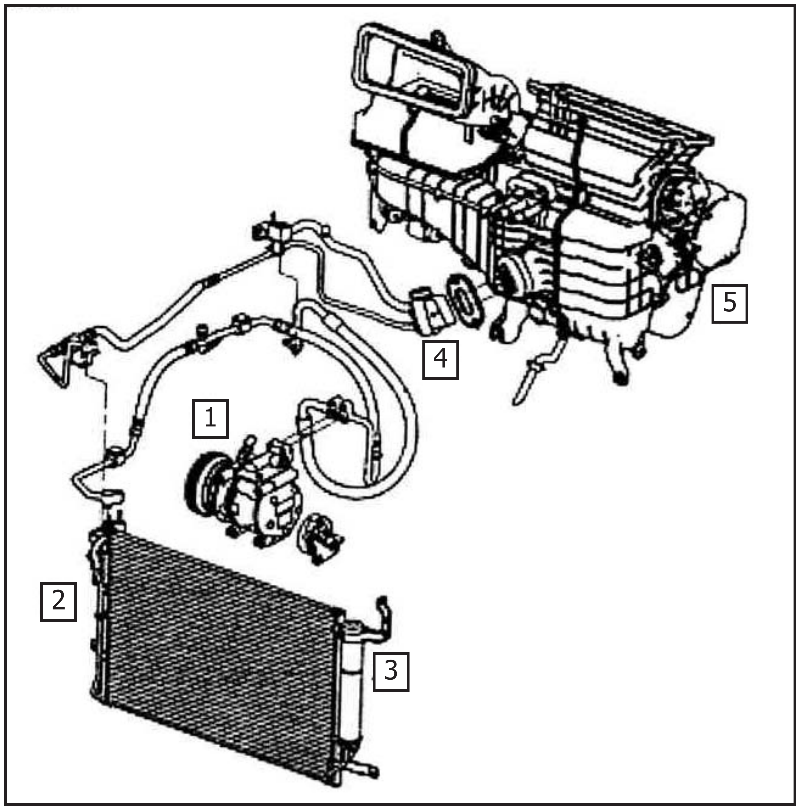


The ventilation system is the vehicle's air mixture and distribution system. Starting at the air intake, fresh or recirculated air flows into the vent box when the vehicle is moving or is drawn in by the blower motor. This air then moves through the evaporator core (if equipped) and/or the heater core, depending on desired temperature. Then, the temperature-corrected air is directed by electrical actuators (3) to the occupants' selected distribution vents:

- Center
- Center - Floor Mix
- Floor
- Floor - Defroster Mix
- Defroster

Note: All actuators are electronic, and not cable-operated.

AIR CONDITIONING SYSTEM



The air conditioning (A/C) system uses the principles of thermodynamics to remove heat from the air entering the vehicle compartment. With the engine running:

1) The compressor compresses R-134a refrigerant into high-temperature/high-pressure gas.
2) Then, it pumps this gas into a condenser unit in front of the vehicle radiator. The condenser transfers heat from the gas to the air passing over its fins. The gas changes into a low temperature liquid refrigerant while maintaining high pressure.
3) The liquid goes through the receiver/drier, which is attached to the condenser, to filter, dry, and store the refrigerant.
4) Next, the refrigerant moves through the expansion valve, which lowers the pressure by metering it into the evaporator. A capillary temperature sensor in the block style expansion valve determines the metering rate.
5) While moving through the evaporator tubes, the refrigerant absorbs heat from the air moving over the evaporator fins and turns it back to a gas state. The gas is returned to the compressor where the cycle begins again.

HVAC TEMPERATURE CONTROL

The Spectra HVAC control panel consists of the following controls to allow vehicle occupants to adjust temperature and regulate airflow to suit their comfort:

- Blower speed control switch with four speeds from 1 (LOW) to 4 (HIGH)
- Air conditioning ON/OFF button (if equipped)
- Mode selection switch to turn air flow ON/OFF and select air flow distribution
- Temperature control switch to adjust cool to warm air flow
- Air intake control switch (Recirculated or Fresh)

BLOWER SPEED CONTROL SWITCH

The blower switch controls the air speed of the ventilation system by controlling blower motor speed. The switch has an electrical circuit containing a resistor block that will regulate blower motor input voltage to control the motor speed.

MODE SELECTION SWITCH

The mode switch controls ventilation system discharge location. The switch contains an electrical circuit to control an actuator that is connected to the mode door for discharge control. The “OFF” or “O” position turns off the fan regardless of the blower speed setting.

TEMPERATURE CONTROL SWITCH

The temperature switch controls the temperature door position that will be used to regulate the ventilation system's discharge air temperature. The switch contains an electrical circuit to control an actuator that is connected to the temperature blend door.

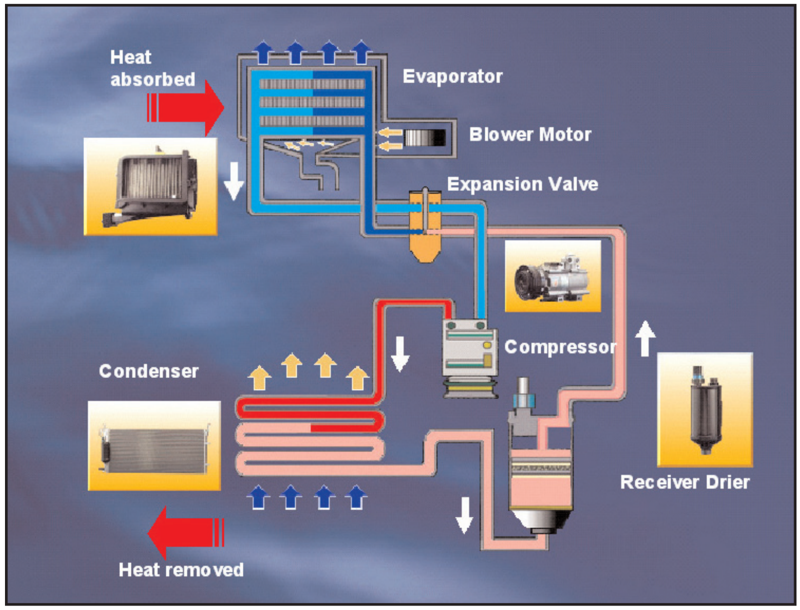
AIR INTAKE SWITCH

The intake switch controls the intake door used to regulate the intake of fresh or recirculated air flow into the ventilation system. The switch contains an electrical circuit used to control the actuator that is connected to the intake door.

AIR CONDITIONING SWITCH

The air conditioning switch controls the ON/OFF selection of the air conditioning system compressor. The switch contains an electrical circuit that will request the PCM/ECM to switch ON or OFF the ground side to the compressor clutch control relay.

AIR CONDITION CIRCUIT COMPONENTS



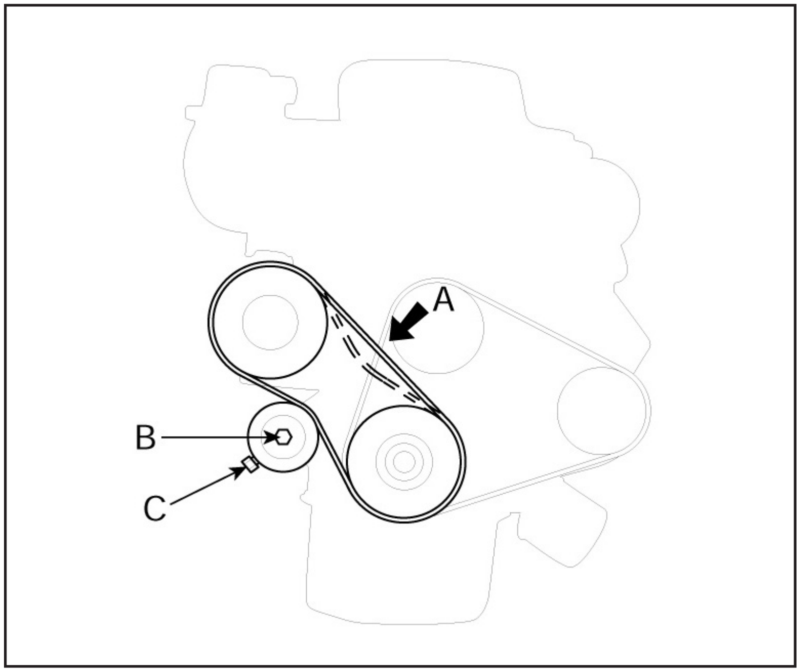
The purpose of the A/C system is to cool and dehumidify fresh or recirculated air before it enters the vehicle's interior. The A/C components in the new Spectra are found in other Kia vehicles. A/C system components include:

- Drive Belt
- Compressor
- Air Conditioning Relay
- Condenser with Receiver/Drier
- Triple Pressure Switch
- Condenser Fan Relay (2)
- Expansion Valve
- Evaporator
- Duct/Fin sensor
- Condenser Fan (not shown)
- A/C control Module

Note: Always refer to under hood A/C label for system type and specifications.

Caution: This A/C system uses only R-134a refrigerant and FD46XG (PAG) refrigerant oil. Using R-12 refrigerant and mineral oil and R-12 servicing equipment will damage the air conditioning system and servicing equipment. Stop leak additives should never be used.

DRIVE BELT



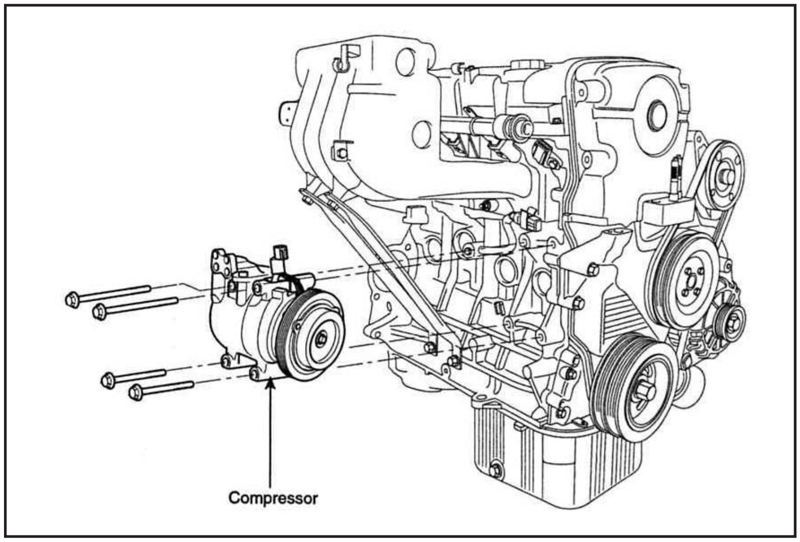
The A/C compressor is driven by the crankshaft pulley via a single drive belt that is adjusted to the deflection listed below. This deflection is measured at the midpoint (A) between the compressor and the crankshaft pulley.

Deflection: 22 lb-ft

Used Belt: 0.24-0.28”

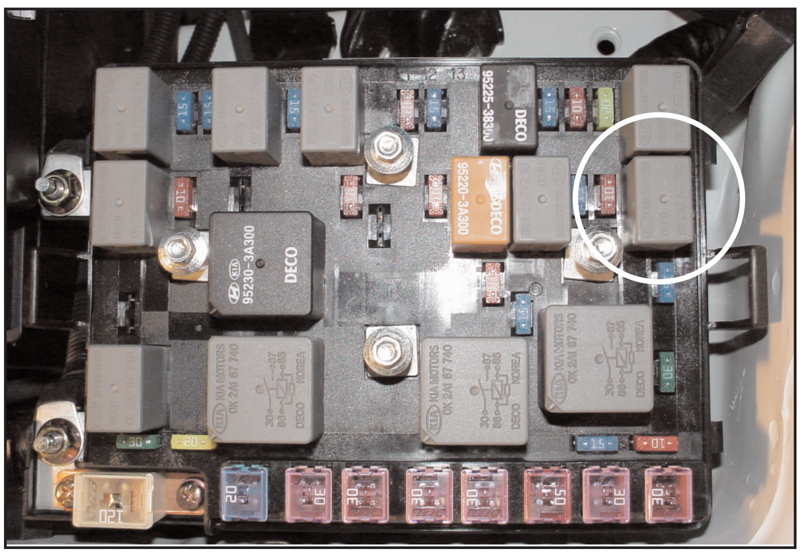
New Belt: 0.20-0.22”

A/C COMPRESSOR



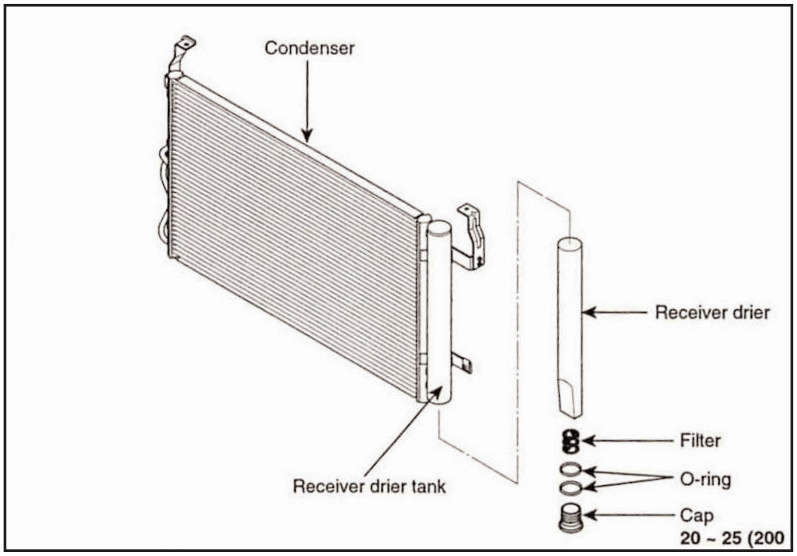
The A/C compressor is a swash plate type unit mounted on the rear side of the engine. The magnetic clutch enables the compressor to start and stop while the engine is running. The compressor compresses the evaporated refrigerant into high pressure (high temperature) gas and pumps it out to the evaporator. Note: The magnetic clutch has a thermal fuse (363.2° F melt point), which disengages the clutch to protect the drive belt and compressor.

A/C RELAY



The A/C relay is a normally open (NO) relay located in the under hood relay box. An A/C ON request signal is sent to the PCM when vehicle occupants push the A/C switch. After checking the operating condition of the engine, the PCM grounds the relay control coil to close the NO switch and energize the magnetic clutch from the 15A A/C fuse. The magnetic clutch uses engine ground to complete the circuit.

CONDENSER AND RECEIVER/DRIER

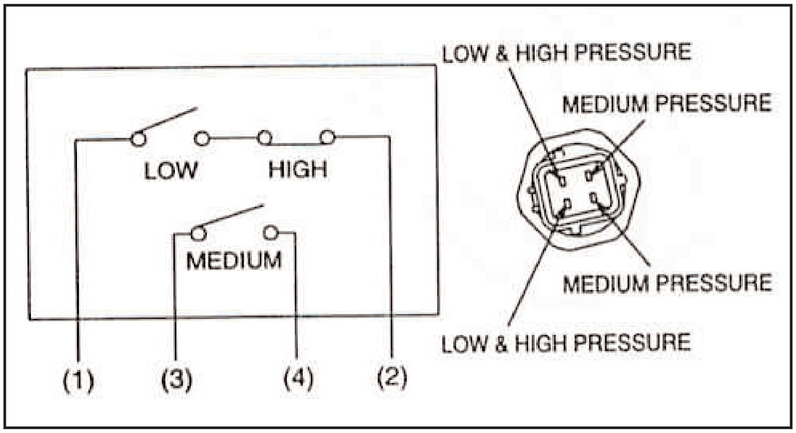


The condenser, which is mounted in front of the Spectra's radiator, dissipates heat to the outside air. The heat is exchanged when air moves through the condenser fins/coils (by the cooling fan and vehicle speed). High pressure gas enters the bottom of the condenser, travels upward dissipating heat, and condenses into a high pressure liquid. The liquid passes through a filter and desiccant material to remove moisture and system contaminants before being stored in the receiver/drier. The high pressure liquid is then supplied to the expansion valve.

The receiver/drier tank, attached to the left side of the condenser assembly, has a cap, two o-rings, and a filter on the bottom. When testing the system, be sure to inspect the receiver/drier tank for leaks. The Spectra is equipped with a receiver/drier that attaches to the condenser. The filter is non-serviceable under normal operation.

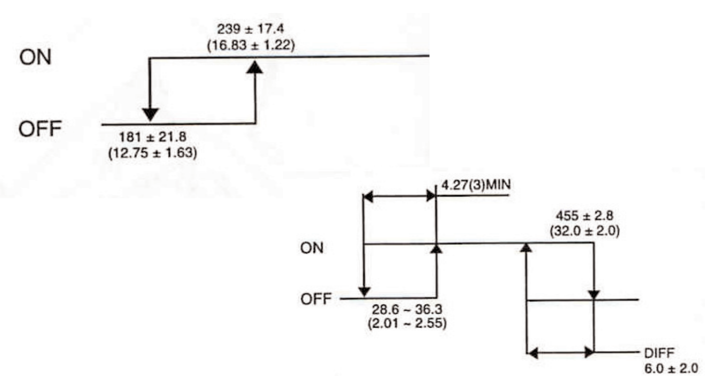
Note: Parts Distribution Center (PDC) stocks the correct size O-Rings.

TRIPLE PRESSURE SWITCH AND CONDENSER FAN

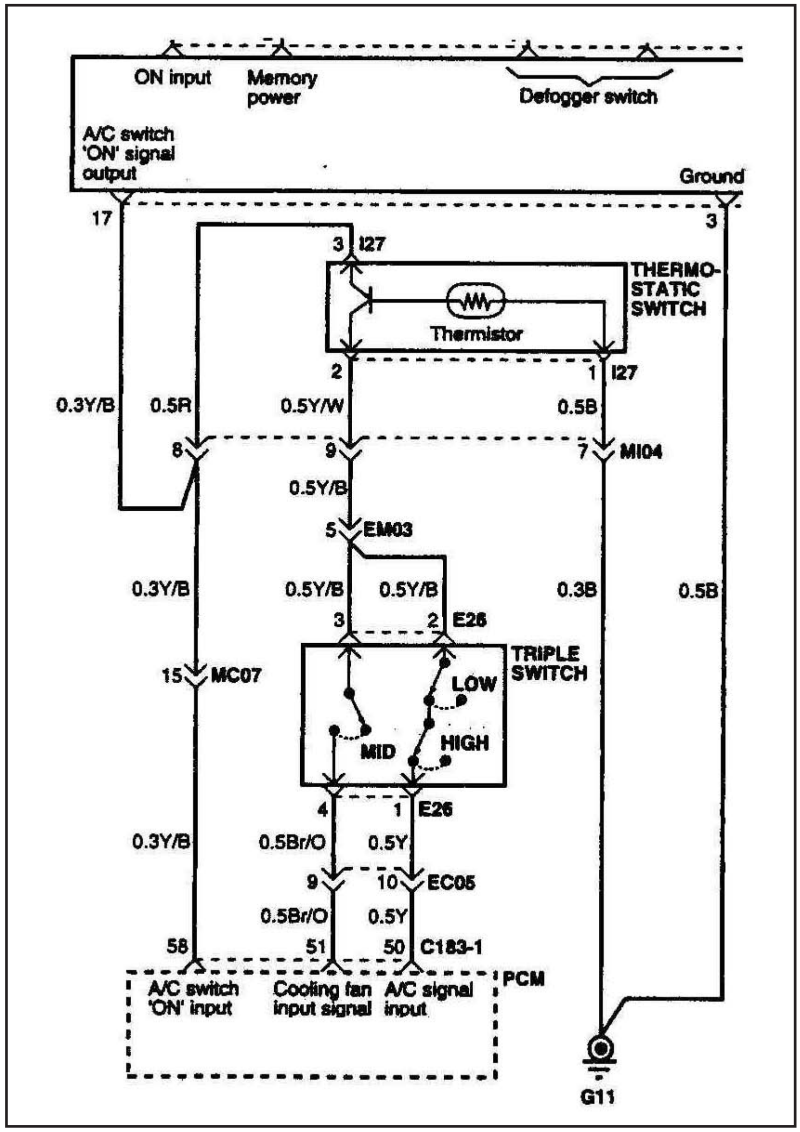


The 4-pin connector triple pressure switch is located on the high pressure line between the compressor and the condenser. It is a combination of a medium pressure switch as well as conventional low pressure and high pressure switches. The low pressure switch is a NO switch held closed by refrigerant pressure, it will open and turn OFF to stop compressor operation by interrupting current to the magnetic clutch if refrigerant pressure is LOW. The high pressure switch is a normally closed (NC) switch, it will open and signal the PCM/ECM to turn OFF compressor operation if refrigerant pressure is too high by interrupting current to the magnetic clutch.

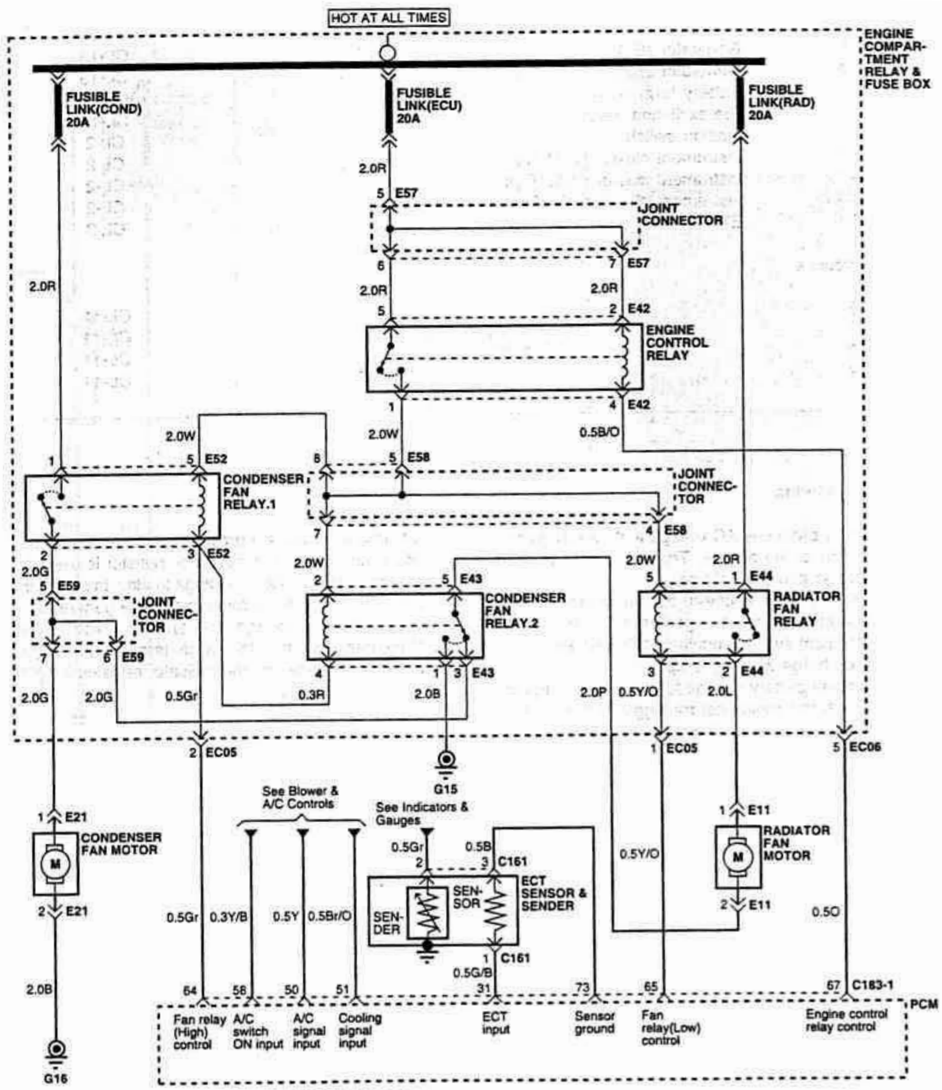
Pressure	ON	OFF
High [psi (kg/cm²)]	370 ± 2.8 (26.0 ± 2.0)	455 ± 2.8 (32.0 ± 2.0)
Low [psi (kg/cm²)]	28.6 ~ 36.3 (2.01 ~ 2.55)	28.4 ± 2.8 (2.0 ± 0.2)
Medium [psi (kg/cm²)]	220 ± 11.4 (15.5 ± 0.8)	164 ± 17.1 (11.5 ± 1.2)



The medium pressure switch is a NO switch and will close to turn ON at a medium level pressure (220 PSI) to prevent the A/C system from overheating, and open, turn OFF when pressure is below 164 PSI.



This medium pressure switch signal is sent to the PCM/ECM, which uses it and the engine coolant temperature sensor to control the operation of the radiator and condenser fan motors through the NO radiator fan relay and 2 NO condenser fan relays (number 1 and number 2) to provide optional cooling fan operation.



A/C	Pressure [psi(kg/cm²)]	Vehicle Speed [MPH(km/h)]	Fan	Coolant temperature[℃(°F)]			
				-30(-22)	95(203)	100(212)	107(224.6)
ON	above 220(15.5)		RAD	HIGH			
			COND	HIGH			
	below 220(15.5)	V<28(45)	RAD	LOW	HIGH		
			COND	LOW	HIGH		
		28(45)≤V<50(80)	RAD	OFF	LOW	HIGH	
			COND	OFF	LOW	HIGH	
		50(80)<V	RAD	OFF		HIGH	
			COND	OFF		HIGH	
OFF		V<28(45)	RAD	OFF	LOW	HIGH	
			COND	OFF	LOW	HIGH	
		28(45)≤V<50(80)	RAD	OFF	LOW		HIGH
			COND	OFF	LOW		HIGH
		50(80)<V	RAD	OFF			HIGH
			COND	OFF			HIGH

When the PCM/ECM sets a "low" speed for both radiator and condenser fans, the control coil of the radiator fan relay is grounded, closing the NO switch and providing B+ to both the radiator and condenser fan motors through both the radiator fan relay and the condenser fan relay #2, with a control coil that is not energized. The relays wire the two fans in series, which cause both fans to operate at low speed due to higher circuit resistance.

When the PCM/ECM determines the need for "high" speed, the control coil of condenser fan #1 is also grounded, closing the NO switch and supplying B+ to the condenser fan motor. Also, condenser fan relay #2 control coil is grounded and energized, which transfers the switch contacts to provide a ground to the radiator fan motor. Both fan motors are now in parallel causing them to operate at high speed to cool the A/C condenser and coolant radiator.

EXPANSION VALVE

The expansion valve is a block style and is located behind the engine on the bulkhead. It contains the capillary temperature sensor within the block to meter high pressure liquid refrigerant into the evaporator as low pressure liquid refrigerant (atomized) to absorb heat through the evaporator fins.

EVAPORATOR

The evaporator, located in the air distribution box, evaporates the atomized refrigerant into a gas while exchanging the heat from the air flowing (by the blower motor fan) across its fins.

