From:	Brian Stouffer
To:	David Caples
CC:	Peter Judis; John Sprague
BCC:	
Sent Date:	2012-05-23 20:14:51:000
Received Date:	
Subject:	Re: Results - Cobalt/HHR,Ion torque to turn key from Run to Accessory
Attachments:	Ignition_Switch_Testing.xlsx

David,

Thanks for summarizing the data and creating the plot. I wasn't sure we would see any trends in the data, but you've obviously found one. This will be helpful as we work to determine root cause.

Thanks as well for spending yesterday helping us collect the data.

I'll copy the data worksheet so I can create other plots without losing the one you've made.

It was nice meeting you.

Thanks again,

Brian Stouffer
Product Investigation
[redacted]

David Caples---05/23/2012 04:05:51 PM---Brian, Attached is the tabulated data from the trip yesterday. I set it up so its one row per vehic

From: David Caples/US/GM/GMC
To: Brian Stouffer/US/GM/GMC[redacted]
Date: 05/23/2012 04:05 PM
Subject: Results

Brian,

Attached is the tabulated data from the trip yesterday. I set it up so its one row per vehicle, and the columns are sortable. Also, I calculated both the traditional average and a trimmed average by excluding the maximum and minimum samples then averaging the remaining four. Also, on the second sheet, titled Plot 1, I plotted Torque against Model Year for each vehicle. There is a noticeable dip in the torque for Model Years 2005 and 2006.

One more note: Unfortunately, every time the data is sorted, the plot needs to be recreated because it will not update. I think there is a way to set it up to update when the data is sorted, but I'm unsure how to do it.

Let me know if you would like me to analyze this data further.

Thanks!

From:	Brian Stouffer
To:	Raymond DeGiorgio; Brian Thompson; John Zuzelski; David Caples; John Sprague; Peter Judis; Jeffrey Konchan
CC:	Terrence E Connolly; David DeFrain; Doug Wachtel
BCC:	
Sent Date:	2012-05-25 14:56:20:000
Received Date:	
Subject:	CORRECTION: Salvage Yard & Ignition Switch Data (Cobalt, Ion, HHR)
Attachments:	Ignition_Switch_Testing bws.xlsx

There was an error in the file I originally sent. For the Force plot, only the Cobalt data is accurate. The data shown for the other models is torque (Ncm). I've updated the file so it is now correct.

The data points shown with no load are those with a replacement key, or a key with a hole vs a slot. We did not measure those switches.

I apologize for any confusion.

Brian

On Tuesday 44 vehicles in a Davison salvage yard were measured for toque (Ncm) and force (N) to turn the ignition switch from Run to Accessory. Five of the vehicles had a replacement key, or a key with a hole instead of a slot, so the force on those vehicles was not measured. I've attached a file with the test results including two data plots.

