REPORT NUMBER TR-P29009-04-NC

SAFETY COMPLIANCE TESTING FOR FMVSS 124
ACCELERATOR CONTROL SYSTEMS

KIA MOTORS CORPORATION

2009 KIA RONDO

5-DOOR MPV

NHTSA NUMBER: C90505

PREPARED BY:

KARCO ENGINEERING, LLC.

9270 HOLLY ROAD

ADELANTO, CALIFORNIA 92301

JULY 30, 2009

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION

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15. Supplementary Notes

16. Abstract

Compliance tests were conducted on the subject 2009 Kia Rondo 5-Door MPV on July 30, 2009 in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-124-06 for the determination of FMVSS 124 compliance.

Test failures identified were as follows: None

The return times for some normal operation and fault conditions were greater than one second. In these cases, throttle angle position decreased rapidly followed by a controlled ramp down to the original idle position. Manufacturers sometimes use this ramp down strategy to improve emission control, which may be the cause here. No engine “racing” was observed at any point during the test.

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.1 PURPOSE OF COMPLIANCE TEST

Tests were conducted on a 2009 Kia Rondo 5-Door MPV manufactured by Kia Motors Corporation, to determine if the tested vehicle meets the minimum performance requirements of Federal Motor Vehicle Safety Standard (FMVSS) 124, “Accelerator Control Systems”. FMVSS 124 establishes requirements for the return of a vehicle’s throttle to the idle position when the actuating force is removed from the accelerator control or in the event of a severance or disconnection in the accelerator control system.

All tests were conducted in compliance with current National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures, specifically, TP-124-06, dated April 2000. Detailed procedures for receiving, inspecting, testing and reporting of test results are described in the test procedures and are not repeated in this report.

SECTION 2

TEST PROCEDURE

2.1 COMPLIANCE TEST PROCEDURE

A 2009 Kia Rondo 5-Door MPV was subjected to FMVSS 124 compliance testing. The tests were conducted at KARCO Engineering, LLC. in Adelanto, California on July 30, 2009. The following tests were performed:

- Inspection
- Time to Return to Idle Position (Complete Normal Operation)
- Time to Return to Idle Position (APS Disconnect)
- Time to Return to Idle Position (APS Spring 1 Removed)
- Time to Return to Idle Position (APS Spring 2 Removed)
- Time to Return to Idle Position (Individual APS Wires Open and Short-to-Ground)
- Time to Return to Idle Position (TPS Disconnect)
- Time to Return to Idle Position (Individual TPS Wires Open and Short-to-Ground)

The vehicle is equipped with an electronic throttle control system with an accelerator pedal position sensor (APS), a throttle position sensor (TPS), an electronic control module (ECM), and a throttle plate actuator motor.

Throttle return time requirements of FMVSS 124 are as follows:

Test Vehicle GVWR	Maximum Throttle Return Time
≤4536 kg	1 second
>4536 kg	2 seconds

2.2 TEST SETUP

Each series of tests were conducted in the following manner: Throttle plate position was measured using the test vehicle's throttle position sensor (TPS) and a TDAS data acquisition system. The time base of the TDAS was used to determine throttle return time where possible. Engine coolant temperature was monitored by placing a thermocouple in the engine coolant, coupled to a digital temperature readout. Engine RPM was monitored using the vehicle's tachometer. Accelerator demand was measured at the accelerator pedal sensor (APS) using a digital voltmeter. Voltage readings were recorded for zero demand, as well as 100% demand (WOT), and then points were calculated for 25%, 50% and 75% demand. Time zero for each test was the instant that accelerator pedal demand was removed, which in the case of an induced electrical fault (APS or TPS individual wire open or grounding, APS or TPS disconnect) was simultaneous to the induced fault condition.

SECTION 3

SUMMARY OF COMPLIANCE TEST

3.1 TEST DATA SUMMARY

Testing was performed on the subject 2009 Kia Rondo 5-Door MPV on July 30, 2009 to determine compliance with FMVSS 124 “Accelerator Control Systems”. The subject vehicle was equipped with a “Drive-By-Wire” accelerator control system. Tests were conducted in the normal operating condition as well as in the following induced system failure modes: throttle return energy removal (APS Spring 1 and 2), electrical system disconnects (APS and TPS electrical connectors), electrical system open circuits (TPS and APS wires), and electrical system circuits shorted to ground (TPS and APS wires). Throttle plate return spring disconnect testing was not performed due to limited access.

The return times for some normal operation and fault conditions were greater than one second. In these cases, throttle angle position decreased rapidly followed by a controlled ramp down to the original idle position. Manufacturers sometimes use this ramp down strategy to improve emission control, which may be the cause here. No engine “racing” was observed at any point during the test. Complete data on the testing performed is available in Data Sheet No. 3 of this report.

SECTION 4

COMPLIANCE TEST DATA

Test Vehicle: 2009 Kia Rondo 5-Door MPV NHTSA No.: C90505

Test Program: FMVSS 124 Accelerator Control Systems Test Date: 7/30/09

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lbf/in^2	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	^oF	^oC	=(tf -32)/1.8
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2009 Kia Rondo 5-Door MPV NHTSA No.: C90505

Test Program: FMVSS 124 Accelerator Control Systems Test Date: 7/30/09

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	C90505	Anti-Lock Brakes	Yes
Make	Kia	All Wheel Drive	No
Model	Rondo	Power Steering	Yes
Body Style	5-Door MPV	Driver Front Airbag	Yes
Vin No.	KNAFG528X97227753	Driver Side Torso Airbag	Yes
Color	Green Agua	Driver Side Head Airbag	No
Delivery Date	5/28/2009	Driver Curtain/Airbag	Yes
Odometer (Miles)	217.0	Rear Pass. Airbag	No
Dealer	Unknown	Rear Pass. Side Airbag	No
Transmission	Automatic	Rear Pass. Head Airbag	No
Final Drive	Front	Rear Pass. Curtain/Airbag	Yes
Type/No. Cyl.	4 Cylinder	Pre-Tensioners	Yes
Engine Disp. (L)	2.4	Load Limiters	Yes
Engine Placement	transverse	Bucket Seats	Yes
Roof Rack	Yes	Air Cond.	Yes
Sunroof/T-Top	No	AM/FM CD	Yes
Tinted Glass	No	Tilt Steering	Yes
Traction Control	No	Automatic Door Locks	Yes
Power Brakes	Yes	Power Windows	Yes
Front Disc	Yes	Power Seats	No
Rear Disc	Yes	Other	N/A

Does Owners Manual provide instructions to turn off automatic door locks.	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Corporation	GVWR (kg)	2200
		GAWR Front (kg)	1140
Date of Manufacture	Jun-08	GAWR Rear (kg)	1180

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				412.0

DATA SHEET NO. 2

VEHICLE THROTTLE CONTROL DATA

Test Vehicle: 2009 Kia Rondo 5-Door MPV NHTSA No.: C90505

Test Program: FMVSS 124 Accelerator Control Systems Test Date: 7/30/09

THROTTLE CONTROL SYSTEM INFORMATION

Throttle Control System Description	Drive by Wire
Describe sources of energy to return throttle to idle position	2 Springs on APS
Accelerator Throttle Position Sensor	Yes
Electronic Control Module	Yes
Throttle Plate Actuator Motor	Yes
Throttle Plate Position Sensor	Yes

WIRE DESCRIPTION

APS Wire Number	Color	TPS Wire Number	Color
1	White	1	Brown
2	Yellow	2	Grey
3	Blue/Orange	3	White
4	Blue	4	Blue
5	Green/Orange	5	Black/Orange
6	Green	6	Yellow

DATA SHEET NO. 3
SUMMARY OF TEST REQUIREMENTS AND RESULTS

Test Vehicle: 2009 Kia Rondo 5-Door MPV NHTSA No.: C90505

Test Program: FMVSS 124 Accelerator Control Systems Test Date: 07/28/09

Test Description / Connector	Engine Temp. (F)	Idle RPM / Throttle Position %	Return Time (msec)	Pass/Fail
(Normal Operation)	190	600 / 1%	2470.0	See note 1 & 2
(Normal Operation)	190	600 / 1%	2540.0	See note 1 & 2
(Normal Operation)	190	600 / 1%	2740.0	See note 1 & 2
(Normal Operation)	190	600 / 1%	2350.0	See note 1 & 2
(APS Spring 1 Disconnected)	190	600 / 1%	2540.0	See note 1 & 2
(APS Spring 1 Disconnected)	190	600 / 1%	2620.0	See note 1 & 2
(APS Spring 1 Disconnected)	190	600 / 1%	2480.0	See note 1 & 2
(APS Spring 1 Disconnected)	190	600 / 1%	2600.0	See note 1 & 2
(APS Spring 2 Disconnected)	190	600 / 1%	2750.0	See note 1 & 2
(APS Spring 2 Disconnected)	190	600 / 1%	2770.0	See note 1 & 2
(APS Spring 2 Disconnected)	190	600 / 1%	2200.0	See note 1 & 2
(APS Spring 2 Disconnected)	190	600 / 1%	2180.0	See note 1 & 2
(APS Wire 1 Open)	190	600 / 1%	2682.9	See note 1 & 2
(APS Wire 2 Open)	190	600 / 1%	2600.4	See note 1 & 2
(APS Wire 3 Open)	190	600 / 1%	2468.4	See note 1 & 2
(APS Wire 4 Open)	190	600 / 1%	2640.0	See note 1 & 2
(APS Wire 5 Open)	190	600 / 1%	2560.8	See note 1 & 2

(1) Throttle plate would only open to approximately 13% irrespective of the accelerator pedal position

(2) The return times for some normal operation and fault conditions resulted in return time greater than 1 second. In these cases, throttle angle position decreased rapidly followed by a controlled ramp down to the original idle position. Manufacturers sometimes use this ramp- down strategy for improved emission control which may be the case here. No engine “racing” was observed at any point in the testing.

DATA SHEET NO. 3…(Continued)
SUMMARY OF TEST REQUIREMENTS AND RESULTS

Test Vehicle: 2009 Kia Rondo 5-Door MPV NHTSA No.: C90505

Test Program: FMVSS 124 Accelerator Control Systems Test Date: 07/28/09

Test Description / Connector	Engine Temp. (F)	Idle RPM / Throttle Position %	Return Time (msec)	Pass/Fail
(APS Wire 6 Open)	190	600 / 1%	2323.2	See note 1 & 2
(APS Wire 1 Short)	190	600 / 1%	2389.2	See note 1 & 2
(APS Wire 2 Short)	190	600 / 1%	2511.3	See note 1 & 2
(APS Wire 3 Short)	190	600 / 1%	2623.5	See note 1 & 2
(APS Wire 4 Short)	190	600 / 1%	2811.6	See note 1 & 2
(APS Wire 5 Short)	190	600 / 1%	2455.2	See note 1 & 2
(APS Wire 6 Short)	190	600 / 1%	2385.9	See note 1 & 2
(APS Disconnect)	190	600 / 1%	881.1	Pass/ See note 1
(TPS Wire 1 Open)	190	600 / 1%	#N/A	See note 3
(TPS Wire 2 Open)	190	600 / 1%	184.8	Pass/ See note 1
(TPS Wire 3 Open)	190	600 / 1%	#N/A	See note 4
(TPS Wire 4 Open)	190	600 / 1%	#N/A	See note 3
(TPS Wire 5 Open)	190	600 / 1%	2399.1	See note 1 & 2
(TPS Wire 6 Open)	190	600 / 1%	#N/A	See note 4
(TPS Wire 1 Short)	190	600 / 1%	#N/A	See note 3
(TPS Wire 2 Short)	190	600 / 1%	174.9	Pass/ See note 1
(TPS Wire 3 Short)	190	600 / 1%	2679.6	See note 1 & 2
(TPS Wire 4 Short)	190	600 / 1%	#N/A	See note 3

(1) Throttle plate would only open to approximately 13% irrespective of the accelerator pedal position

(2) The return times for some normal operation and fault conditions resulted in return time greater than 1 second. In these cases, throttle angle position decreased rapidly followed by a controlled ramp down to the original idle position. Manufacturers sometimes use this ramp- down strategy for improved emission control which may be the case here. No engine “racing” was observed at any point in the testing.

(3) Throttle never returned to baseline position

(4) Induced wire fault caused loss of throttle sensor reading

DATA SHEET NO. 3…(Continued)
SUMMARY OF TEST REQUIREMENTS AND RESULTS

Test Vehicle: 2009 Kia Rondo 5-Door MPV NHTSA No.: C90505

Test Program: FMVSS 124 Accelerator Control Systems Test Date: 07/28/09

Test Description / Connector	Engine Temp. (F)	Idle RPM / Throttle Position %	Return Time (msec)	Pass/Fail
(TPS Wire 5 Short)	190	600 / 1%	2201.1	See note 1 & 2
(TPS Wire 6 Short)	190	600 / 1%	178.2	Pass/ See note 1
(TPS/ Throttle Plate Motor Disconnect)	190	600 / 1%	#N/A	See note 3 & 4

(1) Throttle plate would only open to approximately 13% irrespective of the accelerator pedal position

(2) The return times for some normal operation and fault conditions resulted in return time greater than 1 second. In these cases, throttle angle position decreased rapidly followed by a controlled ramp down to the original idle position. Manufacturers sometimes use this ramp- down strategy for improved emission control which may be the case here. No engine “racing” was observed at any point in the testing.