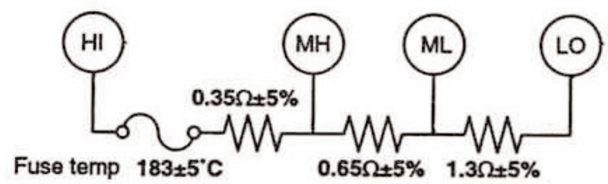
Note: If leak is suspected, insert A/C leak detector at the evaporator drain hole.

BLOWER MOTOR ASSEMBLY AND AIR DISTRIBUTION

BOX COMPONENTS

The blower motor assembly, located on the right side of the dash and behind the glove box, houses the following:

- Blower motor
- Blower Relay
- Air filter (if equipped)
- Blower resistor

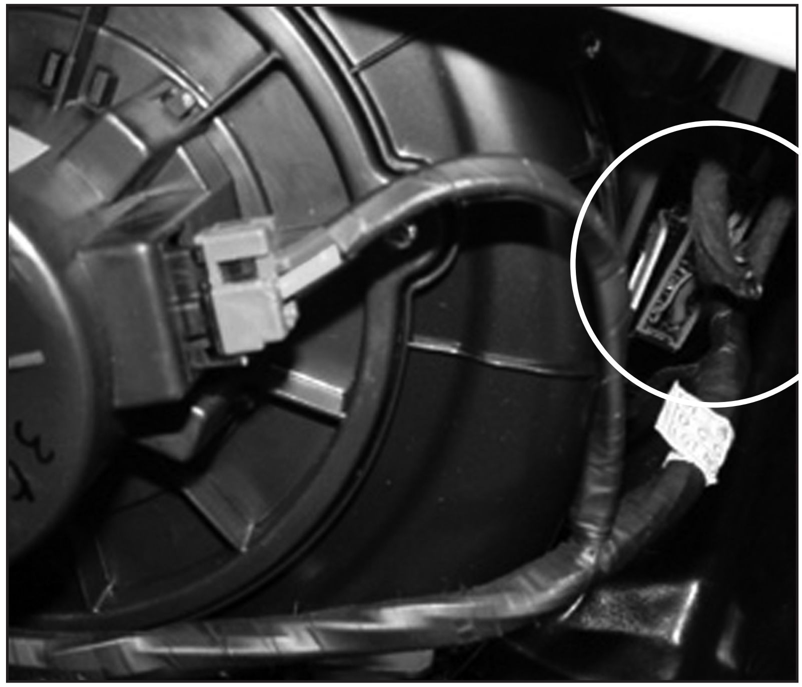


Ohmmeter indication / Terminal / Speed	1 ML	2 MH	3 LO	4 HI	Resistance (Ω)
Continuity is indicated			O	O	2.3 ± 15%
	O			O	1.0 ± 10%
		O		O	0.35 ± 5%

Note
O—O : Indicates that there is continuity between points.

The housing also includes the blower resistor, which contains a protective thermo fuse and 3 resistors in series to provide four voltages for the blower motor operation, depending on the blower switch position. The blower resistor is cooled by the air flow; it is not a power transistor type. The blower resistor is inspected by verifying if high speed operates while other speeds do not. If high speed operates, measure terminal-to-terminal resistance of the blower resistor to determine if within specification. The blower motor does not use a high speed fan relay.

BLOWER MOTOR CONTROL OPERATION



When the ignition switch is in the ON position and the mode switch is in any position except OFF, the blower switch in any speed position energizes the blower motor relay coil. The blower motor fan relay is located next to the blower motor.

The relay provides B+ to the blower motor. Ground is provided to the blower motor through the blower resistor block and the blower switch. As the blower switch is moved from LOW to HIGH (four speed steps), resistance of the resistors (built into the blower resistor) and therefore ground resistance will decrease, which will increase the blower motor speed. When the blower motor switch is in HI, all of the resistors and resistance to ground are bypassed and the blower motor runs at the highest speed.

AIR FILTER (IF EQUIPPED)

Spectra is Kia's second vehicle in the United States to use an air filter in the blower motor assembly to filter intake air for improved air quality in the passenger compartment.

The blower motor draws fresh or recirculation air through the air filter into the air distribution box. If equipped, the recommended service is every 10,000 miles. To service:

- Drop-down the glove box door
- Pull the locking tabs on the air filter cover
- Remove cover.

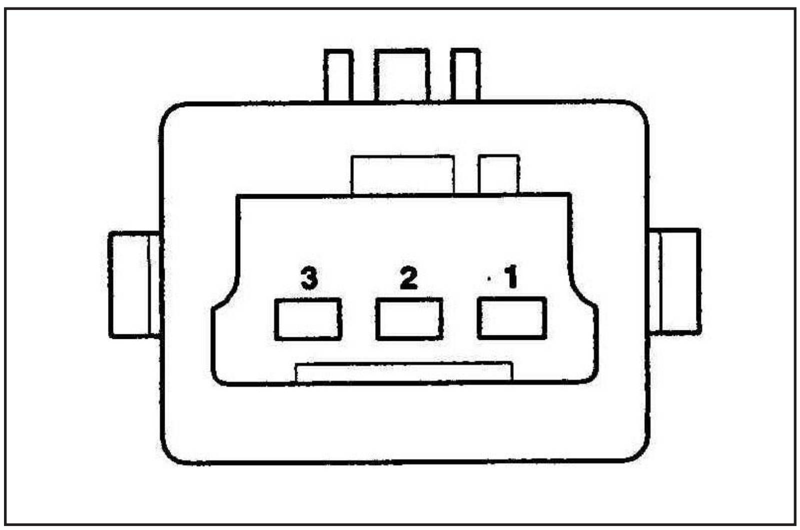
Note the UP direction arrow (circled) on the filter when removing and replacing (if equipped).

AIR DISTRIBUTION BOX COMPONENTS

The air distribution box houses the following:

- Heater Core with engine coolant flowing through it
- Evaporator Core (if equipped)
- Fin Sensor (Thermostatic Switch)
- Mode Control Actuator
  - 3 doors for the following positions
    - Defrost
    - Floor
    - Center
    - Mixed
  - Door position sensor (Potentiometer)
- Fresh and Recirculation Intake Actuator
  - 1 door for the following positions
    - Recirculated
    - Fresh air
- Temperature Actuator
  - 1 door
  - Door position sensor (Potentiometer)

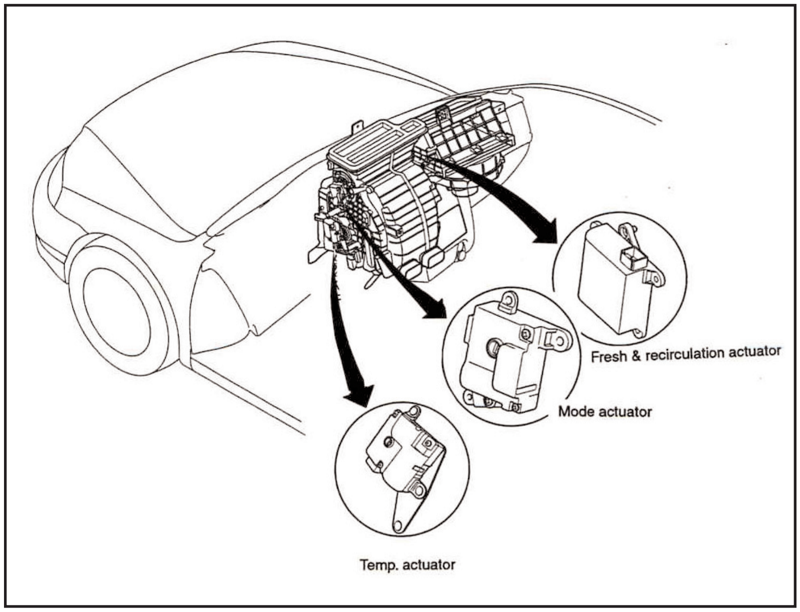
DUCT/FIN SENSOR



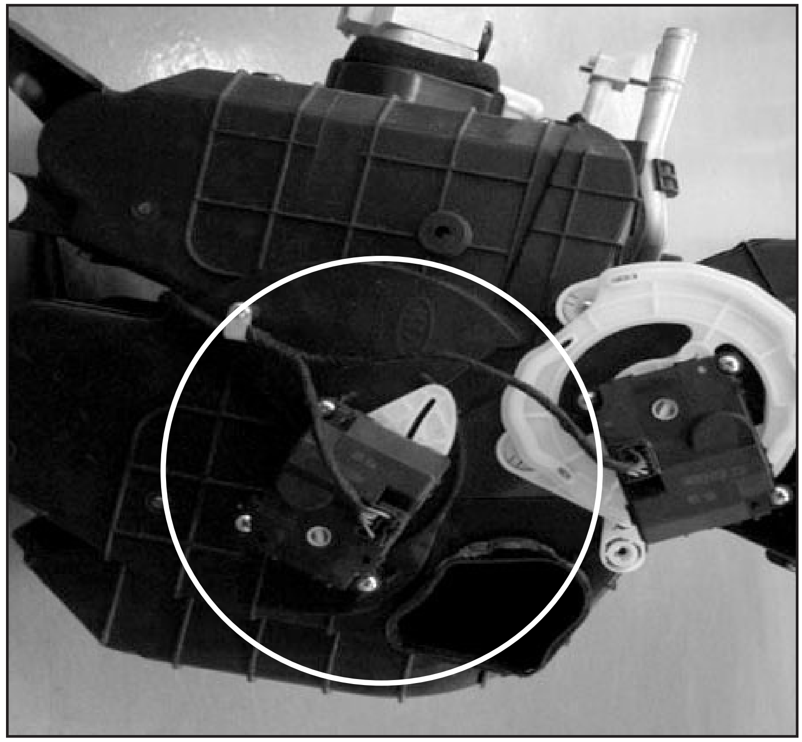
The fin sensor is a thermostatic switch (NTC thermistor) that will detect the evaporator core temperature and interrupt A/C compressor relay power in order to prevent evaporator freeze up due to excessive cooling.

The sensor can be inspected by checking the output voltage at terminal 1. Terminal 2 is 5V reference from A/C control module. Terminal 3 is not used.

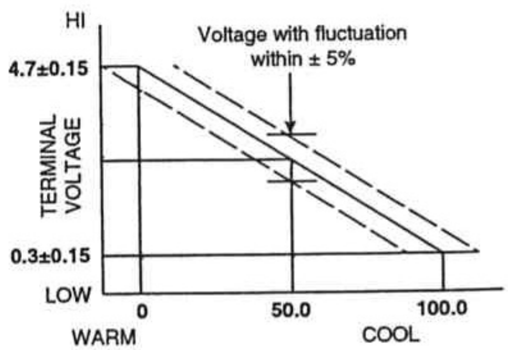
AIR DISTRIBUTION BOX ACTUATORS



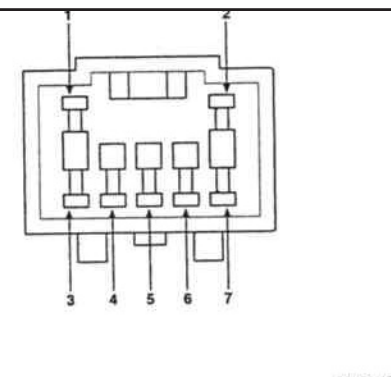
When the ignition switch is in the ON position and the mode switch is selected by the vehicle occupant to any position except OFF, the control module supplies voltage to the 3 actuators and potentiometers.



The control module operates the temperature actuator in one direction and by reversing polarity, it will operate the motor in the opposite direction to control the amount of air moving through the heater core.

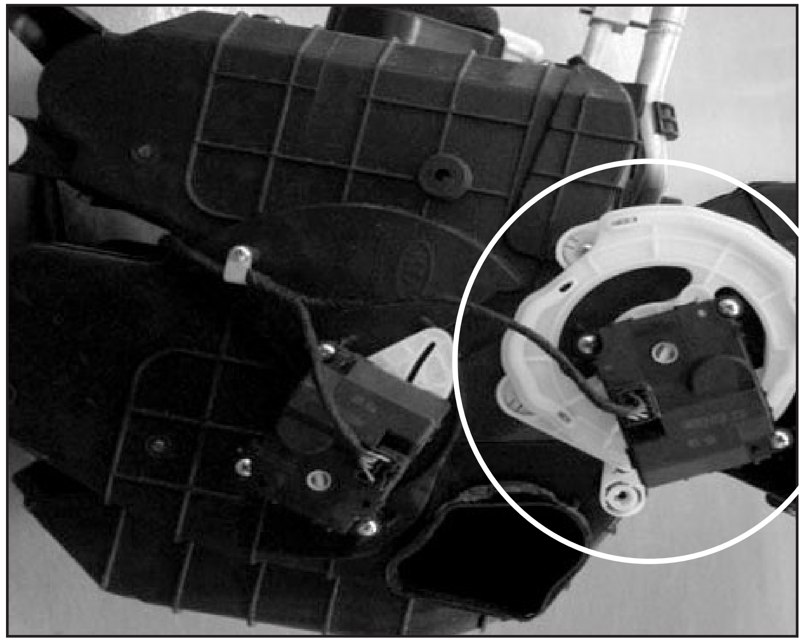


The rotation direction is "WARM" when "+" applied at No.3 terminal in the view of output axis.

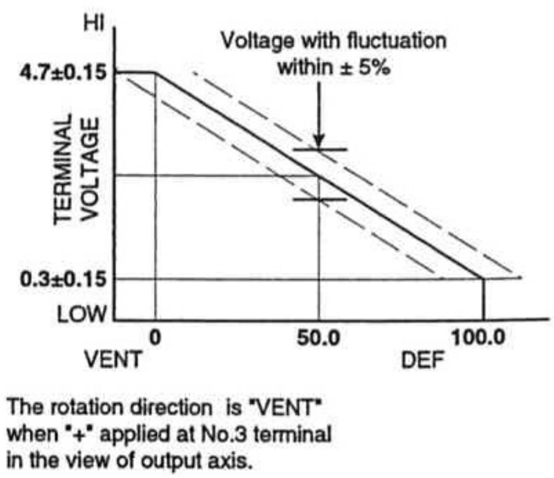


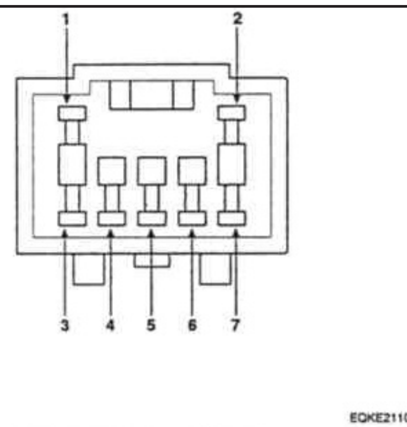
Tem-inal No.	1	2	3	4	5	6	7
Mode	X	X	WARM	COOL	VCC (+)	F/B	SEN-SOR GND(-)

The control module supplies a 5V reference to the potentiometer, which is grounded. Based on the location of the door, a variable feedback voltage is supplied back to the control module, indicating door location. This is compared to the occupant's selected location of the warm-cool switch.



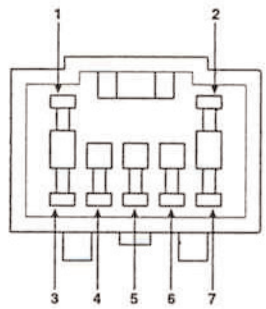
The control module operates the mode control actuator similar to the temperature actuator. Instead of actuating one temperature door, the mode actuator operates a cam, which moves the 3 mode doors into 5 possible positions for distributing air into the cabin.





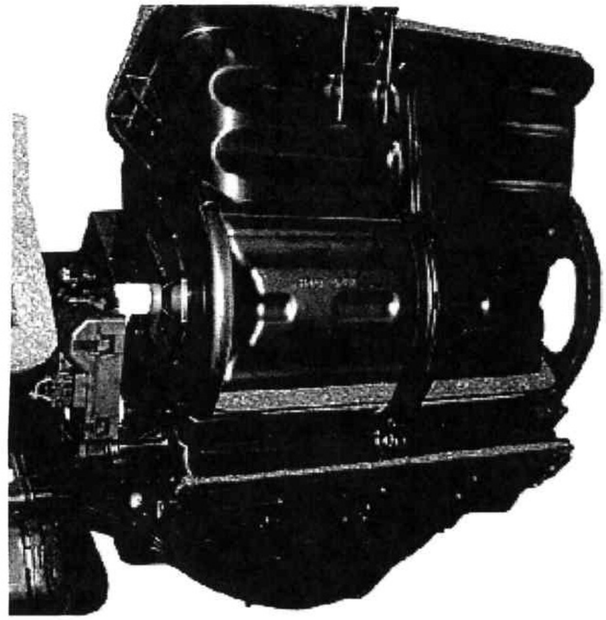
Tem-inal No.	1	2	3	4	5	6	7
Mode	X	X	VENT	DEF	VCC (+)	F/B	SEN-SOR GND(-)

The potentiometer works similar to the temperature potentiometer, as shown on the chart above.



EQKE211C

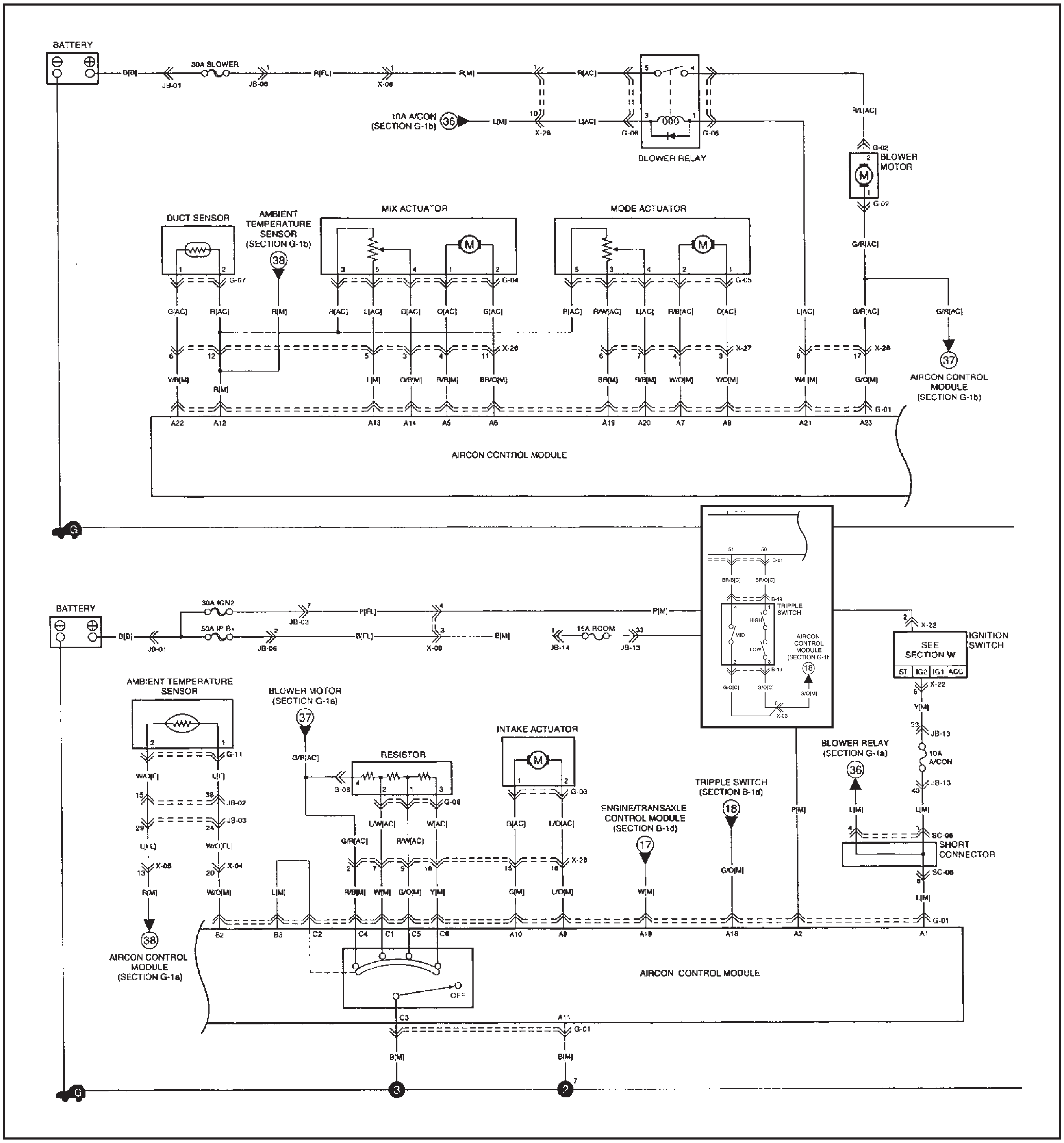
Terminal No.	1	2	3	4	5	6	7
Mode	FRE	REC	X	X	X	X	X



The control module operates the intake (fresh and recirculation) actuator open or closed. With B+ applied to terminal 2, the motor rotates clockwise (CW) to close the fresh air inlet duct. With B+ applied to terminal #1, the motor rotates counter clockwise (CCW) to open the fresh air inlet duct. A potentiometer is not used for door location feedback, the A/C control module senses current flow when the door stalls, then interrupts current to motor.

Note: When mode selection switch is turned OFF, air intake control is set to fresh air mode. However, fresh air or recirculation mode can be selected with mode selection switch turned to OFF.

A/C CONTROL CIRCUIT (IF EQUIPPED)



When the ignition switch is in the ON position, the mode control switch is in any position except OFF and the A/C request button is turned ON, an A/C ON signal is sent to the PCM. With the low and high switches of the triple pressure switch being closedand the duct sensor is closed, the A/C ON request signal is sent to the PCM.

When the engine management system parameters are in place for the PCM to activate the air conditioning system, the PCM energizes the A/C relay coil and the A/C relay contact closes. Battery voltage is applied to the A/C compressor magnetic clutch through the 15 amp relay fuse to the engine relay and fuse box, turning the A/C compressor ON. The A/C compressor is case grounded and operates.

Note: When DEF-FLOOR MIX and DEF mode is selected:

- ***Air conditioning system is switched ON and air intake control is switched to fresh air mode***
- ***A/C can not be turned OFF manually***
- ***If A/C was not ON before selecting DEF-FLOOR MIX or DEF mode, A/C indicator lamp will not be turned ON even though A/C is operating.***

Note: The Spectra HVAC is not supported by the Hi-Scan Pro.

SUMMARY

The 2004.5 Spectra is equipped with a climate control system for heating and ventilation for vehicle occupants to manually adjust temperature and regulate airflow. The air conditioning system is optional on LX models and standard on EX and 5-door.

Unique to the new Spectra is an air filter in the blower assembly for filtering intake air. The 2004.5 Spectra is Kia's second vehicle in the U.S. to use an air filter, following the 2004 Amanti. This air filter is an optional accessory.

In this module, we covered HVAC system and component operation, component location, service, and diagnosis. With this knowledge and hands-on experience from the upcoming guided practice, you should be prepared to diagnose and service your customer's HVAC systems.

PROGRESS CHECK

1. Technician A states that the triple switch controls blower speeds in the HVAC system. Technician B states that the triple switch controls the mode doors to determine at what level the conditioned air will be delivered. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

2. Technician A states that the Expansion Valve keeps the evaporator from freezing. Technician B states that the fin sensor keeps the evaporator from freezing. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

3. Technician A states that as R-134a refrigerant leaves the condenser, it is in a high-pressure liquid state.

   Technician B states that as the R-134a refrigerant enters the evaporator, it changes into a lower pressure gas and absorbs heat. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

4. Technician A states that the cooling fans when operating on low speed are in series and are switched to parallel for high speed operation. Technician B states that the cooling fan relays control fan speed. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

5. The air filter located in the Blower motor housing is used to remove contaminants and moisture from the air before it enters the passenger compartment.

   A. True

   B. False

NOTES:

NOTES:

ANSWER KEY:
1. D 2. C 3. C 4. C 5. B

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Heating, Ventilation, and Air Conditioning (HVAC)

2004.5 Spectra Technology

KIA

Service Technical Training

Student Guide

NMLD.11

Guided Practice

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, you will be given the opportunity to practice performing heating, ventilation, and air conditioning-related service and diagnostic procedures.

MODULE OBJECTIVES

Objectives of this module are for you to demonstrate your ability to:

- Diagnose condenser and cooling fan operation.
- Remove and replace HVAC air filter.
- Inspect Control Actuator Potentiometer

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- 2004.5 Spectra (LD) or LD engine
- #2 pencil or preferred writing instrument
- Air Filter
- KSIS
- DVOM and jumper leads

TIME TO COMPLETE

This module will take approximately 30 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the information you have learned in the Heating, Ventilation, and Air conditioning (HVAC) theory module. Under the supervision of a trained Kia service-training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

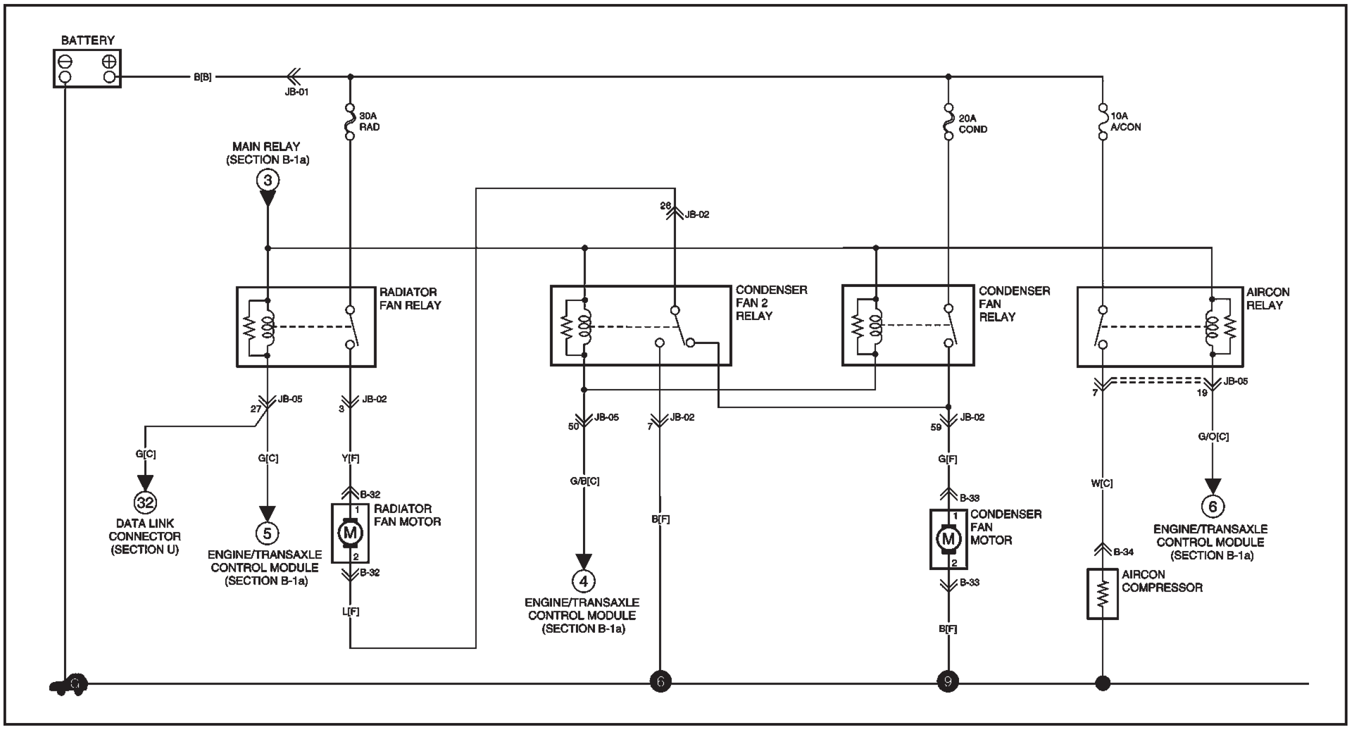
TABLE OF CONTENTS

Total Possible Points: 5

FAN COMPONENT OPERATION

Total Possible Points: 2

1. Using the circuit below, trace and mark the power and groundside for the cooling and condenser fans during low speed operation.