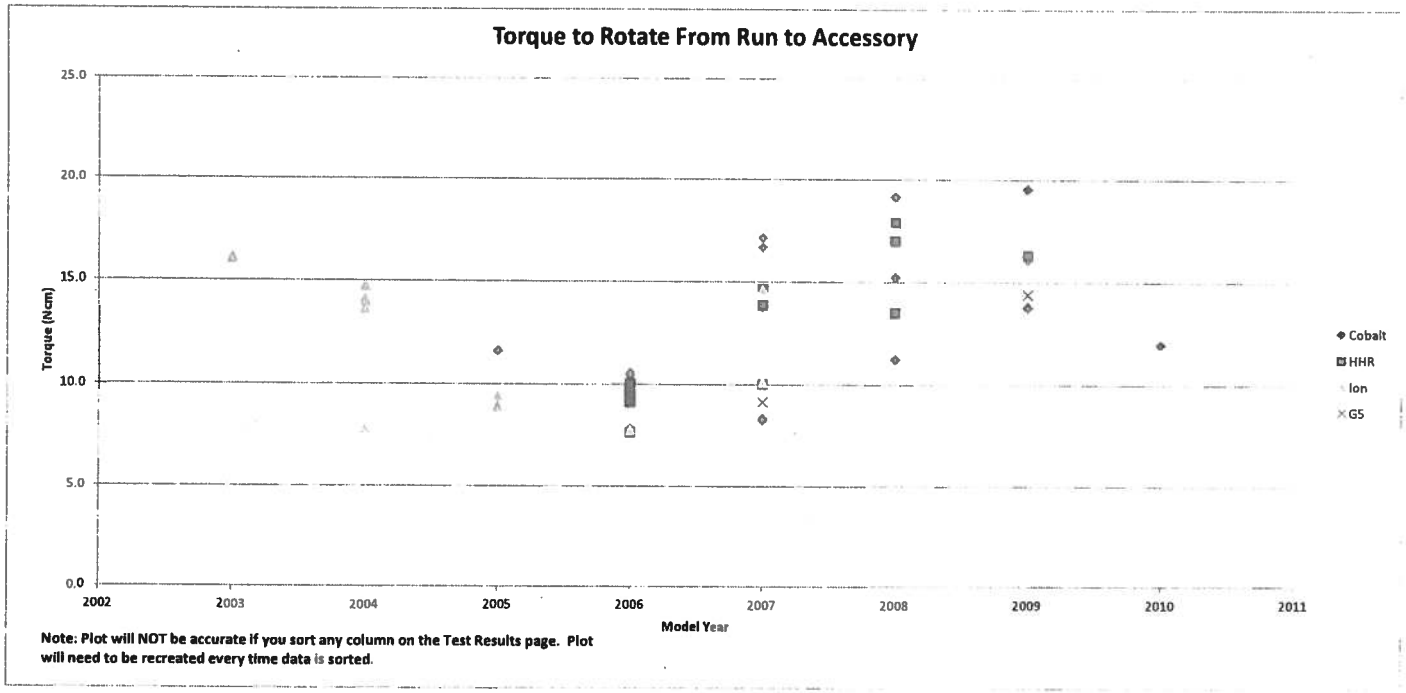
The worksheet "Test Results Full VIN" includes the build, and warranty start dates of the vehicles measured along with the mileage and any ignition related warranty.