(3) Induced wire fault caused loss of throttle sensor reading

(4) The TPS and Throttle Plate Motor utilize the same connector

APPENDIX A

PHOTOGRAPHS

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-1: Front View of Vehicle

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-2: Left Side View of Vehicle

Figure A-3: Right Side View of Vehicle

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-4: Vehicle's Certification Label

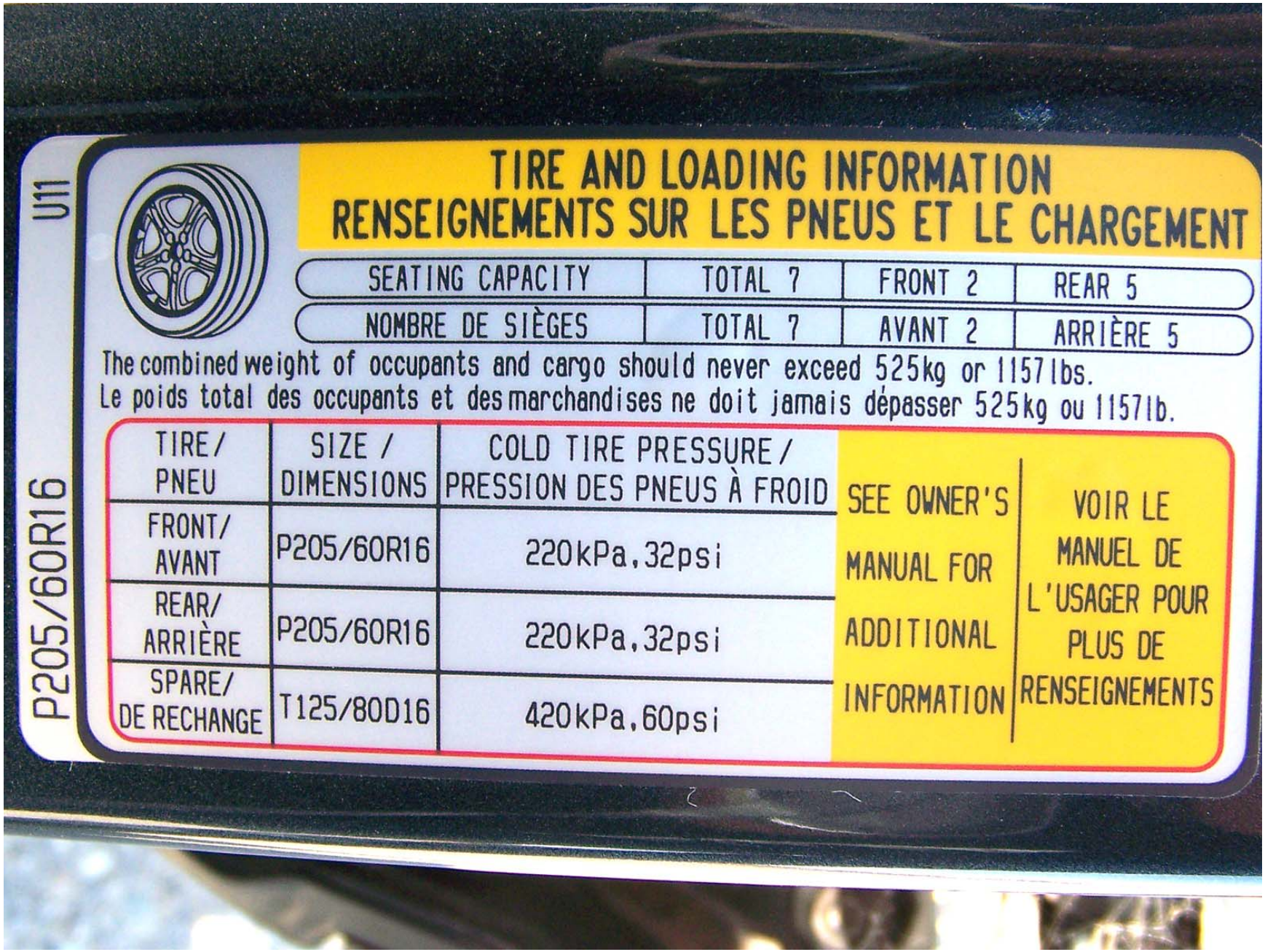


Figure A-5: Vehicle's Tire Placard

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

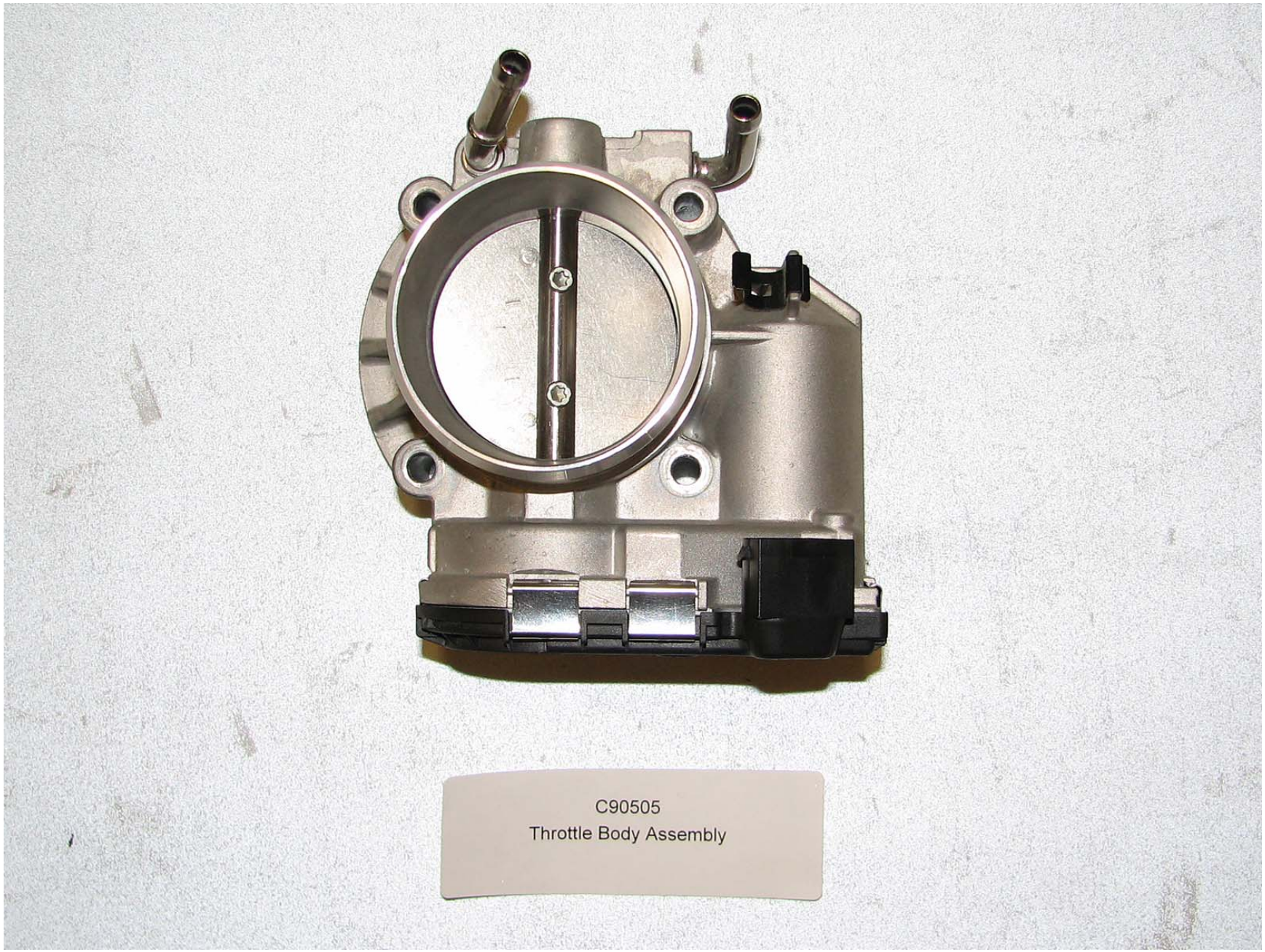


