2008

Late Model Hondas and High-Tech Diagnostics

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www.siucautomotive.com

Note: some images, illustrations and tables found within this presentation are from American Honda Motor Company

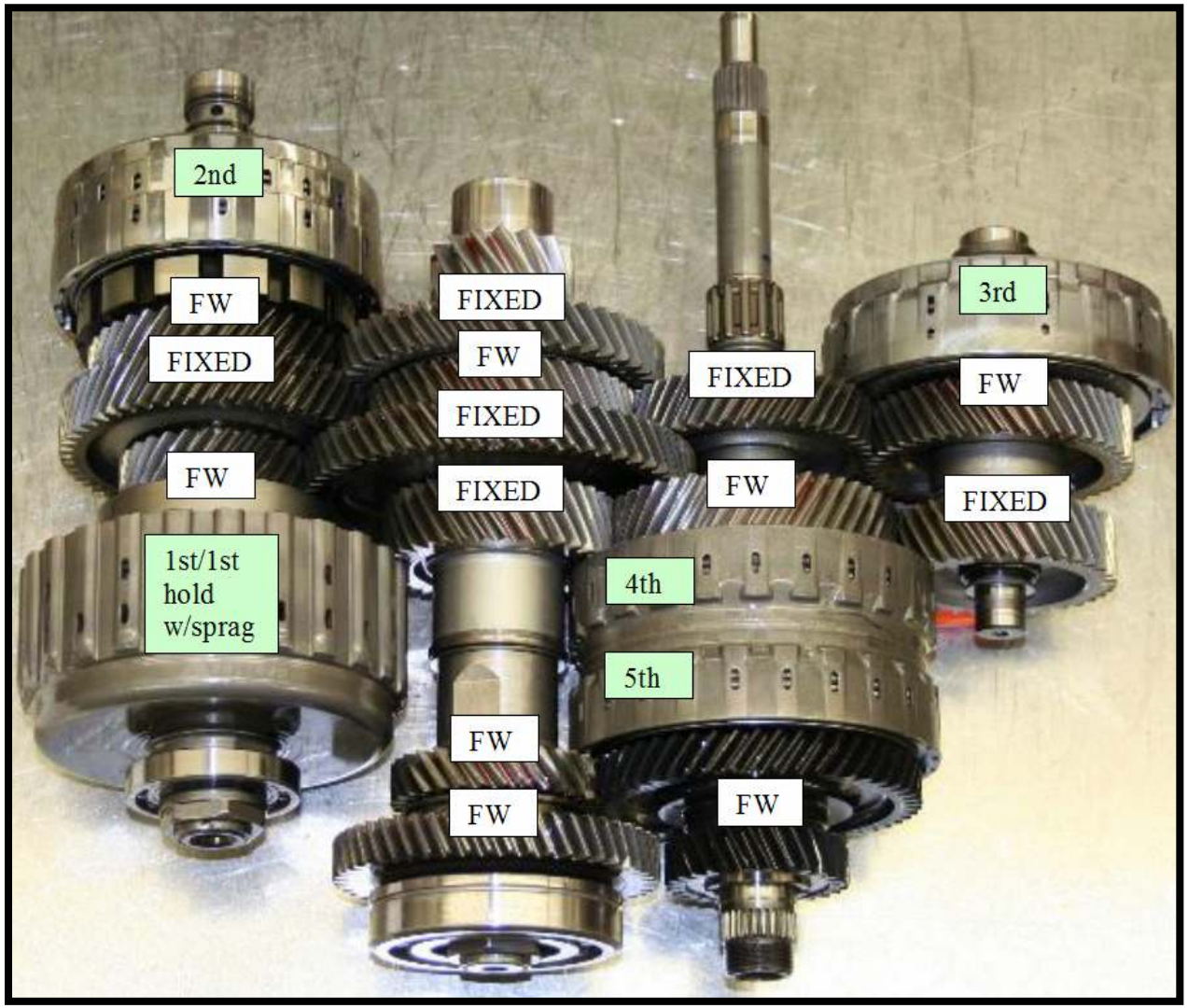
Acura RDX

- Acura RDX AWD transaxle
- Model BWEA
- New turbocharged 2.3 liter
  - 240HP
  - 260 lbs ft. of torque

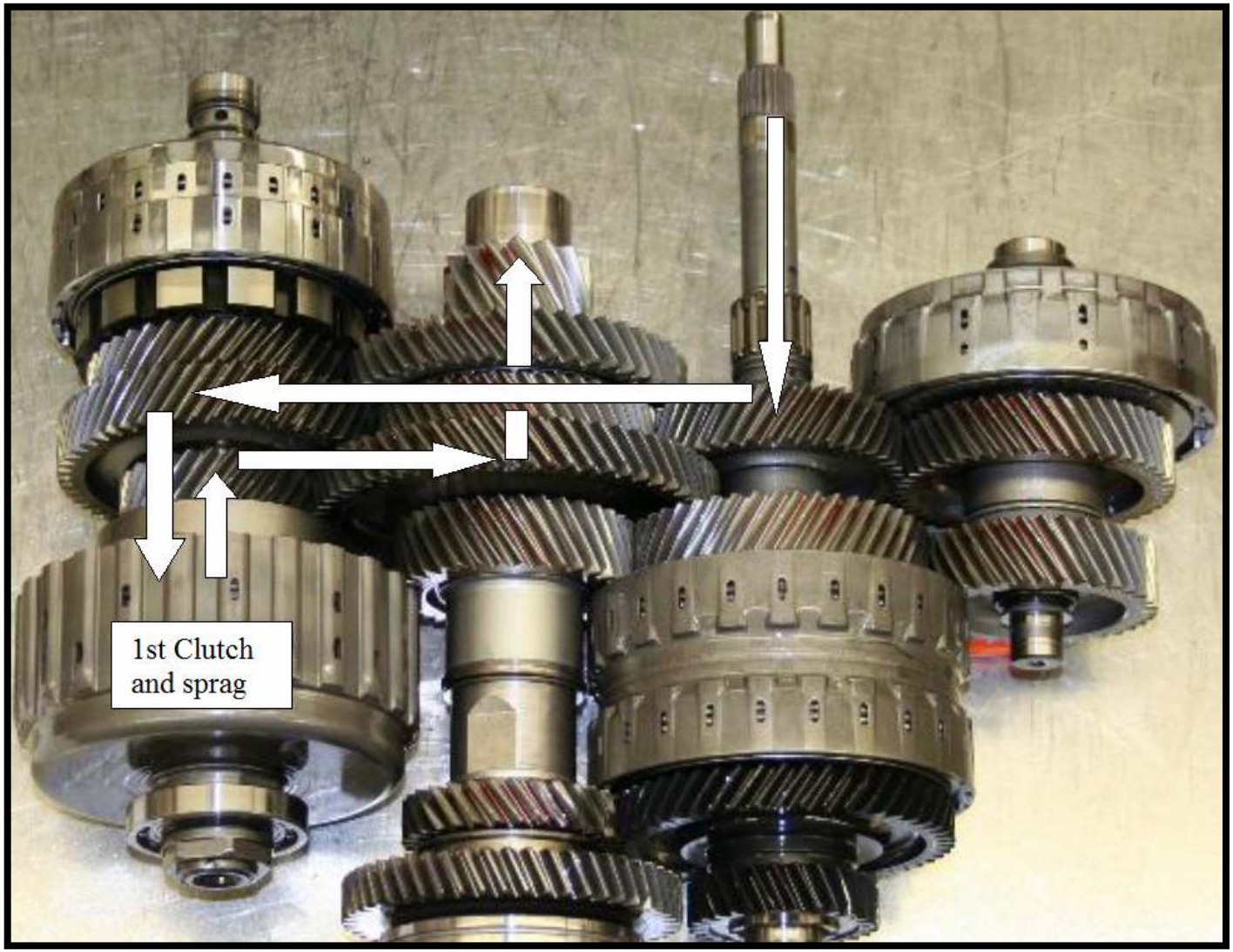
Acura RDX

- Transaxle is not much different than a traditional Honda transaxle aside from:
  - An additional shaft (intermediary)
  - A transfer gear for AWD
  - An additional pressure switch

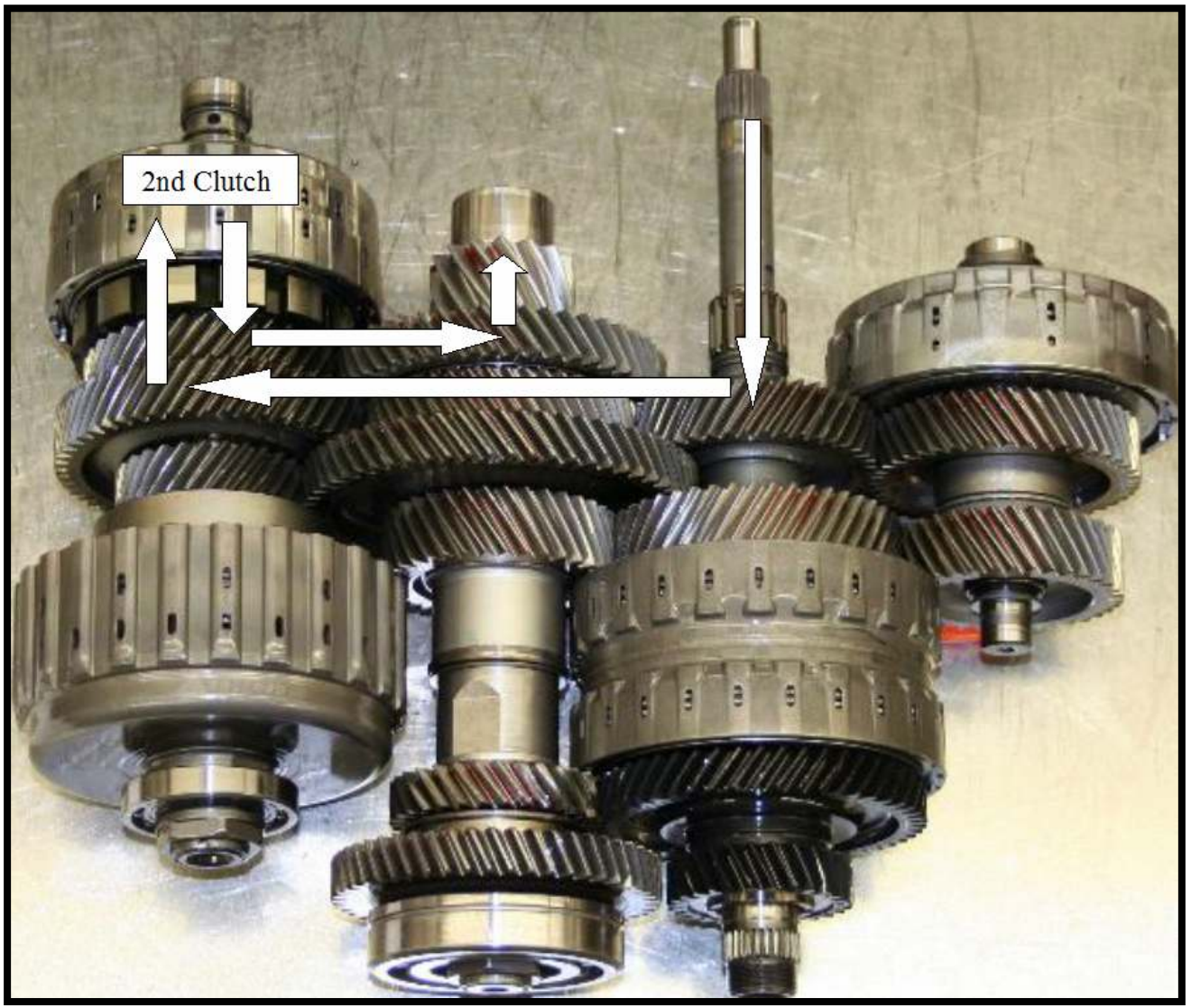
Acura RDX


2nd
FW
FIXED
FW
1st/1st
hold
w/sprag
FIXED
FW
FIXED
FIXED
FW
FW
FW
FIXED
FW
3rd
FIXED
4th
5th
FW
FW