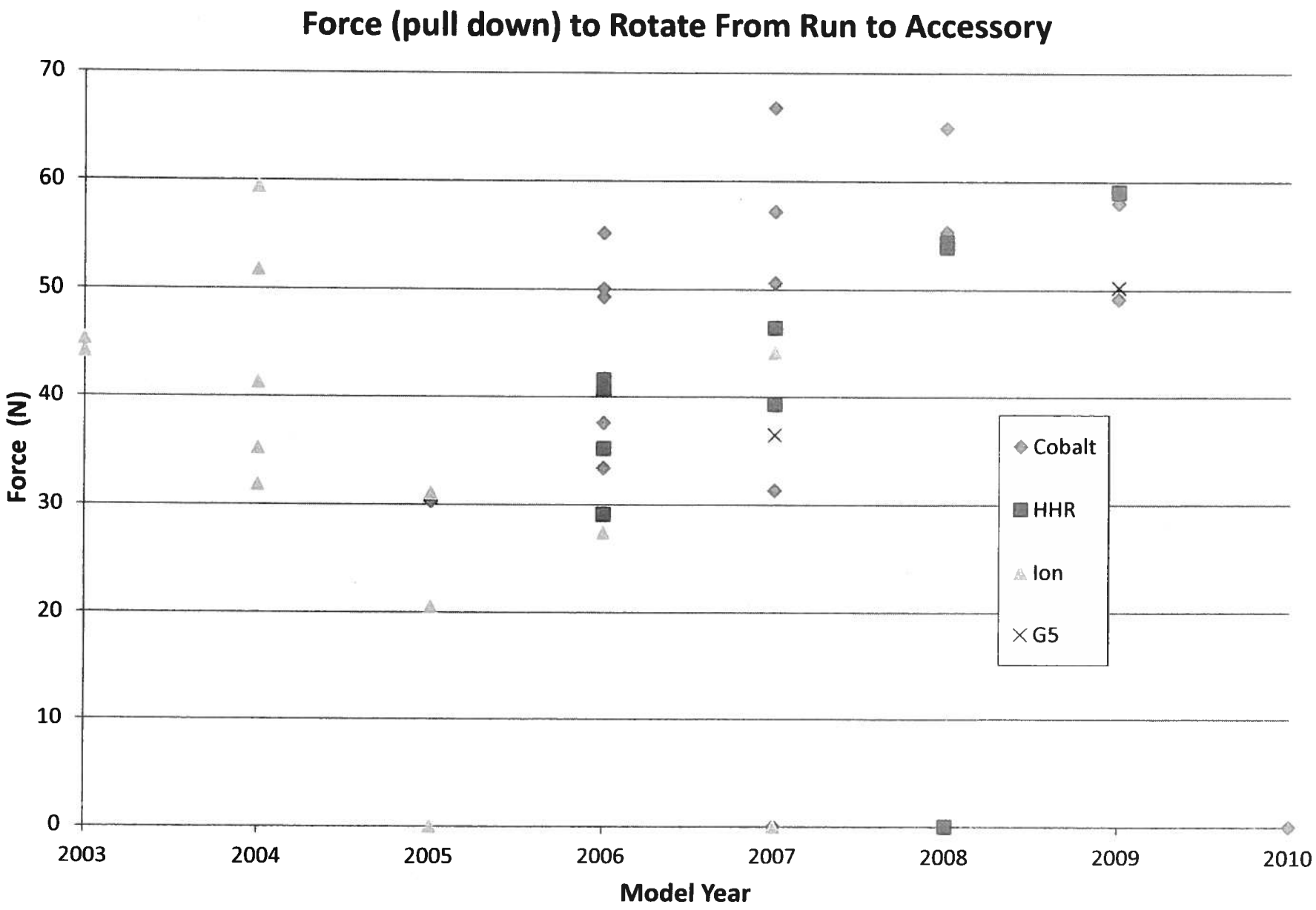
A meeting will be scheduled for Wednesday 5/30 to discuss the data and potential next steps. Your support of that meeting would be appreciated.

Brian Stouffer
Product Investigation
[redacted]

	Model Year								
Model	2003	2004	2005	2006	2007	2008	2009	2010	Grand Total
Cobalt			1	5	5	3	3	1	18
G5					1		1		2
HHR				4	3	3	1		11
Ion	2	5	3	1	2				13
Grand Total	2	5	4	10	11	6	5	1	44