2. Now trace and mark the power and ground side for the cooling and condenser fans during high-speed operation.
3. What component(s) causes the fan to go from low to high speed? ______________________________

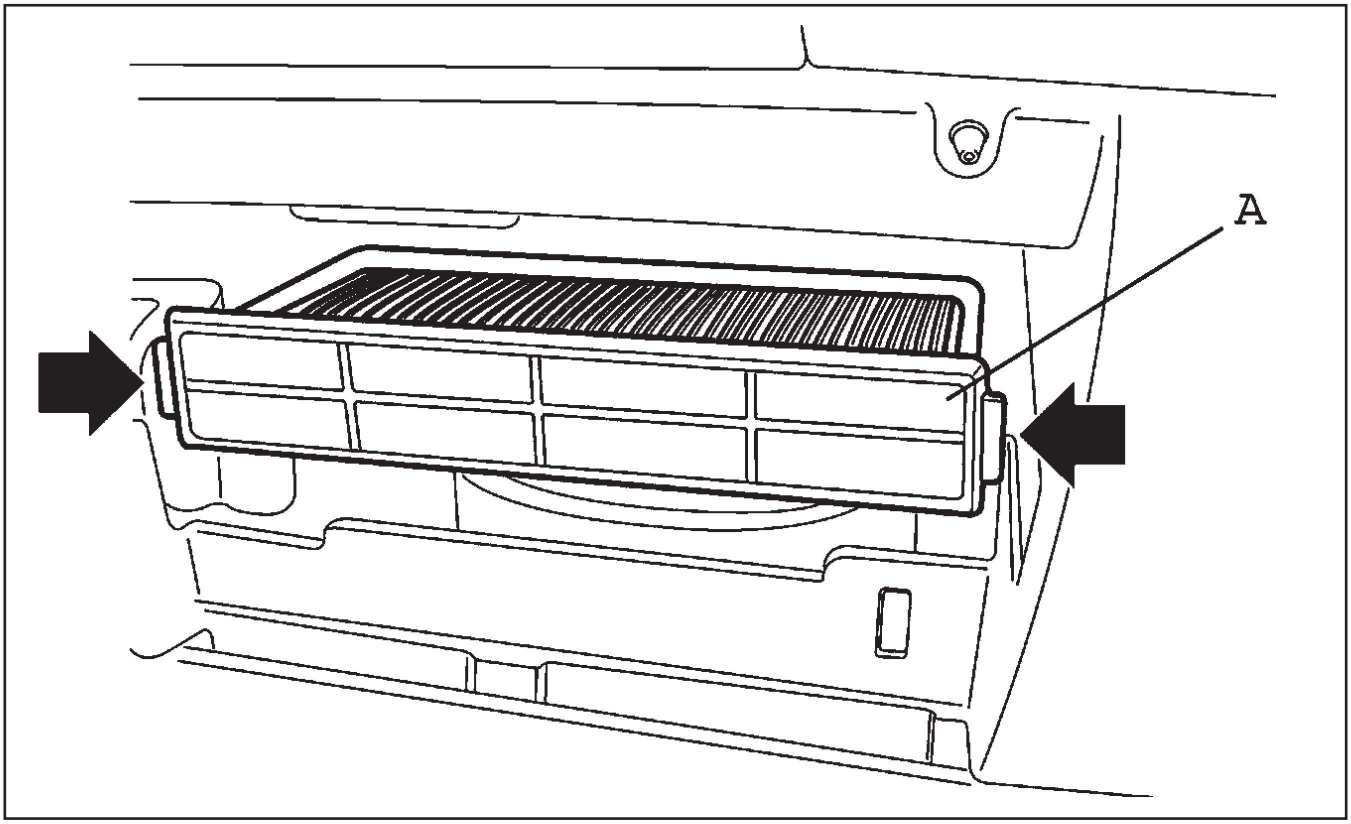
____

____

HVAC AIR FILTER

Total Possible Points: 1

Remove and replace the HVAC air filter.



Record procedure below.

____

____

____

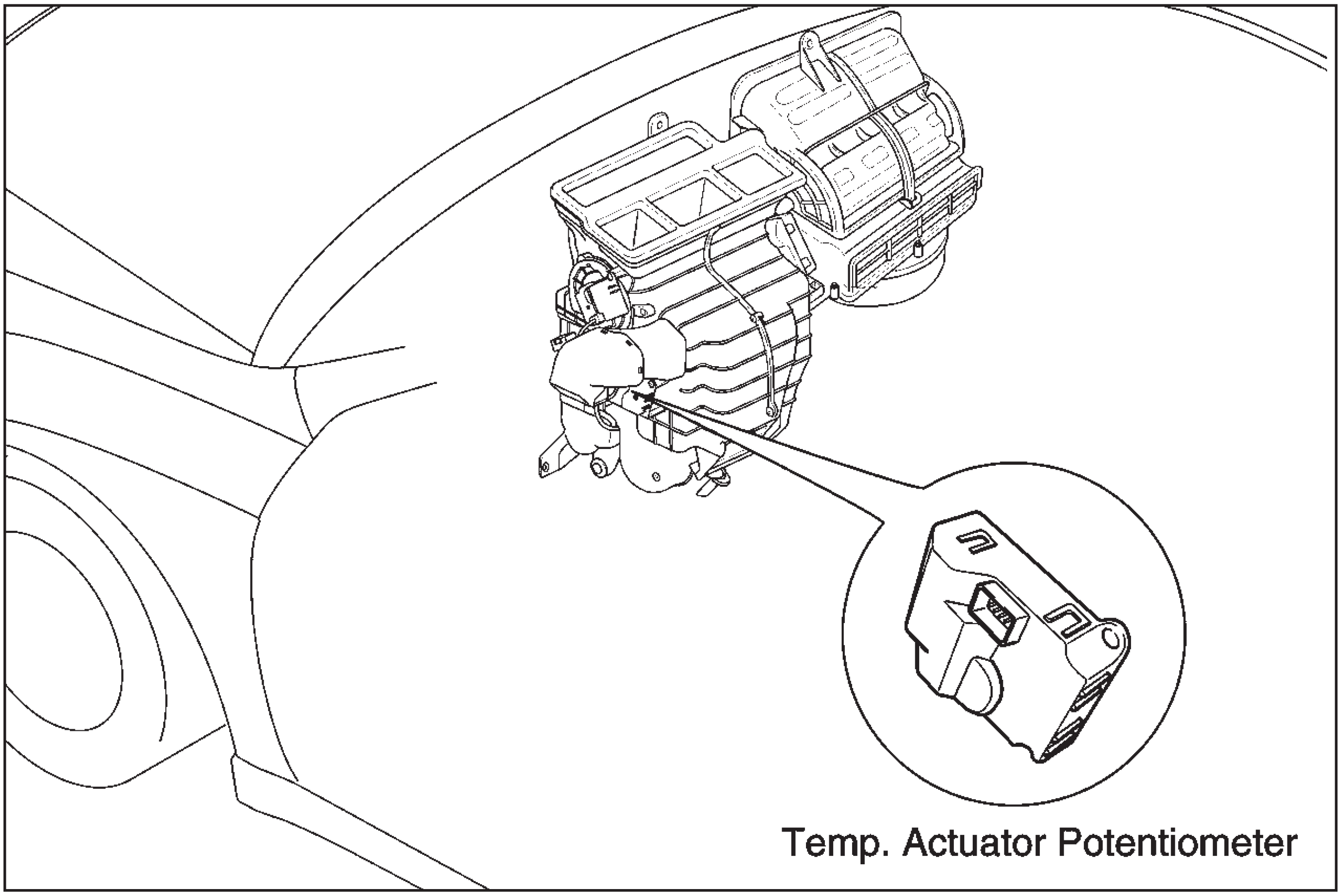
List the direction (A) the air filter goes in: ___________

Note: Complete guided practice if air filter is not installed in your training vehicle.

CONTROL ACTUATOR

Total Possible Points: 2

1. Locate the Mode or Temperature actuator and potentiometer.



2. Disconnect the connector.
3. Verify that the actuator operates by connecting B+ to terminal 2 and grounding terminal 1.
4. Verify the actuator operates in the opposite direction when reversing B+ and ground connection.
5. Connect the connector.
6. Back probe terminal 3 and 4 to check the voltage between them. See chart below.

Door Position	Voltage:	Error Detection:
Max. Cooling	0.4 V	Low voltage: 0.08Vs or less
Max. Heating	4.5 V	High voltage: 4.9V or more

7. List results ___________________________________

NOTES:

NOTES:

NOTES:

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Supplemental Restraint System (SRS)

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.12

Theory

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

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When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

Upon successful completion of this New Spectra Supplemental Restraint System (SRS) theory module, you will be able to:

- Identify and explain the operation and diagnosis of the MY 2004.5 and 2005 Spectra

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify or perform the following with 80% or greater accuracy:

- Application of the Spectra SRS with past Spectra and existing Kia vehicles
- Spectra Supplemental Restraint System (SRS) operation
- Spectra Supplemental Restraint System (SRS) components location and operation
- Diagnosis and repair of:
  - Driver Airbag (DAB) and Passenger Airbag (PAB) dual squib
  - Occupant Classification System (OCS)
  - Side Curtain Bag
  - Front Impact Sensor (FIS) (1) and Side Impact Sensor (SIS) (4)
  - Seat location sensor
- SRS Special Service Tools
- Diagnostics using the Hi-Scan Pro (HSP)

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. In the module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Tools: Dummies, Dummies Adaptor, Hi-Scan Pro

Components/Training aids: SIS and FIS

Resources: KSIS

Vehicle: Spectra (LD) - 2004.5

Other: Preferred writing instrument

TIME TO COMPLETE

This module will take approximately 20 minutes.

ACRONYMS

ACU: Airbag Control Unit

ALR: Automatic Locking Retractor

BPT: Belt Pretensioner

BS: Belt Buckle Switch

CAB: Curtain Airbag

DAB: Driver Airbag

DBPT: Driver Belt Pretensioner

ELR: Emergency Locking Retractor

FIS: Front Impact Sensor

FSAB: Front Side Airbag

IP: Instrument Panel

MIL: Malfunction Indicator Lamp

OCS: Occupant Classification System

PAB: Passenger Airbag

PBPT: Passenger Belt Pretensioner

SDM: Sensing Diagnostic Module

SIS: Side Impact Sensor

SRI: Service Reminder Indicator

SRS: Supplemental Restraint System

SRSCM: Supplemental Restraint System Control Module (also may be referred to as the ACU)

SPECIAL SERVICE TOOLS (SST)

Airbag Load Tool

SAB Load tool Adapter

DAB, CAB, SBP Load tool Adapter

PAB Load tool Adapter

Spectra SAB Deployment Adapter

INTRODUCTION

The seat belt is the primary restraint system to help reduce the risk and severity of injury to the driver and passengers in a frontal or side collision. The 2004.5 Spectra uses a Supplemental Restraint System (SRS) designed to deploy selected airbags and complement the seatbelts and seat belt pretensioners. The Spectra SRS uses an SRS Control Module (SRSCM) with internal and external sensors that differentiate between an event that should deploy the SRS and an event that should not.

PURPOSE

The supplemental Restraint System (SRS) is designed to supplement the seat belts to help reduce the risk and/or severity of injury to the driver and passenger(s) by activating and deploying the driver, passenger, side and curtain airbags as well as the front seat belt pretensioners.

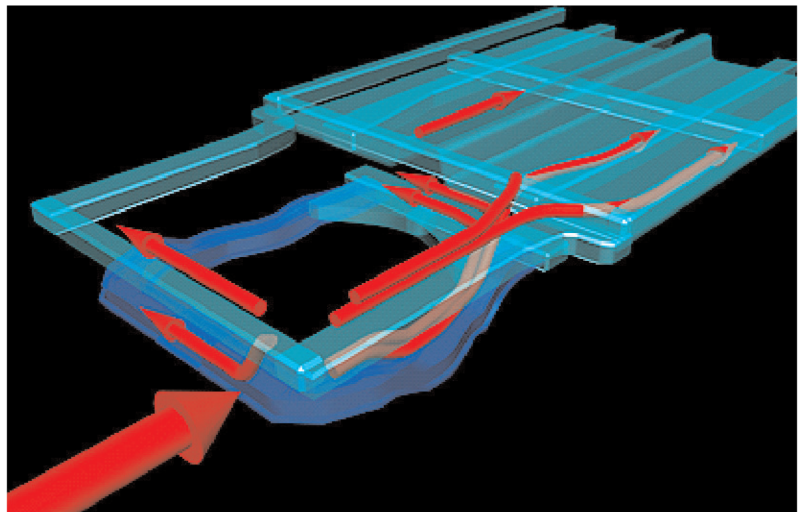
Airbags function to:

- Absorb kinetic energy of occupants
- Protect occupants from interior trim
- Protect occupants from broken glass
- Reduce occupants' neck load by restraining neck spin

With the Ignition key turned to ON position, the SRI Lamp will turn ON for a 3 second bulb check and then flash to indicate a system self-check. The SRI lamp will stay ON if a fault is found; otherwise, the lamp goes OFF.

The Passenger Airbag OFF Indicator will illuminate when there is no passenger on the front passenger seat.

The system is passive and requires no action from the driver. The SRSCM continues to monitor for a frontal or side collision while performing self-diagnosis. If the SRI lamp illuminates any other time, the SRS should be inspected immediately and serviced by a Kia dealership.



When the vehicle is involved in a frontal or side impact event, forces created by the impact moves into the vehicle and are partially absorbed through crumple zones of the vehicle prior to entering the passenger compartment. The SRS measures these forces to determine if sufficient force is present to warrant the deployment of airbags and/or seat belt pretensioners to protect the occupants from serious injury. The seat belt is the primary restraint. If warranted, the SRS Control Module (SRSCM) activates the correct components.

Note: Most SRS components are replaced after deployment.

APPLICATION

2004 Models	1996-1999 Sephia	2000-2003 Spectra SD	2004.5-2005 Spectra LD
SRSCM (TRW)		X	
SRSCM (Breed)			X
Sensing Diagnostic Module (SDM)	X		
Driver's Airbag (DAB) Single Squib	X	X	
Driver's Airbag (DAB) Dual Squib			X
Passenger's Airbag (PAB) Single Squib	X	X	
Passenger's Airbag (PAB) Dual' Squib			X
Front Side Airbags (FSAB)			X
Curtain Airbags (CAB)			X
Front Seat Position Sensor			X
Front Impact Sensors (FIS, 1 point sensing)			X
Side Impact Sensors (SIS, "B" Pillar)			X
Side Impact Sensors (SIS, "C" Pillar)			X
Occupant Classification System (OCS)			X
Passenger Airbag OFF Indicator			X
Clock Spring	X	X	X
Service Reminder Indicator (SRI)	X	X	X
Door Unlock Command			X
Buckle Switch (BS) Driver			X
Buckle Switch (BS) Passenger			X
Front Seat Belt Pretensioners (BPT)		X	X

WARNING *Failure to carry out service operations in the correct sequence could cause the SRS to unexpectedly deploy the airbags during servicing, possibly leading to serious injury. If a mistake is made in servicing the SRS system, it is possible that the airbag will fail to deploy when required.*

- *Before servicing (including removal or installation of parts, inspection or replacement), be sure to consult the service procedures on KSIS.*
- *Be sure to proceed with SRS-related service only after at least 10 seconds from the time the negative (-) battery cable is disconnected from the battery. The SRS is equipped with a back-up power source to ensure the deployment of the airbags in an impact event even when there is a lost of battery power. The back-up power is available for a minimum of 150 ms.*
- *The SRS must not have power supplied (Battery disconnected) to the System when removing or installing the SRSCM, FIS, SIS and/or the buckle switches. Air impact tools should not be used close to the sensors with power applied to the SRS. Refer to System Safety Precautions listed in this module.*
- *Never attempt to disassemble and repair the SRS components (DAB, PAB, SAB, CAB, and BPT), Clock Spring, and wiring. Always replace these components with new parts.*
- *Be sure to install the harness wires so they are not pinched nor interfere with other parts.*
- *Never attempt resistance checks on the air bag itself since air bag deployment may occur resulting in serious injury.*
- *Wear gloves and safety glasses when handling deployed air bags and wash your hands after handling a deployed air bag.*
- *If any component of the SRS was dropped or if there are cracks, dents, or other defects in the case, bracket, or connector, replace them with new ones.*
- *Always store removed airbags with the cover in the up position. Never stack airbags on top of one another.*
- *When welding on a vehicle, always disconnect the battery's negative (-) terminal.*

Note: Record the audio presets before Battery power is removed. Reset after battery power has been restored. Remember to reset the clock.

Note: After work is completed on the SRS, perform an SRS SRI self-check with the Hi-Scan Pro tool.

SYSTEM OPERATION

Many SRS systems and components are standard in today's vehicles, such as the SRS Control Module (SRSCM), Clock Spring, Service Reminder Indicator, and Yellow Wiring Harness. Like the Amanti and Sorento, the new Spectra has additional SRS components, which operate more intelligently through the use of sensors.

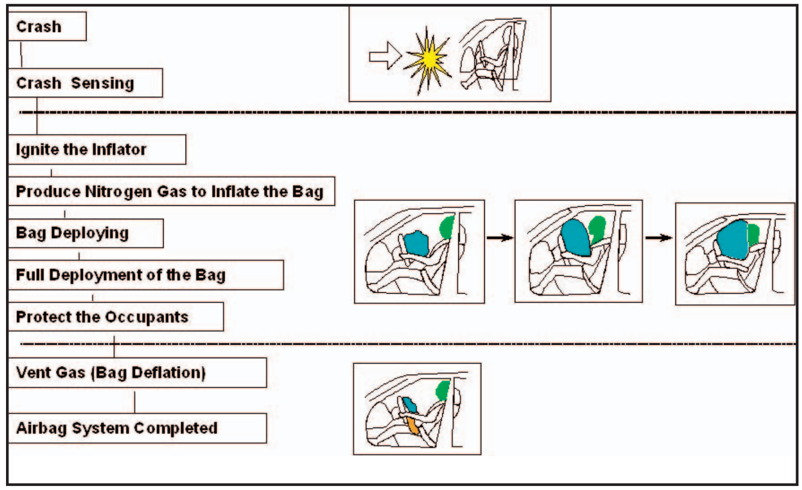
Like the Sorento, the Spectra is equipped with dual squibs for driver and front passenger airbag while the Rio, Optima, Sedona, Sportage, and Amanti have only single squib units. The new Spectra is the only vehicle in Kia's line-up with two side impact sensors, designated as the front side and the rear side impact sensors.

In addition, the 2004.5 Spectra has an Occupant Classification System (OCS) and Passenger Airbag OFF Indicator, which is not found in any other Kia in the United States.

The following chart displays SRS system and component comparisons for Kia vehicles.

	2004.5 LD Spectra	2004 Rio	2004 Optima	2004 Sedona	2004 Sportage	2004 Sorento	2004 Amanti
SRSCM	X	X	X	X	X	X	X
Driver Airbag Single Squib		X	X	X	X		X
Driver Airbag Dual Squib	X					X	
Passenger Airbag Single Squib		X	X	X	X		X
Passenger Airbag Dual Squib	X					X	
Front Side Airbags	X		X				X
Rear Side Airbags							X
Curtain Airbags	X					X	X
Front Impact Sensors	X					X	X
Side Impact Sensors	Dual		X			X	X
Rear Side Impact Sensor	X						
Occupant Classification System	X						
Passenger Airbag OFF Indicator	X						
Clock Spring	X	X	X	X	X	X	X
Service Reminder Indicator	X	X	X	X	X	X	X
Door Unlock Command	X					X	X
Buckle Switch	X		X	X		X	X
Belt Pretensioners	X	X	X	X		X	X
Belt Tension Limiter	X					X	X
Yellow Wiring Harness	X	X	X	X	X	X	X
Active Headrest							

AIRBAG SYSTEM OPERATING SEQUENCE



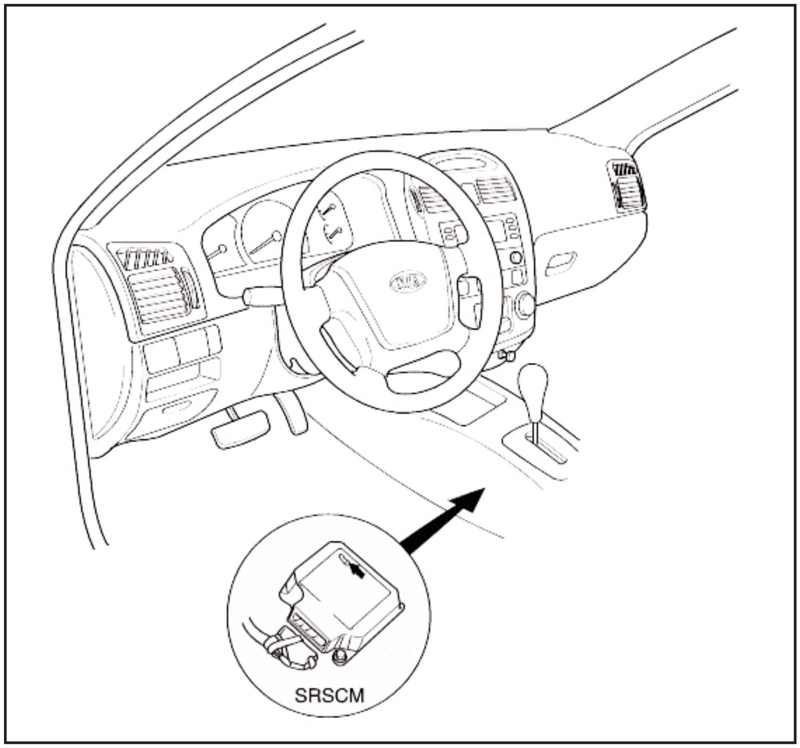
This drawing illustrates the operational and airbag deployment sequence:

- The SRS advises the driver of its operating condition through the Service Reminder Indicator (SRI)
- When a frontal, near frontal or side impact event occurs, it is detected by internal and external sensors to deploy airbags.
  - Front and/or Side impact sensors
  - Safing sensor
  - Accelerometer

One sensor alone cannot deploy airbags.

- Deployment or No Deployment decision is made by the crash algorithm
- If there is a Deployment decision by the SRSCM:
  - The Inflator ignites
  - A gas such as Nitrogen is produced to inflate bag
  - Bag(s) deploy
- After deployment, the airbag(s) vents/deflates
- The SRSCM determines Belt Pretensioner deployment
- SRS event data is recorded
- SRSCM signals the Power Window Main Switch to unlock doors
- SRS operating sequence is completed

SUPPLEMENTAL RESTRAINT SYSTEM CONTROL MODULE (SRSCM)

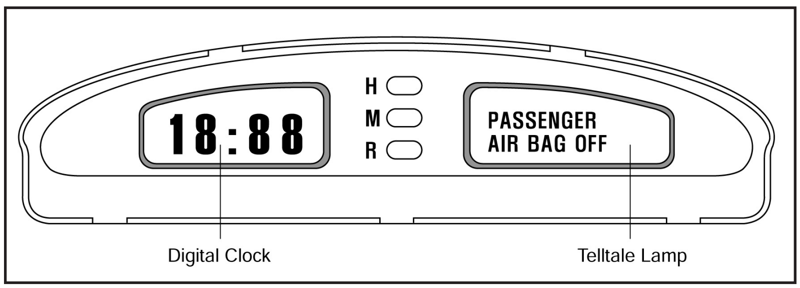


The ignition key ON powers up the SRSCM, charges up the reserve power, performs a diagnostic routine, and turns ON the SRI for a bulb check. If a fault is present, the SRI lamp illuminates. The SRSCM continuously performs diagnostics on input sensors and deployment devices. A serial communication line is used to facilitate diagnosis with the Hi-Scan Pro.

The SRSCM uses input from FIS, SISs and internal sensors to determine if deployment is necessary. When deployment is needed, additional input sensors are used, such as seat belt buckle switches, seat track position sensor, and occupant classification system for the SRSCM to determine which airbags and pretensioners should deploy. The driver and passenger airbags are dual squib and can fire 3 different intensities of low, medium and high.

OCCUPANT CLASSIFICATION SYSTEM (OCS)

The 2004.5 Spectra has an Occupant Classification System (OCS) that continually monitors and senses the presence of an occupant in the front passenger seat. The OCS is designed to detect the presence of a properly seated occupant who is sitting upright and centered on the seat cushion with legs comfortably extended. The driver's airbag and side impact airbags are not affected by the OCS.



The "Passenger Air Bag OFF" lamp will illuminate for 6 seconds after key ON for bulb check and then turn off. Then, the Occupant Classification System (OCS) controls the lamp.

If the front passenger seat is unoccupied or occupied by someone lighter than approximately 55 pounds:

- The indicator "Passenger Airbag OFF" will be displayed
- The front passenger airbag and side impact airbag will be turned off and will not deploy in frontal and side impacts.

Note: Seat belts must be inspected during PDI. If during PDI or normal servicing, you discover that they are not functioning correctly and repairs cannot be done immediately, refer the matter to your Service Manager.