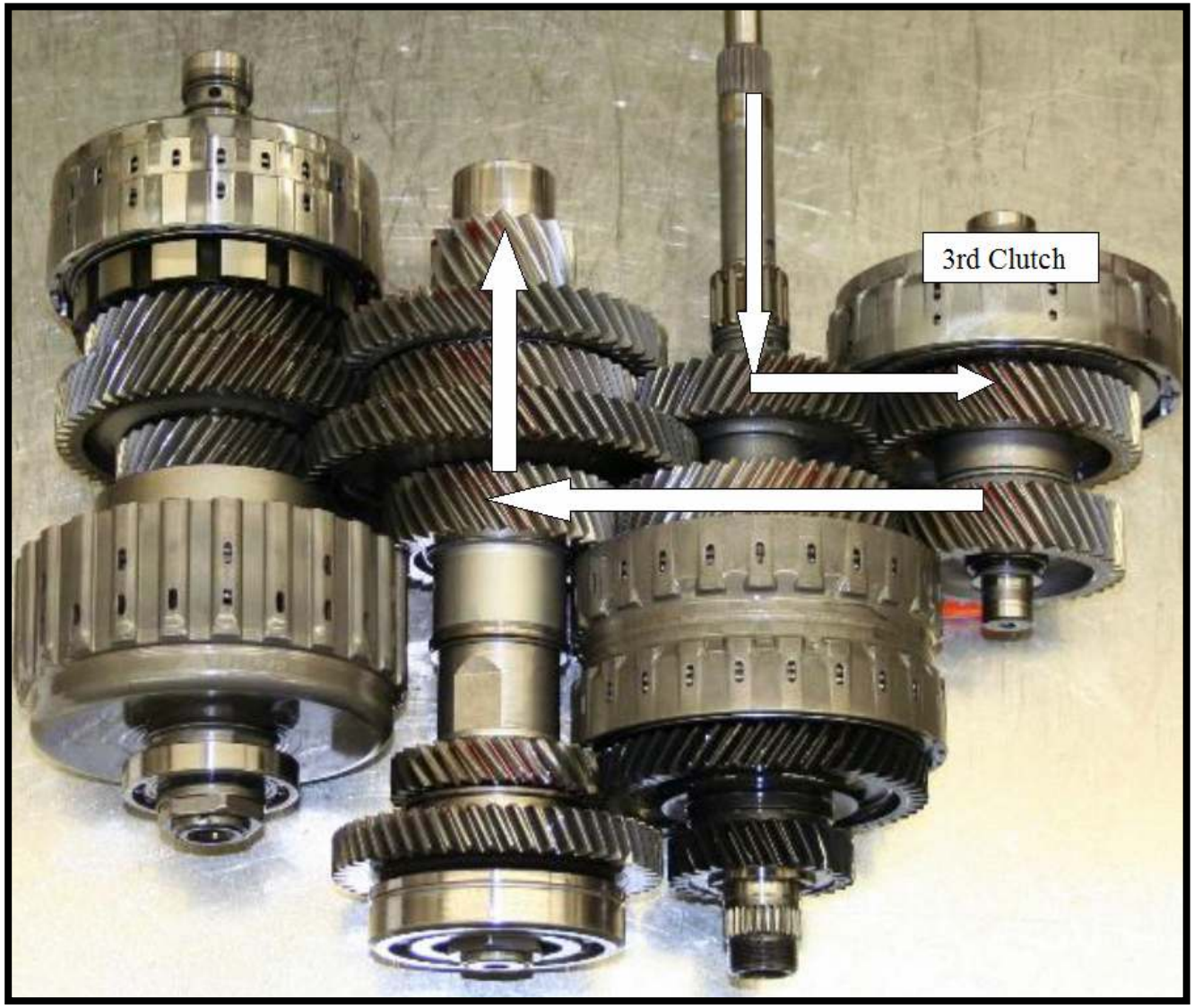
Acura RDX: First Gear



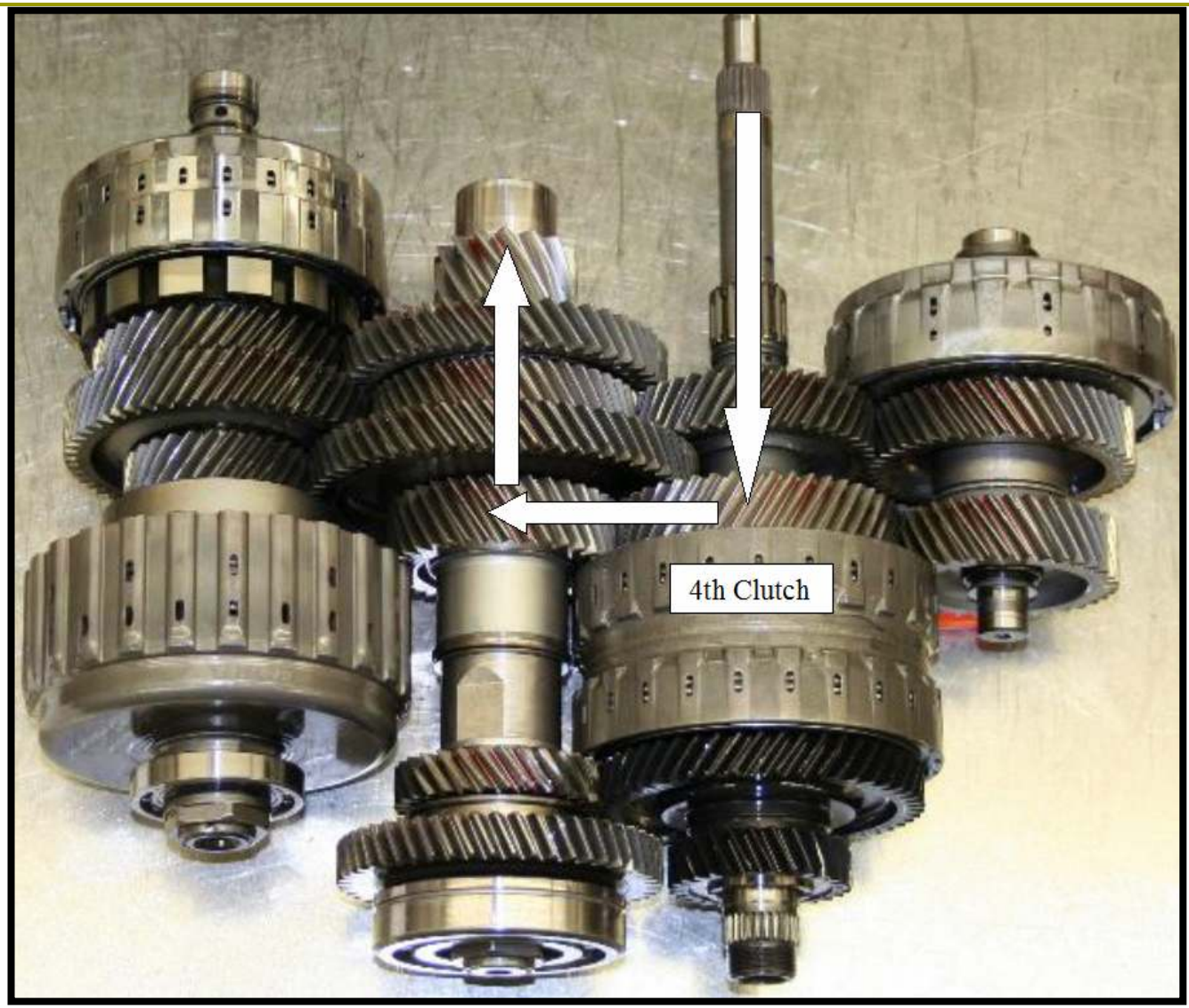
Acura RDX: Second Gear



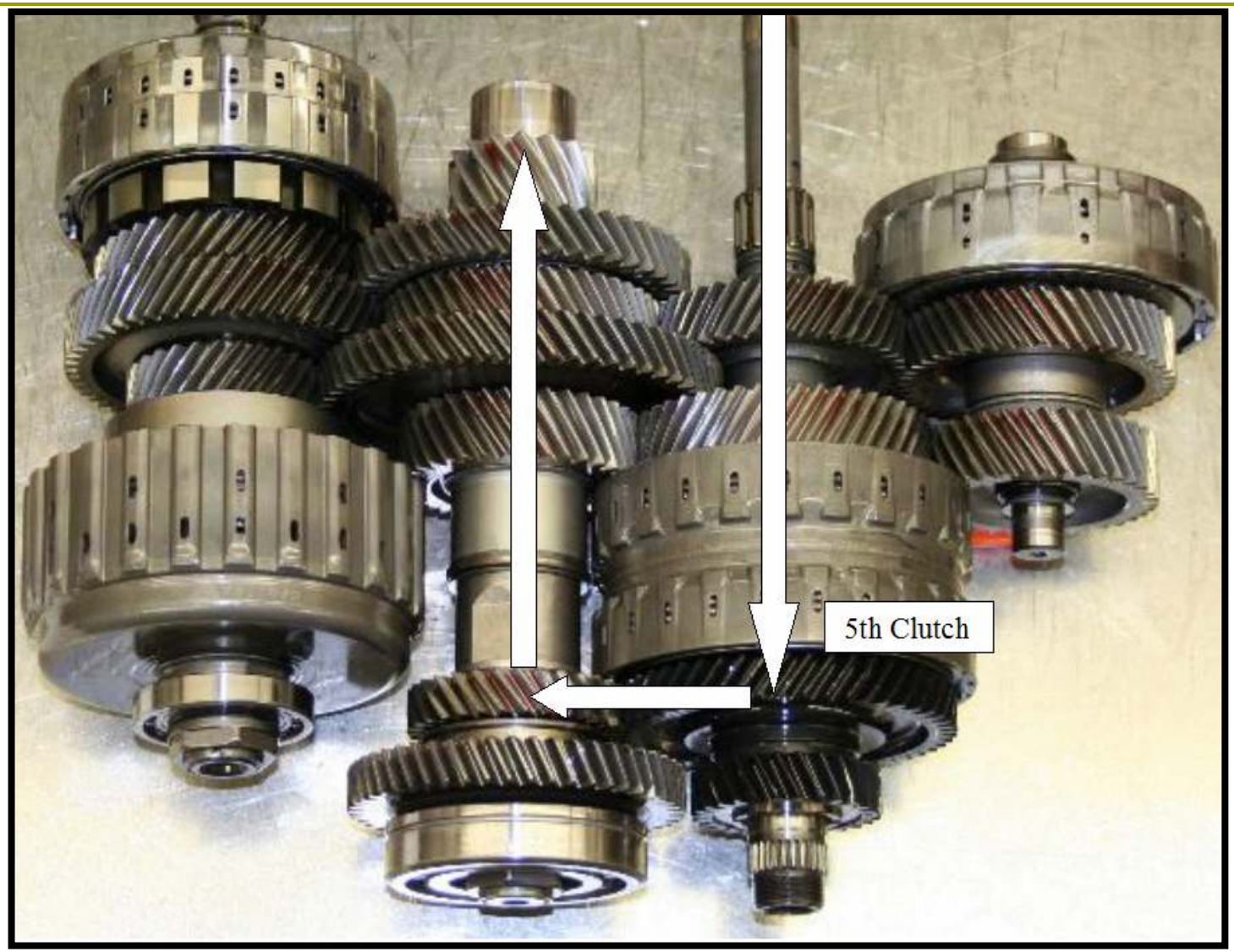
Acura RDX: Third Gear



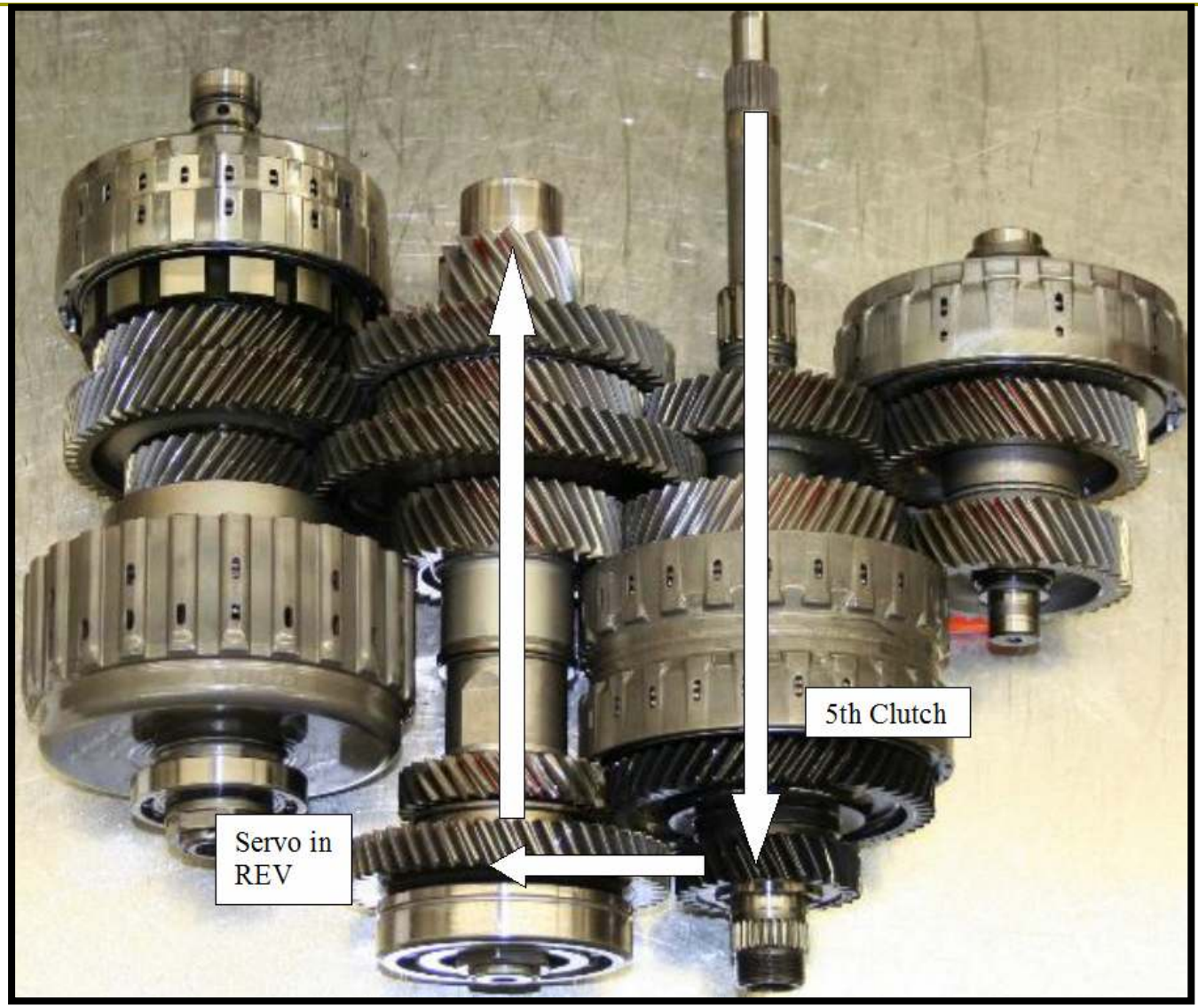
Acura RDX: Fourth Gear