Figure A-6: Throttle Body Assembly

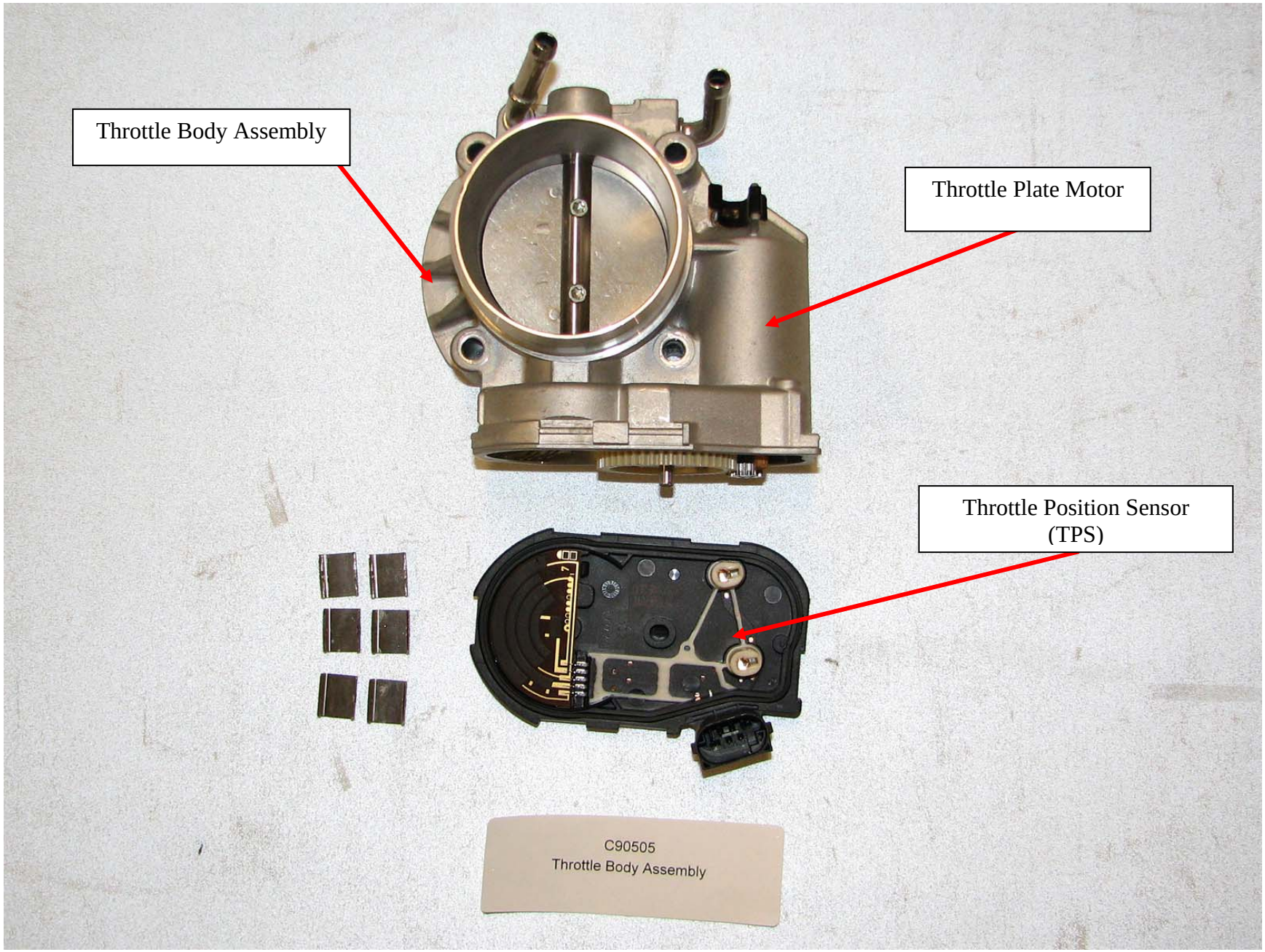


Figure A-7: Throttle Body Assembly, Motor, and Position Sensor

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

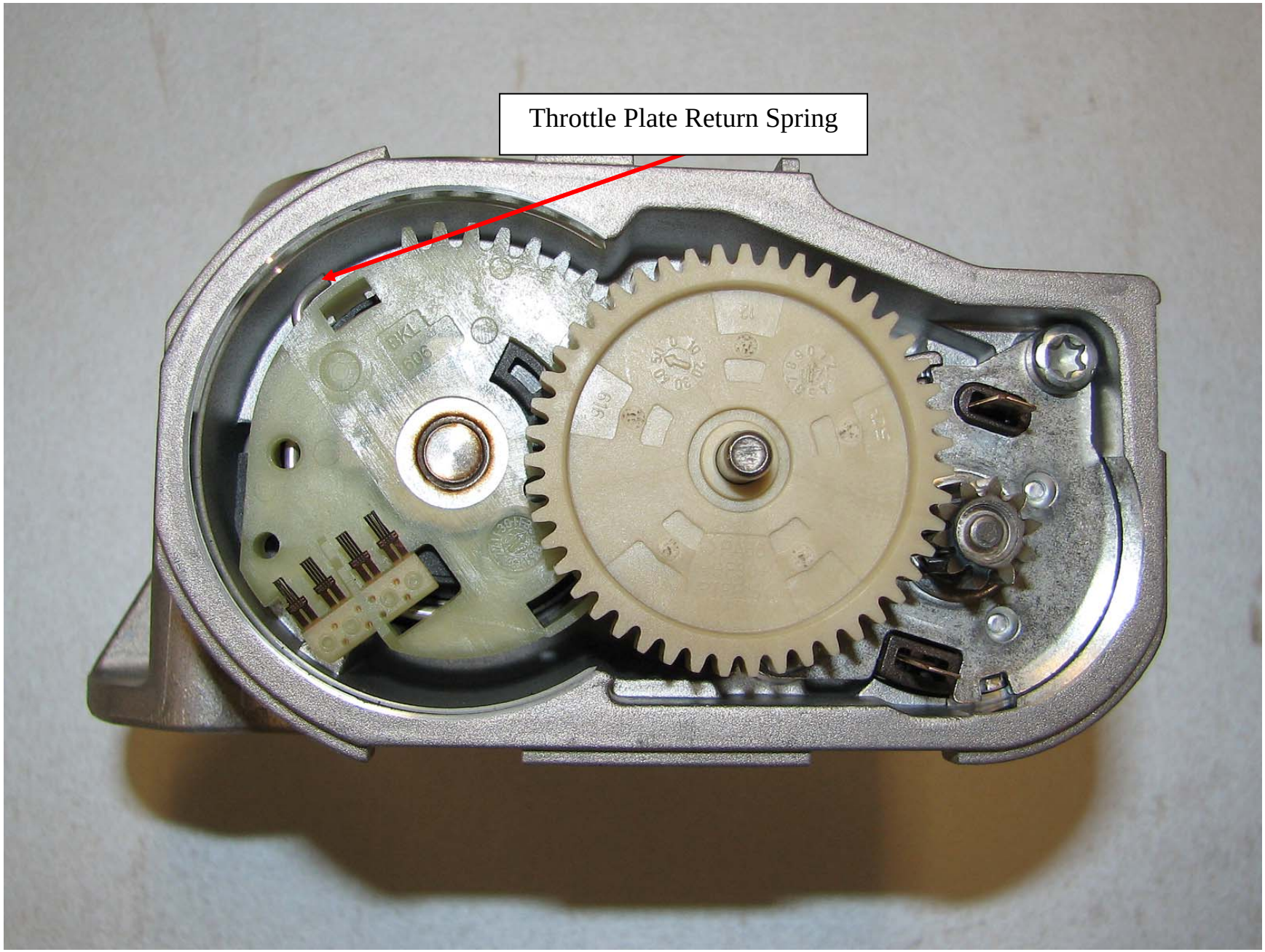


Figure A-8: Throttle Plate Return Spring

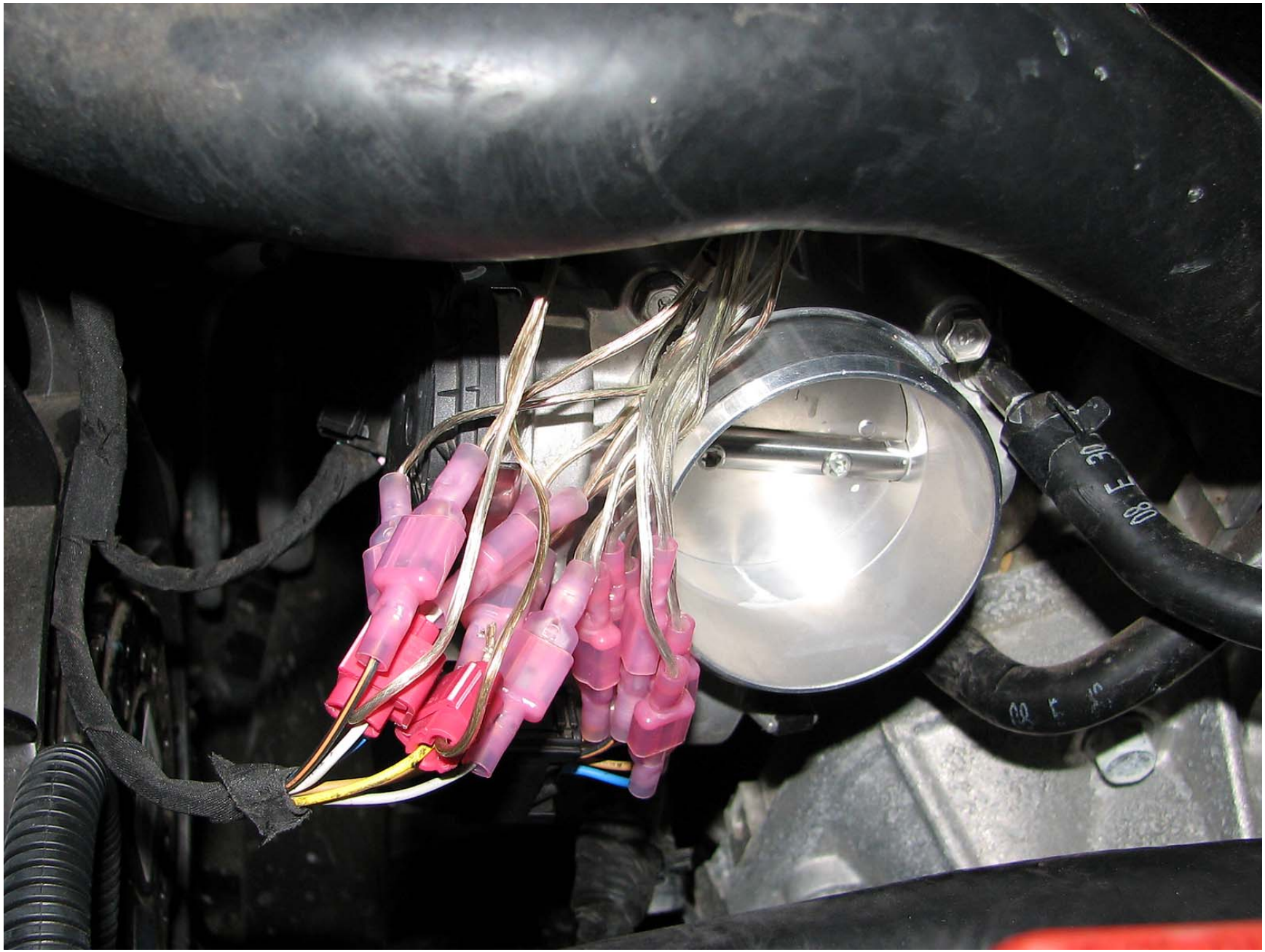
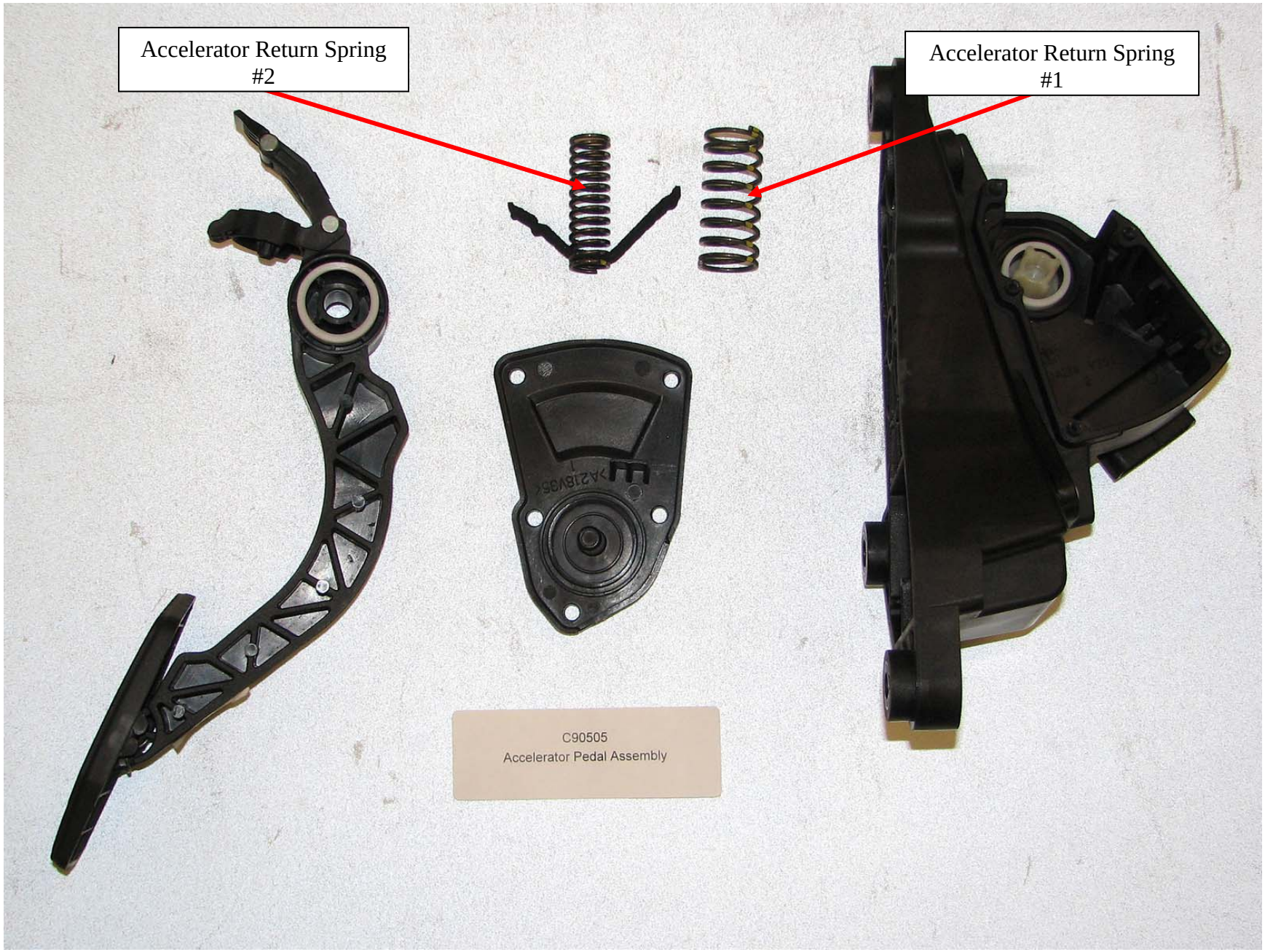


Figure A-9: Throttle Body Test Setup

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-10: Accelerator Pedal Assembly



2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-11: Accelerator Return Springs