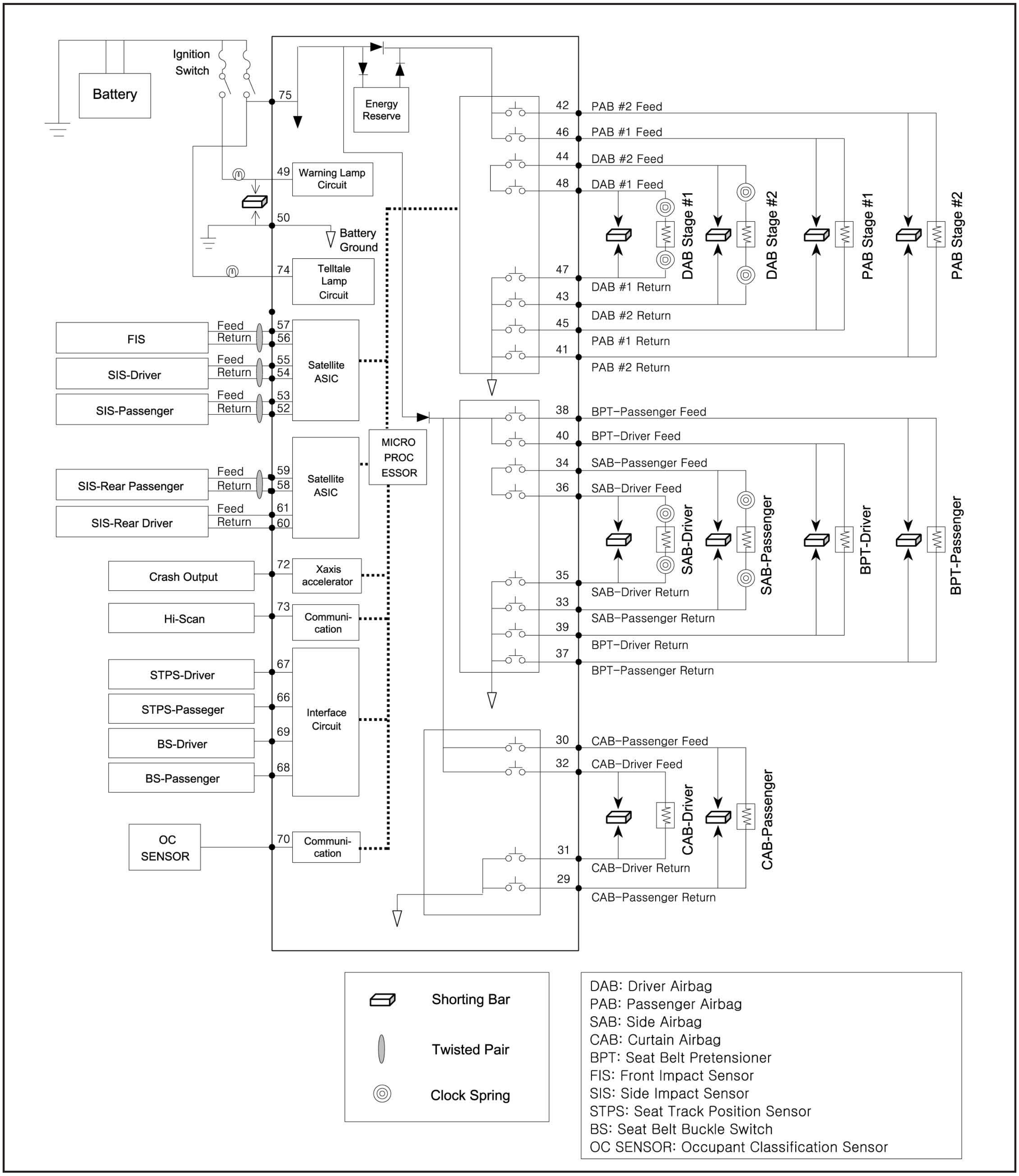
COMPONENT OPERATION

The diagram indicates the locations of various SRS components.

- FIS: Frontal Impact Sensor
- DAB: Driver Airbag
- SRSCM: Supplemental Restraint System Control Module (also called ACU)
- DBPT: Driver Belt Pretensioner
- BS: Belt Switch
- FSAB: Front Side Airbag
- CAB: Curtain Airbag
- SIS: Side Impact Sensor
- RSIS: Rear Side Impact Sensor
- STS: Seat Track Sensor
- PBPT: Passenger Belt Pretensioner
- PAB: Passenger Airbag
- Driver's Window Power Module
- OCS Telltale Lamp: Passenger Airbag OFF Indicator
- OCS: Occupant Classification System

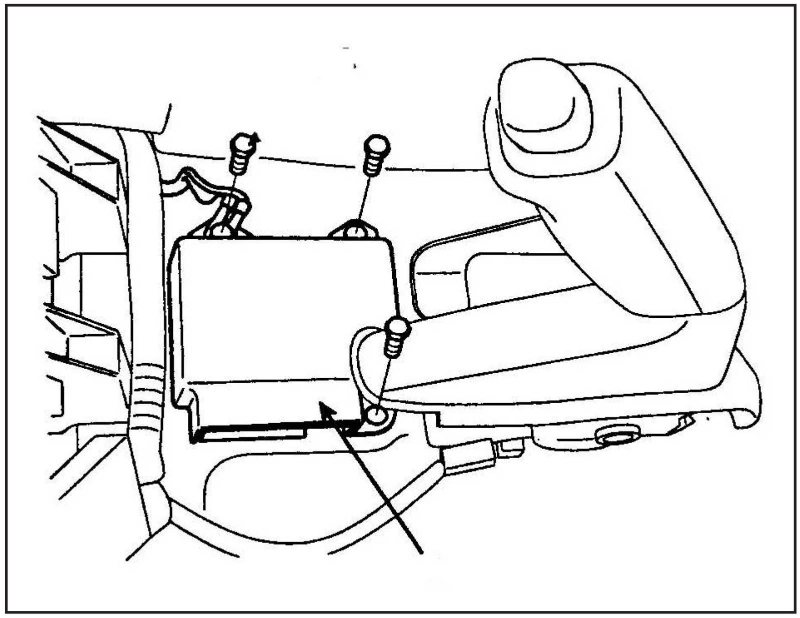
Warning: The SRS must not have power supplied (Disconnect Battery) to the System when removing or installing.

Caution: Be sure to install the harness wires so they are not pinched nor interfere with other parts.



This diagram shows the wiring location of the SRS components. The upper left hand corner shows power input through the fuses to the SRSCM and SRI. Various inputs are shown down the left side. Outputs to deploy the airbags including the shorting bars, clock springs, and deployment stages are to the right of the diagram.

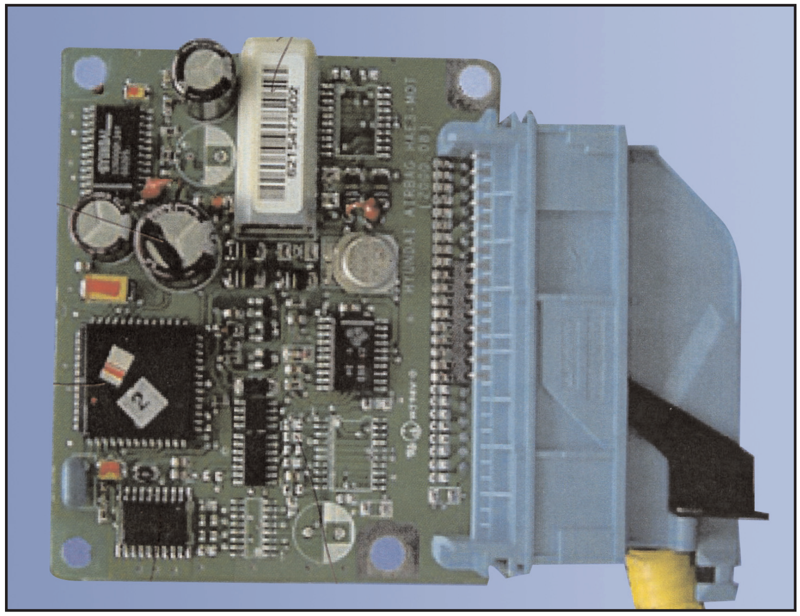
SUPPLEMENTAL RESTRAINT SYSTEM CONTROL MODULE (SRSCM) OPERATION



The Supplemental Restraint System Control Module (also known as the ACU) is located on the floor tunnel along the centerline of the vehicle for maximum impact signal reception.

The SRSCM uses both internal and external sensors to detect that a sufficient impact force has occurred. Then, it internally closes the circuit to deploy the appropriate airbag(s) and/or BPTs based upon the input sensors algorithm. The SRSCM also provides an unlock signal to the driver's master door module to command the doors to unlock after a deployment event.

SRSCM CONTROL PROCESSING UNIT (CPU)



The SRSCM central processing unit (CPU) controls warning lamp functions (SRI), diagnostics, crash discrimination, deployment functions, power backup, and crash data, which is recorded within the SRSCM.

If there is a failure in the SRSCM, the SRI lamp will either not blink or remain ON after the self-check. This information is recorded in Random Access Memory (RAM) in the form of a Body Diagnostic Trouble Code (DTC Bxxxx).

POWER SUPPLY

The Power Supply is delivered by the 12V automotive electrical system, with ignition ON through the 15A SRS fuse located in the dash fuse box. The SRSCM runs off 5 volts converted by the internal power supply. Grounding is through the aluminum housing of the SRSCM.

CAPACITOR

The Capacitor stores the back up power of the power supply system. If SRSCM power is interrupted, the capacitor has emergency energy reserves to provide deployment voltage.

Caution: When servicing the SRS, remove the 15A SRS fuse and wait a minimum of 3 minutes for the capacitors to discharge.

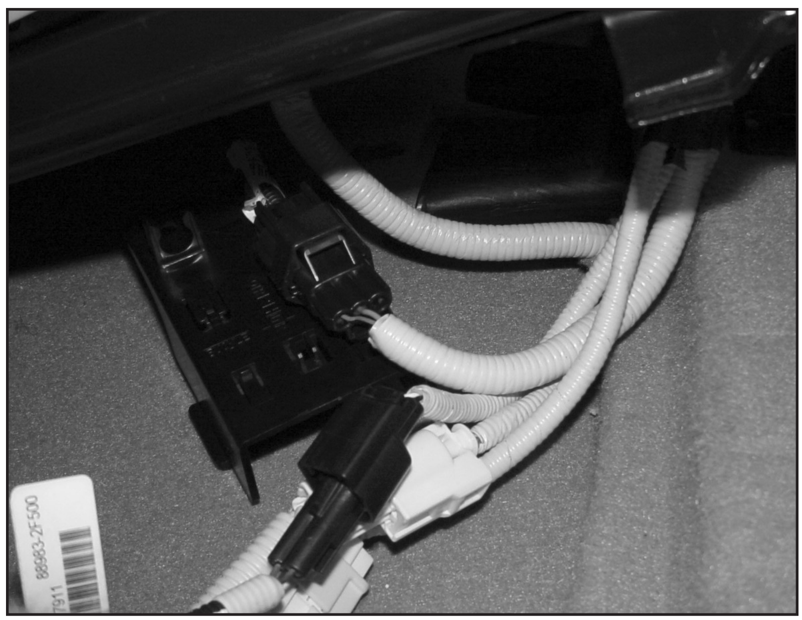
ARMING/SAFING SENSOR

The Arming/Safing Sensor is a dual-contact electromechanical switch that closes if it senses a deceleration exceeding a specified threshold, such as an impact event. Exceeding a specific threshold activates the arming function and firing current must also flow across the safing sensor contact to deploy the air bags. The safing function of the sensor assures that airbag deployment circuits remain disarmed under normal conditions. The closing of just one sensor by itself will not deploy the air bags.

ACCELEROMETER

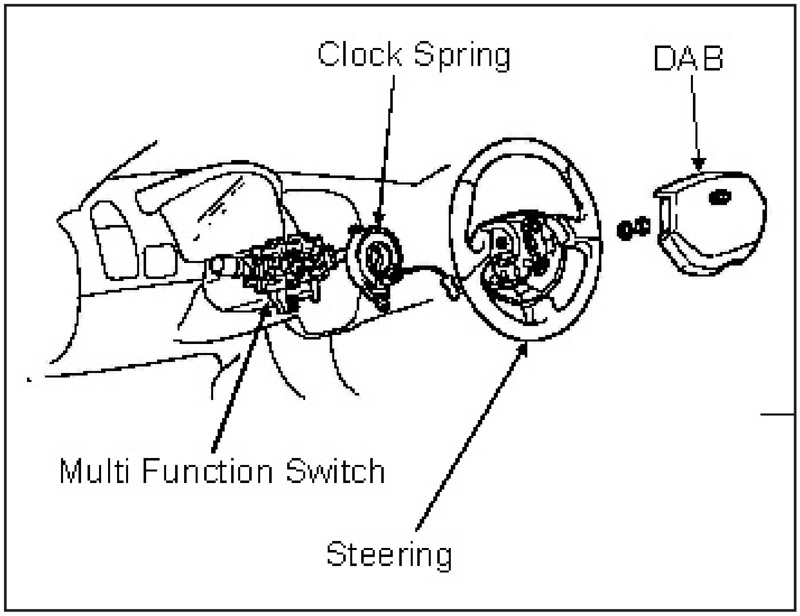
The Accelerometer is an integrated electronic accelerometer that provides an electrical representation of the vehicle acceleration in G-forces. The accelerometer is initialized at key ON. It performs a status check, then a bias calculation, and finally a deflection test. Reliability of impact sensing and airbag deployment is assured so that no single point can cause an inadvertent deployment. See FIS and SIS for additional information on second accelerometer.

SRS WIRING HARNESS



SRS wiring harness is located throughout the vehicle to connect SRS components together electrically. The harness is wrapped in yellow tubing and tape to identify and protect it. SRS wiring harness should not be repaired only replaced. Shorting bars internal to the connectors are used to prevent unwanted deployment and to turn ON the SRI if the SRSCM is disconnected.

CLOCK SPRING

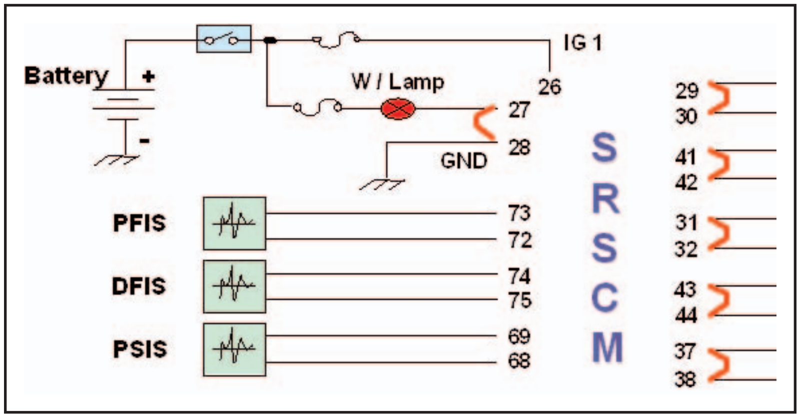


The Clock Spring is a component of the wiring harness and located between the steering wheel and steering column. The clock spring consists of two current carrying coils of wire that provide a continuous electrical circuit for the deployment loop of the dual squib inflator module at the Driver's Air Bag (DAB). Horn wiring and cruise control wiring (if equipped) also utilizes the clock spring.

Note: The steering wheel must be fitted correctly to the steering column with the clock spring in the neutral position. If not, a break in the wire during a full right or left turn of the steering wheel may result. To identify the neutral position:

- ***Rotate the clock spring until it stops.***
- ***Rotate the clock spring counterclockwise by 2.4 revolutions.***
- ***To the "Neutral Mark ><".***

SUPPLEMENTAL RESTRAINT INDICATOR (SRI)



The Supplemental Restraint Indicator (SRI) is located in the instrument cluster, with B+ power from the 10A cluster fuse and ground controlled by the SRSCM. When the ignition key is first turned ON, the SRI illuminates for a bulb check, flashes 6 times and goes OFF with no faults. When commanded by the SRSCM, the SRI illuminates to indicate:

- A fault in the system
- Loss of ignition voltage supply to the SRSCM: lamp turns on continuously. This might be encountered if the harness is disconnected. This is not detected or recorded by the SRSCM, but will cause the SRI to illuminate.
- SRSCM not connected: lamp turns on continuously through shorting bar on the wiring harness connector.

There are also bulb faults which keep the SRI from illuminating, such as:

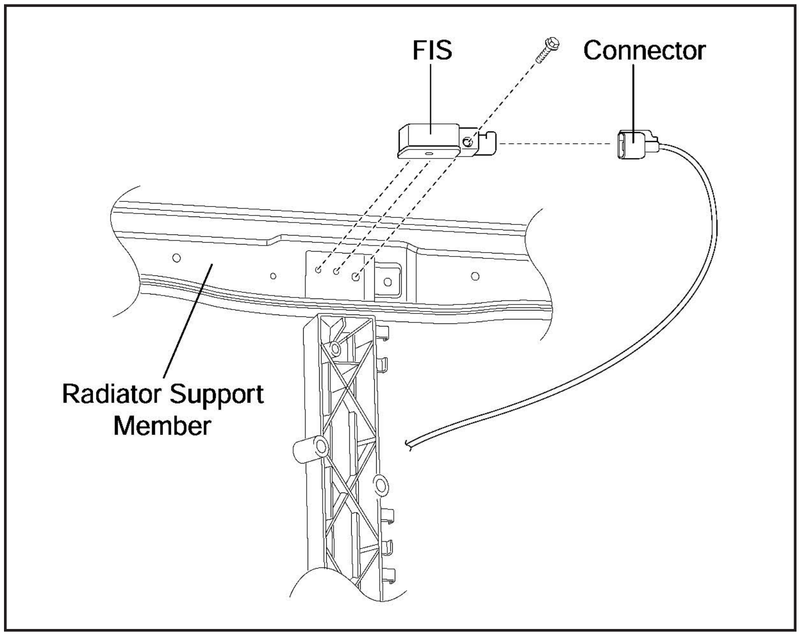
- Bulb shorted or short to battery. In this situation, the SRSCM will retry the SRI every 15 seconds until the fault is repaired or the ignition is turned OFF.
- Open bulb or a short to ground condition.

Note: When electrical continuity is restored, the SRI will light until the open fault is disqualified, assuming there are no other qualified faults.

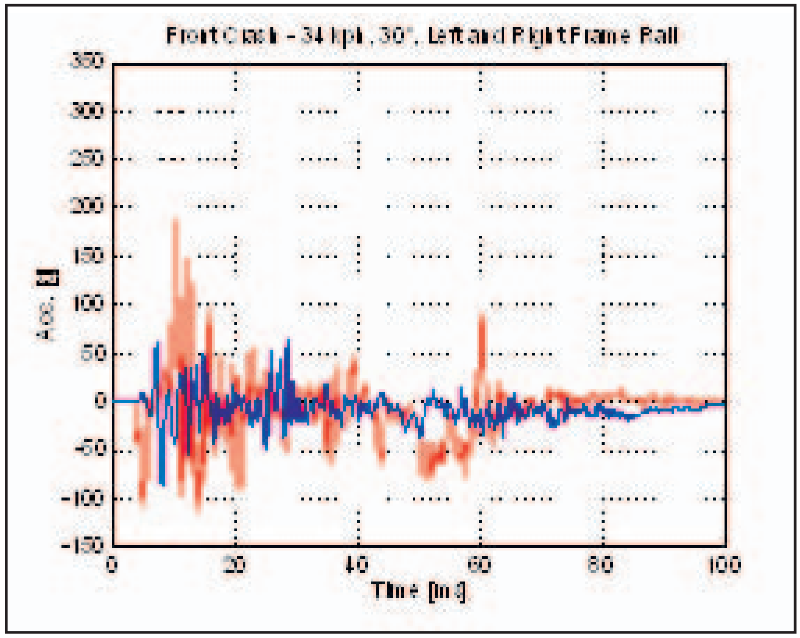
SRS EXTERNAL SENSORS

When an impact event occurs, the SRSCM calculates whether or not the front airbags should be deployed and determines what the deployment timing should be. This deployment decision occurs after the SRSCM compares the Crash Severity Level from the FIS and the signal from the internal Acceleration sensor.

FRONT IMPACT SENSOR (FIS) COMPONENT



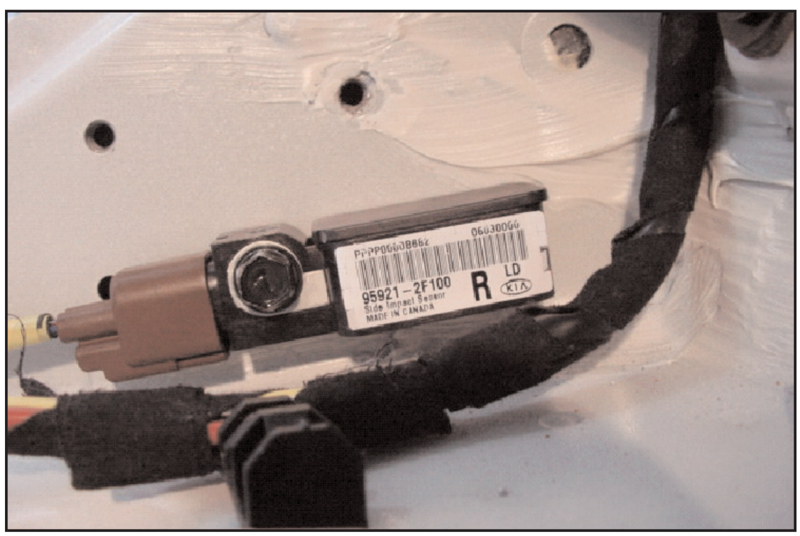
The FIS is a remote intelligent acceleration sensor located in the centerline of the Spectra, just behind the radiator support near the radiator cap. The FIS provides the secondary accelerometer data to the advanced restraint control module to determine if the severity of a frontal impact event warrants a single-stage or dual-stage frontal airbag deployment.



Notice on the chart above that the FIS has an acceleration range of +/- from zero g.

Note: After frontal impact, the FIS mounting positions must be inspected to determine whether they are within specification. Resistance checks may be performed at the FIS after removal from the system. Diagnosis of the FIS can be done with the Hi-Scan Pro by code retrieval and KSIS.

SIDE IMPACT SENSOR (SIS) COMPONENT OPERATION



A pair of SISs is located at the lower "B" and "C" pillars on the left and right sides of the vehicle. The SISs provide data to the SRSCM to detect a side impact event. The reporting status of these impact sensors is continuous when the SRSCM has power.

SIDE IMPACT SENSORS (SIS)

			DRIVER		PASSENGER	
Crash	SIS-Front	SIS-Rear	CAB	SAB	CAB	SAB
Driver Side	No Fault	No Fault	Deploy	Deploy	No Fire	No Fire
		Fault	Deploy	Deploy	No Fire	No Fire
	Fault	No Fault	Deploy	Deploy	No Fire	No Fire
		Fault	No Fire	No Fire	No Fire	No Fire
Passenger Side	No Fault	No Fault	No Fire	No Fire	Deploy	Deploy
		Fault	No Fire	No Fire	Deploy	Deploy
	Fault	No Fault	No Fire	No Fire	Deploy	Deploy
		Fault	No Fire	No Fire	No Fire	No Fire

The SISs are remote intelligent acceleration sensors that detect acceleration when a collision occurs near their mounted locations and send acceleration data information to the SRSCM. The primary purpose of remote Side Impact Sensors is to detect a collision impact earlier than possible from a centrally mounted sensor.

The SRSCM can support up to four SIS style sensors. The SRSCM interface provides both power and communication to the SISs. The wiring is a twisted pair, in a daisy chain wiring configuration, providing both power and communication interfaces. The features of the interface include:

- Two wire interface for power/GND and signal from the SRSCM
- Voltage level signaling to the SIS for SRSCM commands
- Current sensing interface from the SISs answering SRSCM commands
- Ensured communication reliability

Note: Because the "low side" connection of the SIS interface is a chassis ground connection, it is not diagnosed nor protected against shorts to the battery.

SRSCM/SIS COMMUNICATION INTERFACE

The SRSCM sends command signals to the SIS and receives response signals from the SIS.

The command and response signals are separated in time; when the SRSCM sends the clock synchronized signal command out to the SIS, the SIS responds when the SRSCM sends out the next command. Also, the SRSCM command includes an address so that only the addressed SIS will respond, again separated in time by one command sequence (16 or 20 bit message lengths).

SIS INITIALIZATION

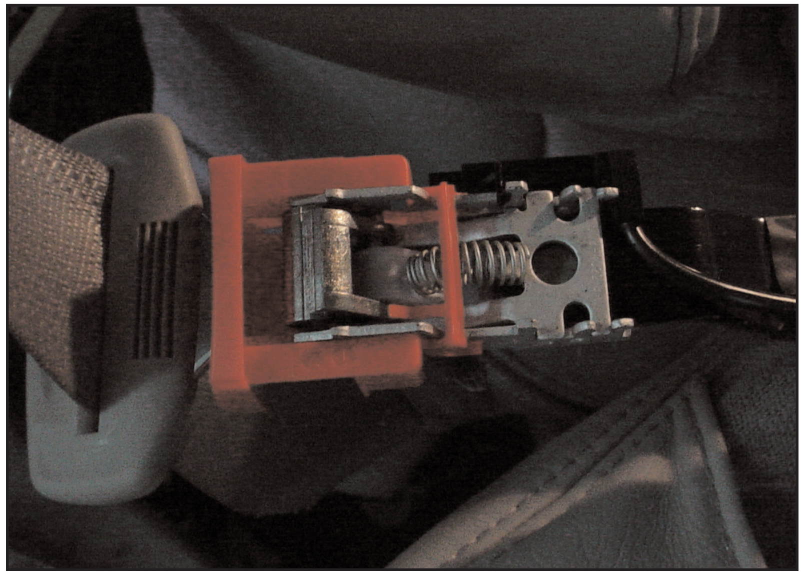
As each SIS is initialized at power up, a 20-bit command message containing address and initialization data is sent to each SIS. During this prove-out, the SRSCM performs an address initialization to establish the address in a daisy-chained application or to verify the pre-programmed non-volatile address in the parallel application.

Once the address has been initialized, the SRSCM can send commands to a unique SIS module on a bus and a unique SIS module can respond to commands directed to it. The next part of the prove-out process consists of accelerometer initialization. Accelerometer acceleration consists of three basic steps: status check, bias calculation, and deflection test.

When a side impact event occurs, the SRSCM decides whether or not the side and curtain airbags should deploy and determines what the deployment timing should be. This deployment decision occurs after the Crash Severity Level from the SIS is received by the SRSCM and compared with a signal from the Acceleration Sensor within the SRSCM.

Note: Both the left and right SISs have the same part number and have locating tabs for mounting to the body to orient each sensor for the left and right sides. After side/frontal impact, the SIS mounting position must be inspected to be within specification. Diagnosis of the FSIS can be done with the Hi-Scan Pro by code retrieval and KSIS for procedures. Resistance checks may be preformed at the FSIS after removal from the system.

BUCKLE SWITCH (BS) OPERATION



The BSs are located in the buckle portion of the driver and front passenger's seat belts.

The BSs are 5 volt reference hall effect type sensors that are able to determine if the seat belts are fastened by a change in the magnetic field when the seat belt male portion is inserted into the buckle portion.

The SRSCM monitors the state of the driver and passenger seat belt buckles for:

1. Seat belt buckle fastened
2. Seat belt buckle not fastened
3. Open/Short to battery
4. Short to ground

This buckled/unbuckled information is sent to the SRSCM to determine the deployment threshold level of the air bags and the Belt Pretensioners BPT. A seat belt that is not buckled reduces the threshold for deployment of the airbag. The driver and/or passenger that do not have the seat belt buckled will experience an airbag deployment at a lower (less severe) impact event. The safety belt is the primary safety restraint.

The Spectra BPT fire/no fire algorithm chart will change based upon seat buckle.