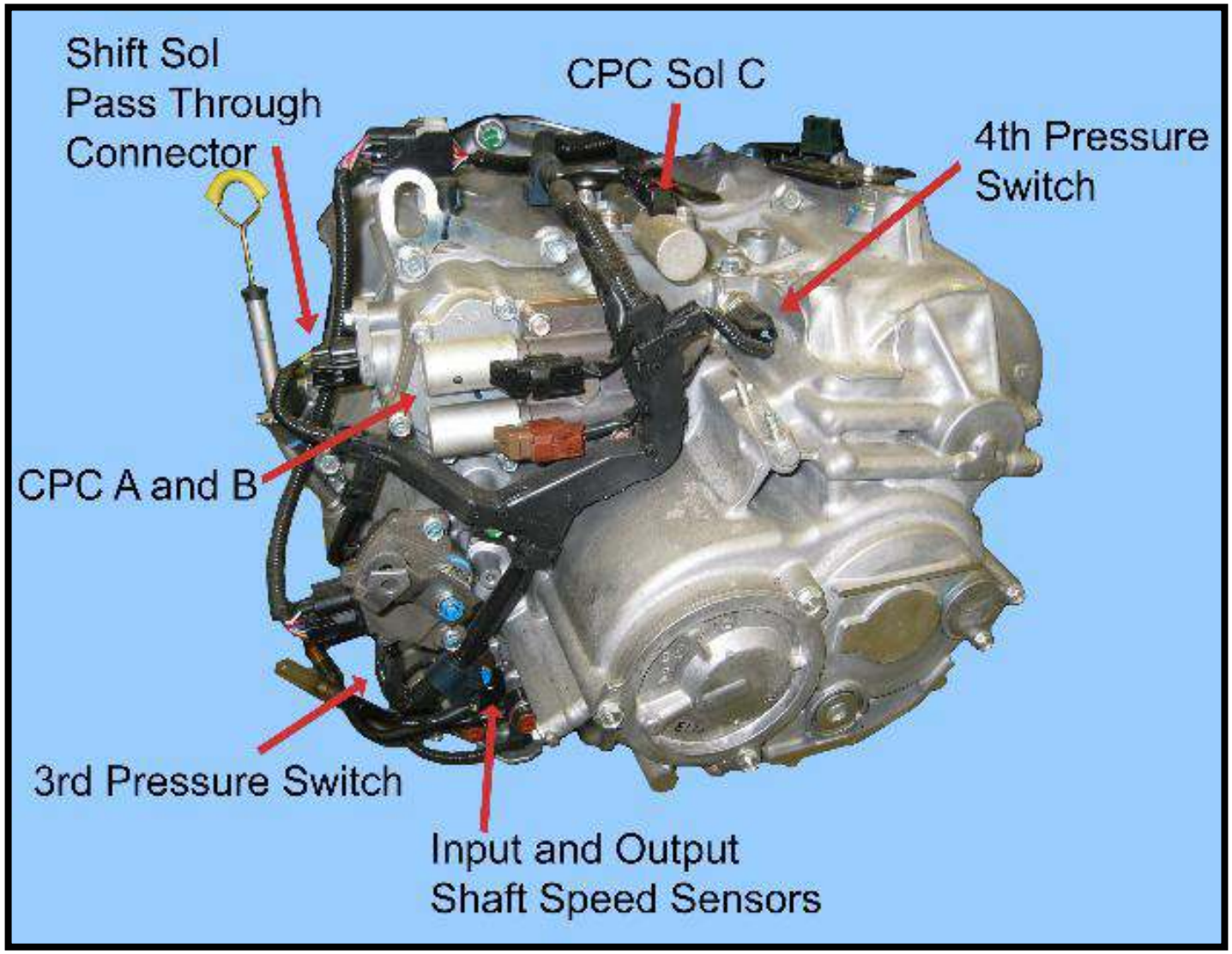
Acura RDX: Fifth Gear



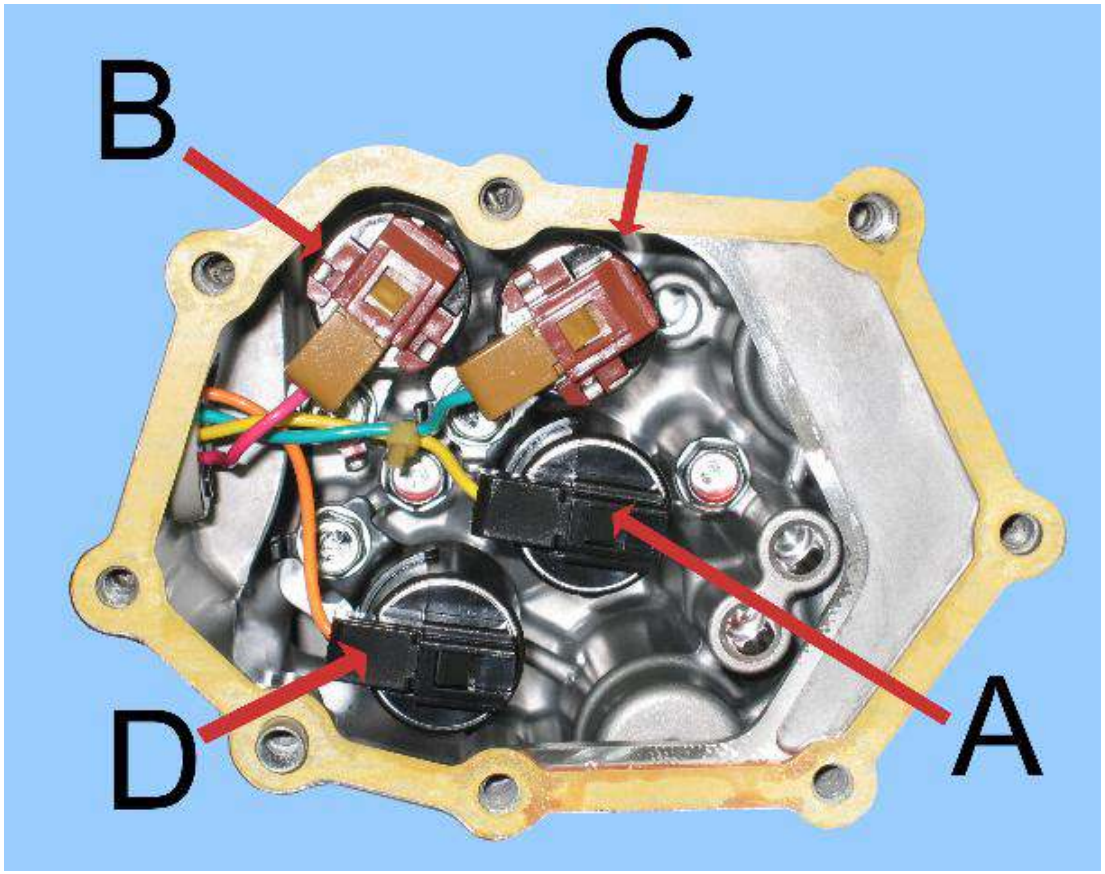
Acura RDX: Reverse



Acura RDX


Shift Sol
Pass Through
Connector
CPC Sol C
4th Pressure
Switch
CPC A and B
3rd Pressure Switch
Input and Output
Shaft Speed Sensors