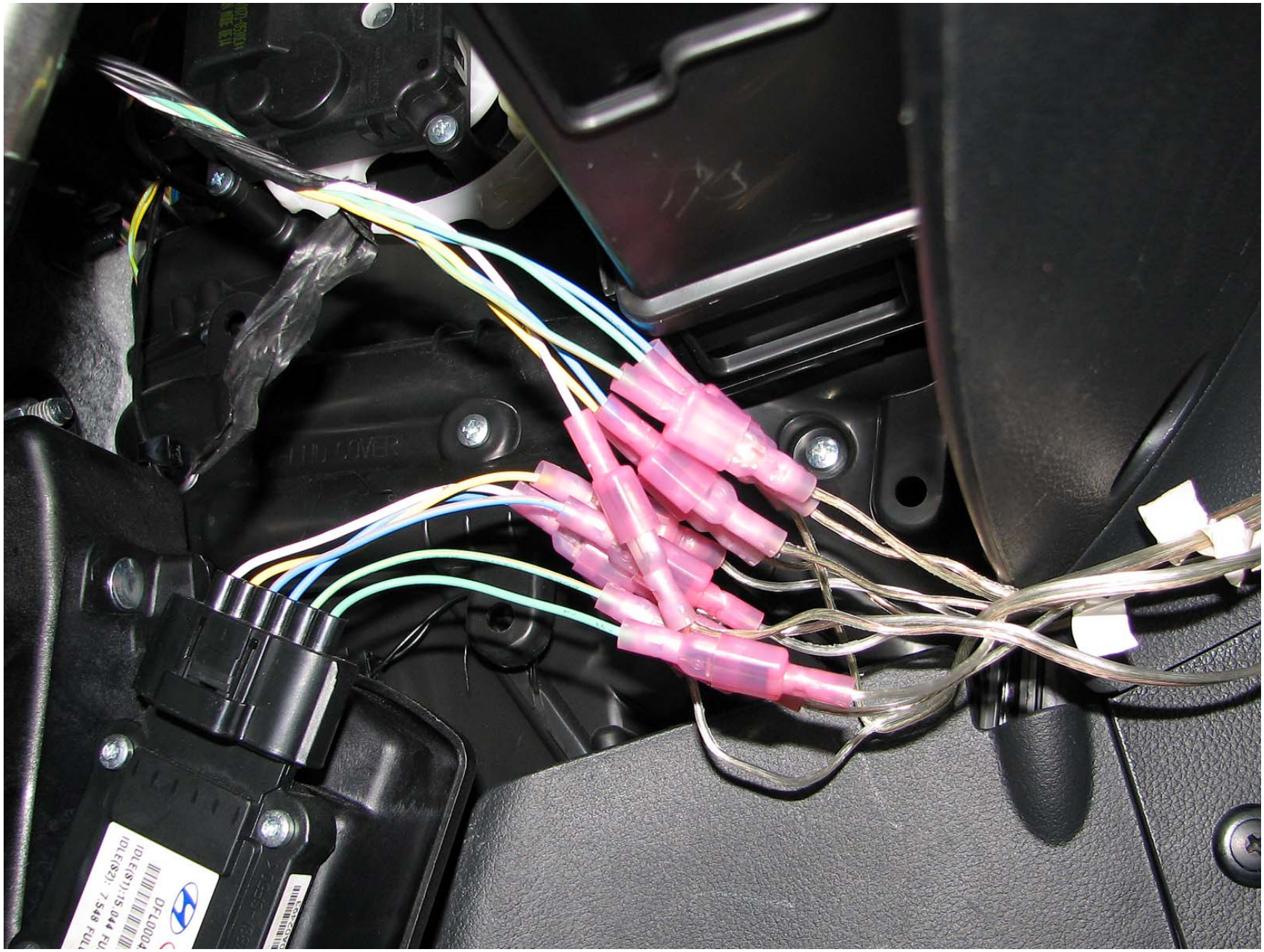


Figure A-12: Accelerator Pedal Test Setup

2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-13: Vehicle Test Setup

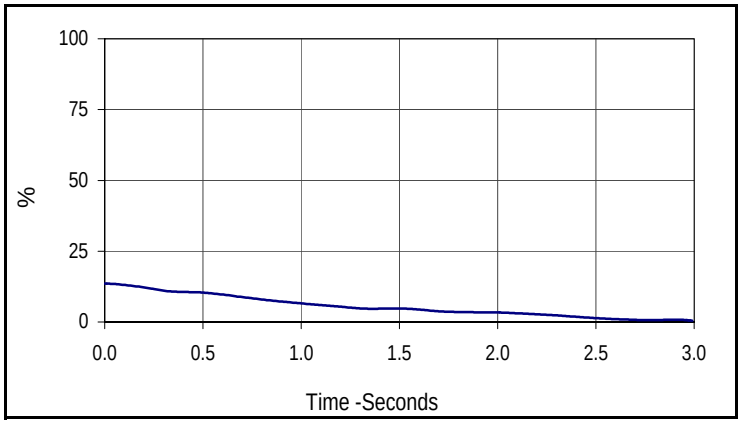
2009 KIA RONDO
NHTSA NO. C90505
FMVSS NO. 124

Figure A-14: Instrumentation

APPENDIX B

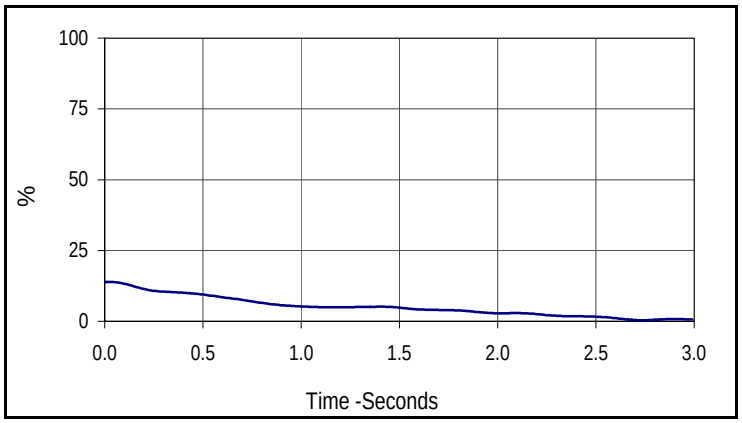
DATA PLOTS

Test Vehicle:	2009 Kia Rondo 5-Door MPV	Test Date:	7/28/09
Test Program:	FMVSS 124 Accelerator Control Systems	NHTSA No.:	C90505



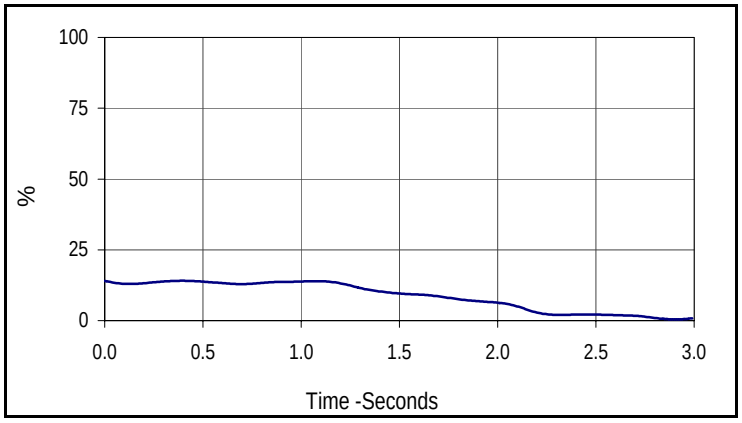
Curve Description			
Throttle Position (Normal Operation)			
CURNO	Type	Filter Freq	Units
001	FIL	2	%
Max	Time	Return Time (msec)	
13.5	0.0	2470.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



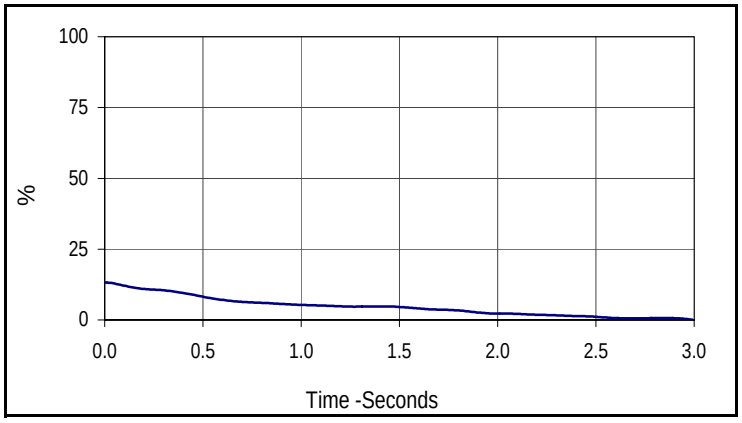
Curve Description			
Throttle Position (Normal Operation)			
CURNO	Type	Filter Freq	Units
002	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.0	2540.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



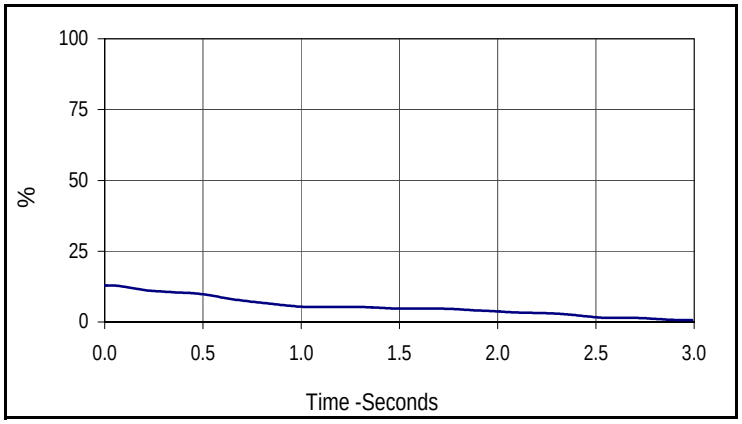
Curve Description			
Throttle Position (Normal Operation)			
CURNO	Type	Filter Freq	Units
003	FIL	2	%
Max	Time	Return Time (msec)	
14.1	0.4	2740.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



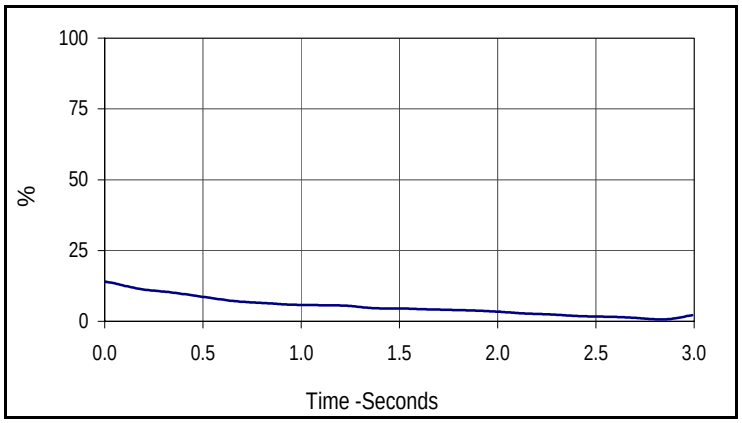
Curve Description			
Throttle Position (Normal Operation)			
CURNO	Type	Filter Freq	Units
004	FIL	2	%
Max	Time	Return Time (msec)	
13.3	0.0	2350.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



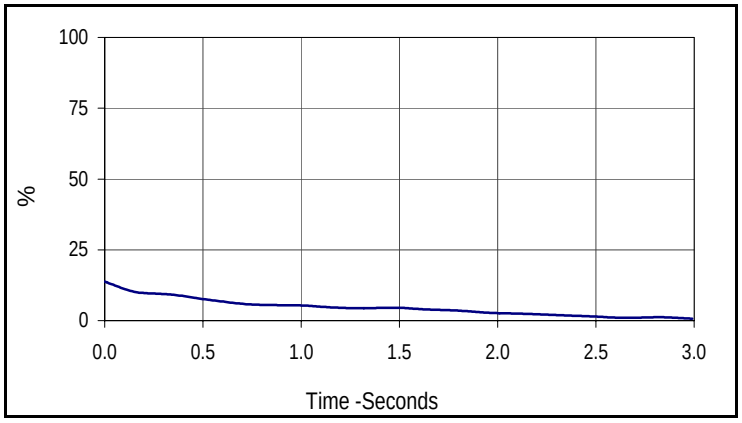
Curve Description			
Throttle Position (APS Spring 1 Disconnected)			
CURNO	Type	Filter Freq	Units
005	FIL	2	%
Max	Time	Return Time (msec)	
12.9	0.0	2540.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



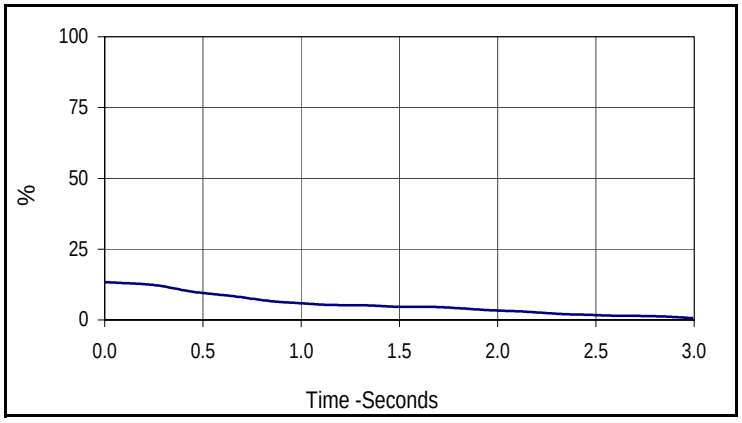
Curve Description			
Throttle Position (APS Spring 1 Disconnected)			
CURNO	Type	Filter Freq	Units
006	FIL	2	%
Max	Time	Return Time (msec)	
14.1	0.0	2620.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



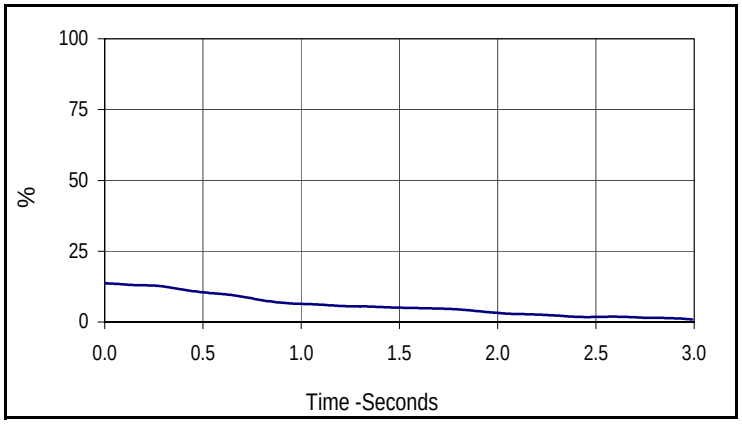
Curve Description			
Throttle Position (APS Spring 1 Disconnected)			
CURNO	Type	Filter Freq	Units
007	FIL	2	%
Max	Time	Return Time (msec)	
13.8	0.0	2480.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