Buckle		Frontal		Pretensioner	
Driver	Pass	Driver	Pass	Driver	Pass
Belted	Belted	Fire	Fire	Fire	Fire
	Unbelted	Fire	Fire	Fire	Not Fire
	Failure	Fire	Fire	Fire	Fire
Unbelted	Belted	Fire	Fire	Not Fire	Fire
	Unbelted	Fire	Fire	Not Fire	Not Fire
	Failure	Fire	Fire	Not Fire	Fire
Failure	Belted	Fire	Fire	Fire	Fire
	Unbelted	Fire	Fire	Fire	Not Fire
	Failure	Fire	Fire	Fire	Fire

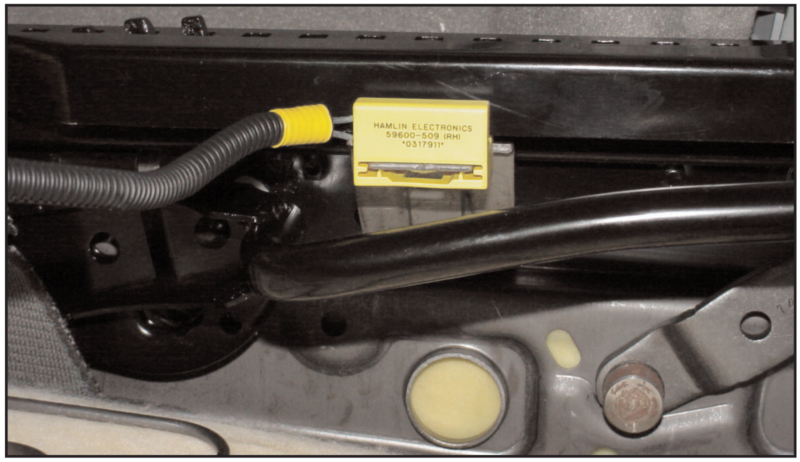
Buckle Effect on Frontal Crash

Buckle Status		Side & Curtain Airbag		Pretensioner	
Driver	Pass	Driver	Pass	Driver	Pass
Belted	Belted	Fire	Fire	Not Fire	Not Fire
	Unbelted	Fire	Fire	Not Fire	Not Fire
	Failure	Fire	Fire	Not Fire	Not Fire
Unbelted	Belted	Fire	Fire	Not Fire	Not Fire
	Unbelted	Fire	Fire	Not Fire	Not Fire
	Failure	Fire	Fire	Not Fire	Not Fire
Failure	Belted	Fire	Fire	Not Fire	Not Fire
	Unbelted	Fire	Fire	Not Fire	Not Fire
	Failure	Fire	Fire	Not Fire	Not Fire

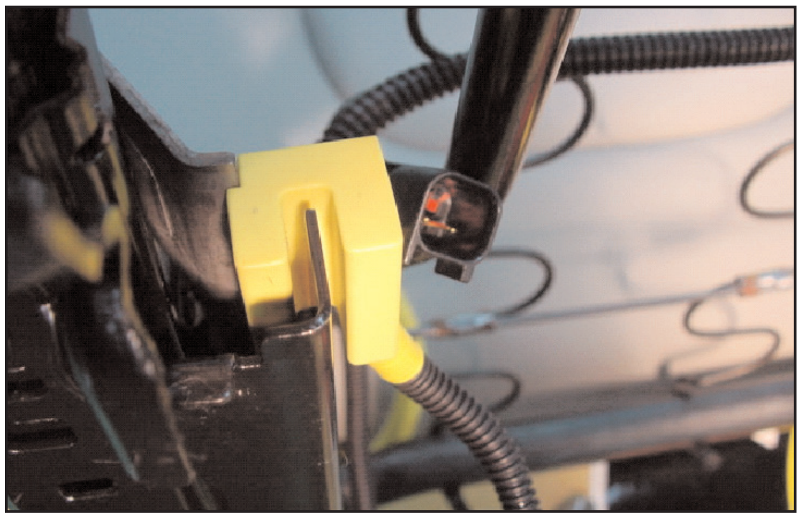
Buckle Effect on Side Crash

Note: Diagnosis of the Buckle Switch is accomplished with the Hi-Scan Pro tool and KSIS for procedures. Both amperage and resistance checks may be performed.

SEAT TRACK POSITION SENSOR (STPS) OPERATION



The Seat Track Position Sensors (STPSs) are beneath the seat cushion on the inside seat rail of the front driver and passenger seat. There is one sensor for each seat.



The STPS is a non-contacting magnetic proximity sensing device sensor with a simple electronic circuit, resulting in the ability of producing two separate and distinct logic level signals.

The STPS output signal is altered by the proximity of a separate ferro-magnetic shunt in the seat track. The logic signal is produced as the result of the proximity device. The logic signal output is one of two distinct logic levels:

1. Active - No shunt present

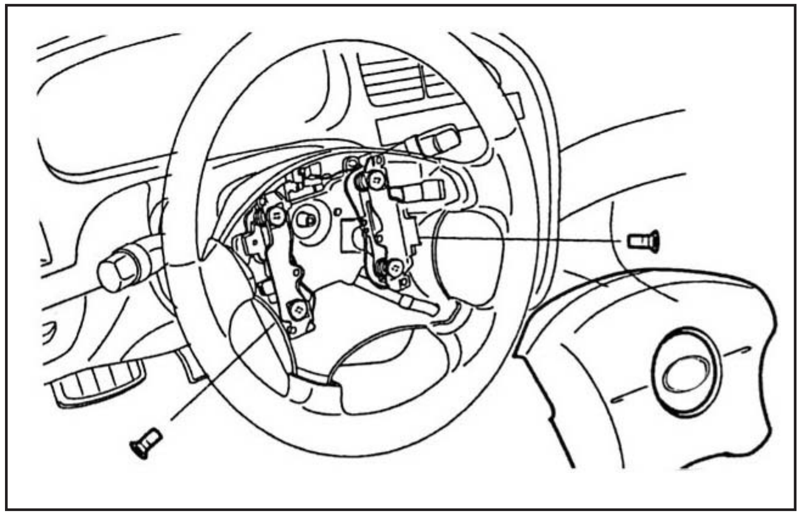
2. Deactivated – Shunt present.

The STPS resistance changes depending on its location relative to a vane mounted on the seat rail. When the STPS is positioned over the vane (9 latching positions or more rearward of the forward-most position), its resistance is approximately 900 ohms. When it is positioned off the vane (within 8 latching positions from the forward-most position), the sensor's resistance is approximately 300ohms. The STPS resistance values are measured without requiring power to the circuit.

If the front seat(s) is placed within 8 latching positions from the forward-most position (off the vane) in the event of a frontal impact severe enough to deploy the airbags, only the first stage circuit will be activated for that airbag. If the front seat(s) is placed 9 latching positions or more rearward of the forward-most position (over the vane), then the SRSCM will deploy the bag with either the first or second circuit, depending on seat belt usage and severity of the impact.

If an STPS condition prevents the SRSCM from determining the position of the seat, a Seat Track Sensor Fault Code is generated and the SRS warning light will illuminate until erased from the SRSCM memory with the Hi-Scan Pro.

DRIVER'S AIR BAG (DAB) OPERATION



The DAB, located in the center of the steering wheel, contains a folded cushion and an inflator unit. The inflator assembly is equipped with two squibs designed to deploy in stages depending on the severity and velocity of the collision.

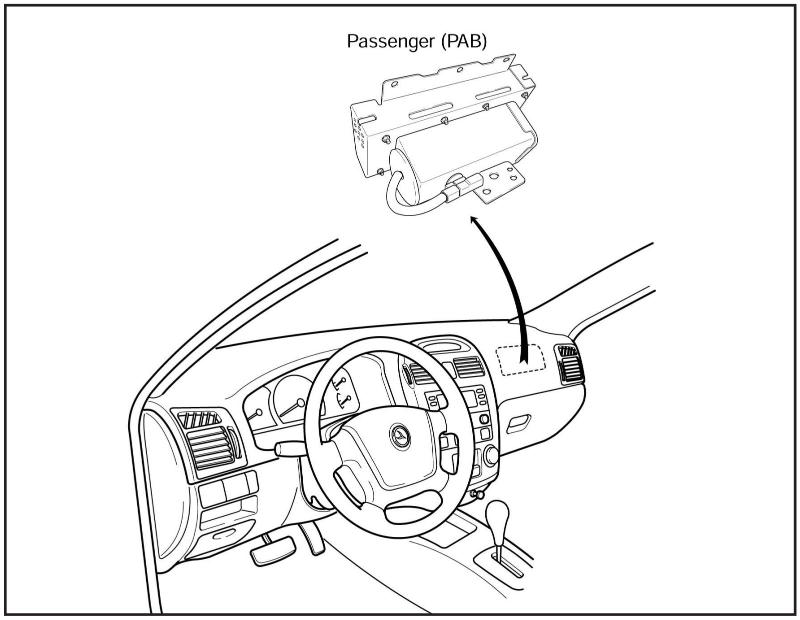
The dual squib inflator design is used to tune the deployment characteristics of the driver airbag system into three stages.

- Stage 1 – One squib fires (70%)
- Stage 2 – Second squib fires after the first (30%)
- Stage 3 – Both squibs fire simultaneously (100%)

The dual stage front airbag system has two (2) circuits and the DAB has 2 connectors for the circuits. The two (2) connectors are different styles and not interchangeable. The driver airbag has two vent holes.

Note: Diagnosis can be performed using the Hi-Scan Pro by code retrieval and KSIS for procedures. System resistance checks may be performed using the Load tool special service tool. Refer to KSIS for complete information and follow all safety recommendations, as serious injury may result.

PASSENGER AIR BAG (PAB) OPERATION



The PAB, located on the right side dash pad assembly just above the glove box, contains a folded cushion and an inflator unit. The inflator assembly also has two squibs similar to the DAB. The inflator assembly is equipped with two squibs designed to deploy in stages depending on the severity and velocity of the collision. Stage(s) of deployment depends on the severity and velocity of the collision and the occupant's proximity to the airbag position. The dual squib inflator design is used to tune the deployment characteristics of the driver airbag system into three stages.

- Stage 1 – One squib fires (70%)
- Stage 2 – Second squib fires after the first (30%)
- Stage 3 – Both squibs fire simultaneously (100%)

The passenger airbag has no vent holes. After deployment, the gas vents through the back side material. Like the DAB, the PAB is a dual-stage airbag, but it has only one connector with 4 pins for the two circuits. The 4-pin connector can be located by removing the glove compartment on the upper left side.

Note: Diagnosis can be performed using the Hi-Scan Pro and KSIS for procedures. System resistance checks may be performed using the load tool special service tool. Refer to KSIS for complete information and follow all safety recommendations as serious injury may result.

Warning: Do not install a child restraint system in the front passenger seat.

FRONT SIDE AIR BAGS (FSAB) OPERATION

Both right and left Front Side Airbags (FSAB) are located on the outboard side of the driver and passenger seat backs. The FSAB contains a folded cushion and a single squib inflator unit. The two-pin connector is located under the seat back frame.

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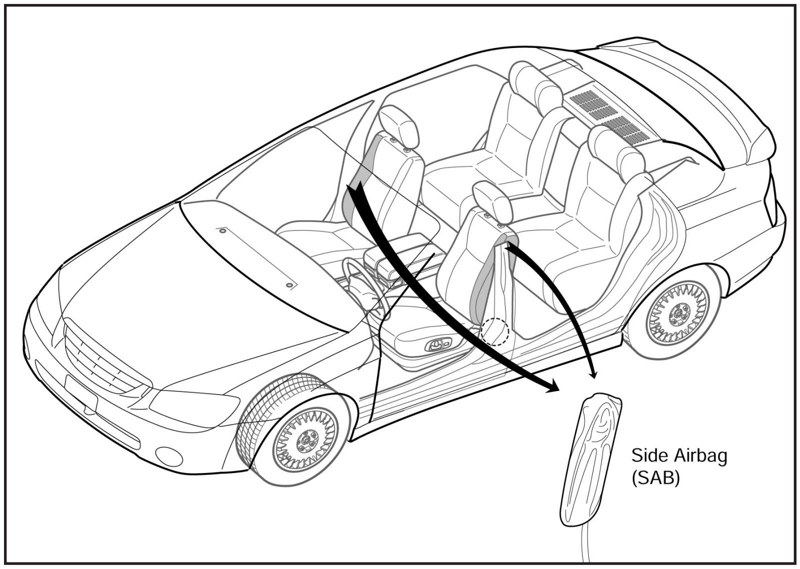
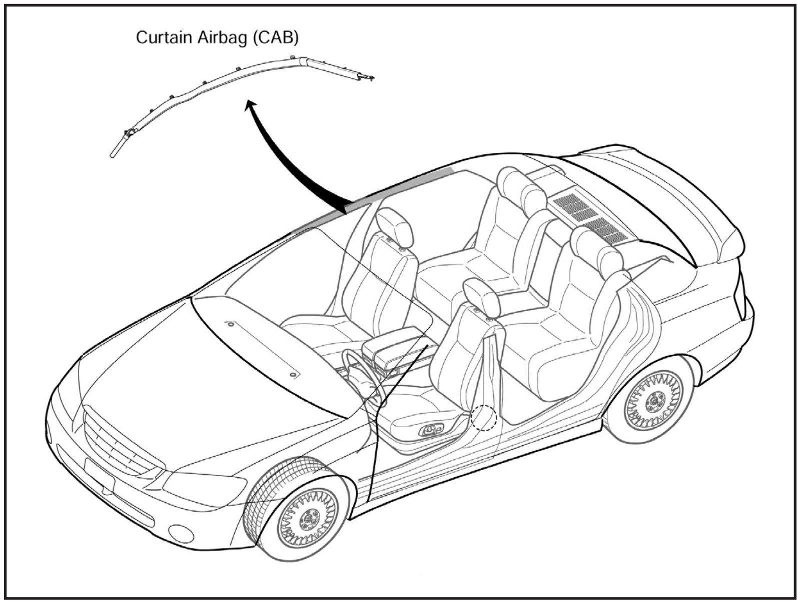


Note: Diagnosis can be performed using the Hi-Scan Pro and KSIS for procedures. System resistance checks may be performed using the Load tool special service tool. Refer to KSIS for complete information and follow all safety recommendations as serious injury may result.

Warning: Seat covers should not be installed in a way that would block the deployment of FSAB.

CURTAIN AIR BAG (CAB) OPERATION



The CAB contains a rolled cushion and an inflator unit. The CAB drops down from the headliner and can inflate on either side of the vehicle. The curtain airbags operate independently of each other and of the DAB and PAB. CAB deployment is based upon right or left SIS input to the SRSCM

The Curtain Air Bags are located behind the headliner on both the left and right sides above the doors. The connector is located in the rear above the speaker deck and behind the headliner.

Note: Diagnosis can be performed using the Hi-Scan Pro and KSIS for procedures. System resistance check may be performed using the SST load tool. Refer to KSIS for complete information and follow all safety recommendations as serious injury may result.

SEAT BELTS

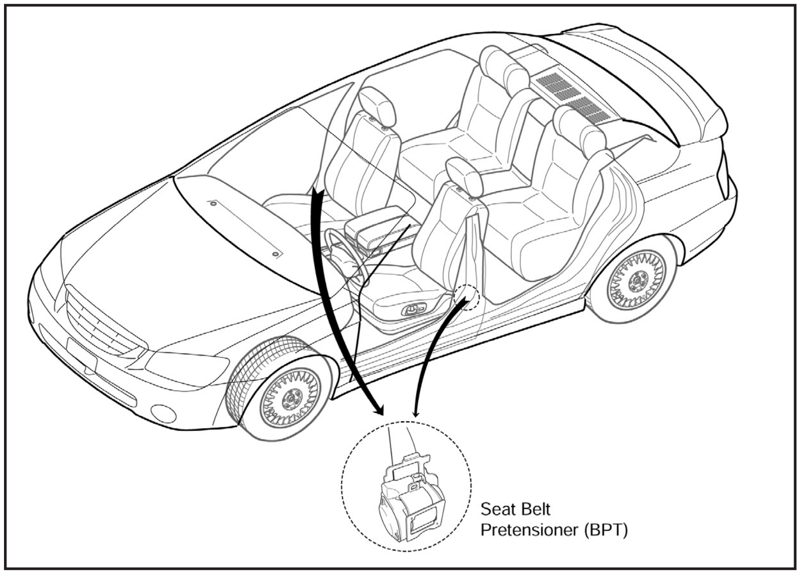
The Spectra front seat belts are Automatic Locking Retractor (ALR)/Emergency Locking Retractor (ELR) with a pretensioner and load limiter. The seatbelt anchor has a height adjustment.

ALR are automatic locking retracting. When you pull the belt all the way out to maximum and let it back in, the belt will lock in place when you stop.

ELR are emergency locking on acceleration and deceleration.

The Spectra rear seat belts on the right and left sides are ALR/ELR. The center rear seat belt is an ALR due to having shoulder and lap belts.

BELT PRETENSIONERS (BPT) OPERATION



The front seat Belt Pretensioners are located at the bottom of the “B” pillar behind the trim panel, incorporated within the seat belt retractor.

When a vehicle has experienced an impact event that causes the SRSCM to determine the event has exceeded a threshold value, the BPTs will be deployed. The Belt Pretensioners help reduce the severity of injury to the front seat occupants by retracting the seat belt webbing to keep the occupants in position.

After the seat belt is tightened, it then releases slightly during the collision through the use of the built-in force limiter that provides the occupant with a controlled ride into the frontal airbags.

The BPTs are part of the seat belt retractors and contain a pyrotechnic gas generator, which causes movement of the piston in the manifold case that in turn operates a rack gear. The seat belt webbing is then retracted by the rotation of the retractor spool.

The gas generator is a service part and can be replaced with out replacing the seat belt if undamaged. The SRSCM can deploy the BPT 6 times before the control module will need to be replaced. This data is viewable on the Hi-Scan Pro.

Note: Very low speed impacts may only detonate the pretensioners with the seat belt fastened.

SEAT BELT FORCE LIMITER

The front seatbelt force limiter is designed to reduce the restraining force of the seatbelt webbing to the occupant's chest during a collision. If the collision force reaches a certain value, the torsion bar in the pretensioning seatbelt system deforms and allows a small webbing to be extracted from the seat belt, thus, reducing the restraining force on the occupant

DIAGNOSTIC REQUIREMENTS

SYSTEM FAULT RECOGNITION

The SRSCM shall start the self-diagnostic during the power on. The SRSCM qualifies a fault when the fault has been detected for the period or number of samples listed in the DTC List.

If a fault has been qualified, the SRSCM stores the fault codes in EEPROM and turns on the SRI.

A fault is "dequalified" when the fault has not been detected for the period or number of samples listed in the Fault Code List. If no other faults are active, the SRI turns OFF. This status is called "historic fault."

SYSTEM FAULT RECOVERY AND ERASE

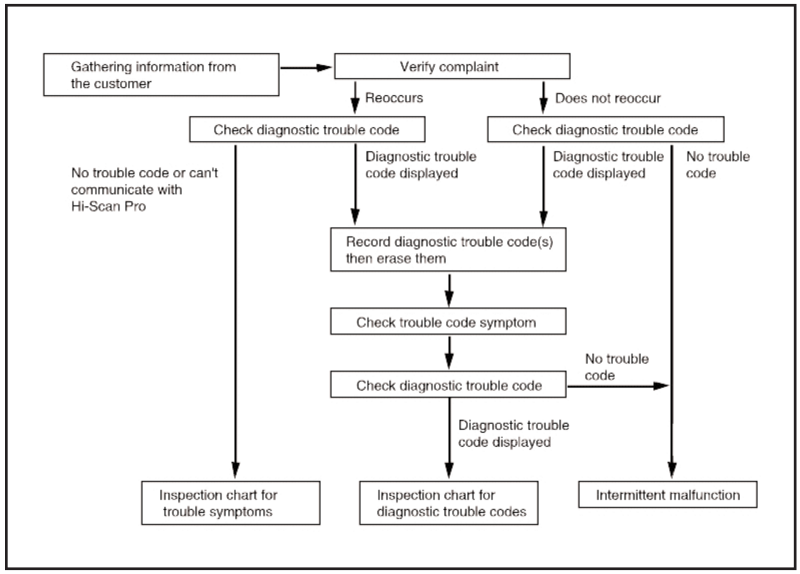
The SRSCM sets active faults and historic faults as soon as the fault condition is no longer present.

The Hi-Scan Pro may erase system faults and active and historic trouble codes. But if the cause of a current fault is not corrected, the fault will again be recorded as an active fault with a new "first detected" time.

Belt Pretensioner only deployment fault code is erasable using the Hi-Scan Pro unless the indication counter reaches its maximum reusable value of 6.

Note: Faults detected only at power up will be qualified at the next ignition cycle.

DIAGNOSTIC TROUBLESHOOTING FLOW



The above chart from KSIS outlines the SRS diagnostic flow. Start your diagnosis by verifying the customer's concern, such as viewing the action of the SRI. Does the concern come on during bulb and system check or does the SRI stay ON indicating a possible DTC or go OFF due to a possible intermittent malfunction?

Use the Hi-Scan Pro (HSP) to check for a DTC and refer to KSIS for diagnostic inspection procedure for trouble code. To diagnose SRS concerns, technicians can use the HSP to communicate with the SRSCM, inspect the current data list, and read current and history DTC. For intermittent concerns, use the inspection chart for trouble symptoms.

SUMMARY

The 2004.5 Spectra uses a Supplemental Restraint System (SRS) designed to deploy selected airbags. Its SRS Control Module (SRSCM) has internal and external sensors to determine whether to deploy one or more airbags. Both driver and front passenger airbags are dual squib inflator design, which will deploy airbags in stages depending on the severity and velocity of the collision.

Another unique SRS feature on this new Spectra is Occupant Classification System (OCS). The OCS is designed to monitor for the presence of a properly seated occupant in the front passenger seat to determine whether to deploy airbags during an impact event.

Now, you should have a better understanding of the supplemental restraint system, and its components, on the Spectra, including its operation, component locations and diagnostic procedures.

REVIEW QUESTIONS

1. Technician A states that the 2004.5 Spectra has a dual squib air bag on the driver's side and the passenger side is single squib but has a seat location sensor to detect seat position for deployment levels. Technician B states that the 2004.5 Spectra utilizes an OCS system to determine seat position. Who is correct?

   A. A only

   B. B only

   C. Both A and B

   D. Neither A or B

2. The seat location sensor is used to determine if the passenger is present and will activate or deactivate the PAB.

   A. True

   B. False

3. Technician A states that the FIS and SIS sensors determine impact events earlier than the SRSCM and are included in the Spectra to assist dual squib deployment. Technician B states that the OCS is used to determine whether there is a passenger present in the passenger seat and will send a signal to the SRSCM to determine threshold levels for bag deployment of the passenger side air bag. Who is correct?

   A. A only

   B. B only

   C. Both a and B

   D. Neither A or B

4. All of these statements are true except:
   A. The 2004.5 SRS system is dual squib for both the driver and passenger's airbags.
   B. The 2004.5 Spectra uses five impact sensors.
   C. The OCS may turn off the Passenger Airbag in a low speed impact event.
   D. The OCS sends passenger presence information to the SRSCM for determination of Passenger's air bag deployment.

5. The Spectra has active headrests.
   A. True
   B. False?

6. All of the following are true about using the Hi-Scan Pro for SRS diagnostics, EXCEPT:
   A. HSP can show current data
   B. HSP can read DTC
   C. HSP can deploy an air bag
   D. HSP can communicate with the SRSCM

ANSWER KEY:
1. D 2. A 3. D 4. C 5. B 6. C

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Supplemental Restraint System (SRS)

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.13

Guided Practice

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

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A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, you will be given the opportunity to practice performing Supplemental Restraint System (SRS) inspection and diagnostic procedures.

MODULE OBJECTIVES

Objectives of this module are for you to demonstrate your ability to:

- Locate, inspect, and diagnose SRS sensors.
- Diagnose SRS component malfunction.

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

To complete this module, you will need the following items:

- 2004.5 Spectra (LD) or LD engine
- #2 pencil or preferred writing instrument
- Hi-Scan Pro
- KSIS and Sign/Log On
- Passenger Airbag load tool

TIME TO COMPLETE

This module will take approximately 30 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the information you have learned in the Supplemental Restraint System (SRS) theory module. Under the supervision of a trained Kia service-training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

TABLE OF CONTENTS

Total Possible Points: 5

SRS SENSOR INSPECTION

Total Possible Points: 3

1. Locate both SIS on one side of the vehicle. Show instructor the location.
2. Record SRI lamp operating condition at key on.

    ____
3. Remove battery power and safely wait: __________
4. Move the passenger front seat to the rear position
5. Locate and disconnect the Passenger Air Bag Connector (PAB).

    Connect airbag diagnostic load tool
6. Locate and disconnect the passenger Seat Track Position Sensor (STPS) connector
7. Connect battery power
8. Turn Ignition on.
9. List SRI condition: ___________________________
10. Using the Hi-Scan Pro, list any DTCs:

    ____

    ____

    ____
11. Is there a current DTC for the PAB?

    ____

    ____

SRS COMPONENT MALFUNCTION DIAGNOSIS

Total Possible Points: 2

1. Using KSIS, look up the diagnostic procedures for the DTC recorded above and list the steps.

   ____

   ____

   ____

2. List the specifications:

   ____

   ____

   ____

3. Perform the diagnostic procedures
4. Record test results: ___________________
5. Disconnect the battery, wait, reconnect the STPS connector, and reconnect the battery.
6. Using the Hi-Scan Pro, clear the DTC.
7. Turn IGN Key ON and record the actions of the SRI:

   ____

   ____

   ____

   ____

NOTES:

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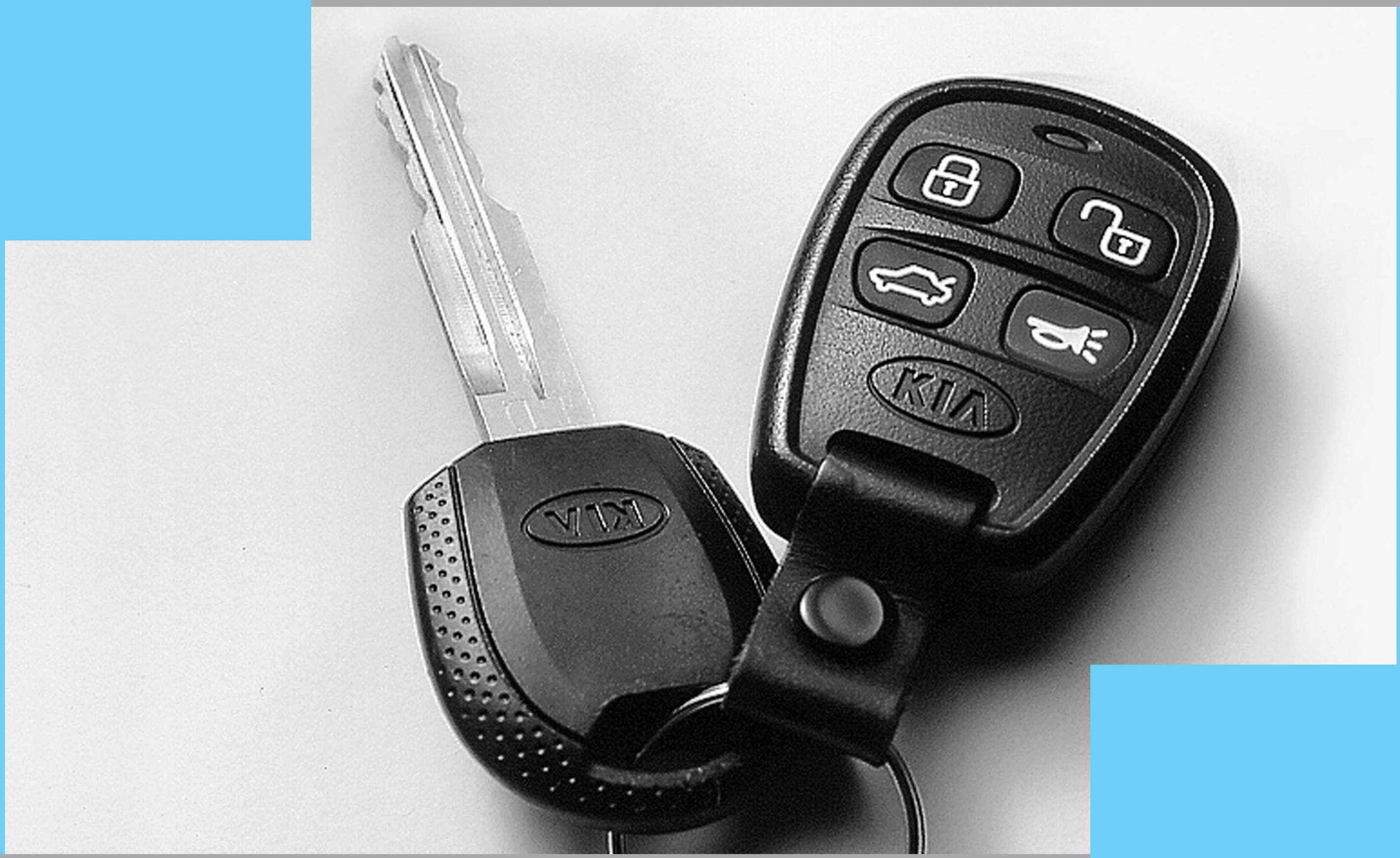
Body Electrical



2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.14

Theory

SAFETY FIRST

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When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

The goal for this module is to identify and explain the operation of the 2004.5 Spectra Body Electrical System that relates to the Electronic Time Alarm Control System Control Module (ETACS).