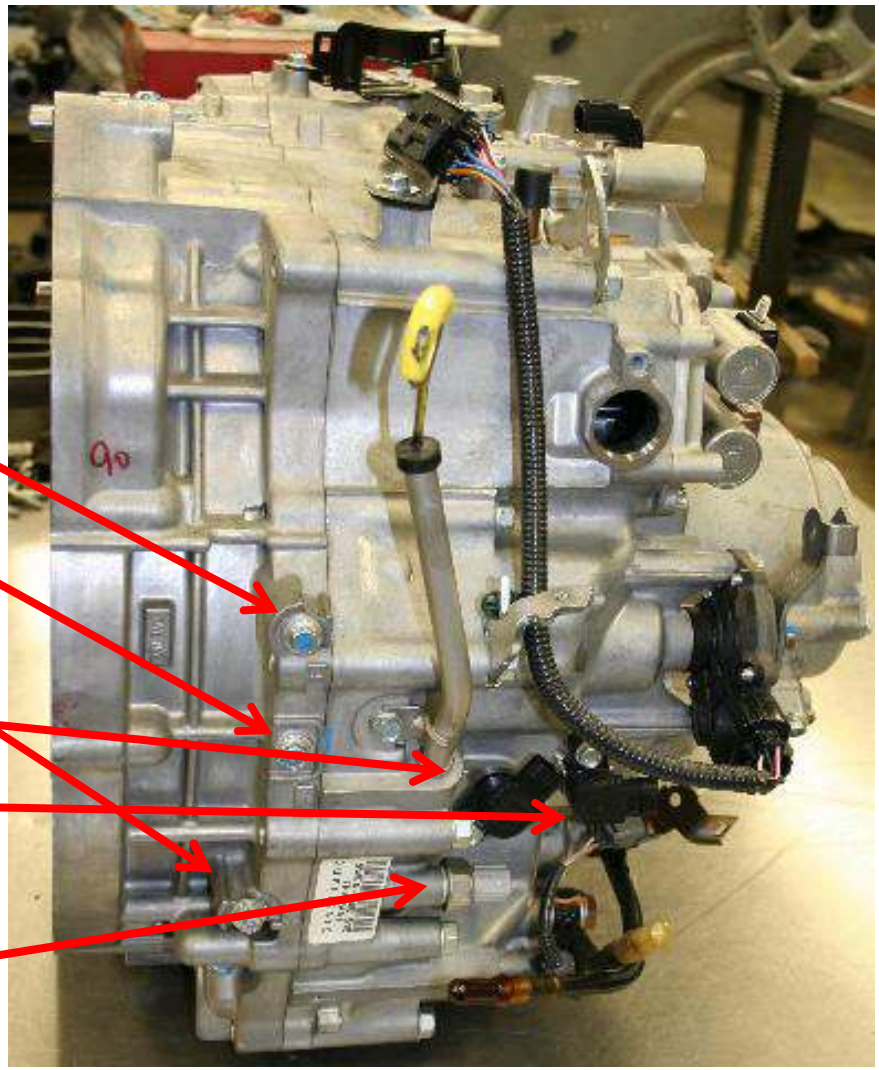
Acura RDX



12 – 24 Ohms

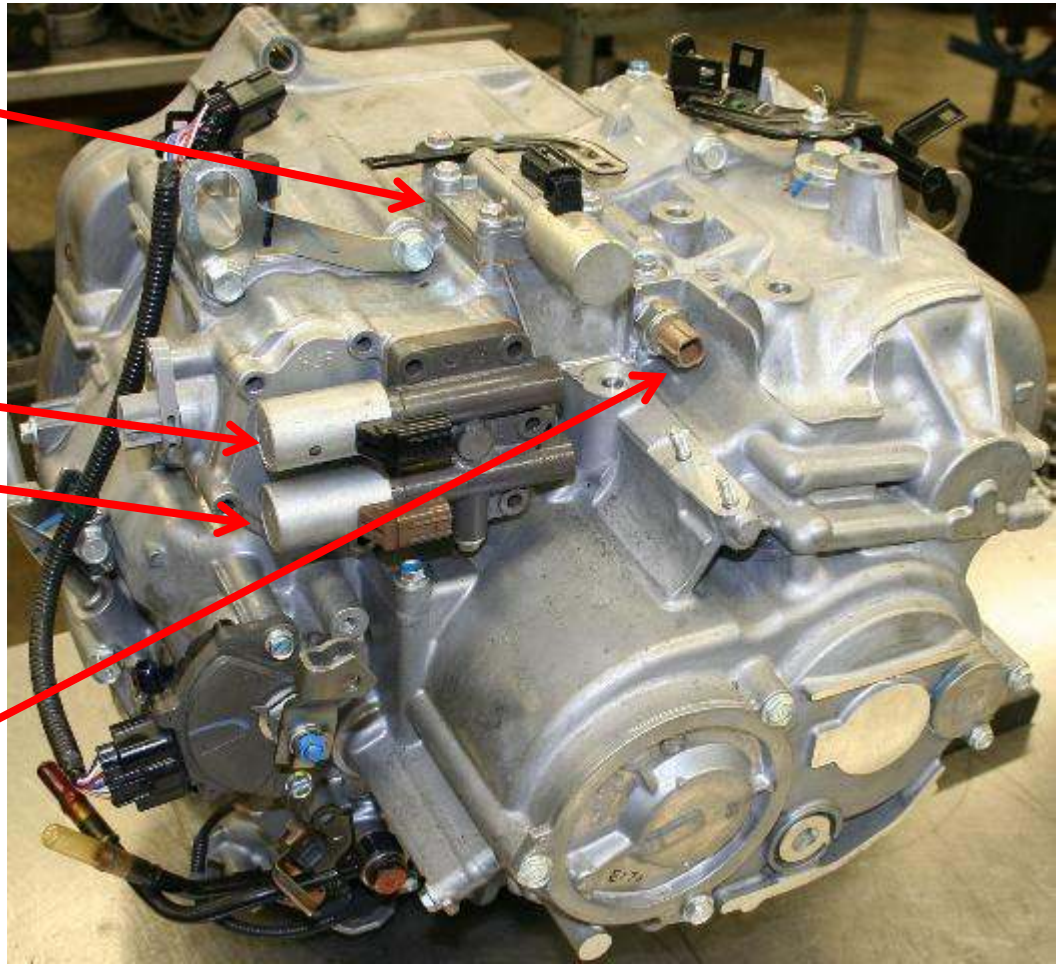
Acura RDX

- Pressure Taps
  - 5th
  - Line
  - 3rd
- Speed sensors
  - Input
  - Output
- Pressure Switch
  - 3rd



Acura RDX

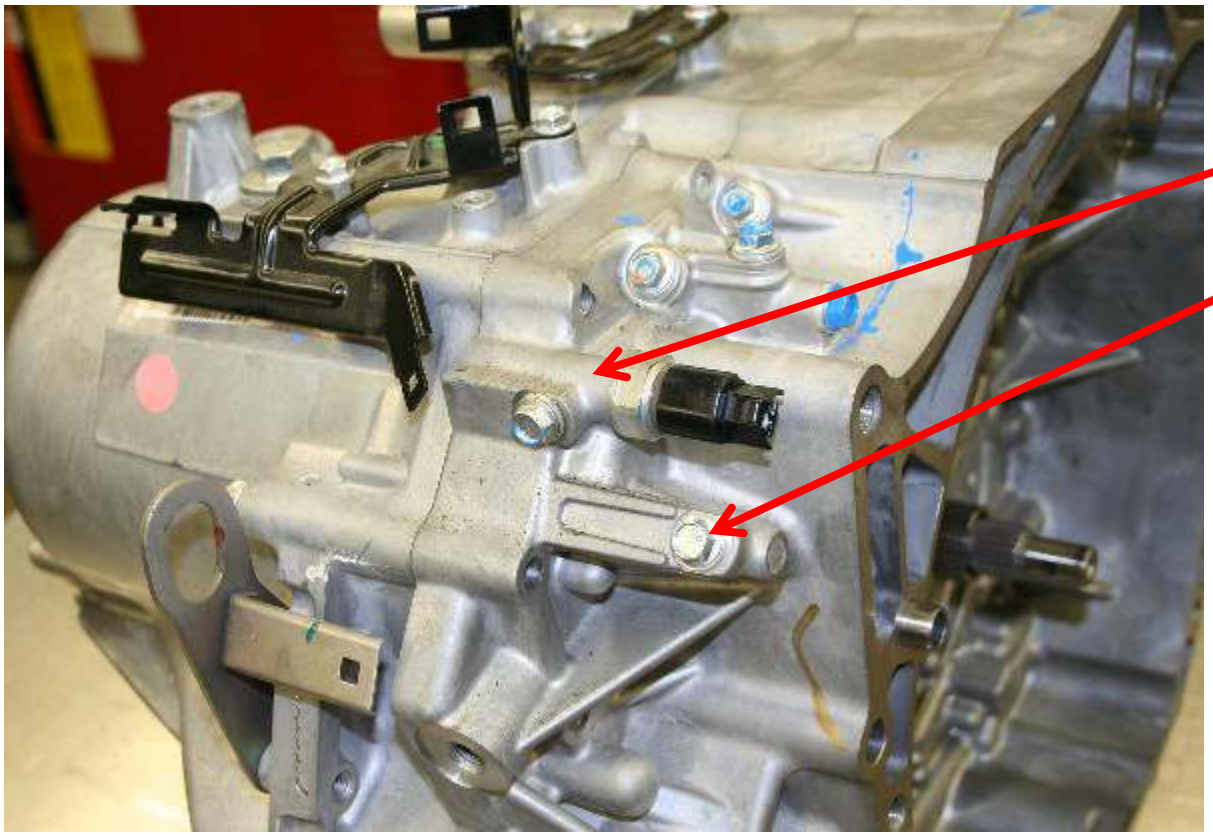
- CPC C
- CPC A
- CPC B
- 4th Pressure Switch



Acura RDX

- Pressure Taps
  - 1st
  - LH

Acura RDX



- Pressure Taps
  - 2nd
  - LH
- Pressure switch
  - 2nd

Acura RDX

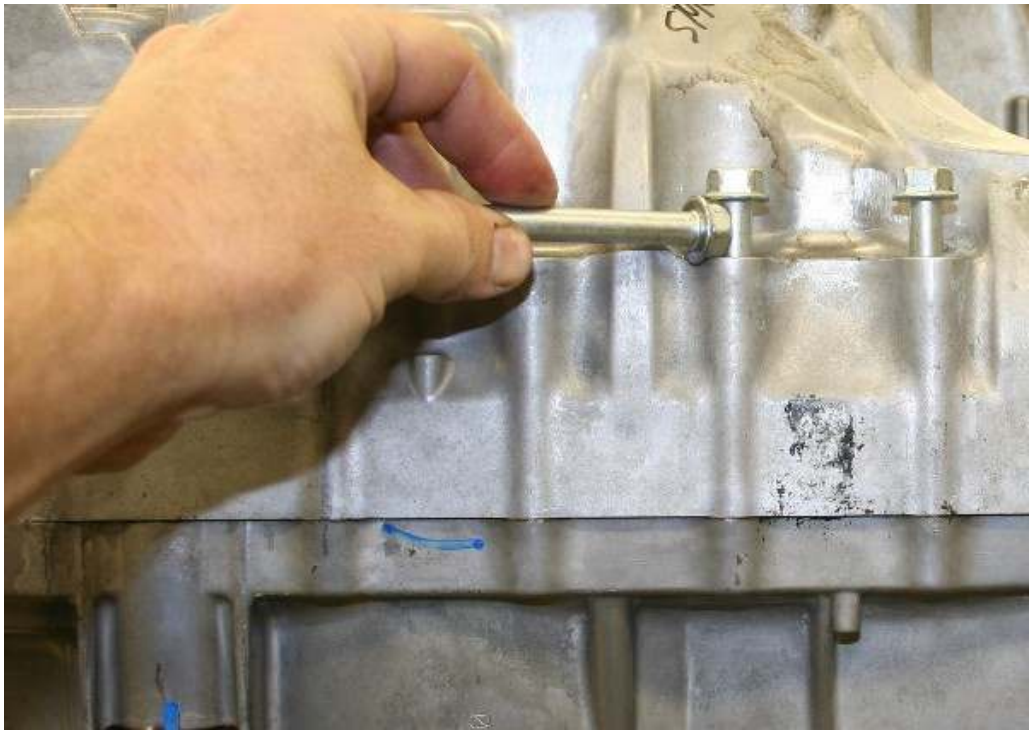
Still have plenty of feed tubes. Check the packet for sizes and locations