VIN (Last 8):	Make:	Model:	Model Year:	Load to Rotate from Run to Accessory (N)							
				Sample 1:	Sample 2:	Sample 3:	Sample 4:	Sample 5:	Sample 6:	Average:	Trimmed Average*:
[redacted]	Chevrolet	Cobalt	2007	---	---	---	---	---	---	---	---
	Chevrolet	Cobalt	2006	32.0	50.0	45.7	51.3	50.2	71.1	50.1	49.3
	Chevrolet	Cobalt	2007	58.2	72.8	62.3	53.4	73.8	75.0	65.9	66.8
	Chevrolet	Cobalt	2006	40.2	45.3	39.0	37.0	34.0	29.7	37.5	37.6
	Chevrolet	Cobalt	2008	51.9	60.7	66.6	50.6	49.2	53.8	55.5	54.3
	Chevrolet	Cobalt	2009	49.7	65.0	54.3	71.9	59.0	56.5	59.4	58.7
	Chevrolet	Cobalt	2009	62.3	59.1	58.5	62.3	46.7	52.3	56.9	58.1
	Chevrolet	Cobalt	2008	49.2	45.7	60.3	58.4	58.3	55.7	54.6	55.4
	Chevrolet	Cobalt	2006	65.5	51.7	45.2	51.3	49.0	48.3	51.8	50.1
	Chevrolet	Cobalt	2006	37.0	34.2	28.6	33.3	33.9	32.1	33.2	33.4
	Chevrolet	Cobalt	2007	36.5	28.0	30.3	32.4	27.0	34.6	31.5	31.3
	Chevrolet	Cobalt	2007	51.2	49.5	55.5	50.6	45.9	51.3	50.7	50.7
	Chevrolet	Cobalt	2005	45.4	43.2	21.6	19.5	32.5	23.9	31.0	30.3
	Chevrolet	Cobalt	2007	60.1	46.7	58.6	56.2	54.0	60.2	56.0	57.2
	Chevrolet	Cobalt	2008	45.5	72.7	74.5	67.0	42.6	84.2	64.4	64.9
	Chevrolet	Cobalt	2006	60.0	58.9	50.7	52.2	56.5	53.3	55.3	55.2
	Chevrolet	Cobalt	2009	54.2	51.9	44.2	46.4	42.1	54.4	48.9	49.2
	Chevrolet	Cobalt	2010	---	---	---	---	---	---	---	---
	Pontiac	G5	2009	61.2	48.8	47.0	43.9	46.8	53.9	50.3	49.1
	Pontiac	G5	2007	38.2	43.6	41.2	51.0	21.7	23.1	36.5	36.5
	Chevrolet	HHR	2009	60.6	63.9	59.6	57.8	55.8	58.3	59.3	59.1
	Chevrolet	HHR	2008	---	---	---	---	---	---	---	---
	Chevrolet	HHR	2006	55.1	44.2	40.1	39.8	36.6	38.7	42.4	40.7
	Chevrolet	HHR	2007	53.2	40.1	44.4	45.1	45.8	50.6	46.5	46.5
	Chevrolet	HHR	2008	50.0	54.1	57.8	54.1	60.8	47.2	54.0	54.0
	Chevrolet	HHR	2007	78.7	90.5	78.3	80.9	83.9	88.9	83.5	83.1
	Chevrolet	HHR	2006	38.6	41.6	24.6	24.2	20.6	29.0	29.8	29.1
	Chevrolet	HHR	2006	33.2	31.7	35.9	37.4	35.4	36.3	35.0	35.2
	Chevrolet	HHR	2006	33.6	38.7	42.8	59.4	40.7	44.4	43.3	41.7
	Chevrolet	HHR	2008	57.4	49.5	60.3	53.0	58.0	49.1	54.6	54.5
	Chevrolet	HHR	2007	36.5	22.9	55.0	33.3	32.5	57.2	39.6	39.3
	Saturn	Ion	2007	---	---	---	---	---	---	---	---
	Saturn	Ion	2007	47.2	45.4	41.9	42.8	42.7	45.8	44.3	44.2
	Saturn	Ion	2004	51.9	49.5	51.0	54.8	54.7	46.4	51.4	51.8
	Saturn	Ion	2004	59.2	51.2	71.2	50.8	70.4	56.9	60.0	59.4
	Saturn	Ion	2004	39.7	38.4	45.4	41.9	35.8	46.1	41.2	41.4
	Saturn	Ion	2003	51.4	47.5	36.6	43.8	43.0	42.5	44.1	44.2
	Saturn	Ion	2005	21.0	20.5	21.2	20.9	19.9	19.8	20.6	20.6
	Saturn	Ion	2005	---	---	---	---	---	---	---	---
	Saturn	Ion	2005	19.0	43.7	36.8	21.4	35.3	30.9	31.2	31.1
	Saturn	Ion	2004	43.9	35.7	34.1	30.3	36.3	34.9	35.9	35.3
	Saturn	Ion	2006	29.1	27.0	22.1	43.0	20.9	31.5	28.9	27.4
	Saturn	Ion	2004	33.7	34.0	29.1	36.4	30.6	25.2	31.5	31.9
	Saturn	Ion	2003	47.2	45.8	48.1	43.4	45.0	39.5	44.8	45.4


Torque to Rotate From Run to Accessory
25.0
20.0
15.0
10.0
5.0
0.0
Torque (Ncm)
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Model Year
Cobalt
HHR
Ion
G5
Note: Plot will NOT be accurate if you sort any column on the Test Results page. Plot will need to be recreated every time data is sorted.