MODULE OBJECTIVES

After completing this module and using this module with related materials, you will be able to identify the following with 80% or greater accuracy:

- The 2004.5 Spectra ETACS
- 2004.5 Spectra ETACS operation
- RKE receiver
- KSIS in researching ETACS concerns
- Alarm Operation

MODULE INSTRUCTIONS

Carefully read through the material, take notes based on the classroom discussion, and study each illustration. In the module there will be Progress Check questions for you to answer. You may use the module to answer the questions.

REQUIRED MATERIALS

The following materials are required to complete this module:

Tools: Hi-Scan Pro

Parts: Remote Keyless Entry

Vehicle: Spectra

Other: Preferred writing instrument

TIME TO COMPLETE

This module will take approximately 15 minutes.

ACRONYMS

BCM: Body Control Module

ETACS: Electronic Time Alarm Control System

ETACSCM: Electronic Time Alarm Control System Control Module

IBEC: Integrated Bussed Electrical Center

INTRODUCTION

The 2004.5 Spectra has many electrical accessories to provide comfort and convenience for the occupants. These accessories include:

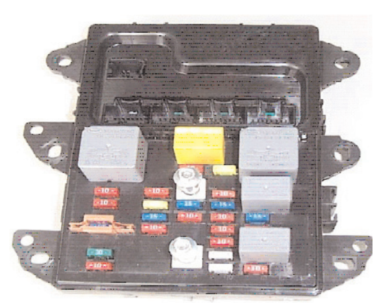
- Remote keyless entry (RKE)
- Power windows
- Power door locks
- Lamps and windshield wiper/washer systems
- Alarm functions
- Timer functions

In past vehicles, these systems represent separate electrical units that were added to the vehicle one at a time as either standard or optional equipment. However, these separate electrical units, each with its control unit and wiring, added to the electrical complexity of the vehicle.

To reduce this complexity while increasing functionality, automotive electrical engineers have designed an Electronic Time and Alarm Control System (ETACS) for the 2004.5 Spectra, which incorporate many of these electrical accessories into one unit.

PURPOSE

The ETACS module is fitted together with the Integrated Bussed Electrical Center (IBEC) containing the interior fuse and relay box. This design provides the driver of the Spectra with one central location to replace blown fuses and listen to the warning buzzer.



APPLICATION

Vehicle:	BCM:	ETACS:	IBEC:	ETACS/IBEC
Sephia	No	Yes	Yes	No
2000-2004 Spectra	No	Yes	Yes	No
2004.5-2005 Spectra	No	No	No	Yes

ETACS: Electronic Time Alarm Control System
IBEC: Integrated Bussed Electric Center

The 2004.5 Spectra is the first Kia vehicle sold in the U.S. to combine the ETACS/IBEC, includes the interior in-panel junction box, relay box, and fuse box, into one unit.

In service documents, there may be references to a BCM associated with the 2004.5 Spectra. The 2004.5 Spectra is equipped with an ETACS but not a BCM. While both BCM and ETACS appear to perform similar functions, the BCM has a processor that controls body electrical functions while the ETACS is a controller that facilitates input signals and body electrical functions through a series of relays and actuators.

SYSTEM OPERATION

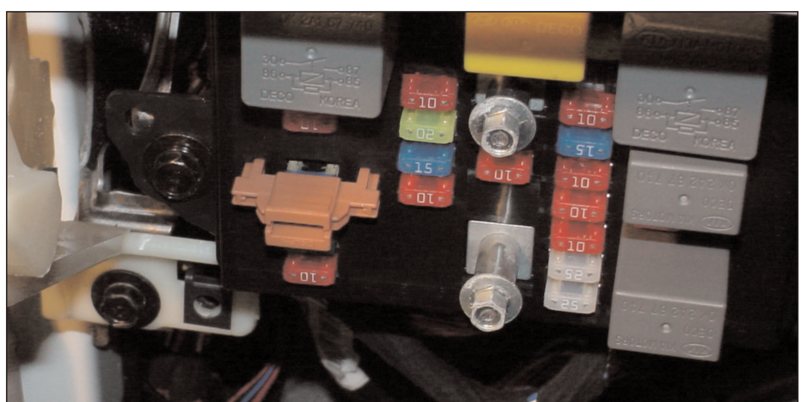
All Kia 2004 model year vehicles sold in North America have either a BCM or ETACS incorporated into the body electrical system.

2004 Vehicles:	BCM:	ETACS:
Rio	No	Yes
Spectra 2004.5	No	Yes
Optima	No	Yes
Sedona	No	Yes
Sorento	No	Yes
Amanti	Yes	No

Most of Kia's vehicles use an ETACS unit to control time and alarm related electrical devices on the vehicle. Amanti is the only Kia to use a Body control Module (BCM) to control time and alarm systems and components.

Accessories controlled by the ETACS normally vary by vehicle trim levels. Refer to Kia Service Information System (KSIS) for more information on each Kia vehicle's ETACS and the systems and components within its control.

ETACS



this approach simplifies the wiring of multiple comfort, convenience, and security features, it also allows these features to interact with one another to increase their functionality and convenience.

The ETACS is an input to output controller that is controlled by the logic programmed into the ETACS Control Module. This logic program determines which inputs, such as switch closures or openings, will cause an action in one or more electrical systems. An action could be a wiper motor turning, a dome lamp illuminating, or a door lock solenoid energizing.

The ETACS consists of wires and modules that control relays, buzzers, and chimes. Body electrical systems controlled by the ETACS include:

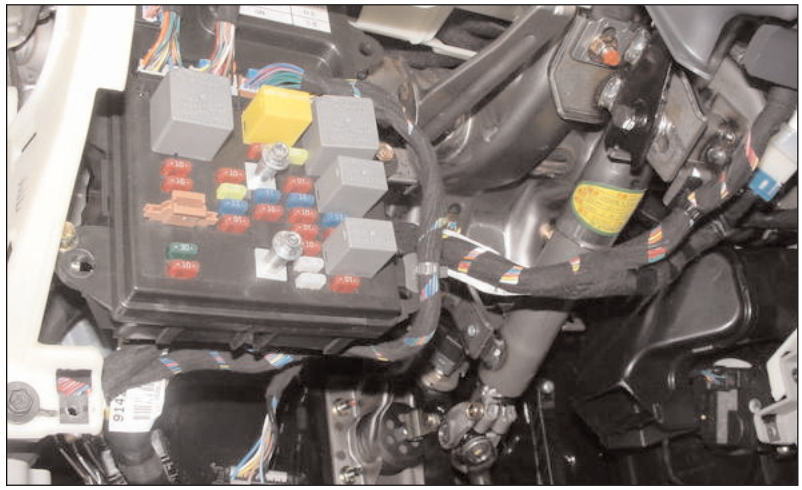
- Remote keyless entry (RKE)
- Power windows
- Power door locks
- Lamps and windshield wiper/washer systems
- Alarm functions
- Timer functions

ETACS FUNCTIONS

The ETACS module receives input switch signals for the following electrical functions.

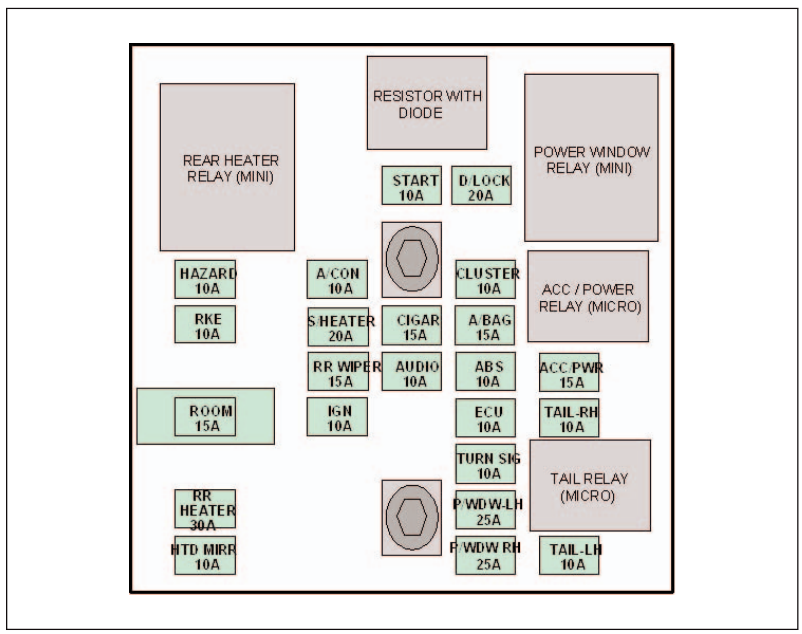
- Tail lamp auto cut
- Ignition key hole illumination control
- Room lamp delay out control
- Central door lock control
- Power main switch lock/unlock control
- Crash door unlock control
- Key reminder control
- Seat belt warning timer control
- Key operated warning control
- Rear window heated glass
- Power window timer control
- Intermittent wiper & washer control
- 2-turn unlock control
- Front window de-icer control
- Rear wiper & washer control
- Turn signal & hazard lamp control
- Anti-theft function with panic control

COMPONENT OPERATION



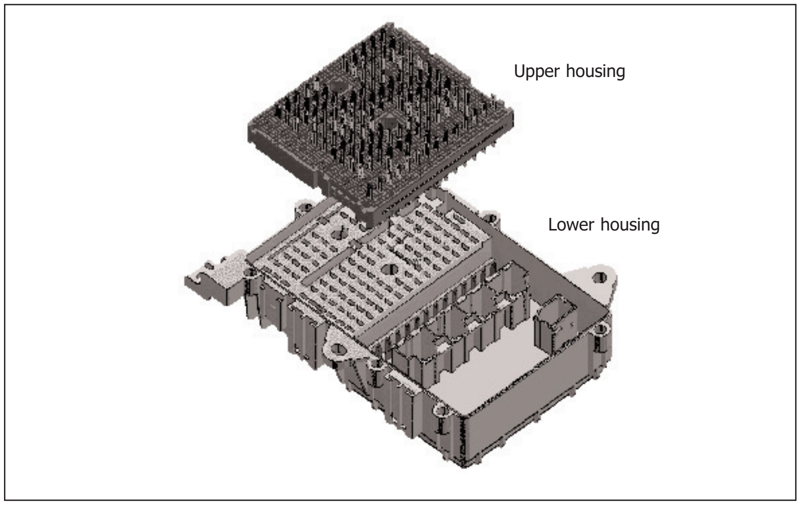
The ETACS/IBEC is located on the left side of the steering column, below the instrument panel (IP). Access to the entire ETACS unit requires removal of the lower left dash trim panel. With the trim panel removed, the ETACS plugs and harnesses are accessible.

INTEGRATED BUSSED ELECTRICAL CENTER (IBEC)



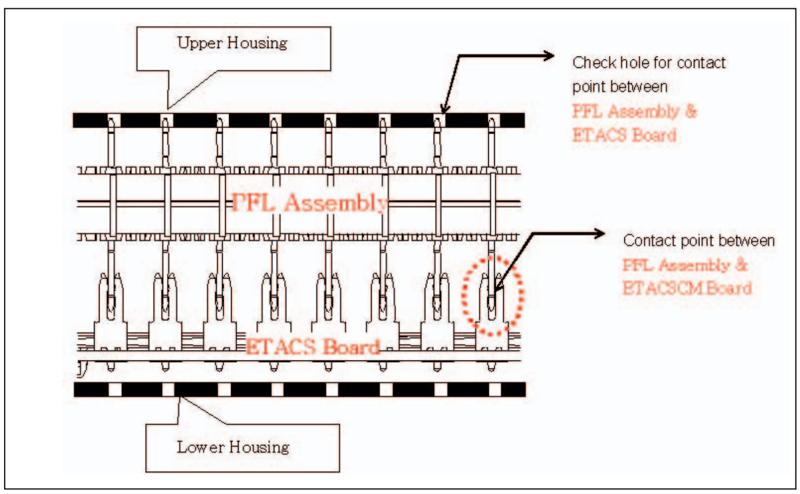
Access to the fuses and relays is accomplished by removing the panel cover in the IBEC, which lists the fuses and relays. The IBEC contains the interior fuse and relay box.

Interior Electrical Box Junction



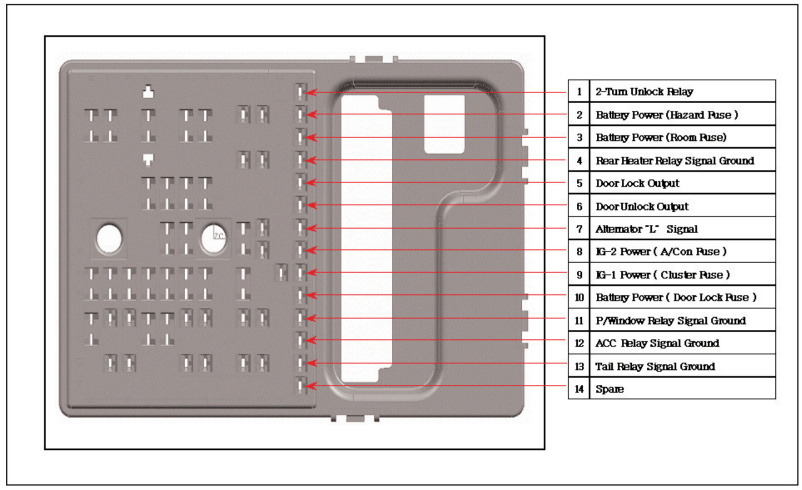
The IBEC is made up of two parts: the upper and lower housing assemblies. The upper housing contains the terminals for fuses, relays and connectors. The lower housing is a structure or frame that holds the IBEC. These are press fit together.

The Press Fit Layer (PFL) type construction of the electrical junction box offers greater durability and heat resistance than a previous Printed Circuit Board (PCB) type junction box and also allowes weight and thickness to be reduced.



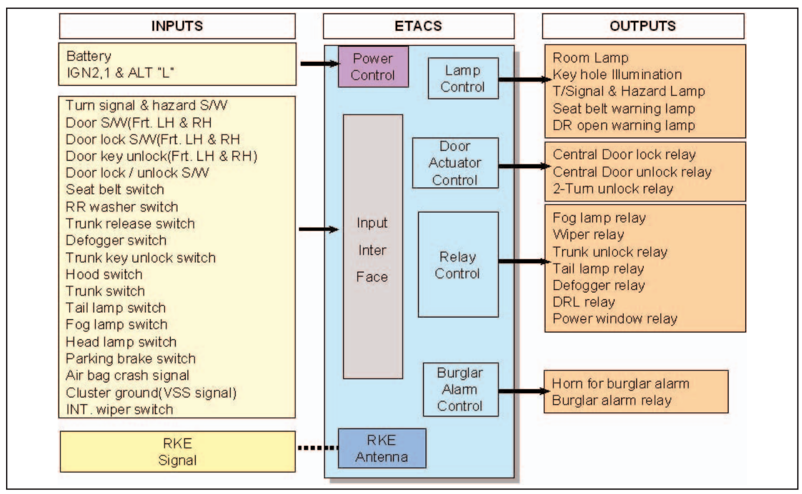
This construction also provides check holes permitting measurement of ETACS voltages and resistances and confirmation of ETACS board continuity, as shown in the illustration. This aids in diagnostics by allowing technicians to measure each circut.

VOLTAGE CHECK HOLES



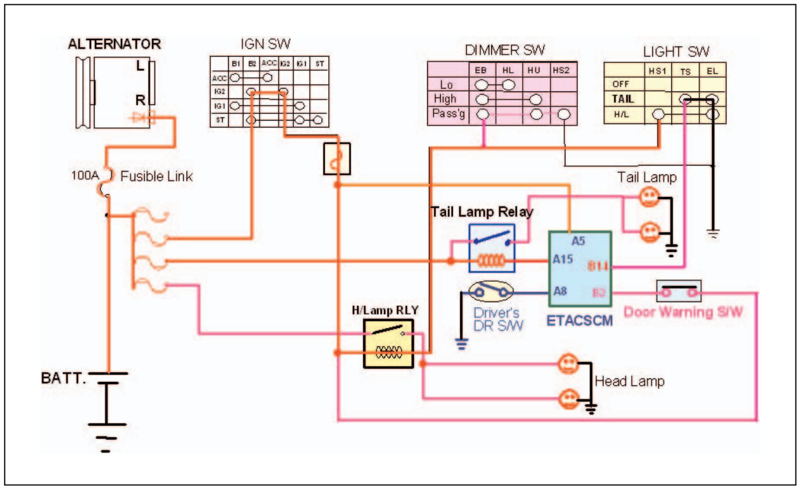
The indicated "check holes" provide ETACS voltage information needed to perform diagnostics and troubleshooting procedures.

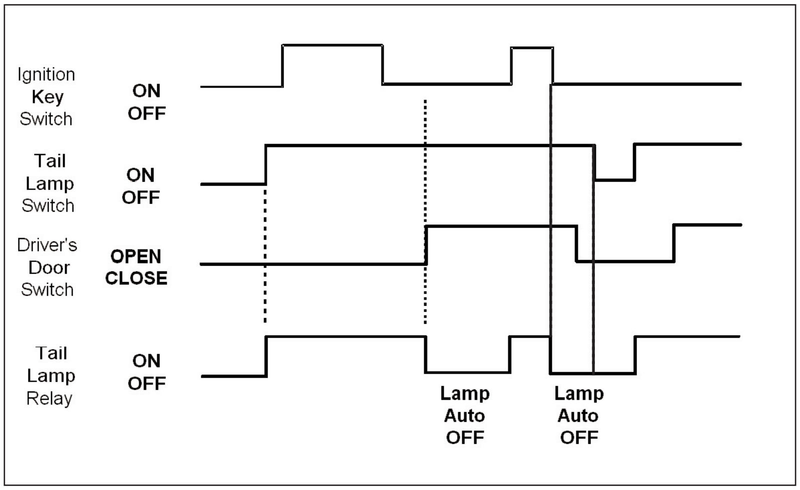
ETACS LOGIC



As seen above, many electrical accessories inputs are sent to the ETACS. Then, the ETACS outputs the command or actuation based on it's programmed logic.

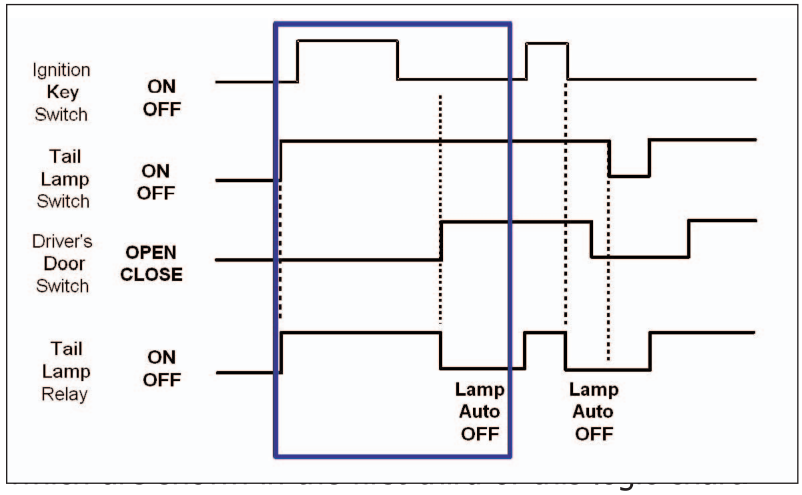
The ETACS may pass one input through to one actuator output, or hold an output until several required inputs are received based upon its logic programming. The service information (service manuals or KSIS) contains logic charts to graphically demonstrate ETACS logic programming of actuators based on one or more inputs.





Logic charts represent ON and OFF events of switches, lamps, motors, and solenoids. Logic charts may also indicate time between events, in which case they may be labeled as "timing charts."

As an example, the ETACS function of "Tail Lamp Auto Cut" circuit may be modified by several inputs as shown in the logic chart. A schematic representing the electrical circuit of the "Tail Lamp Auto Cut" and the logic chart depicts more than one switch input affecting the state of the tail lamp relay.



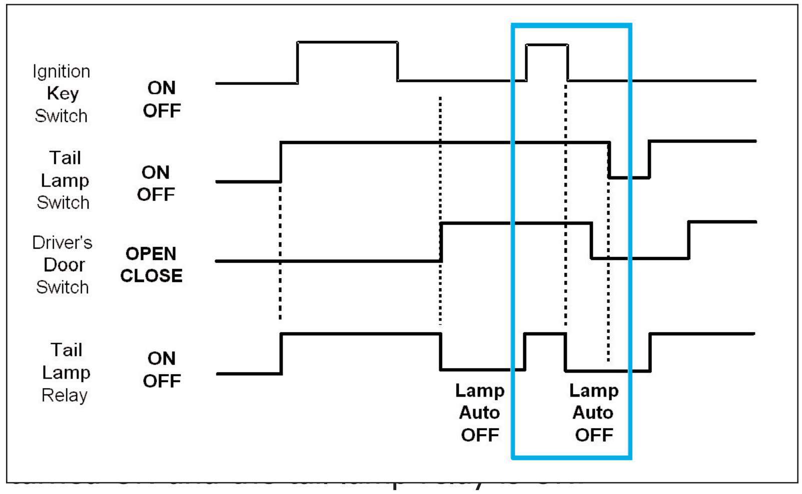
To read this chart, break it down into activity segments and read from left to right.

- Ignition Switch ON
- Tail Lamp Switch ON
- Door Closed
- Tail Lamp Relay ON

- Ignition Switch OFF
- Tail Lamp Switch ON
- Door Open
- Tail Lamp Relay OFF

The Tail Lamp Auto OFF, or auto cut function is shown in the first segment of the logic chart. The tail lamp relay is ON or closed when the ignition switch and tail lamp switch are ON. The driver's door switch is closed.

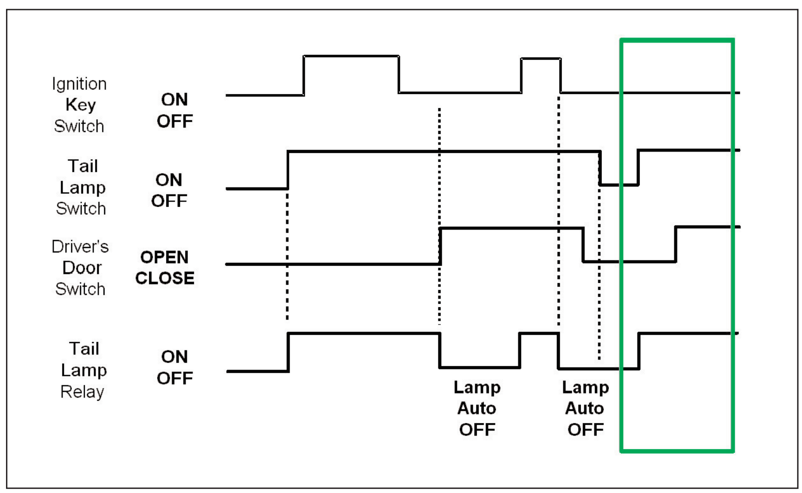
When the ignition switch alone is turned OFF, the tail lamp relay stays ON until the door opens, then it goes to OFF.



When the ignition switch is turned OFF, the tail lamp relay goes OFF.

- Ignition Switch OFF
- Tail Lamp Switch ON
- Door Closed
- Tail Lamp Relay ON

- Ignition Switch OFF
- Tail Lamp Switch ON
- Door Open
- Tail Lamp Relay ON



In the third segment boxed, the ignition switch is OFF, the tail lamp switch is turned ON and the tail lamp relay goes ON. When the door switch is open, the tail lamp relay remains ON.

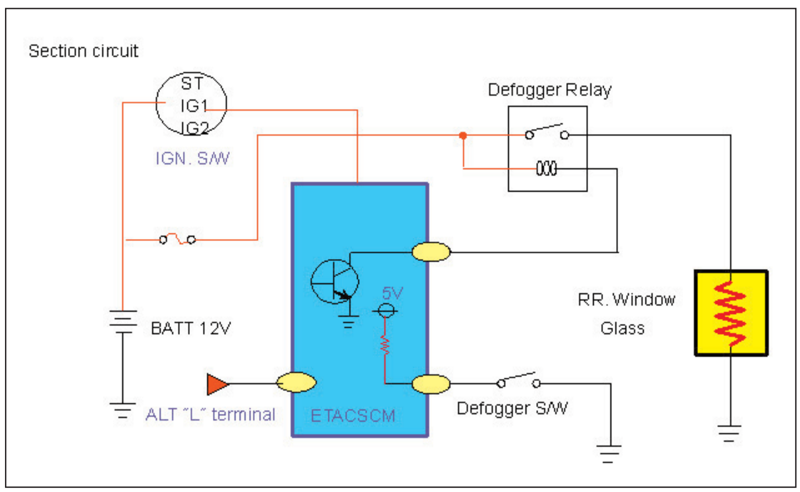
If one of the functions of this ETACS circuit is not operating as the logic chart shows, the next step is to divide the system into components to determine the fault.