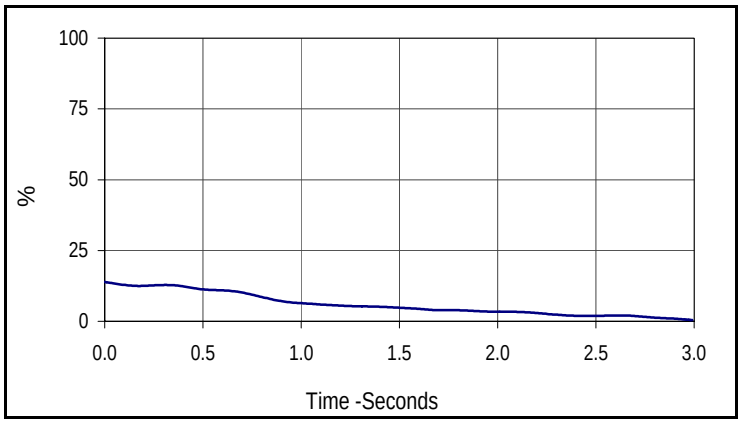
Curve Description			
Throttle Position (APS Spring 1 Disconnected)			
CURNO	Type	Filter Freq	Units
008	FIL	2	%
Max	Time	Return Time (msec)	
13.4	0.0	2600.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



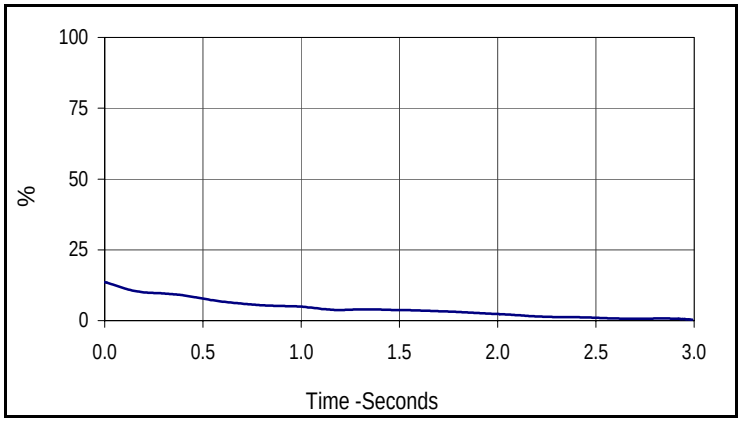
Curve Description			
Throttle Position (APS Spring 2 Disconnected)			
CURNO	Type	Filter Freq	Units
009	FIL	2	%
Max	Time	Return Time (msec)	
13.7	0.0	2750.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



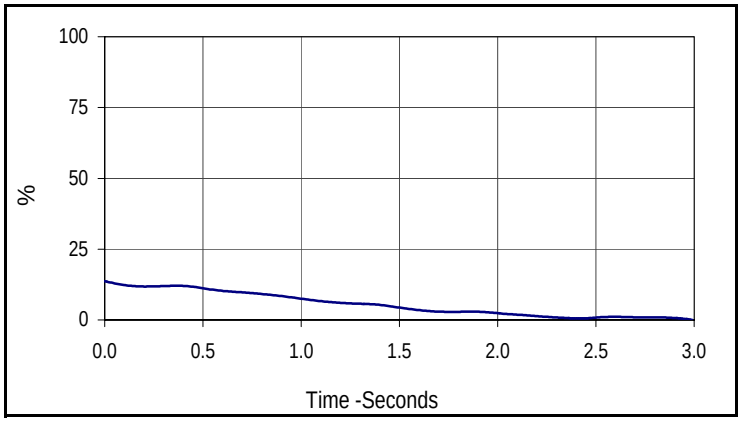
Curve Description			
Throttle Position (APS Spring 2 Disconnected)			
CURNO	Type	Filter Freq	Units
010	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.0	2770.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



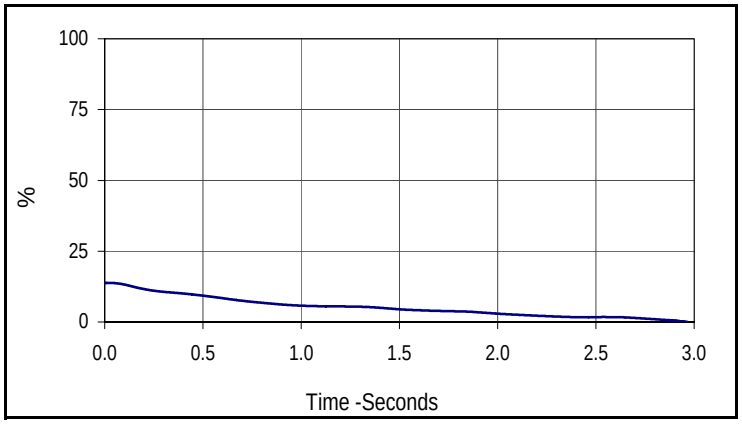
Curve Description			
Throttle Position (APS Spring 2 Disconnected)			
CURNO	Type	Filter Freq	Units
011	FIL	2	%
Max	Time	Return Time (msec)	
13.6	0.0	2200.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



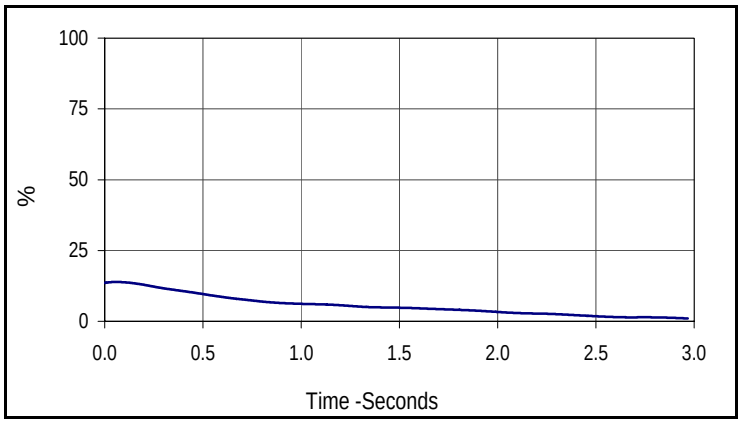
Curve Description			
Throttle Position (APS Spring 2 Disconnected)			
CURNO	Type	Filter Freq	Units
012	FIL	2	%
Max	Time	Return Time (msec)	
13.7	0.0	2180.0	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



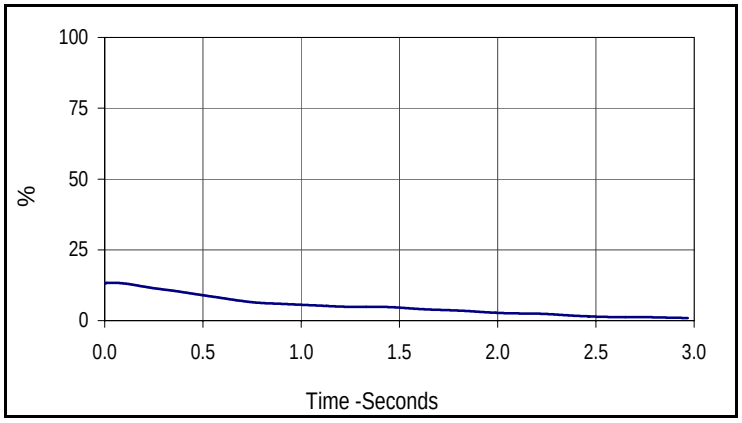
Curve Description			
Throttle Position (APS Wire 1 Open)			
CURNO	Type	Filter Freq	Units
013	FIL	2	%
Max	Time	Return Time (msec)	
13.8	0.0	2682.9	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



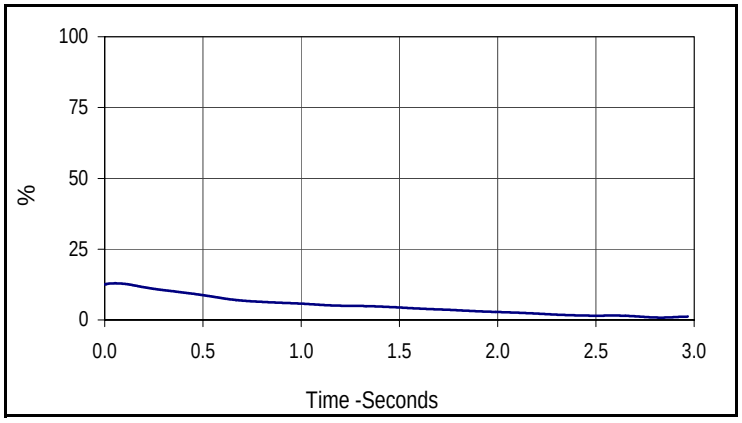
Curve Description			
Throttle Position (APS Wire 2 Open)			
CURNO	Type	Filter Freq	Units
014	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.1	2600.4	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



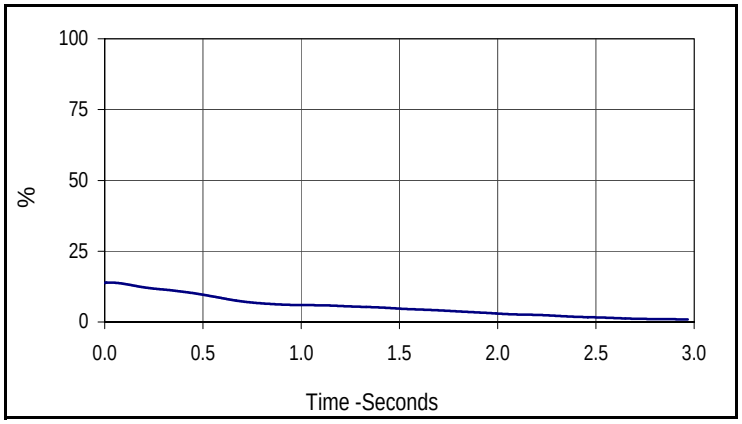
Curve Description			
Throttle Position (APS Wire 3 Open)			
CURNO	Type	Filter Freq	Units
015	FIL	2	%
Max	Time	Return Time (msec)	
13.4	0.0	2468.4	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (APS Wire 4 Open)			
CURNO	Type	Filter Freq	Units
016	FIL	2	%
Max	Time	Return Time (msec)	
12.9	0.1	2640.0	

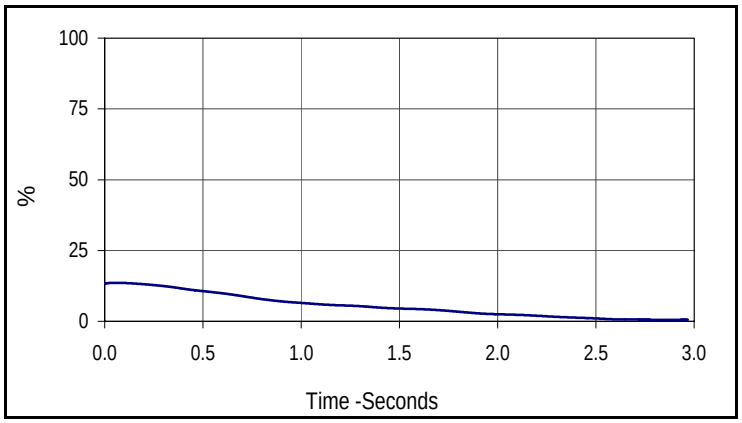
Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (APS Wire 5 Open)			
CURNO	Type	Filter Freq	Units
017	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.0	2560.8	

Throttle % reading at baseline (idle) is 1%

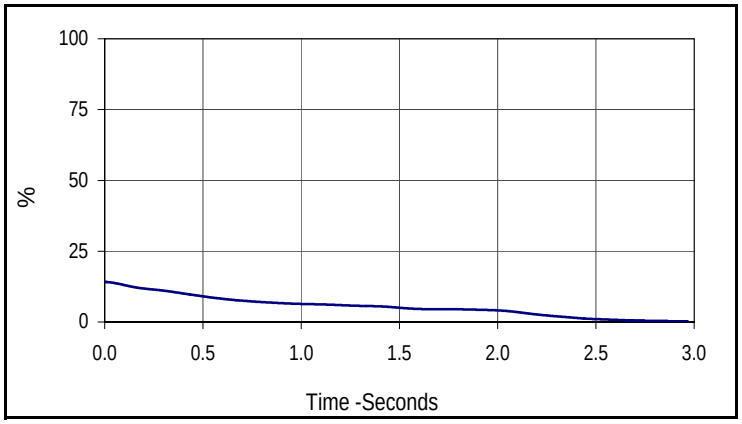
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (APS Wire 6 Open)			
CURNO	Type	Filter Freq	Units
018	FIL	2	%
Max	Time	Return Time (msec)	
13.6	0.1	2323.2	