Force (pull down) to Rotate From Run to Accessory
70
60
50
40
30
20
10
0
Force (N)
2003
2004
2005
2006
2007
2008
2009
2010
Model Year
Cobalt
HHR
Ion
G5

Event:	Ignition Switch Field Testing
Location:	Auto Salvage Auction in Davison, MI
People:	John Sprague, Brian Stouffer, David Caples, Glen Bailey, Matt Pleatman
Purpose:	To test several Cobalt's, Ion's, HHR's, and G5's ignition switches. The necessary torque and downward force were determined to switch the ignition switch from run to accessory position. Six tests were performed on each vehicle.

Date:	VIN (Last 8):	Complete VIN	Build Date	Warranty Start Date	Branded Title	Mileage @ ASA	Switch or Column Warranty	Make:	Model:	Model Year:	Sample 1:
5/22/2012	[redacted]	[redacted]	9/5/2006	12/18/2006	Junk 5/1/12	65,060	N/A	Chevrolet	Cobalt	2007	---
5/22/2012			10/24/2005	11/15/2005	No	95,601	3/3/2010 E7680-Strg Col Replace @ 58,975 MI	Chevrolet	Cobalt	2006	32.0
5/22/2012			1/12/2007	1/13/2007	Junk 5/1/12	76,763	N/A	Chevrolet	Cobalt	2007	58.2
5/22/2012			10/4/2005	10/5/2005	No	162,096	11/10/2006 E7680-Strg Col Replace @ 30,510 MI	Chevrolet	Cobalt	2006	40.2
5/22/2012			5/5/2008	5/6/2008	No	89,083	N/A	Chevrolet	Cobalt	2008	51.9
5/22/2012			7/11/2008	9/22/2008	No	55,113	N/A	Chevrolet	Cobalt	2009	49.7
5/22/2012			8/11/2008	5/15/2009	No	46,337	N/A	Chevrolet	Cobalt	2009	62.3
5/22/2012			9/13/2007	5/16/2008	Junk 4/1/12	59,445	N/A	Chevrolet	Cobalt	2008	49.2
5/22/2012			09/27/2005	09/28/2006	No	not on list	N/A	Chevrolet	Cobalt	2006	65.5
5/22/2012			08/25/2005	02/27/2006	No	146,499	N/A	Chevrolet	Cobalt	2006	37.0
5/22/2012			6/19/2006	8/29/2006	Junk 4/1/12	130,687	12/15/2006 E7200 - Cyl, Ignition Lock @ 9,076 MI	Chevrolet	Cobalt	2007	36.5
5/22/2012			8/25/2005	3/23/2007	No	59,068	N/A	Chevrolet	Cobalt	2007	51.2
5/22/2012			3/14/2005	5/21/2005	No	112,397	N/A	Chevrolet	Cobalt	2005	45.4
5/22/2012			06/18/2007	9/28/2007	No	83,855	N/A	Chevrolet	Cobalt	2007	60.1
5/22/2012			3/14/2008	4/7/2008	No	not on list	N/A	Chevrolet	Cobalt	2008	45.5
5/22/2012			11/9/2005	11/30/2005	No	131,662	N/A	Chevrolet	Cobalt	2006	60.0
5/22/2012			10/1/2008	3/18/2009	No	13,004	N/A	Chevrolet	Cobalt	2009	54.2
5/22/2012			10/20/2009	11/5/2009	No	missing	N/A	Chevrolet	Cobalt	2010	---