Acura RDX

- OSS
  - Bracket to pull sensor away from gear
  - Hall effect

Acura RDX

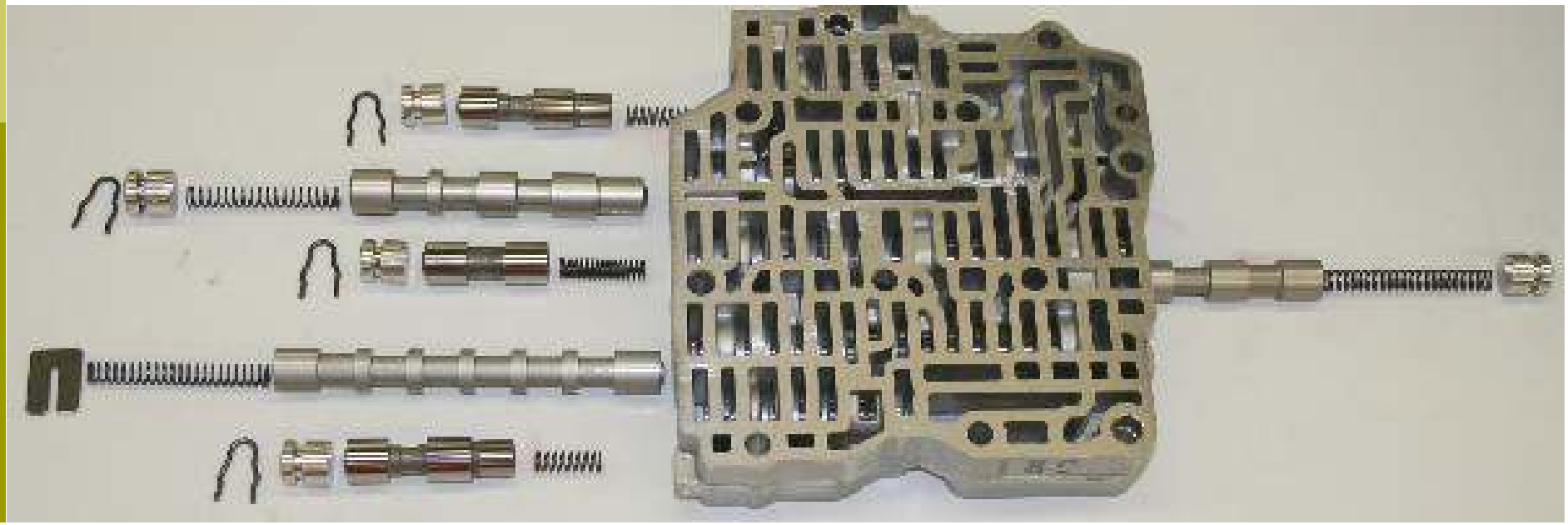
- Bolt ID in packet
  - Generally speaking, most bolts stick out of the case about the same distance as the thickness as the bolt head



Acura RDX

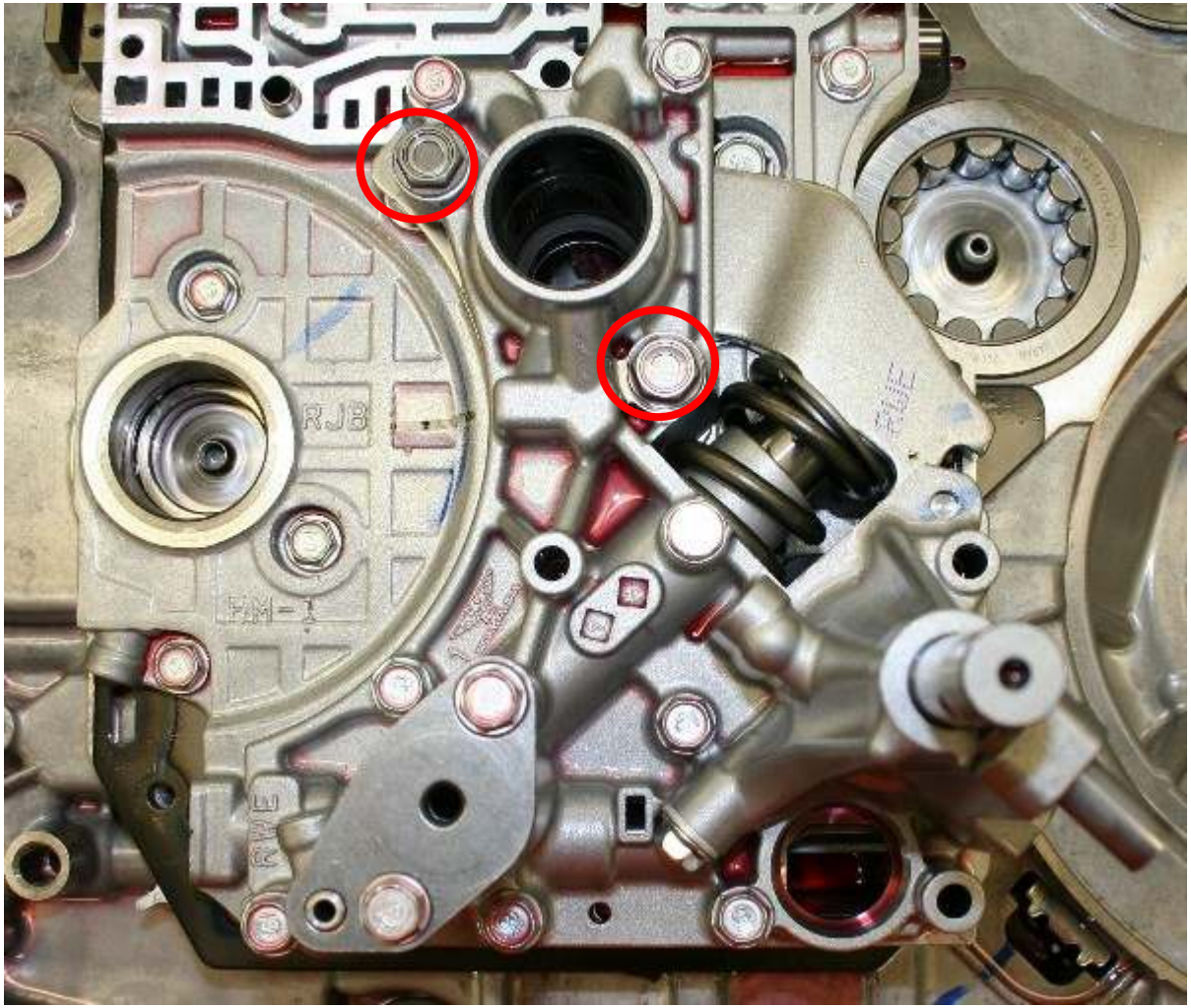
- CPC C
- Shift valve D
- Rev CPC
- Shift valve C
- CPC valve B

Like most Honda/Acura units, the CPC valves are steel



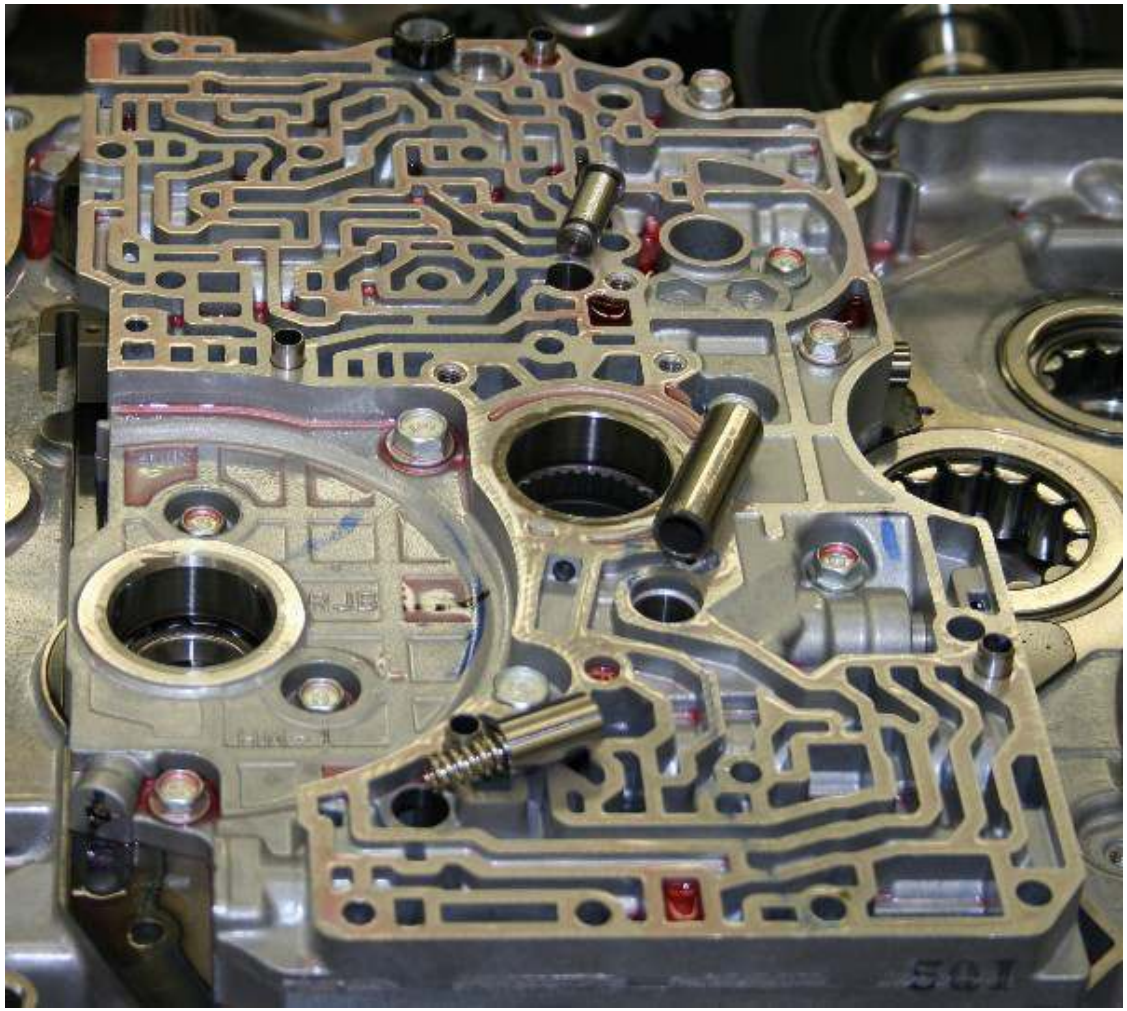
Acura RDX

- Check-valve bolts
  - Air should vent through with compressed air when installed



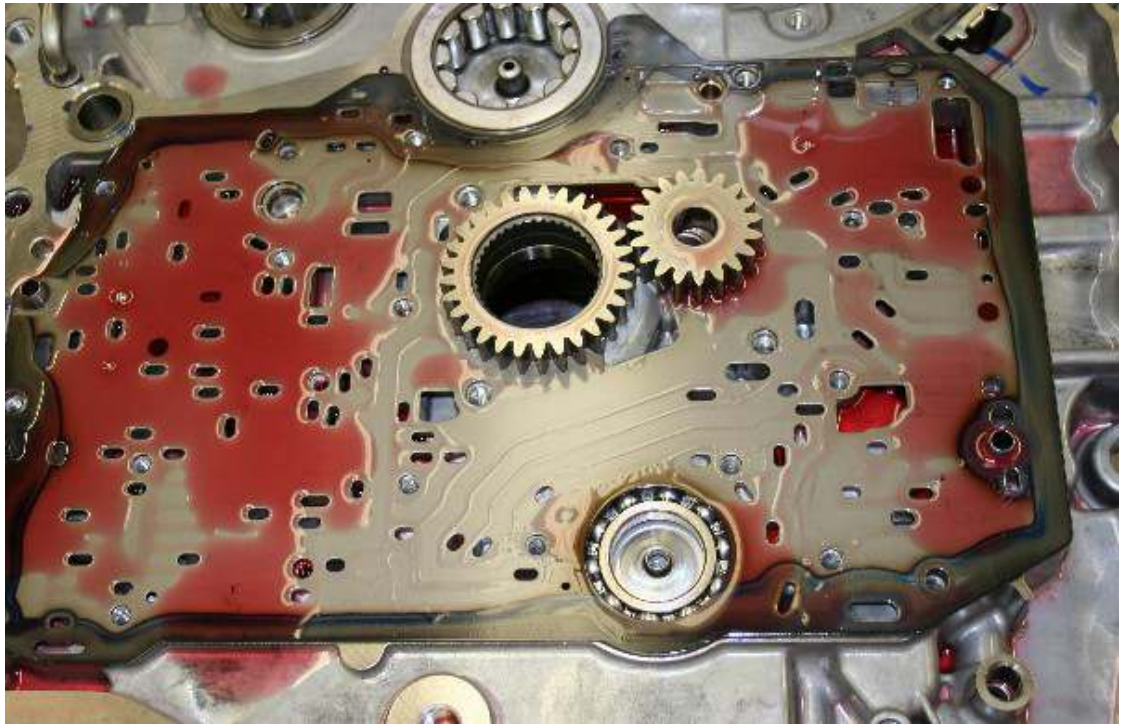
Acura RDX

- Filter (cup down)
- Lubrication check valve
- Pump shaft
- Torque converter check valve



Acura RDX

- The large gear is installed with the shoulder facing in to the transmission housing and the small gear has the smooth side toward the Main VB.