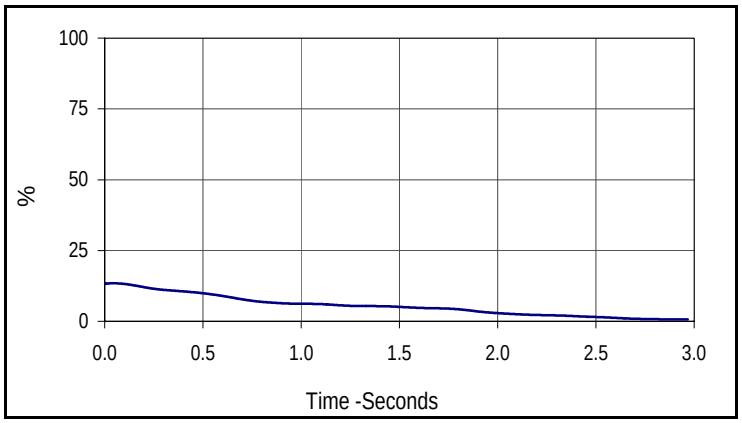
Throttle % reading at baseline (idle) is 1%

All return times were calculated at a return to 1%



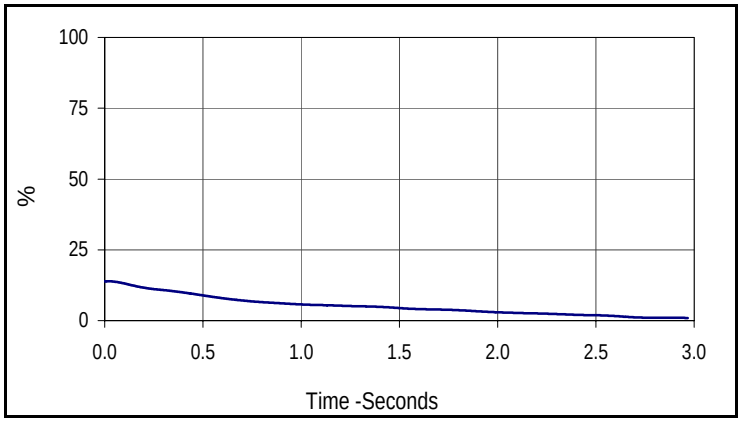
Curve Description			
Throttle Position (APS Wire 1 Short)			
CURNO	Type	Filter Freq	Units
019	FIL	2	%
Max	Time	Return Time (msec)	
14.1	0.0	2389.2	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



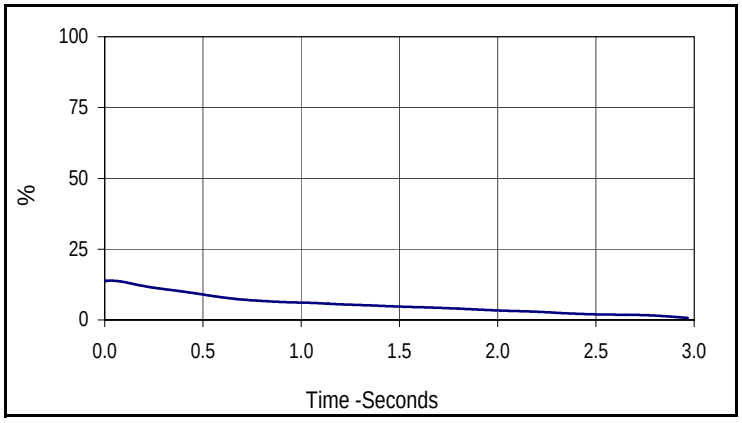
Curve Description			
Throttle Position (APS Wire 2 Short)			
CURNO	Type	Filter Freq	Units
020	FIL	2	%
Max	Time	Return Time (msec)	
13.4	0.0	2511.3	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



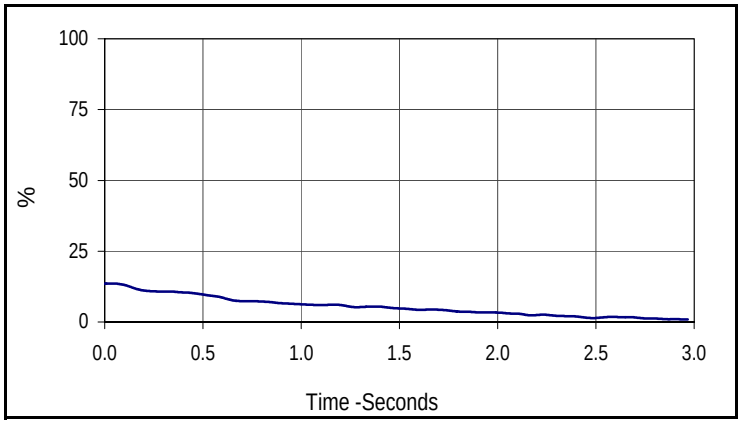
Curve Description			
Throttle Position (APS Wire 3 Short)			
CURNO	Type	Filter Freq	Units
021	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.0	2623.5	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



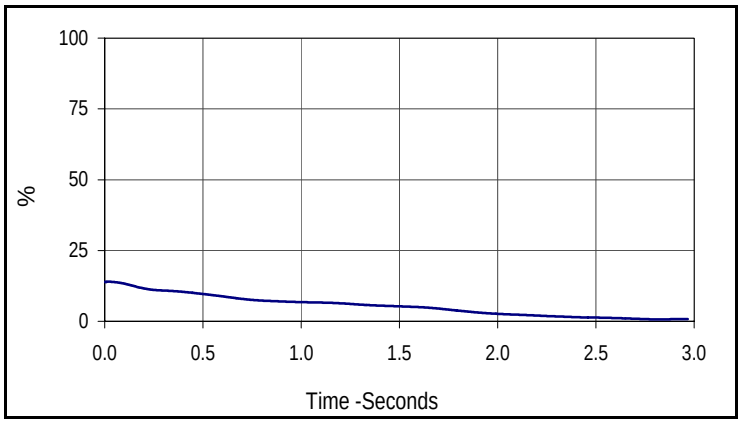
Curve Description			
Throttle Position (APS Wire 4 Short)			
CURNO	Type	Filter Freq	Units
022	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.0	2811.6	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



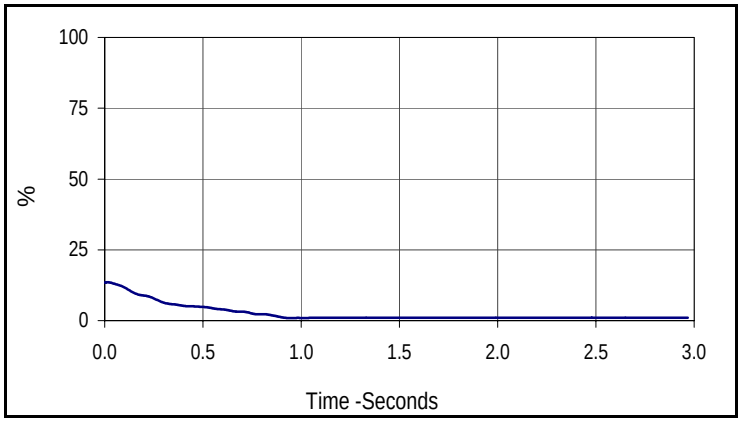
Curve Description			
Throttle Position (APS Wire 5 Short)			
CURNO	Type	Filter Freq	Units
023	FIL	2	%
Max	Time	Return Time (msec)	
13.6	0.0	2455.2	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



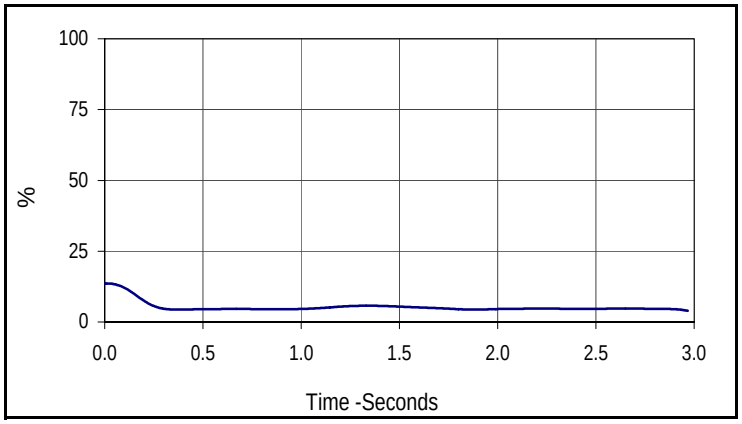
Curve Description			
Throttle Position (APS Wire 6 Short)			
CURNO	Type	Filter Freq	Units
024	FIL	2	%
Max	Time	Return Time (msec)	
14.0	0.0	2385.9	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (APS Disconnect)			
CURNO	Type	Filter Freq	Units
025	FIL	2	%
Max	Time	Return Time (msec)	
13.5	0.0	881.1	

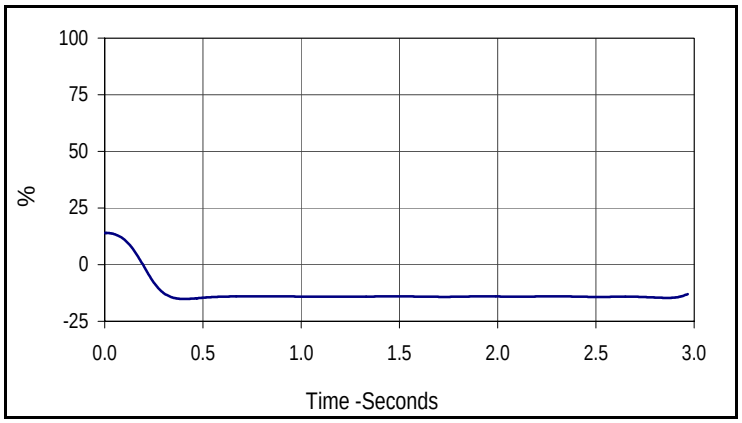
Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS Wire 1 Open)			
CURNO	Type	Filter Freq	Units
026	FIL	2	%
Max	Time	Return Time (msec)	
13.6	0.0	*	

Throttle % reading at baseline (idle) is 1%

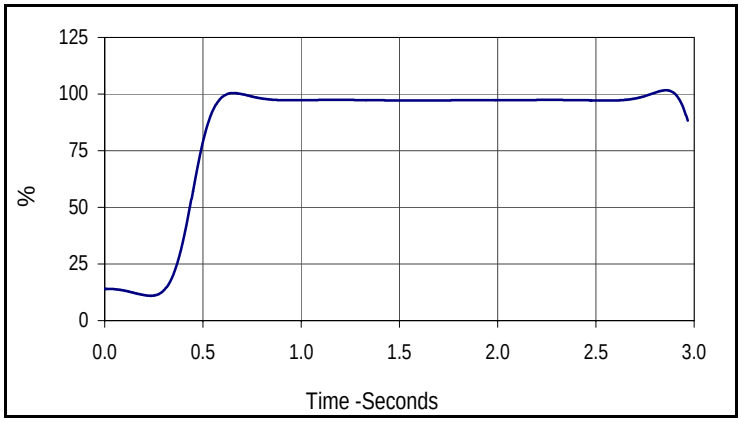
* Throttle never returned to baseline



Curve Description			
Throttle Position (TPS Wire 2 Open)			
CURNO	Type	Filter Freq	Units
027	FIL	2	%
Max	Time	Return Time (msec)	
14.0	0.0	184.8	

Throttle % reading at baseline (idle) is 1%

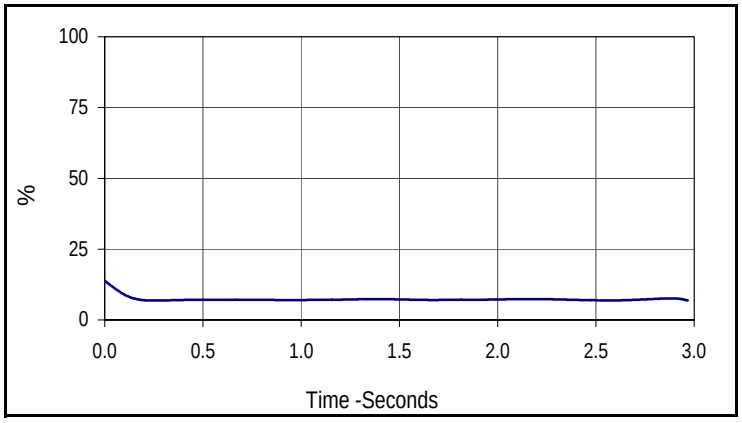
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS Wire 3 Open)			
CURNO	Type	Filter Freq	Units
028	FIL	2	%
Max	Time	Return Time (msec)	
101.7	2.9	*	

Throttle % reading at baseline (idle) is 1%

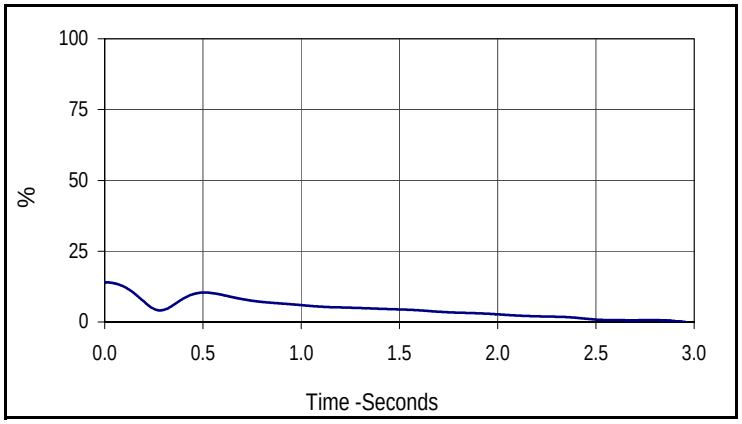
* Induced wire fault cause loss of sensor reading