5/22/2012			8/15/2008	6/30/2009	Salvaged 3/1/12	not on list	N/A	Pontiac	G5	2009	61.2
5/22/2012			8/9/2006	9/15/2006	Salvaged 5/1/12	not on list	N/A	Pontiac	G5	2007	38.2
5/22/2012			9/2/2008	3/26/2009	Salvaged 4/1/12	66,543	N/A	Chevrolet	HHR	2009	60.6
5/22/2012			5/18/2010	5/19/2010	No	35,309	N/A	Chevrolet	HHR	2008	---
5/22/2012			12/22/2005	3/8/2006	No	30,935	09/29/2006 E7200 - Cyl, Ignition Lock @ 3,784 MI	Chevrolet	HHR	2006	55.1
5/22/2012			3/12/2007	4/3/2007	No	96,830	N/A	Chevrolet	HHR	2007	53.2
5/22/2012			12/11/2007	12/12/2007	Junk 5/1/12	104,343	N/A	Chevrolet	HHR	2008	50.0
5/22/2012			11/7/2006	7/12/2007	Junk 5/1/12	140,265	N/A	Chevrolet	HHR	2007	78.7
5/22/2012			7/14/2005	7/15/2005	No	100,963	N/A	Chevrolet	HHR	2006	38.6
5/22/2012			8/23/2005	9/13/2005	No	56,355	N/A	Chevrolet	HHR	2006	33.2
5/22/2012			1/23/2006	3/10/2006	No	139,165	N/A	Chevrolet	HHR	2006	33.6
5/22/2012			5/19/2008	6/24/2008	Salvaged 2/1/12	59,650	N/A	Chevrolet	HHR	2008	57.4
5/22/2012			8/8/2006	8/9/2006	No	95,524	N/A	Chevrolet	HHR	2007	36.5
5/22/2012			12/1/2006	4/27/2007	No	44,367	N/A	Saturn	Ion	2007	---
5/22/2012			3/2/2007	7/6/2007	Salvaged 5/1/12	51,000	N/A	Saturn	Ion	2007	47.2
5/22/2012			9/13/2003	12/27/2003	No	128,621	1/4/2008 N2320 - Ign Switch Replace @ 76,162 MI	Saturn	Ion	2004	51.9
5/22/2012			4/22/2004	7/28/2004	No	144,700	N/A	Saturn	Ion	2004	59.2
5/22/2012			5/18/2004	6/9/2004	No	124,856	1/21/2009 N2320 - Ign Switch Replace @ 75,998 MI	Saturn	Ion	2004	39.7
5/22/2012			9/27/2002	11/9/2002	No	73,487	12/6/2007 N2320 - Ign Switch Replace @ 58,430 MI	Saturn	Ion	2003	51.4
5/22/2012			9/8/2004	10/8/2004	No	48,510	N/A	Saturn	Ion	2005	21.0
5/22/2012			1/19/2005	3/29/2005	Flood 4/1/12	45,368	N/A	Saturn	Ion	2005	---
5/22/2012			9/16/2004	1/12/2005	Flood 4/1/12	103,913	N/A	Saturn	Ion	2005	19.0
5/22/2012			3/31/2004	4/29/2004	No	110,101	1/21/2005 N2320 - Ign Switch Replace @ 10,726 MI	Saturn	Ion	2004	43.9
5/22/2012			2/24/2006	3/20/2006	No	99,993	N/A	Saturn	Ion	2006	29.1
5/22/2012			10/10/2003	12/12/2003	No	26,629	N/A	Saturn	Ion	2004	33.7
5/22/2012			11/27/2002	7/21/2003	No	135,974	12/27/2007 N2320 - Ign Switch Replace @ 55,725 MI	Saturn	Ion	2003	47.2

* Trimmed average removes the maximum and minimum sample, then averages the remaining four