Acura RDX

- 4th Gear is pressed onto the mainshaft with the bearing installed. You will damage the bearing if you remove this gear.

Acura RDX

- Fluid (air check) passage for:
  - 5th/Rev clutch
  - 4th clutch

Acura RDX

- Check for arrows on the shaft nuts
- Indicate reverse trhead

Acura RDX

You can still get the reverse sleeve installed wrong if you're not paying attention

Acura RDX

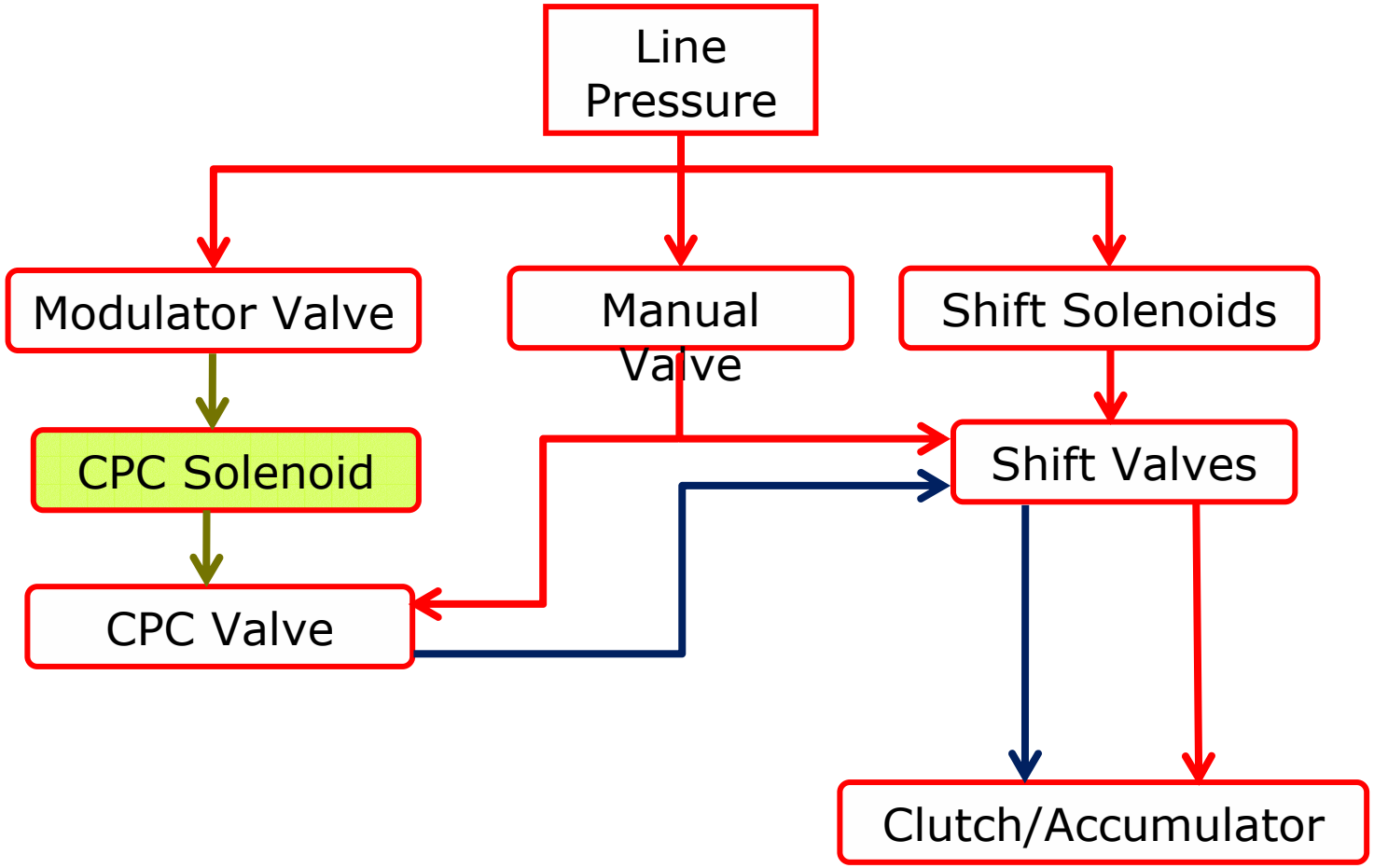
- The outer race of the sprag should freewheel in the clockwise direction when positioned as shown

Acura RDX

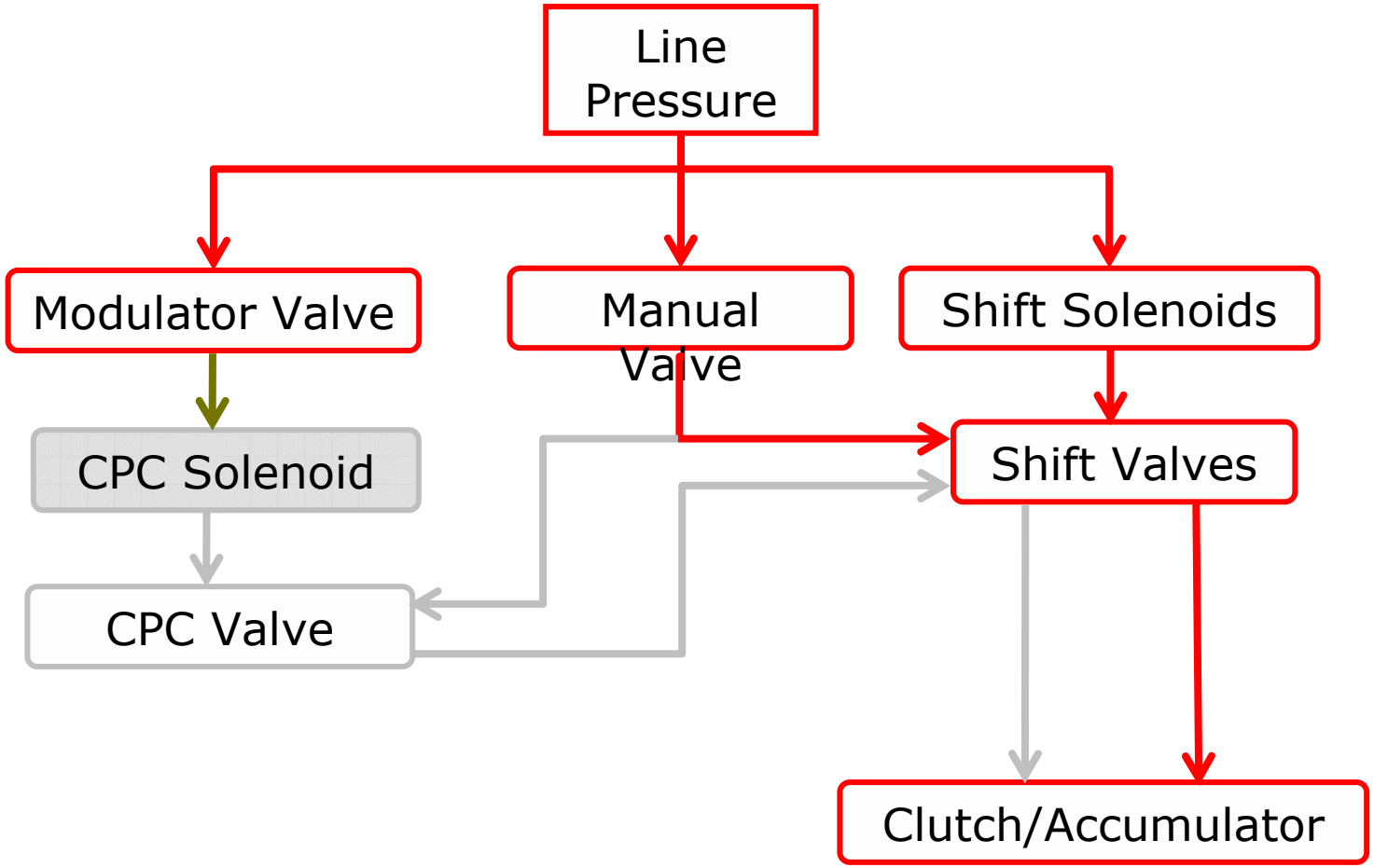
- CPC pressure controls fluid to applying and releasing clutches during shift transition
- Line pressure is directed to the clutch while the transmission is in-gear

Shift solenoid valve / Clutch		In gear	1st	1st - 2nd	2nd	2nd - 3rd	3rd	3rd - 4th	4th	4th - 5th	5th
	A	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF
	B	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON
	C	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON
	D	OFF	OFF	OFF/ ON	OFF/ ON	OFF/ ON	OFF/ ON	OFF/ ON	OFF/ ON	OFF/ ON	OFF/ ON
1st Clutch		CPC C	LINE	LINE	LINE	LINE	LINE	LINE	LINE	LINE	LINE
2nd Clutch		CPC A		CPC A	LINE	CPC A					
3rd Clutch				CPC B		CPC B	LINE	CPC B			
4th Clutch								CPC A	LINE	CPC A	
5th Clutch										CPC B	LINE