Other ETACS circuits work in similar fashion. For each signal event, such as a switch opening or closing, there is a time and action control event, such as keeping a light ON for a period of time, or until another signal event causes the light to be turned OFF.

ETACS DIAGNOSTIC

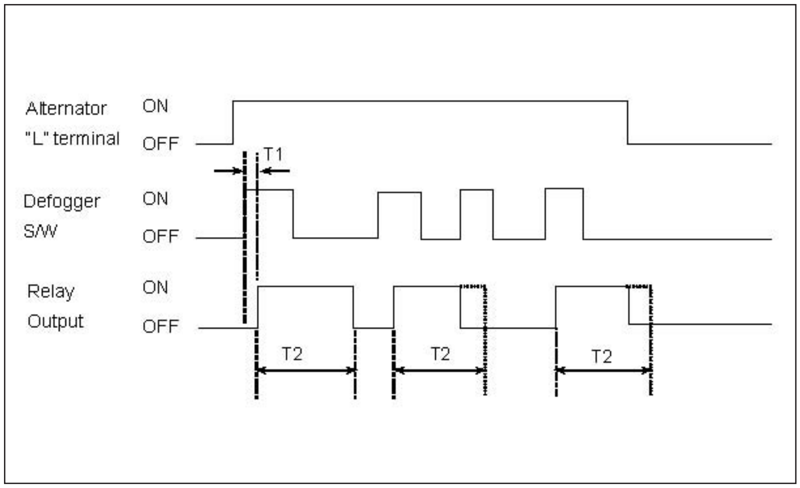
ETACS is a complex system, but one that is fairly simple to diagnose. The ETACS is basically a means of controlling electrical systems and components. Inputs to the ETACS control module are typically switches closing or opening. Outputs may be lights, solenoids, or motors.

Diagnostics and troubleshooting ETACS should, then, follow the basic diagnostic philosophy. That means diagnosing an ETACS controlled system is basically the same as any other circuit performing the same function, except that there is now a central input/output component that may or may not contribute to a malfunction.



We have seen logic charts that define how an ETACS controlled system works normally. Now, let's try inspecting a circuit with which a customer has a concern.

The customer concern is the defogger in a 2004.5 Spectra will work sometimes, but often won't stay on long enough to defog the rear window. The customer says that the element in the rear window barely gets warm, however the outside mirrors are defogging fine.



Looking at the timing chart. It's stated that T2 is supposed to be approximately 20 minutes in duration. But note a few other operational features about this circuit:

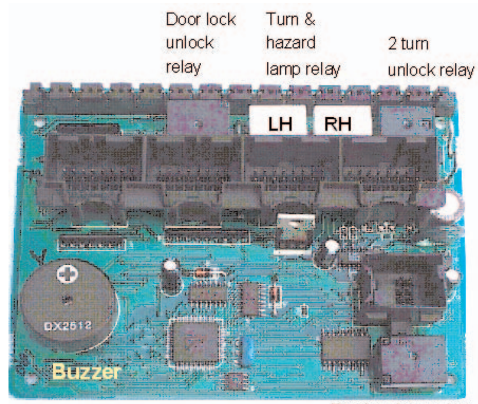
1. If the defogger switch is pressed while the defogger is ON, the defogger turns OFF.
2. If ALT "L" power is lost, the defogger will turn OFF.

If the customer, believing the defogger isn't working fast enough, presses the defogger switch before time is up, he will actually turn it OFF. Verify that the customer does not impatiently press the defogger switch before the unit has a chance to work.

If there is actually a problem with the defogger, look for a reason that power to the rear window defogger is intermittent. Note that the outside mirrors, which are in the same circuit, are not affected. Such a symptom indicates power could be lost on either side of the defogger grid.

Refer to Kia Service Information System (KSIS) for diagnostic procedures and specifications.

ETACS CIRCUIT

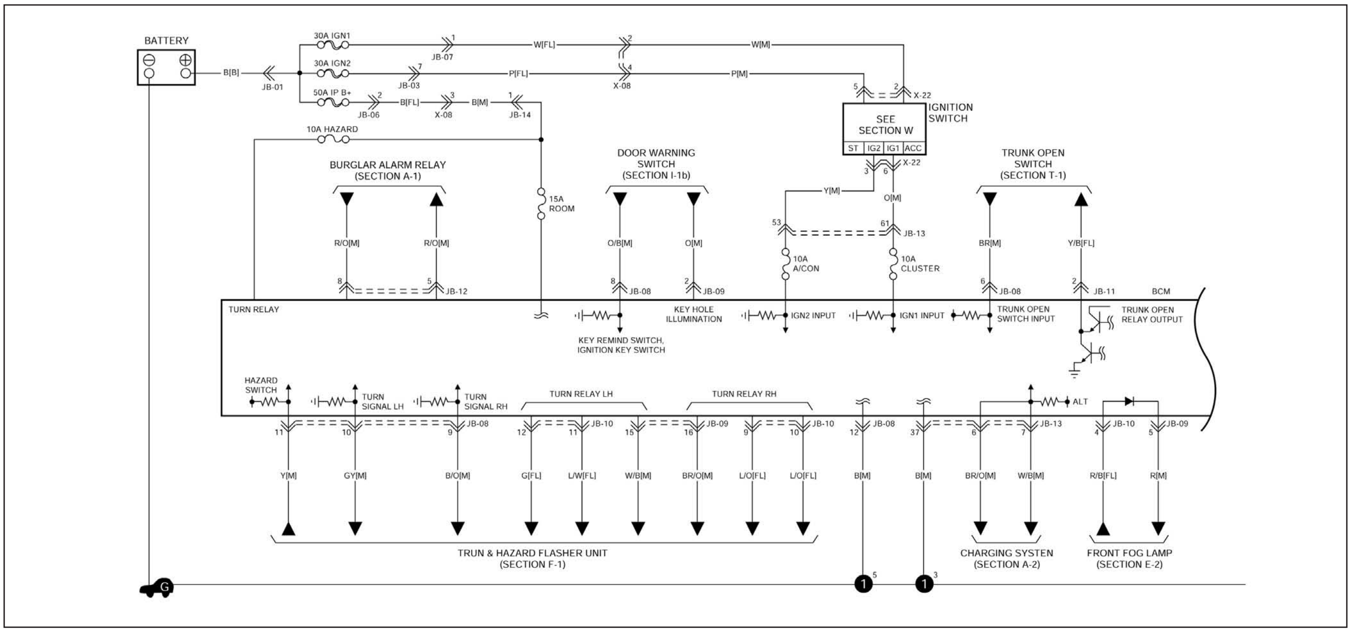


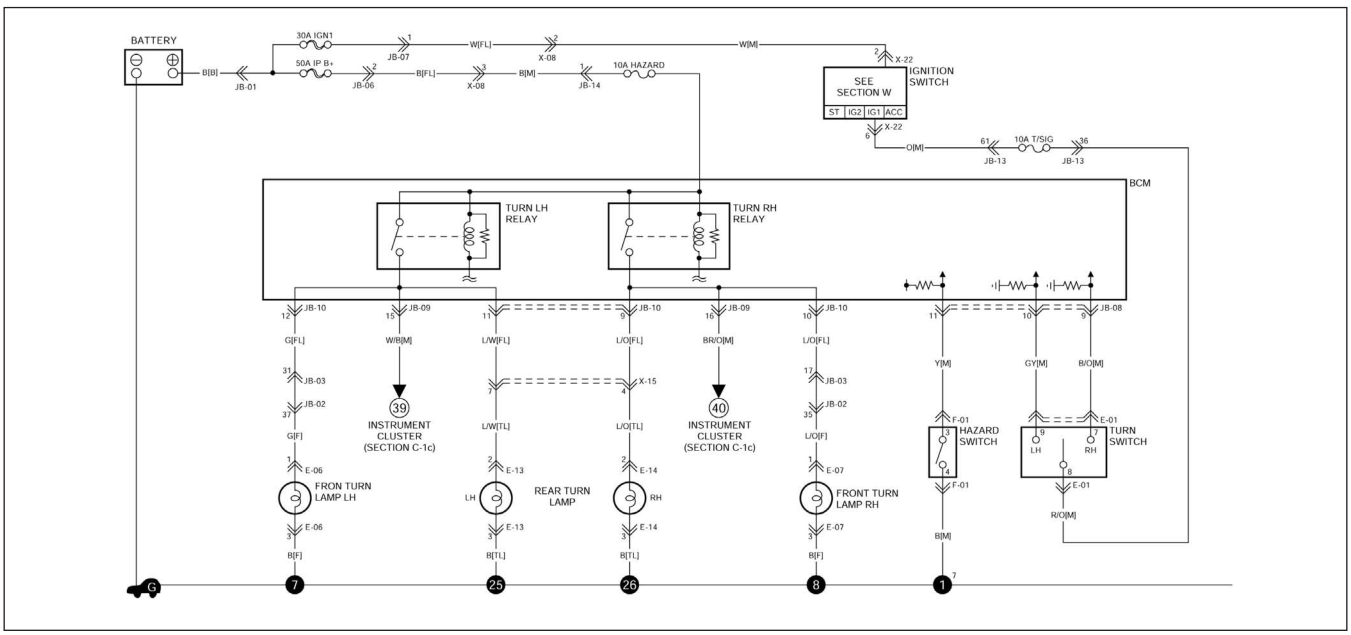
ETACS Control Module

The ETACS has relays affecting door lock/unlock, turn and hazard lamp, 2 turn lock, and burglar alarm plugged or soldered onto it's circuit board. The ETACS circut plugs into the upper half of the IBEC lower housing assembly.

The 2004.5 Spectra ETACS incorporates several other components. For example, the lamp flasher relay for turn signal and hazard lamps is controlled by the ETACS and is plugged into the ETACS for lamp operation. Also, the ETACS controls the door lock/unlock relay, 2 turn unlock relay, burgular alarm relay, and buzzer.

TURN SIGNAL LAMP

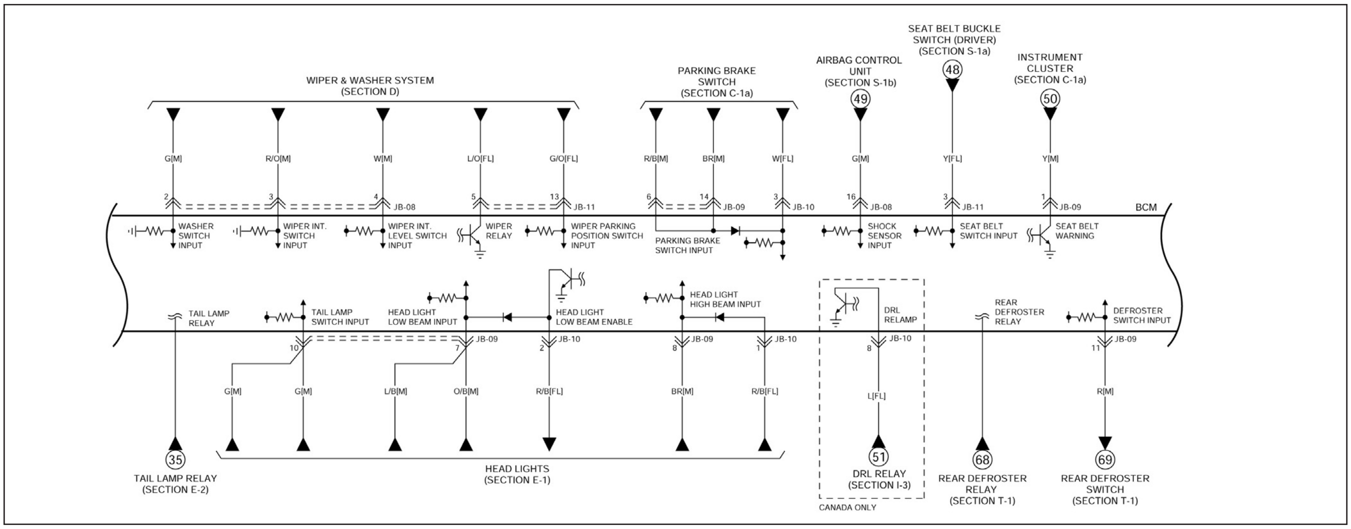


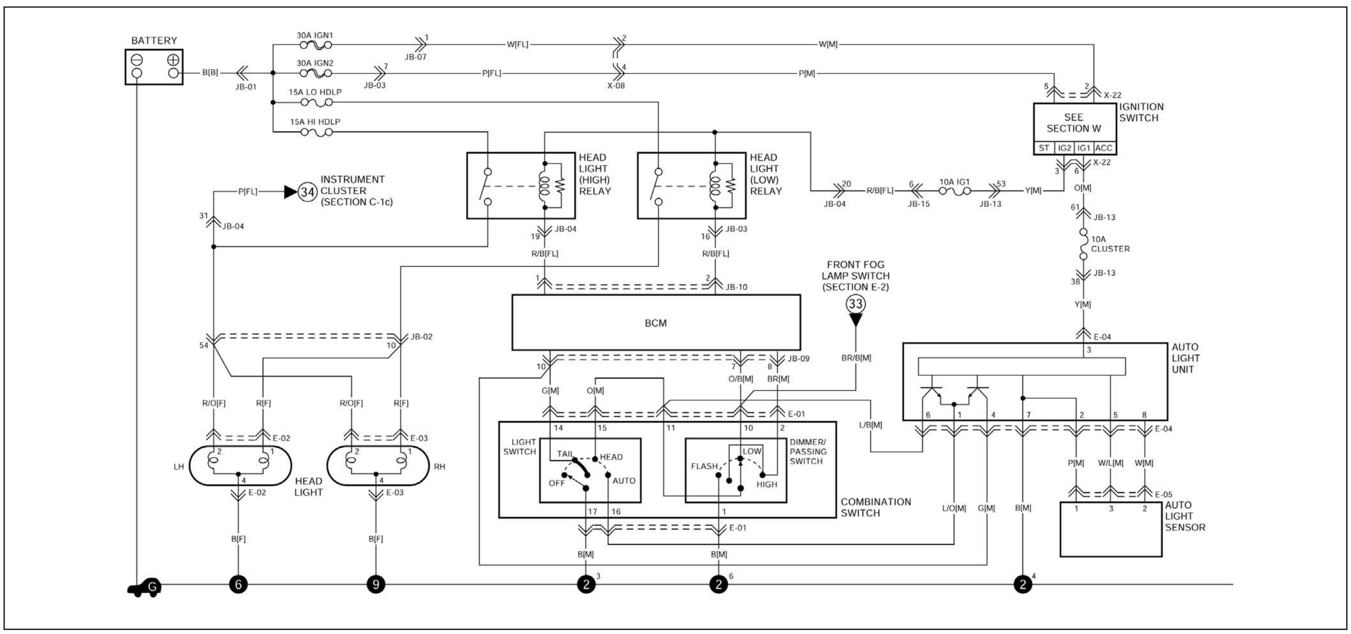


The turn signal switch inputs a voltage signal to the ETACS indicating LH or RH turn signal lamp operation. Then, the ETACS controls the LH and RH turn relay ON/OFF, which flashes related front and rear turn lamps ON/OFF through ground side control. The turn relays plug into the ETACS/IBEC.

Note: The ETACS is being called a BCM in these wiring diagrams. While the terms BCM and ETACS may be used interchangeably in service documents, the 2004.5 Spectra is equipped with an ETACS.

AUTO SWITCH, AUTO LIGHT UNIT, AND AUTO LIGHT SENSOR





Light switch inputs to the ETACS are headlamp ON/OFF voltage signals. The ETACS controls the high and low beam headlight relays in the engine compartment relay box, which turns the headlights ON/OFF through ground side control.

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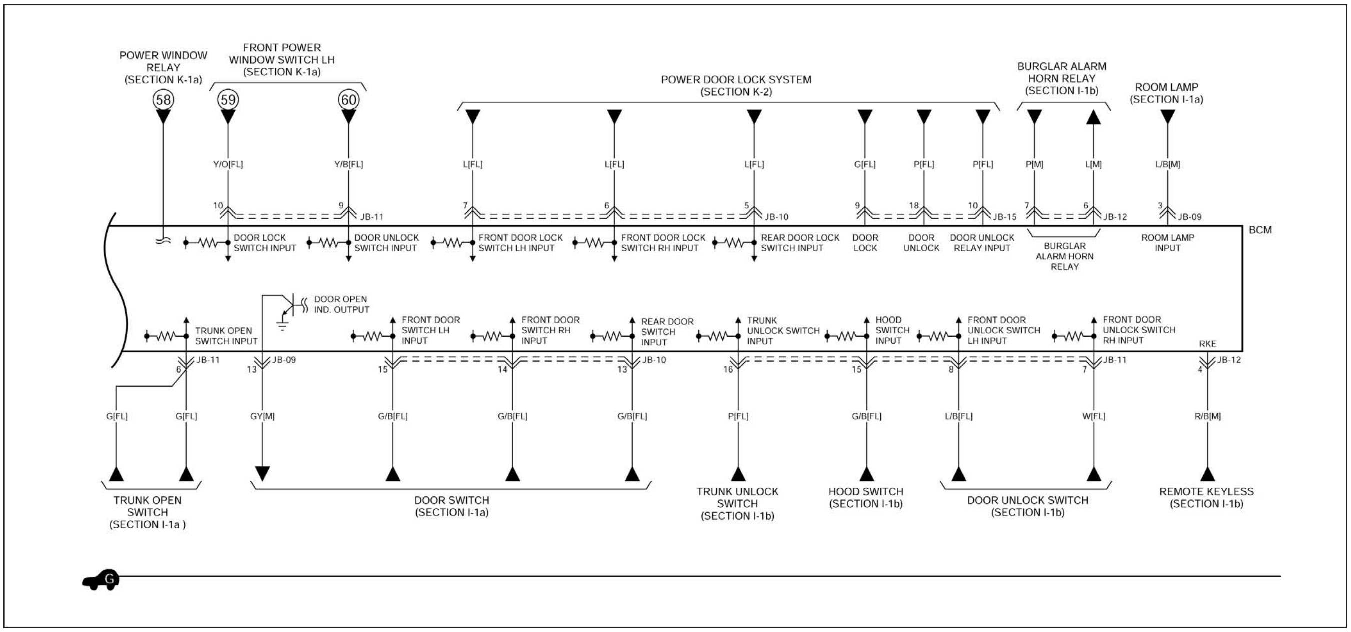
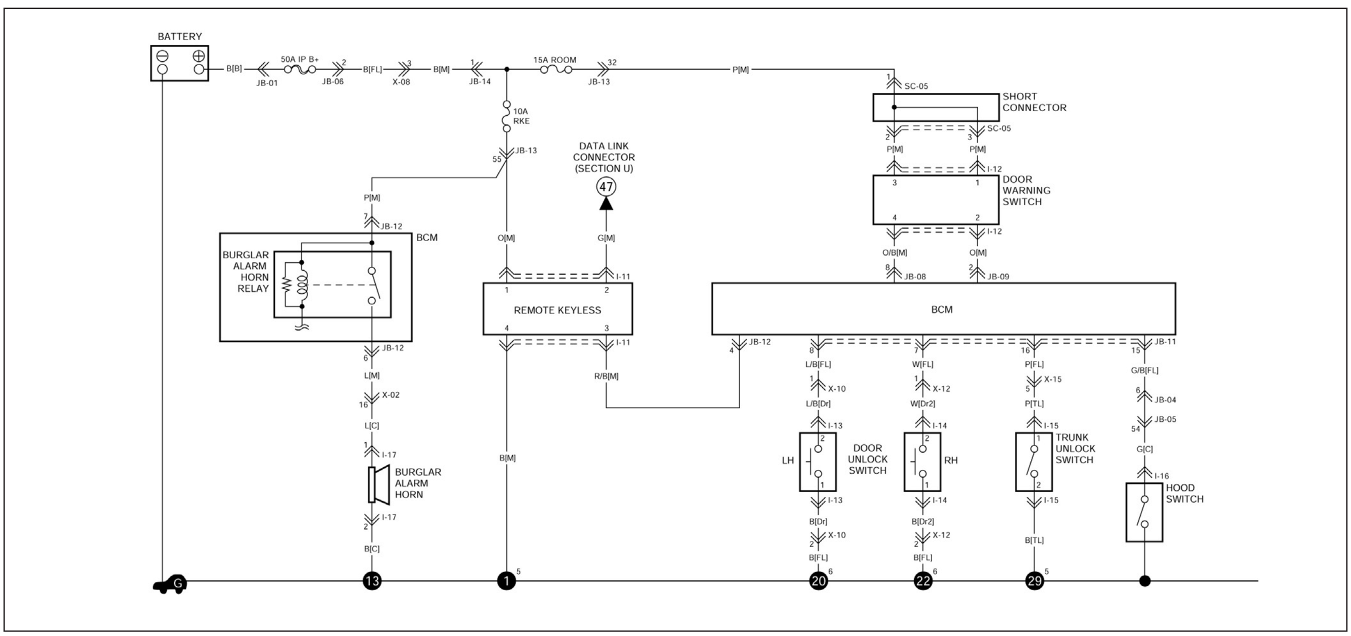
RKE SIGNAL





The RKE transmitted signal is received by the Remote Keyless Entry (RKE) unit, which inputs a serial data signal to the ETACS. The ETACS then controls related actuators such as the Burglar Alarm Horn Relay.

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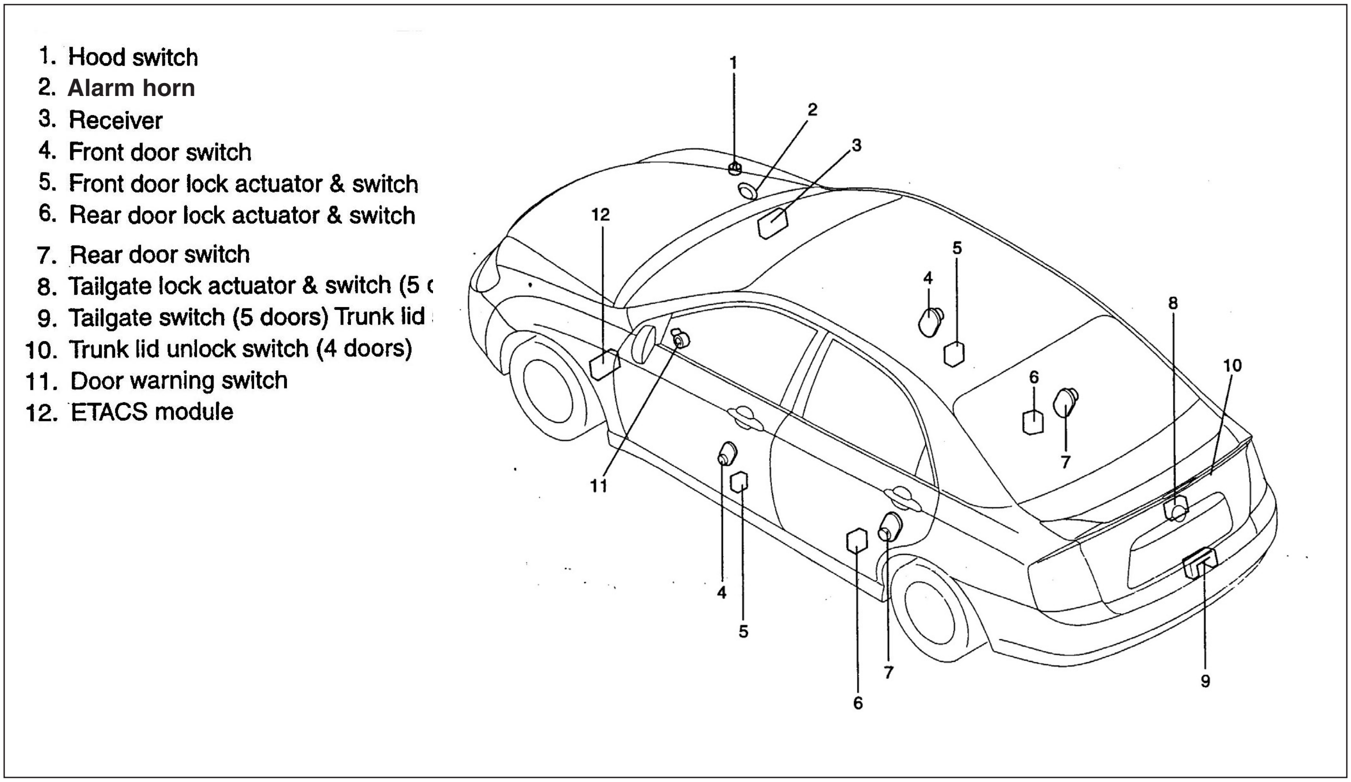
ADDITIONAL ETACS FEATURES

Additional ETACS features include:

- Rear window washer control on 5-door model
- Washer and Wiper for Front Windshield
- Variable Intermittent Front Windshield Wiper
- Turn and hazard lamp control
- SRS crash all doors unlock
- Ignition Keyhole Illumination
    - ON with front door open
    - OFF 10 seconds after door closed or alarm armed
- Ignition key in reminder
    - Prevents door lock if ignition key is left in cylinder
- Seat belt warning timer for lamp and chime
    - If drivers seat belt unbuckled, will flash seat belt lamp and chime for 6 seconds
- Key operated warning buzzer
    - If ignition key in cylinder with driver door open
- Rear window & side mirror defogger Timer
- Power window timer
    - Remains ON for 30 sec after Ignition Key OFF
    - If a door is opened, power is turned OFF
- Delayed room lamp
    - With all doors closed, dome lamp drops to 75% intensity and then fades out within 6 seconds.
- 2-turn door key unlocks all doors
- Power door lock and unlock

ANTI-THEFT (BURGLAR ALARM SYSTEM)



The Anti-Theft system is armed automatically after the ETACS determines an "open" circuit/signal to the doors, hood and trunk. The system alarm is activated (sounds) when:

- Any door, hood, or trunk is opened without key or RKE
- Door is unlocked without using the RKE
- The RKE panic is activated
- Ignition Key is OFF and removed from the cylinder.

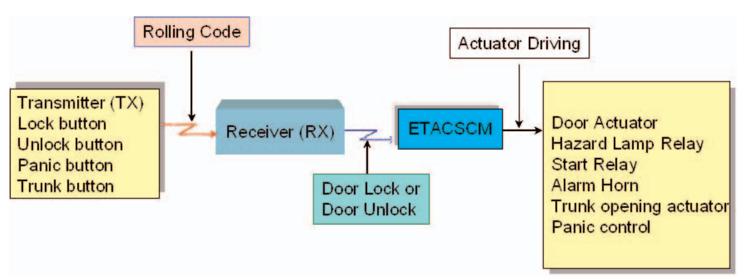
Any of the above conditions will cause the horn to sound, and hazard lamps flash for approximately 2 minutes or until the system is disarmed by RKE or Ignition Key ON signal is received by the ETACS.

Note: If one of the switches is misadjusted or there is a short in the system, the alarm system will not arm. Conversely, a switch that is slightly misadjusted or temperature sensitive the alarm would sound.