Curve Description			
Throttle Position (TPS Wire 4 Open)			
CURNO	Type	Filter Freq	Units
029	FIL	2	%
Max	Time	Return Time (msec)	
13.7	0.0	*	

Throttle % reading at baseline (idle) is 1%

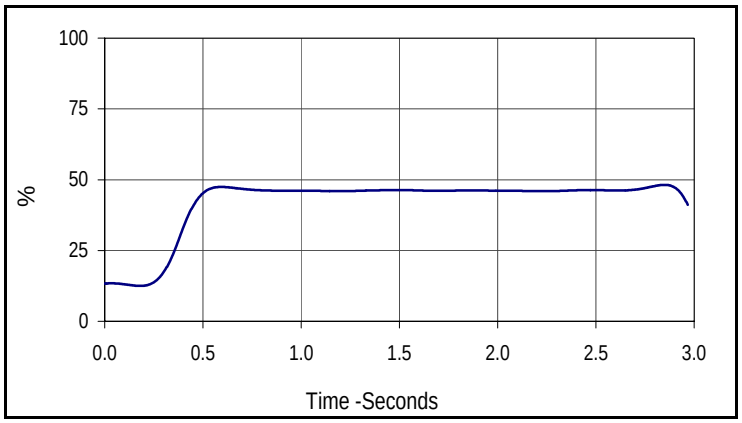
* Throttle never returned to baseline



Curve Description			
Throttle Position (TPS Wire 5 Open)			
CURNO	Type	Filter Freq	Units
030	FIL	2	%
Max	Time	Return Time (msec)	
14.0	0.0	2399.1	

Throttle % reading at baseline (idle) is 1%

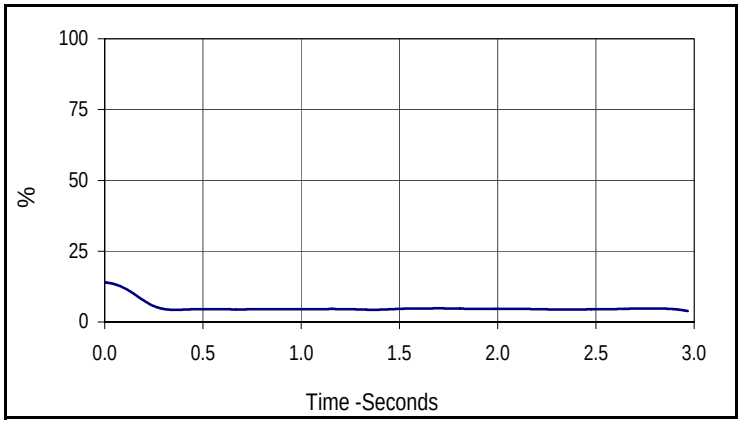
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS Wire 6 Open)			
CURNO	Type	Filter Freq	Units
031	FIL	2	%
Max	Time	Return Time (msec)	
48.2	2.9	*	

Throttle % reading at baseline (idle) is 1%

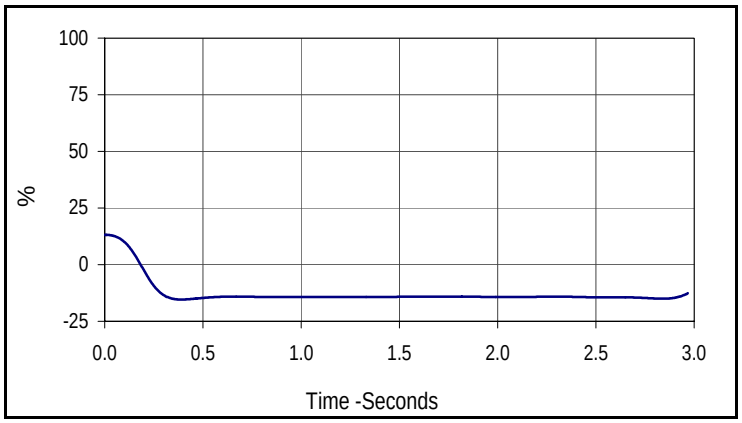
* Induced wire fault cause loss of sensor reading



Curve Description			
Throttle Position (TPS Wire 1 Short)			
CURNO	Type	Filter Freq	Units
032	FIL	2	%
Max	Time	Return Time (msec)	
13.9	0.0	*	

Throttle % reading at baseline (idle) is 1%

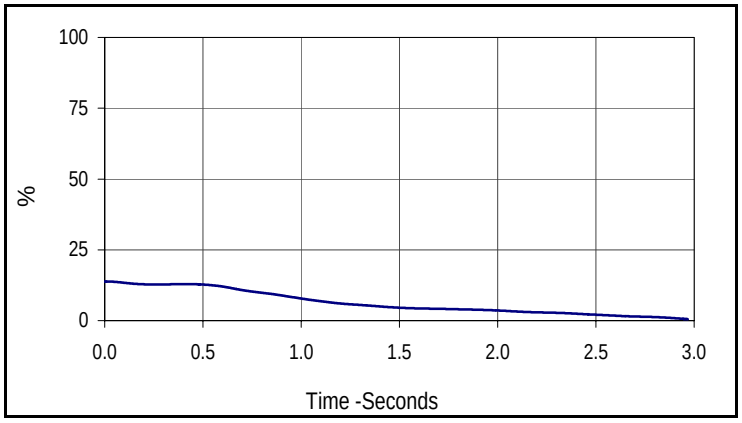
* Throttle never returned to baseline



Curve Description			
Throttle Position (TPS Wire 2 Short)			
CURNO	Type	Filter Freq	Units
033	FIL	2	%
Max	Time	Return Time (msec)	
13.1	0.0	174.9	

Throttle % reading at baseline (idle) is 1%

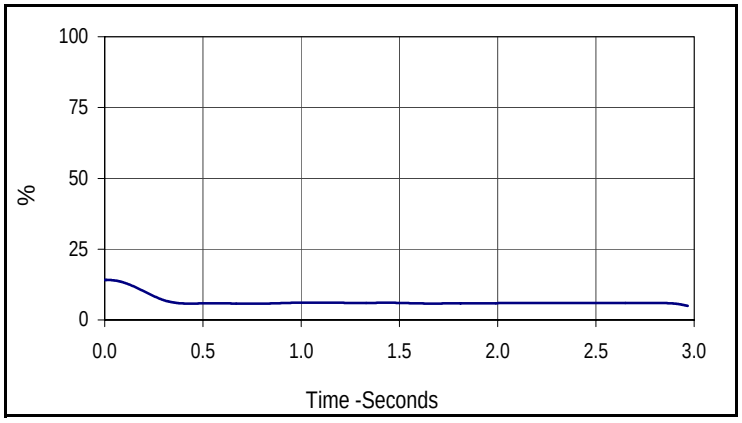
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS Wire 3 Short)			
CURNO	Type	Filter Freq	Units
034	FIL	2	%
Max	Time	Return Time (msec)	
13.8	0.0	2679.6	

Throttle % reading at baseline (idle) is 1%

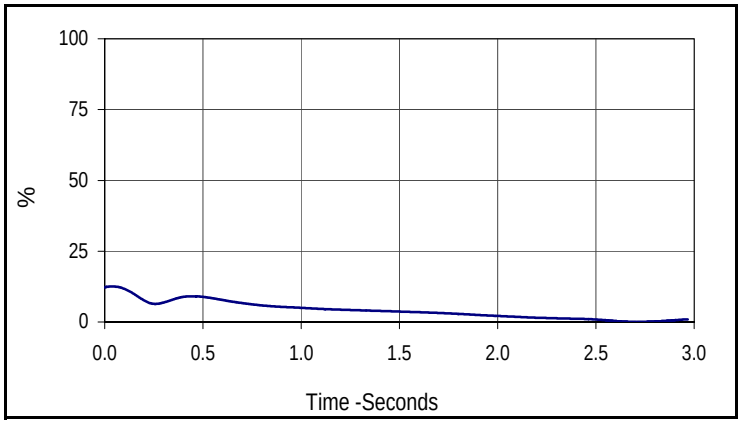
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS Wire 4 Short)			
CURNO	Type	Filter Freq	Units
035	FIL	2	%
Max	Time	Return Time (msec)	
14.1	0.0	*	

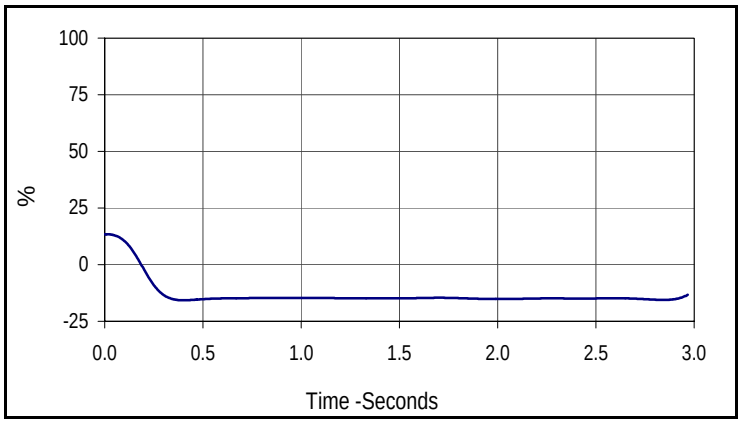
Throttle % reading at baseline (idle) is 1%

* Throttle never returned to baseline



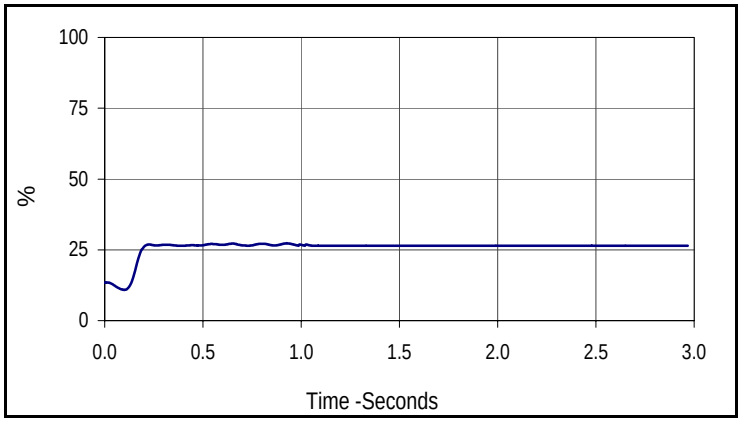
Curve Description			
Throttle Position (TPS Wire 5 Short)			
CURNO	Type	Filter Freq	Units
036	FIL	2	%
Max	Time	Return Time (msec)	
12.6	0.0	2201.1	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS Wire 6 Short)			
CURNO	Type	Filter Freq	Units
037	FIL	2	%
Max	Time	Return Time (msec)	
13.4	0.0	178.2	

Throttle % reading at baseline (idle) is 1%
All return times were calculated at a return to 1%



Curve Description			
Throttle Position (TPS/ Throttle Plate Motor Disconnect)			
CURNO	Type	Filter Freq	Units
038	FIL	2	%
Max	Time	Return Time (msec)	
27.3	0.9	*	

Throttle % reading at baseline (idle) is 1%
* Induced wire fault cause loss of sensor reading

APPENDIX-C

TEST EQUIPMENT AND CALIBRATION INFORMATION

FMVSS 124 Accelerator Control Systems

Test Equipment List and Calibration Information

7/28/09

2009 Kia Rondo 5-Door MPV

Description	Manufacturer	Model No.	Serial No.	Limit	Accuracy	Cal. Date	Due Cal.
TDAS	DTS	TDAS	DM0101	N/A	SAE J211	11/14/08	11/14/09
Computer	Toshiba	PAS4014	X8065355A	N/A	N/A	N/A	N/A

KARCO Engineering LLC

APPENDIX-D

MANUFACTURER SUBMITTED INFORMATION

FORM – 124
Rev. 10/24/2003

VEHICLE INFORMATION / TEST SPECIFICATIONS

FMVSS No. 124

Requested Information:

1. A sketch of the driver operated accelerator control system (ACS) starting from the accelerator pedal up to and including the fuel metering device (carburetor, fuel injectors, fuel distributor, or fuel injection pump).
Refer to the attachment


fuel injection system

2. For Normal ACS operation, the method utilized to determine the engine idle state (air throttle plate position, fuel delivery rate, other).
Refer to the attachment
Use general scan tool or special scan tool for kia vehicle (HI-SCAN or HIDS)


ENGINE IDLE STATE.xls

3. For Fail-Safe operation of the ACS (disconnection or severance), the method utilized to determine return of engine power to the idle state (air throttle plate position, fuel delivery rate, air intake, engine rpm, other)
Refer to the attachment
Use general scan tool or special scan tool for kia vehicle (HI-SCAN or HIDS)


ENGINE IDLE STATE.xls

4. Is the vehicle ACS equipped with any of the following: A,B,C,D

A. Accelerator Pedal Position Sensor (APS)
B. Throttle Plate Position Sensor (TPS)
C. Electronic Control Module (ECM)
D. Air throttle plate actuator motor

5. If air throttle plate equipped, is there a procedure which can be utilized by the test laboratory to measure the position of the throttle plate by tapping into the TPS or ECM? If so, please describe.
TPS pin arrangement and circuit diagram is referred to attachment

TPS_PIN_ARRANGEMENT

6. Point(s) chosen to demonstrate compliance with FMVSS No. 124 for single point disconnect and severance.
In severed mode, the severed point was chosen at the end of the TPS control cable to simulate failure of the accelerator control system.