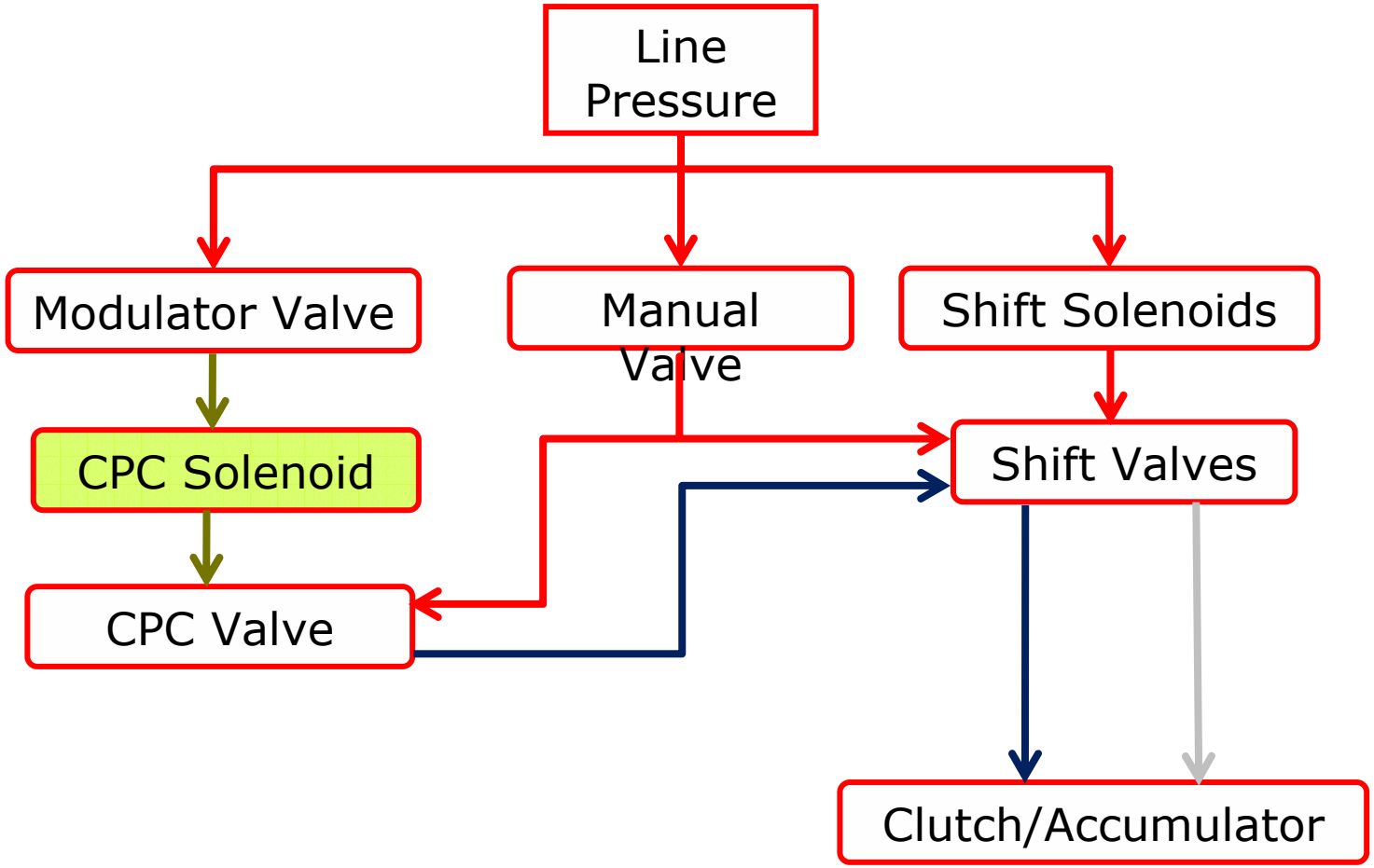
Hydraulic Flow Chart



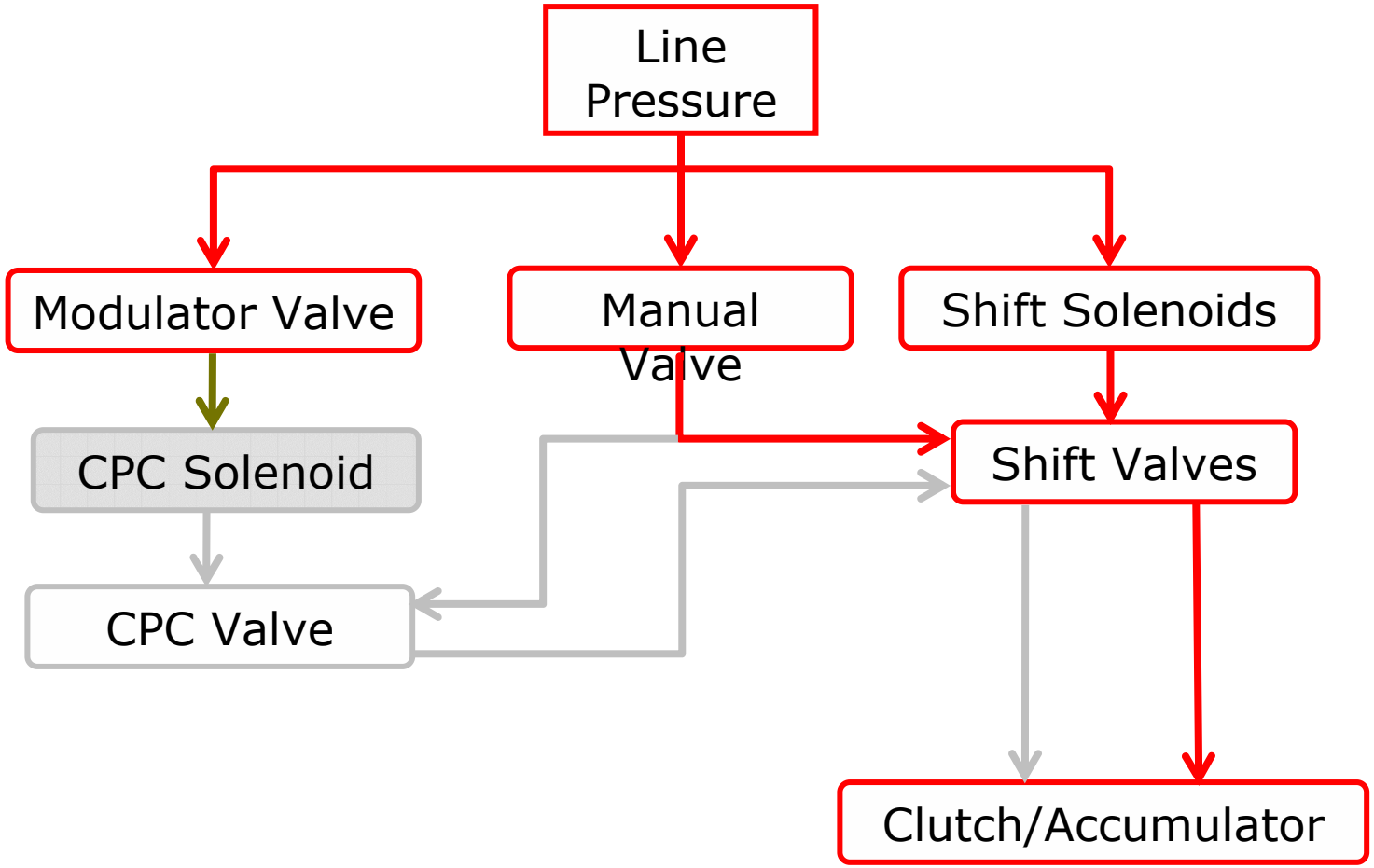
Hydraulic Flow: Line in Control



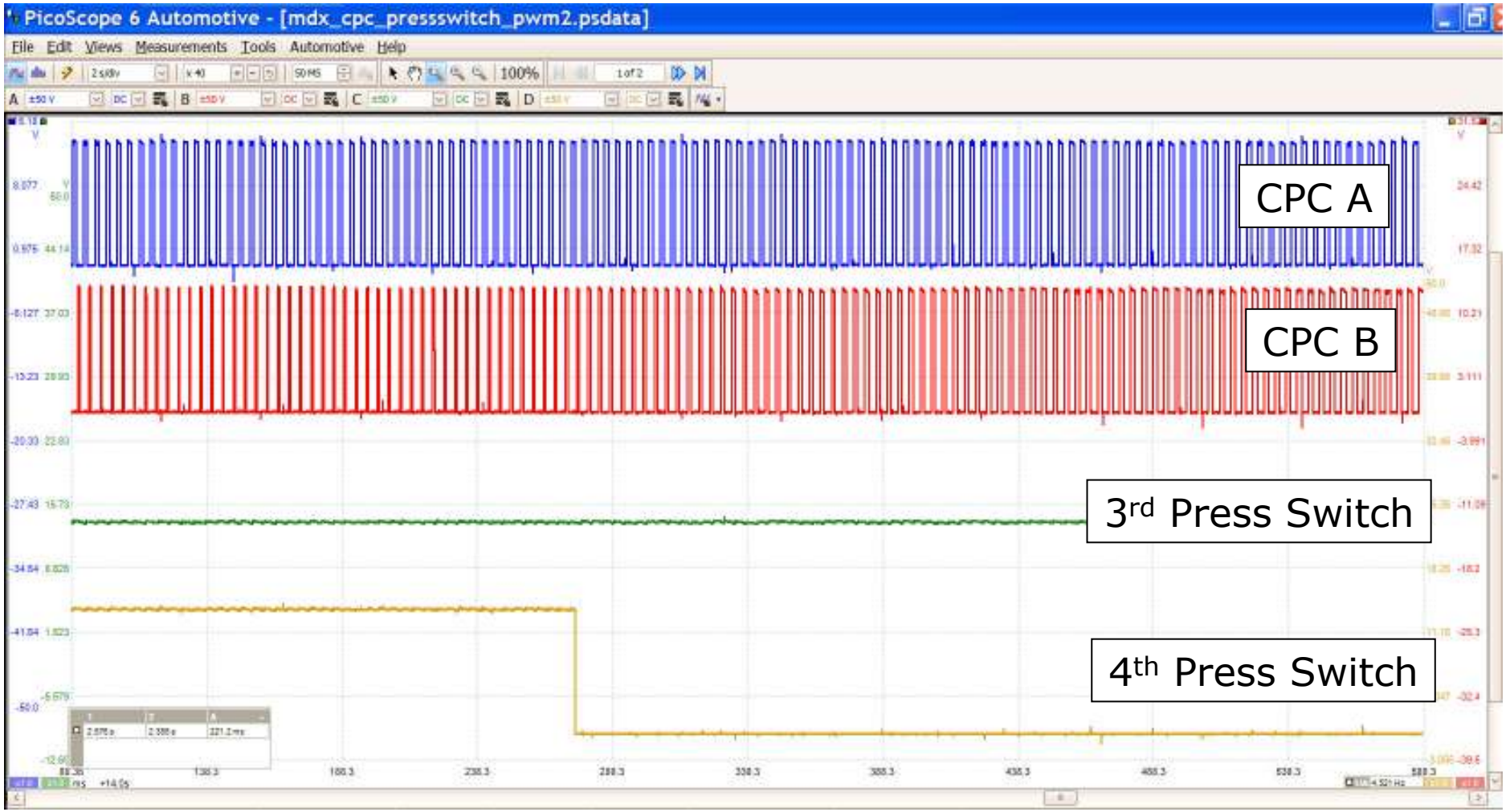
Hydraulic Flow: CPC in Control



Hydraulic Flow: Line in Control



Acura MDX Example

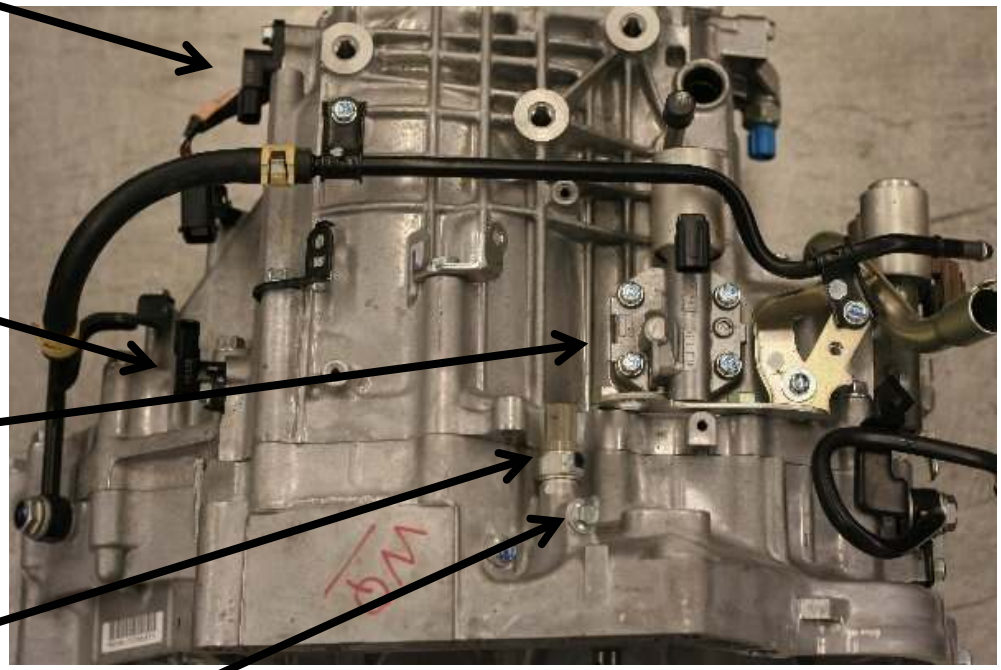


Honda CRV AWD

- 166 HP
- 161 lbs ft torque
- 2.4L engine
- 2WD or AWD

Honda CRV AWD

- Mainshaft (input) Speed Sensor
- Output (countergear) Speed Sensor
- CPC A
- Pressure Switch
- 2nd Pressure Tap