Load to Rotate from Run to Accessory (N)							Torque to Rotate from Run to Accessory						
Sample 2:	Sample 3:	Sample 4:	Sample 5:	Sample 6:	Average:	Trimmed Average*:	Sample 1:	Sample 2:	Sample 3:	Sample 4:	Sample 5:	Sample 6:	Average:
---	---	---	---	---	---	---	6.7	9.3	7.9	10.3	8.6	7.2	8.3
50.0	45.7	51.3	50.2	71.1	50.1	49.3	7.4	8.5	8.8	10.2	6.7	6.5	8.0
72.8	62.3	53.4	73.8	75.0	65.9	66.8	12.4	13.1	14.4	14.5	16.2	13.1	14.0
45.3	39.0	37.0	34.0	29.7	37.5	37.6	8.8	10.1	8.8	10.9	11.7	10.6	10.2
60.7	66.6	50.6	49.2	53.8	55.5	54.3	14.6	10.6	14.5	10.1	8.7	9.8	11.4
65.0	54.3	71.9	59.0	56.5	59.4	58.7	14.3	16.0	19.5	21.9	21.9	20.8	19.1
59.1	58.5	62.3	46.7	52.3	56.9	58.1	13.6	14.2	14.3	14.9	13.0	12.6	13.8
45.7	60.3	58.4	58.3	55.7	54.6	55.4	13.7	16.4	10.1	16.2	16.1	14.9	14.6
51.7	45.2	51.3	49.0	48.3	51.8	50.1	11.9	9.2	10.9	13.0	9.8	9.6	10.7
34.2	28.6	33.3	33.9	32.1	33.2	33.4	9.6	7.9	7.5	12.4	9.5	9.9	9.5
28.0	30.3	32.4	27.0	34.6	31.5	31.3	9.2	8.6	7.4	5.8	8.9	8.6	8.1
49.5	55.5	50.6	45.9	51.3	50.7	50.7	15.8	17.4	16.2	15.5	17.2	18.7	16.8
43.2	21.6	19.5	32.5	23.9	31.0	30.3	11.4	11.0	11.5	11.6	12.0	12.6	11.7
46.7	58.6	56.2	54.0	60.2	56.0	57.2	15.8	19.3	16.6	19.5	15.3	16.8	17.2
72.7	74.5	67.0	42.6	84.2	64.4	64.9	19.3	19.3	18.5	19.2	18.8	19.4	19.1
58.9	50.7	52.2	56.5	53.3	55.3	55.2	12.0	10.2	12.4	9.4	9.6	10.0	10.6
51.9	44.2	46.4	42.1	54.4	48.9	49.2	17.2	18.2	12.5	18.1	14.1	14.8	15.8
---	---	---	---	---	---	---	11.5	12.7	12.9	9.7	11.6	12.1	11.8
48.8	47.0	43.9	46.8	53.9	50.3	49.1	14.6	16.9	13.7	13.5	14.6	14.7	14.7
43.6	41.2	51.0	21.7	23.1	36.5	36.5	9.9	5.9	8.4	9.1	12.6	9.3	9.2
63.9	59.6	57.8	55.8	58.3	59.3	59.1	16.9	16.8	15.1	16.8	12.3	16.4	15.7
---	---	---	---	---	---	---	15.8	18.2	18.8	20.1	18.8	14.4	17.7
44.2	40.1	39.8	36.6	38.7	42.4	40.7	7.7	8.0	8.3	5.3	7.8	7.2	7.4
40.1	44.4	45.1	45.8	50.6	46.5	46.5	13.2	12.1	13.6	15.5	16.5	13.1	14.0
54.1	57.8	54.1	60.8	47.2	54.0	54.0	20.0	16.0	15.3	16.7	17.5	17.7	17.2
90.5	78.3	80.9	83.9	88.9	83.5	83.1	13.3	12.2	12.3	15.6	17.9	17.4	14.8
41.6	24.6	24.2	20.6	29.0	29.8	29.1	9.1	8.8	10.1	12.3	9.1	10.2	9.9
31.7	35.9	37.4	35.4	36.3	35.0	35.2	11.0	11.3	8.6	9.7	9.2	10.2	10.0
38.7	42.8	59.4	40.7	44.4	43.3	41.7	8.8	9.3	8.9	9.0	10.1	9.3	9.2
49.5	60.3	53.0	58.0	49.1	54.6	54.5	14.8	15.5	11.6	13.3	11.7	14.2	13.5
22.9	55.0	33.3	32.5	57.2	39.6	39.3	10.3	10.0	9.1	9.8	11.9	---	10.2
---	---	---	---	---	---	---	14.5	13.1	14.4	16.7	15.6	14.1	14.7
45.4	41.9	42.8	42.7	45.8	44.3	44.2	9.3	10.4	11.1	9.7	8.1	13.0	10.3
49.5	51.0	54.8	54.7	46.4	51.4	51.8	16.5	10.2	8.3	18.2	17.9	11.9	13.8
51.2	71.2	50.8	70.4	56.9	60.0	59.4	14.5	12.9	10.7	14.5	17.4	17.1	14.5
38.4	45.4	41.9	35.8	46.1	41.2	41.4	13.3	15.4	14.6	13.0	15.0	11.4	13.8
47.5	36.6	43.8	43.0	42.5	44.1	44.2	15.3	13.7	17.1	15.9	15.8	17.6	15.9
20.5	21.2	20.9	19.9	19.8	20.6	20.6	9.1	8.9	7.2	8.2	9.7	9.6	8.8
---	---	---	---	---	---	---	9.9	7.9	8.7	8.6	10.9	8.3	9.1
43.7	36.8	21.4	35.3	30.9	31.2	31.1	9.4	9.1	10.4	9.4	8.3	9.9	9.4
35.7	34.1	30.3	36.3	34.9	35.9	35.3	15.2	10.5	15.3	13.6	13.1	12.7	13.4
27.0	22.1	43.0	20.9	31.5	28.9	27.4	7.4	6.7	10.2	9.1	6.9	7.8	8.0
34.0	29.1	36.4	30.6	25.2	31.5	31.9	8.4	8.1	8.2	6.5	5.0	8.7	7.5
45.8	48.1	43.4	45.0	39.5	44.8	45.4	18.1	19.0	15.6	15.1	15.8	14.4	16.3