REMOTE KEYLESS ENTRY (RKE)

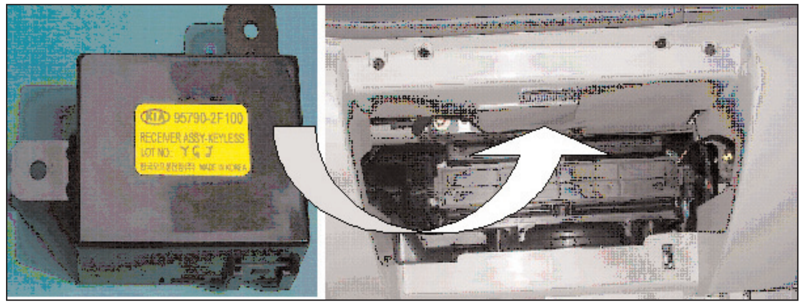
The RKE system provides the driver with a system to lock and unlock the vehicle with a remote transmitter. The 4-door uses a 4-button (with trunk) and the 5-door uses a 3-button (without trunk) RKE. Two RKEs can be programmed into the receiver using the Hi-Scan Pro.

When the room lamp switch is in the center position, it will illuminate when the RKE unlock button is pressed. If the ETACS does not receive a door open signal within 30 seconds, the door will be relocked and the system armed. If the doors are relocked within the 30-second time period after unlocking, the doors lock, alarm arms and room lamp goes out immediately.

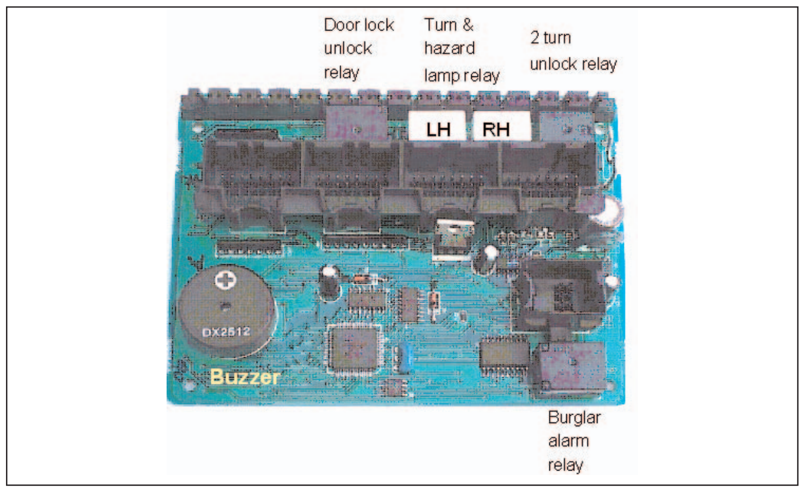


When a RKE button is depressed, a rolling code is sent to the receiver, which sends an input command signal to the ETACSCM to activate that specific item.

RKE COMPONENTS



The RKE receiver is located above the passenger glove compartment with a communication line to the ETACS. It only has a power and ground feed, serial communication line with ETACS and a line to the under-hood, 20-pin connector for RKE programming.



The components located on the ETACS circuit board (and not the fuse relay portion) include:

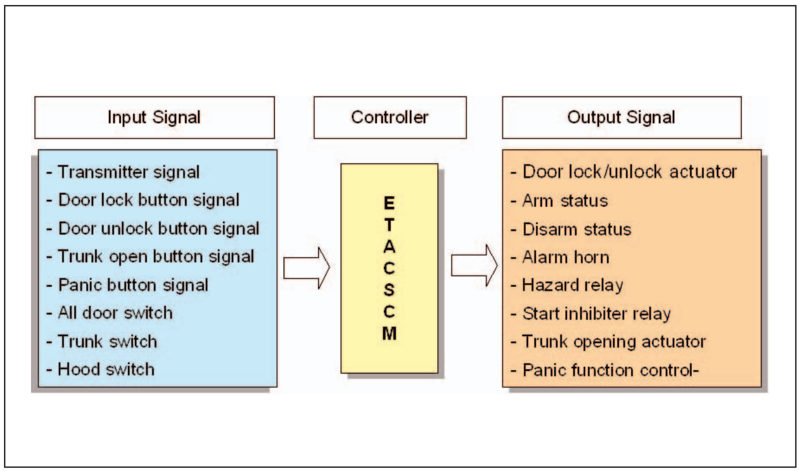
- Door unlock relay
- 2 turn door unlock relay
- Burglar Alarm (Anti-Theft) Relay

BURGLAR ALARM SYSTEM

The burglar alarm system is integrated with the keyless entry system. The burglar alarm system is armed automatically after the ignition switch is turned to the OFF position and the key removed. Then, the ETACS module must receive signals that the doors, hood, and trunk lid are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.

The door switches, hood switch, and trunk lid switch are all open. Immediately after locking doors with the remote transmitter, the system arms. If anything is opened or improperly unlocked after the system is armed, the ETACS module gets a ground signal from that switch, and the system engine compartment alarm horn is activated.

BURGLAR ALARM ACTIVATION



The burgular alarm activates when any of these things occur:

- A door is forced open
- A door is unlocked without using the transmitter
- The trunk lid is opened without the key or RKE
- The hood is opened prior to entry to vehicle

When the system activates, the alarm (siren) sounds and the hazard lamps flash for about two minutes or until the system is disarmed by unlocking with the transmitter.

If the trunk is opened using the key after the system is armed, the doors and hood continue to be in the armed state and the alarm will not activate. Then after the trunk is closed, the trunk is also armed.

ANTI-THEFT FUNCTION

When the remote key lock button (transmitter) is depressed ONCE, a 0.5 second pulse command is issued to lock all doors.

ARMING

As part of the arming sequence, the alarm first enters a pre-armed state before the armed state. In the pre-armed state the vehicle and audible warnings are disabled.

The system enters the armed state from the pre-armed state after 0.6 seconds when all door locks are locked, the hood and trunk are closed, and there is no warning switch (no key in ignition).

On entering the armed state, the hazard lamps flash once.

If the ETACS sends a signal to an open door, trunk, or hood, lock output is given but the exterior lamp will not flash.

The system cannot be armed by locking the car with the keys.

Depressing the remote key unlock button ONCE will send a 0.5-second unlock pulse command to unlock all doors.

DISARMING

Disarming can be performed while the alarm is armed, alarming, or after alarming. The alarm can be disarmed by the following methods:

- Pressing the unlock transmitter key lock button. The hazard lamps will flash twice.
- If the door-warning switch is on, and the ignition switch is ON, the armed state will be immediately canceled.

ALARM FUNCTIONS

Once armed, should any door, hood or the trunk be opened without using the RKE, then:

- The starter relay is disabled, inhibiting starting.
- An audible alarm horn is activated for three cycles; each cycle is ON 27 seconds and OFF for 10 seconds. The hazard warning lamps flash during this period.

After the three cycles, the system maintains the start inhibit state, where no audible and visual warnings are issued but engine cranking is not possible.

DISARMING

The alarm can be cancelled by depressing the unlock button on the key lock transmitter. Placing the key in the ignition and turning it to ON and leaving it there for approximately 30 seconds can also disarm the alarm. After that time, the alarm is cancelled, and the system enters the disarm state.

If power to the ETACS module is interurupted in the following states:

- Alarmed
- After alarming system

TRANSMITTER INSPECTION AND DIAGNOSIS

Upon restoring the battery, the alarm state shall be entered and the alarm cycle shall restart.

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. If the red light doesn't flicker, remove the transmitter battery and check battery voltage.
3. Replace the transmitter battery with a new one if voltage is below 3V. Then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K. If the doors don't lock and unlock, program the transmitter code using Hi-Scan Pro, then try to lock and unlock the doors.
5. If the doors lock and unlock, the transmitter is O.K. If the doors don't lock and unlock, replace the transmitter.

If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long

ALARM & ANTI-THEFT SYSTEM DIAGNOSTICS

as the ETACS module continues to get a ground signal from one of the door, trunk, or hood circuits, it thinks the vehicle is open and will not arm.

A switch that is on the threshold of misadjustment may activate the alarm for no apparent reason. In this case, it may only take a change in outside temperature, the vibration of the passing truck, or someone bumping into the vehicle to activate the alarm.

SYSTEM VOLTAGE, BATTERY

The Spectra uses a maintenance free 60AH battery, which has a 550A cold cranking amperage (CCA). A Kia Micro 570 Analyzer has been sent to all dealers as a new essential Kia special Service Tool (SST). This tool will assist technicians in battery management through technology that detects accurate battery condition in less than five minutes. Kia requires that the Kia Micro 570 Battery Analyzer be used whenever diagnosing a battery concern that is a possible warranty replacement. The tester will indicate one of the following conditions:

- Good Battery: Good State, Recharge the Battery and Use Charge Battery and Retest Replace Battery
- Bad Battery Cell, Charge and retest the battery.

If the battery needs replacement, the Kia tester will display a 10-digit code that must be written on the warranty RO plus the printed results must be attached. Refer to TSB on KSIS for complete information.

STARTING CHARGING

The Kia Micro 570 Analyzer also has the ability to test the charging and starting systems (alternator and starter). After the battery test, press ENTER immediately for the starter test. After starting the engine, cranking voltage and starter test results will be displayed on the screen. Press ENTER to continue on to the charging test. The analyzer will then display alternator voltage. To test the charging system, press ENTER, turn OFF all electrical loads, increase the engine RPM for 5 seconds and press ENTER. Return the engine RPM to idle and review the results on the tester screen.

SUMMARY

In this module, you have learned that the Electronic Time Alarm Control System (ETACS) Control Module is a controller that facilitates input signals and body electrical functions. In addition, the ETACS allows multiple comfort, convenience, and security features to interact with one another to increase their functionality and convenience.

While the ETACS is a complex system, it is fairly simple to diagnose because its inputs are typically switches closing or opening to control lights, solenoids, and motors. Also, the ETACS module is combined with the Integrated Bussed Electrical Center (IBEC) to contain the interior fuse/relay electric center. This design provides technicians and customers with one location to replace blown fuses and listen for warning buzzer.

PROGRESS CHECK

1. Which best describes the interior electronic junction center in the 2004.5 Spectra:
   A. Body Control Module
   B. ETACS
   C. IBEC
   D. ETACS/IBEC

2. 2004.5 Spectra electronic timing and alarm control system (ETACS) is all of the following, EXCEPT:
   A. Centralizes SRS front and side impact sensors
   B. Centralized control and timing functions
   C. Simplifies electrical accessories wiring
   D. An input to output controller

3. The RKE receiver is located:
   A. In the ETACS
   B. In the BCM
   C. Above the passenger glove compartment
   D. In the drivers door including the antenna

4. Technicians can access KSIS for Spectra service information on all of the following, EXCEPT:
   A. Body Electrical
   B. Immoblizer
   C. RKE Reprogramming
   D. Electrical Accessories

5. The system alarm is activated when the:
   A. RKE is used to open the door
   B. Trunk is opened
   C. Vehicle is bumped with sufficient force
   D. Electrical pulse shoots through the vehicle

ANSWER KEY:
1. D 2. A 3. C 4. B 5. B

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Body Electrical

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.15

Guided Practice

SAFETY FIRST

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the individual performing the repair. There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual performing the service. This workbook cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this workbook must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires under-body work.
- Be sure the ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when the engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

Within this workbook you will find Notes, Cautions and Warnings which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms.

NOTE
The purpose of a Note is to help you do your job more efficiently. A Note may provide additional information to help clarify a particular point or procedure.

CAUTION
A Caution alerts you to the possibility of damage to tools, equipment, or the vehicle. A Caution recommends that a procedure must be done in a certain way to avoid potential problems resulting from improper techniques or methods.

WARNING
A Warning alerts you to the highest level of risk. Warnings inform you that a procedure must be done in a particular way to minimize the chances of an accident that could result in personal injury or even loss of life.

When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

In this module, you will be given the opportunity to practice performing ETACS related service and diagnostic procedures.

MODULE OBJECTIVES

Objectives of this module are for you to demonstrate your ability to:

- Program an RKE
- Conduct voltage checks on the ETACS
- Test battery with Kia Micro 570 Battery Tester

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service-training instructor evaluate your work and sign-off that it has been properly completed.

You will be divided up into teams and given a series of tasks to complete. If you do not understand the instructions or have any questions, don't hesitate to ask the instructor for further clarification.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- 2004.5 Spectra (LD)
- #2 pencil or preferred writing instrument
- Hi-Scan Pro
- KSIS
- Midtronics Battery Tester
- DVOM
- Unregistered RKE

TIME TO COMPLETE

This module will take approximately 45 minutes.

OVERVIEW

This guided practice will give you the opportunity to put into practice the information you have learned in the Body Electrical theory module. Under the supervision of a trained Kia service-training instructor you will perform a series of tasks to fulfill the objectives of this guided practice.

TABLE OF CONTENTS

Total Possible Points: 15

PRORAMMING AN RKE

Total Possible Points: 3

Get from your instructor an RKE to program on a Spectra.

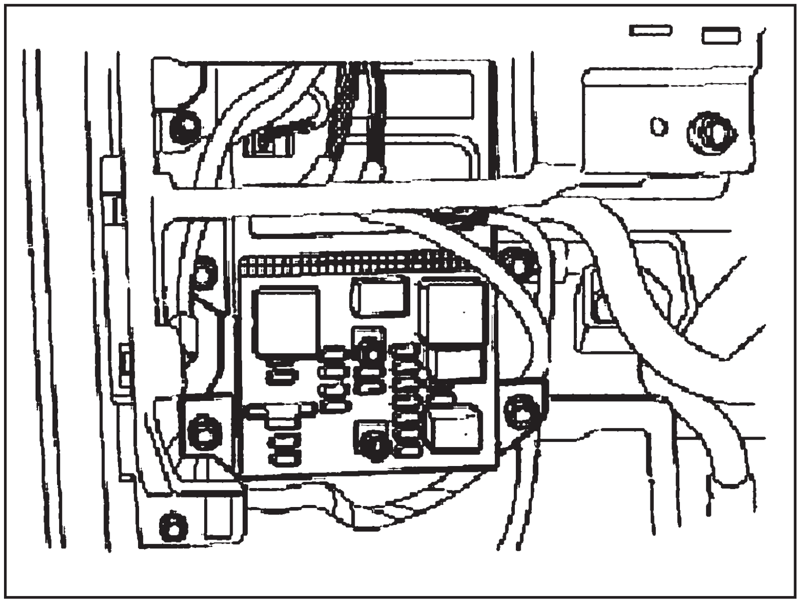
1. Connect the HSP to: ___________________________
   a. Using which cable: __________________________
2. On the HSP, select the: ________________________
3. Select menu: __________________________________
4. Remove: _____________________________________
5. Perform steps 1-3
6. Verify the RKE programming
7. Does the new RKE work? _______________________

What about the other RKE, is it programmed?

VOLTAGE CHECKS OF THE ETACS

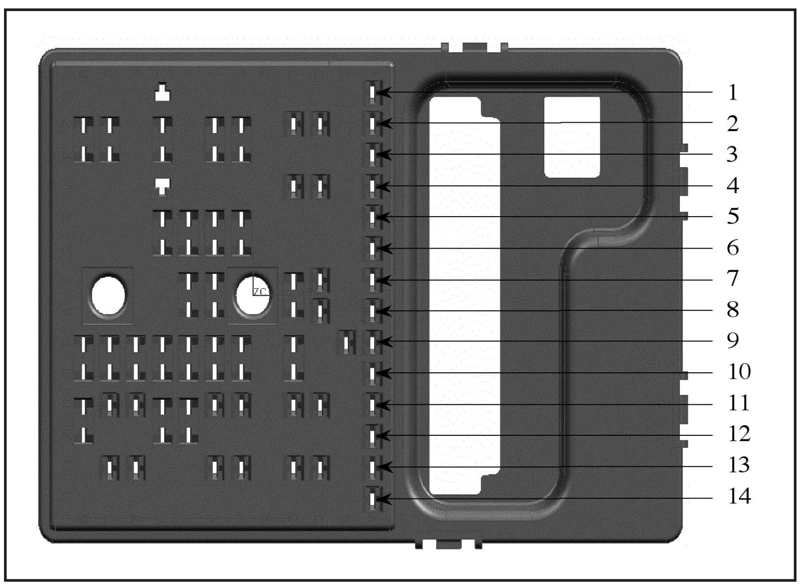
Total Possible Points: 6

Gain access to the ETACS.



Notice the pins above the relays that are also listed by number below.

The numbers are for this guided practice, not identified to any manual



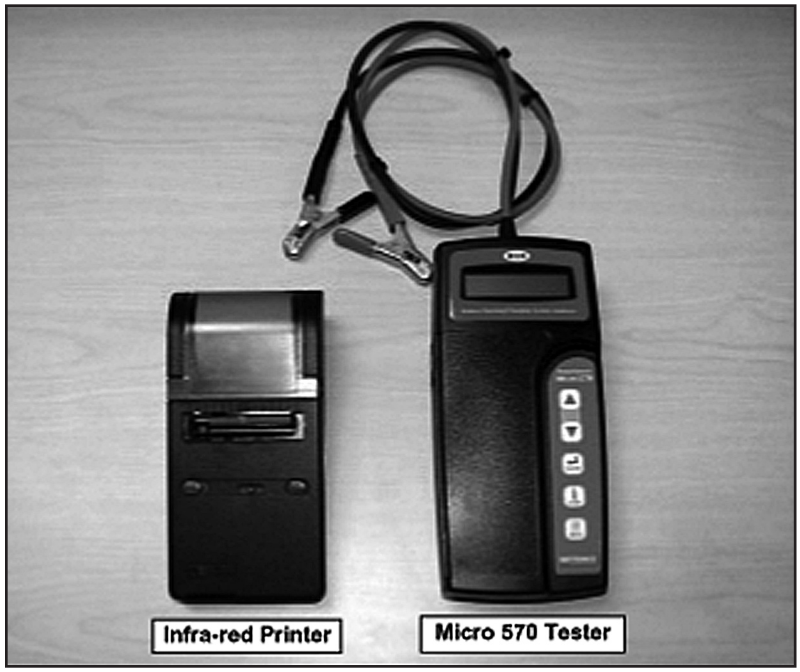
Measure each of the pins and record your reading below. Then list the test conditions on the second line of each pin.

Check Hole Pin No	Check Item	Voltage characteristic
1	2-Turn Unlock Relay	volts, volt
Test Conditions:		
2	Battery Power (Hazard Fuse)	volts
Test Conditions:		
3	Battery Power (Room Fuse)	volts
Test Conditions:		
4	Rear Window Glass Heated Relay Signal Ground	volts
Test Conditions:		
5	Door Lock Output	volts, volt
Test Conditions:		
6	Door Unlock Output	volts, volt
Test Conditions:		
7	Alternator "L" Signal	volts, volts
Test Conditions:		
8	IG-2 Power (A/Con Fuse)	volts
Test Conditions:		
9	IG-1 Power (Cluster Fuse)	volts
Test Conditions:		
10	Battery Power Door Lock Fuse	volts, volt
Test Conditions:		
11	P/Window Relay Signal Ground	volts, volt
Test Conditions:		
12	ACC. Relay Signal Ground	volts, volt
Test Conditions:		
13	Tail Lamp Relay Signal Ground	volts, volt
Test Conditions:		
14	Spare	

BATTERY TESTER

Total Possible Points: 6

The Spectra's battery needs to be tested with the Kia Micro 570 Battery tester when it may be a warrantable replacement item.

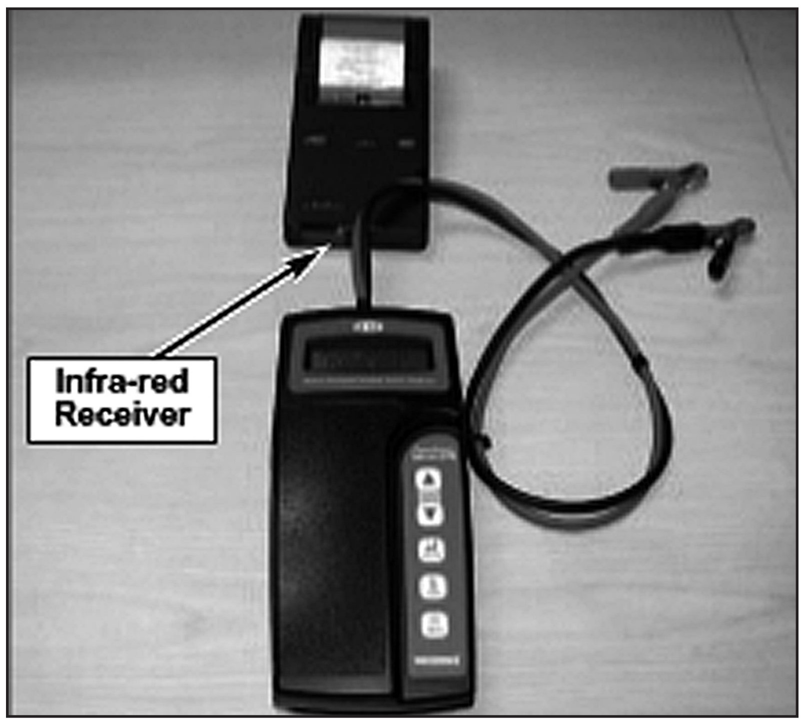


This tester indicates if the battery needs to be replaced or recharged. If replacement is necessary, the tester displays a 10 digit code to be recorded on the RO with the printed results from the printer.

Testing Procedures

1. Safety connect the tester up to a Spectra Battery

2. Scroll to and select the test In-Vehicle”
3. Press ENTER
4. Scroll to and select the Test By CCA
5. Press ENTER
6. List the CCA of the Spectra Battery: _____________
7. Scroll to and select the battery rating in CCA
8. Press ENTER to start the test
9. Record the test results: _______________________
10. If test results indicate Replace Battery, press CODE
11. Record the CODE: __________________________
12. Turn the Printer ON
13. Press the menu button for 2 seconds to turn ON the battery tester



14. Scroll and select the option PRINT RESULTS
15. Aim the top of the Kia Battery Tester at the infra-red receiver on the lower left of the printer and press ENTER
16. Attach the printed results to this sheet

NOTES:

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Performance Assessment

2004.5 Spectra Technology

Service Technical Training

Student Guide

NMLD.16

SAFETY FIRST

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- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

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When you see a Note, Caution, or Warning, be certain you understand the message before you attempt to perform any part of a service procedure.

TARGET AUDIENCE

The target audience for this module will be Kia Master level, Master level candidates, Senior level, and Senior level candidates service technicians.

MODULE GOAL

This module is designed to evaluate what you have learned throughout this course. You will be assigned tasks, which must be successfully completed to receive credit for this performance assessment module.

MODULE OBJECTIVES

The objective of this module is for you to demonstrate your ability to:

- Retain knowledge presented in the theory module lectures
- Look up technical information about the Spectra on KSIS
- Use the Hi-Scan Pro on the Spectra

MODULE INSTRUCTIONS

Carefully read and follow the instructions for each activity. Answer the questions and fill in the blanks with the requested information as you perform the activity. When you have finished, have your service training instructor evaluate your work and sign-off that it has been properly completed.

REQUIRED MATERIALS

In order to complete this module, you will need the following items:

- An Spectra vehicle
- A #2 pencil or preferred writing instrument
- KSIS and log/sign on
- HSP

TIME TO COMPLETE

Approximately 30 minutes.

OVERVIEW

This module will give you the opportunity to demonstrate some of the information you have learned regarding the Spectra. Under the supervision of a trained Kia service training instructor you will answer a series of questions and perform a series of tasks in the areas of:

- HSP - Powertrain
- KSIS – Driveability
- HSP – Driveability

You will be given a series of tasks to independently complete. If you do not understand the instructions or have any questions don't hesitate to ask the instructor for further clarification.

Note: You must have the instructor sign-off and issue points on your performance scorecard for the written and performance assessment before going on to the next one.

TABLE OF CONTENTS

Total Possible Points: 30

WRITTEN PERFORMANCE

Total Possible Points: 10

Below are questions based upon the Theory Modules.
Each question is worth 1 point.
Circle the best answers for the questions.

1. Which key system requires consumer interactions for service and repair?
   A. Instrumental panel warning lamps
   B. CVVT engine
   C. Both A and B
   D. Neither A or B

2. Why does the Spectra with SULEV certification use a new style three-way catalytic converter?
   A. Internal temperature is 50% of standard catalytic converters
   B. Better conversion rate
   C. Increased CPSI allows for exhaust filtering
   D. All of the above

3. Technician A states that a Spectra equipped with CBS has ABS as an option. Technician B states that a Spectra equipped with ABS will also have EBD as part of the option. Who is Correct?
   A. A only
   B. B only
   C. Both a and B
   D. Neither A or B

4. Technician A states that the 2004.5 Spectra uses a new Trident negative resistive front sensor and a Zirconia rear sensor. Technician B states that the 2004.5 Spectra uses a new wide range oxygen sensor that shows high voltage lean and low voltage rich just opposite typical Zr02 sensors Who is correct?
   A. A only
   B. B only
   C. Both A and B
   D. Neither A or B

5. The ETACS on the 2004.5 Spectra is all of the following, EXCEPT:
   A. Centralized control and timing functions
   B. Simplifies electrical accessories wiring
   C. Centralizes SRS front and side impact sensors
   D. An input to output controller

6. Technicians can access KSIS for Spectra service information on all of the following, EXCEPT:
   A. Body Electrical
   B. Immoblizer
   C. RKE Reprogramming
   D. Electrical Accessories

7. All of the following are true about using the Hi-Scan Pro for SRS diagnostics, EXCEPT:
   A. HSP can show current data
   B. HSP can deploy an air bag
   C. HSP can read DTC
   D. HSP can communicate with the SRSCM

8. Technician A states that the Spectra 2.0L CVVT engine uses an oil temperature sensor to measure oil density for proper valve timing during cold weather operation. Technician B states that highest viscosity oil should be used in the CVVT engine to assure variable valve timing is accomplished. Who is correct?
   A. A only
   B. B only
   C. Both A and B
   D. Neither A or B

9. The air filter located in the Blower motor housing is used to remove __________ from the air before it enters the passenger compartment.
   A. Moisture
   B. Contaminants
   C. Odor
   D. All of the above

10. Technician A states the CVVT engine has a better power curve, lower emissions and better fuel economy than a fixed cam timed engine. Technician B states that the CVVT engine has higher compression ratio than the 2004 Spectra, increased displacement and mechanical valve lifters. Who is correct?
    A. A only
    B. B only
    C. Both A and B
    D. Neither A or B

PERFORMANCE ASSESSMENT

Total Possible Points: 20

Customer's concern is CEL is illuminated

1. Verify the customers concern, perform a visual inspection and record results:
 ____
2. Pull the DTC and record it: ____________________
3. Review the data list that pertains to the DTC:
 ____
4. Record DTC help, if available: __________________
5. Log on to KSIS
6. List the DTC information: _____________________
7. List the possible cause: _______________________
8. List if DTC will cause Limp Home mode: _________
9. List Diagnostic and Inspection Procedure including any test specifications: ________________________
 ____
 ____
10. Record diagnostic performed: _________________
 ____
 ____
11. Record test results: __________________________
12. Record the Repair: ___________________________
13. Verify the repair: ____________________________

NOTES:

NOTES:

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