7. Where applicable, were connections in the ACS beyond the ECM such as the fuel injectors tested for disconnection and severance. If yes, provide details.
N/A

8. Where applicable, were idle return times tested for electrical severance accompanied by shorting to ground? If yes, please provide details.
N/A

9. All sources of return energy (springs) for the accelerator pedal and if applicable, the air throttle plate.
-Throttle body: Refer to the attachment

throttle body spring

-Accelerator pedal: Accelerator pedal has two springs that is consist of inner and outer spring. If one of the springs is out of order, accelerator pedal has return force since another spring is remained.

10. If fuel delivery rate is used to demonstrate return to idle state, provide:

A. The method used to measure this signal i.e. connection to standard SAE J1587 data bus.
B. Equipment required to measure signal.

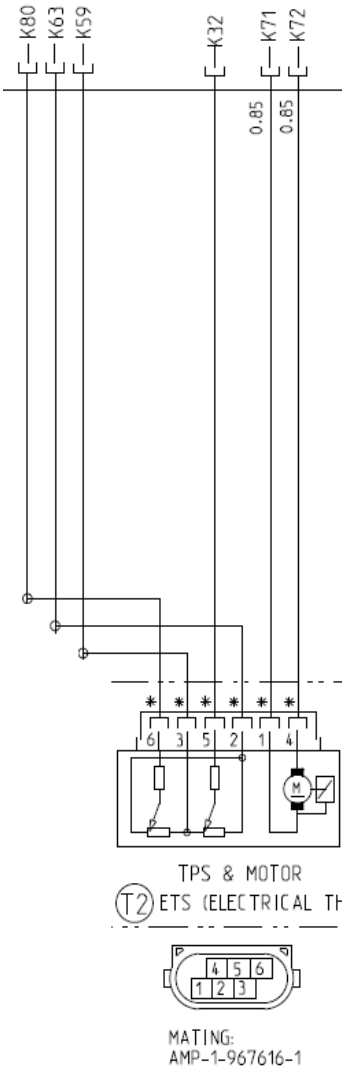
The fuel supply ratio is not related with idle speed control

11. Fuel rate signal output range at the idle state.
The fuel supply ratio is not related with idle speed control

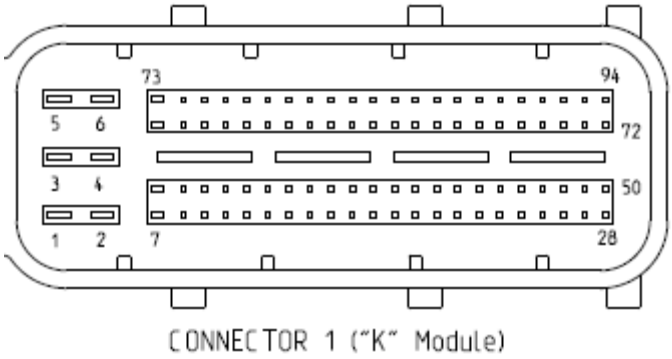
12. Is the ACS equipped with a limp home mode? If yes, provide operation description.
When the ACS failed, the throttle plate returned to the default position.
The ETC was controlled by the torque and , the RPM and the vehicle speed was limited.

13. Method by which the test laboratory can record engine RPM by connection to ECM, OBD connector, etc.
The engine RPM will be confirmed using general scan tools which Support OBD-II function. (MODE 01, ENGINE RPM, IGNITION TIMING)

1. THROTTLE POSITION SENSOR CONNECTOR PIN ARRANGEMENT



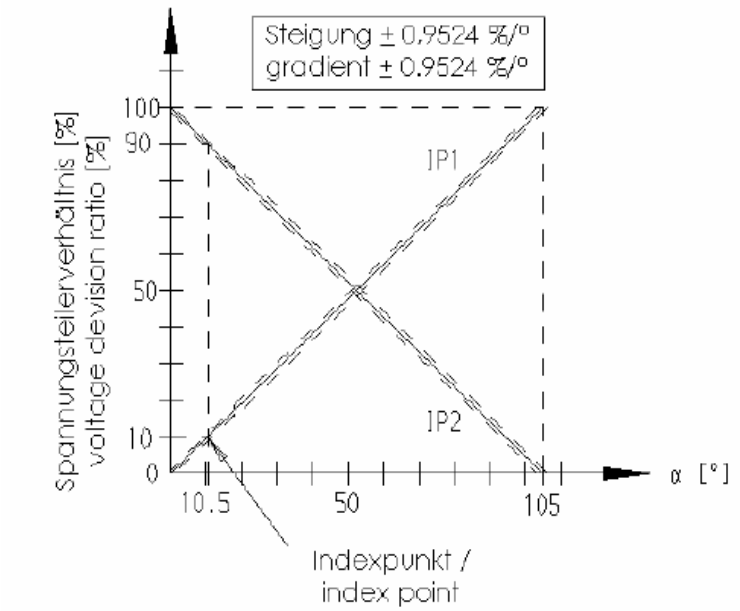
K80(6); Throttle position sensor 1
K63(2); TPS supply voltage (5V)
K59(3); TPS GROUND
K32(5); Throttle position sensor 2
K71(1); Electric throttle control DC motor 1
K72(4); Electric throttle control DC motor 2



CONNECTOR 1 ("K" Module)

PIN ARRANGEMENT OF THE ECM

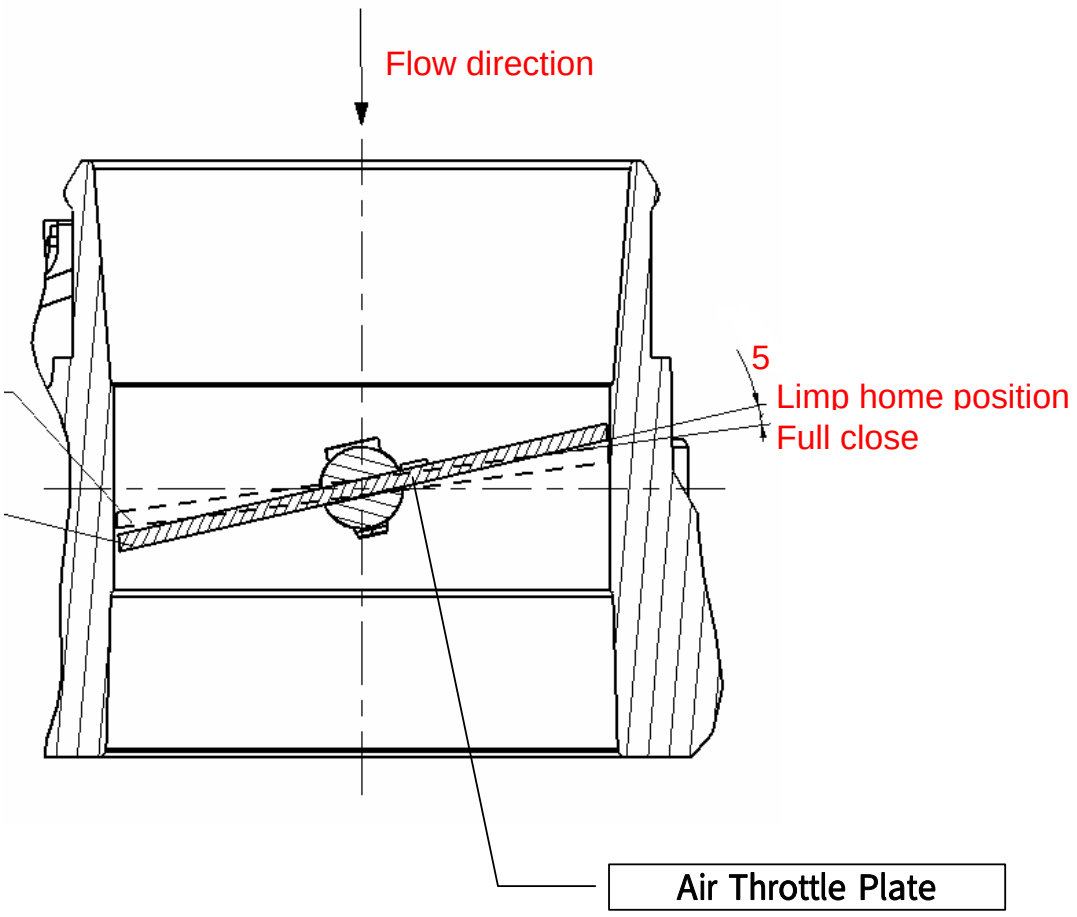
2. THROTTLE POSITION SENSOR OUTPUT CHARACTERISTIC CURVE



ATTACHMENT 3

1. Air throttle plate position

The air throttle plate position is 5° at the close condition.



2. Idle rpm :620±100 [RPM at P or N range after engine warm up]
3. Ignition timing : 10°BTDC ± 5°[BTDC @ IDLE]
4. kia ask you using special scan tool for kia vehicle (HI-SCAN or HI-DS) ,Idle status will be seen on the scan tool.

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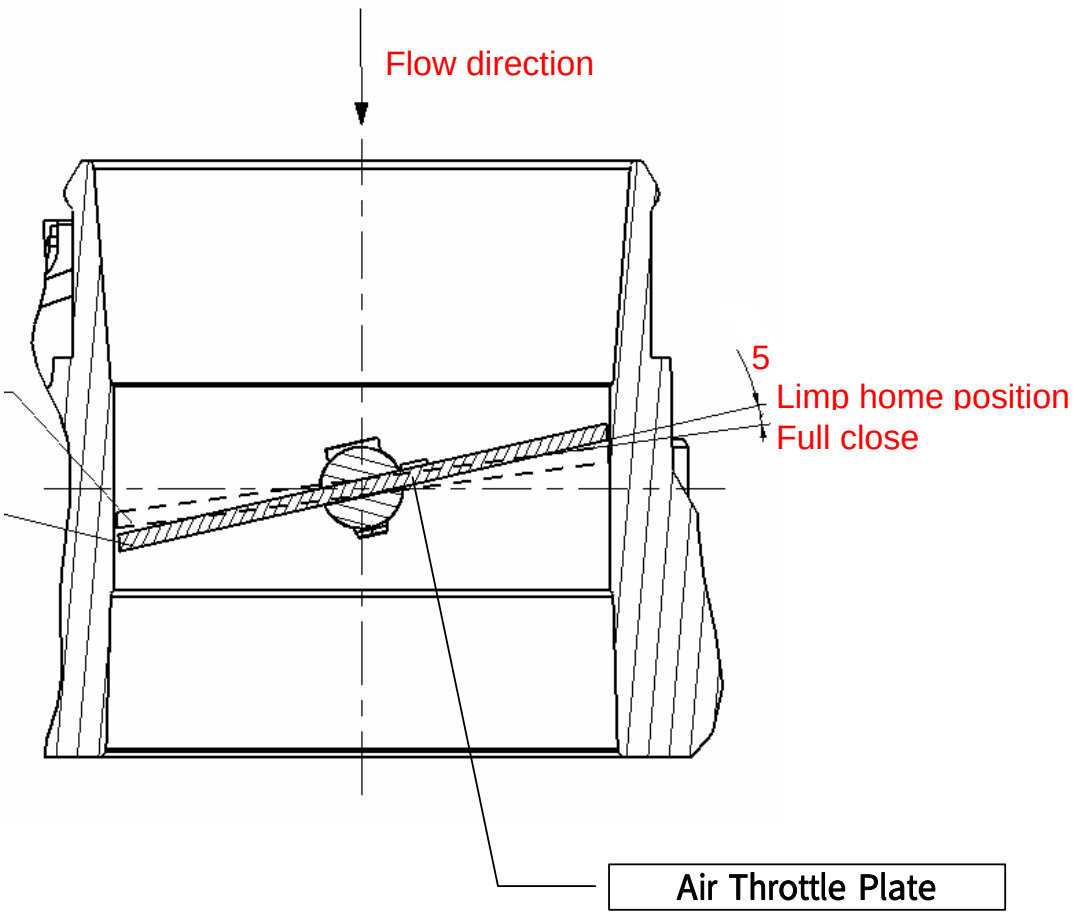
The air throttle plate position is 5° at the close condition.



2. Idle rpm :620±100 [RPM at P or N range after engine warm up]
3. Ignition timing : 10°BTDC ± 5°[BTDC @ IDLE]
4. kia ask you using special scan tool for kia vehicle (HI-SCAN or HI-DS) ,Idle status will be seen on the scan tool.

1. RETURN SPRING DRAWING (2 PICES ON A THROTTLE)