Trimmed Average*:	Notes:
8.3	Replacement key with inline hole.
7.9	
13.8	Windshield Cracked
10.1	
11.3	
19.6	Both airbags deployed.
13.8	Both airbags deployed.
15.2	Test performed from driver seat, no access from passenger seat. Noted because most tests were performed from passenger seat.
10.6	Both airbags deployed.
9.2	146499 Miles, 13000 ignition cycles. Pulled data logs from vehicle.
8.4	130687 Miles. Test performed from driver seat, no access from passenger seat. Noted because most tests were performed from passenger seat.
16.7	Both airbags deployed.
11.6	MISSING DIGIT IN VIN
17.1	
19.2	Vin # may be [redacted] Both are recorded for this vehicle in test logs.
10.5	
16.1	
12.0	Driver door damage.
14.4	Both airbags deployed.
9.2	
16.3	Right front window out.
17.9	Key had inline hole rather than slot. Water on floor, damaged sunroof. Switch "felt different" than others.
7.7	Windshield cracked. Roll Over. Tape over door glass.
13.9	
17.0	
14.7	Key binding and bending prior to rotating.
9.6	
10.0	
9.1	Test performed from driver seat, no access from passenger seat. Noted because most tests were performed from passenger seat.
13.5	Both airbags deployed.
10.0	Both airbags deployed.
14.7	Replacement Key.
10.1	If key is turned to start and rapidly released, it will retract past run into accessory.
14.1	Worn key. Key can be removed when in accessory or run.
14.8	Both airbags deployed.
14.0	Windshield shattered.
16.0	
9.0	
8.9	Replacement Key.
9.5	
13.7	
7.8	
7.8	
16.2	