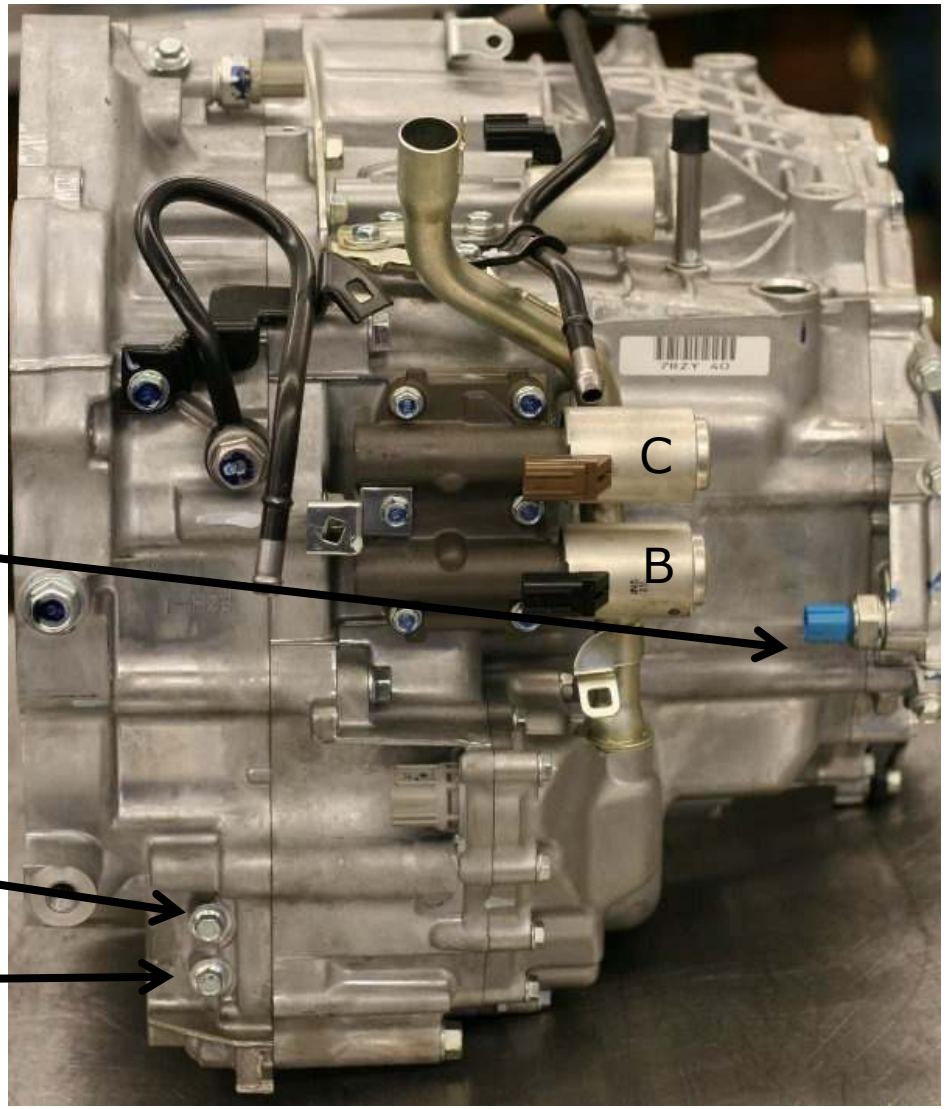


Honda CRV AWD

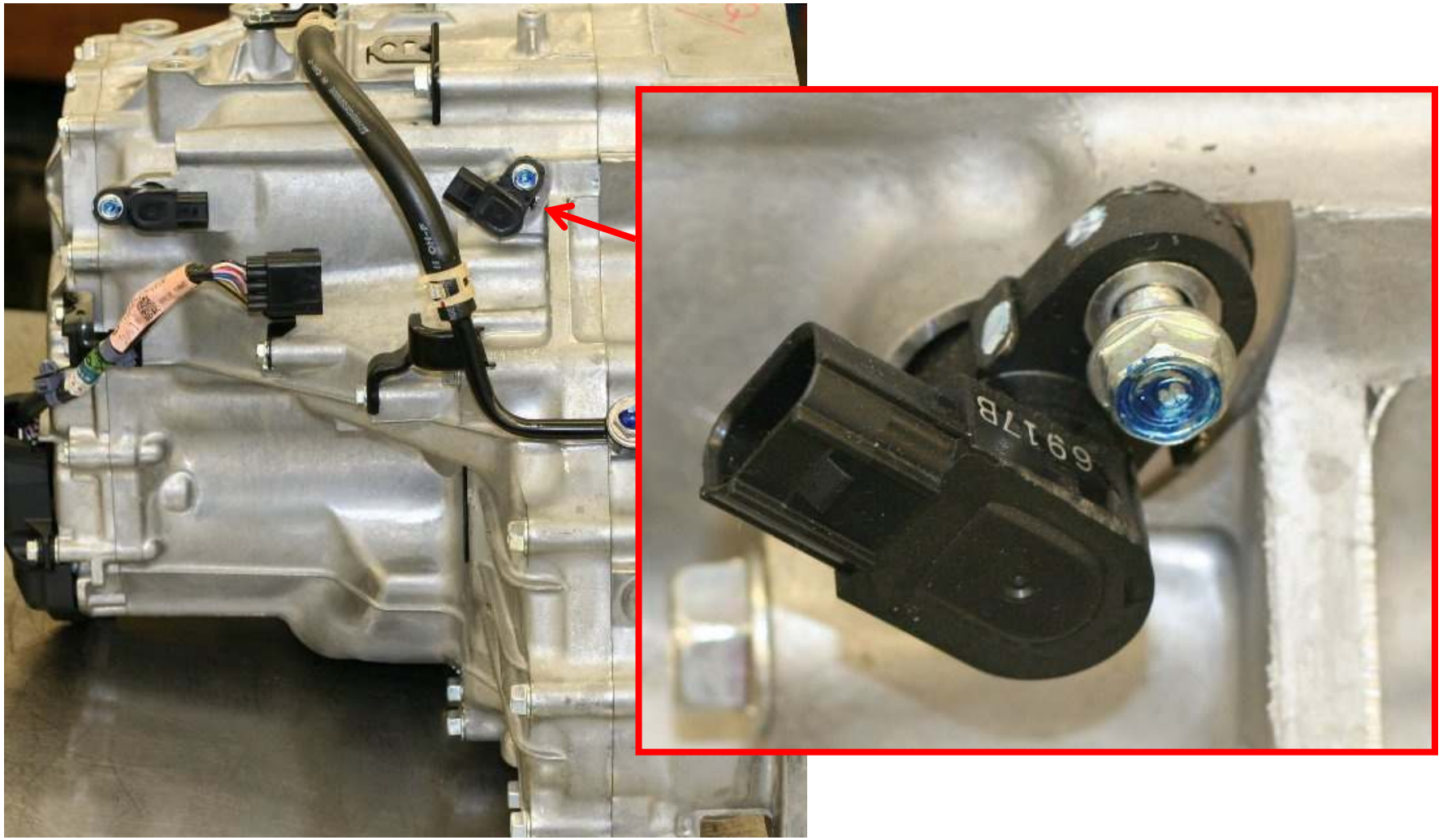
- Pressure Taps
  - 1st
  - 3rd
  - 5th

Honda CRV AWD

- CPC B and C
- 3rd Pressure Switch
- Pressure Taps
  - 4th
  - PL



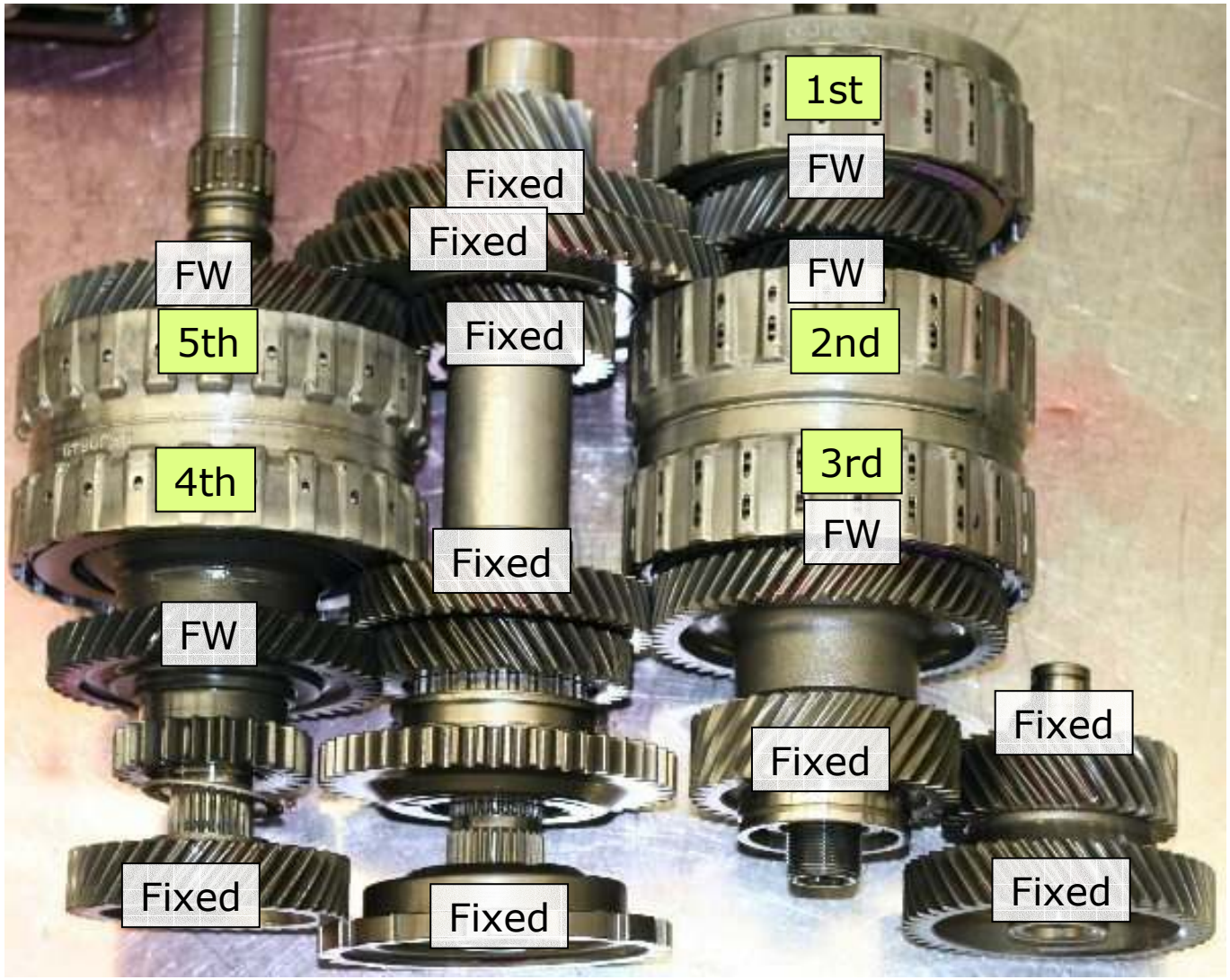
Honda CRV AWD



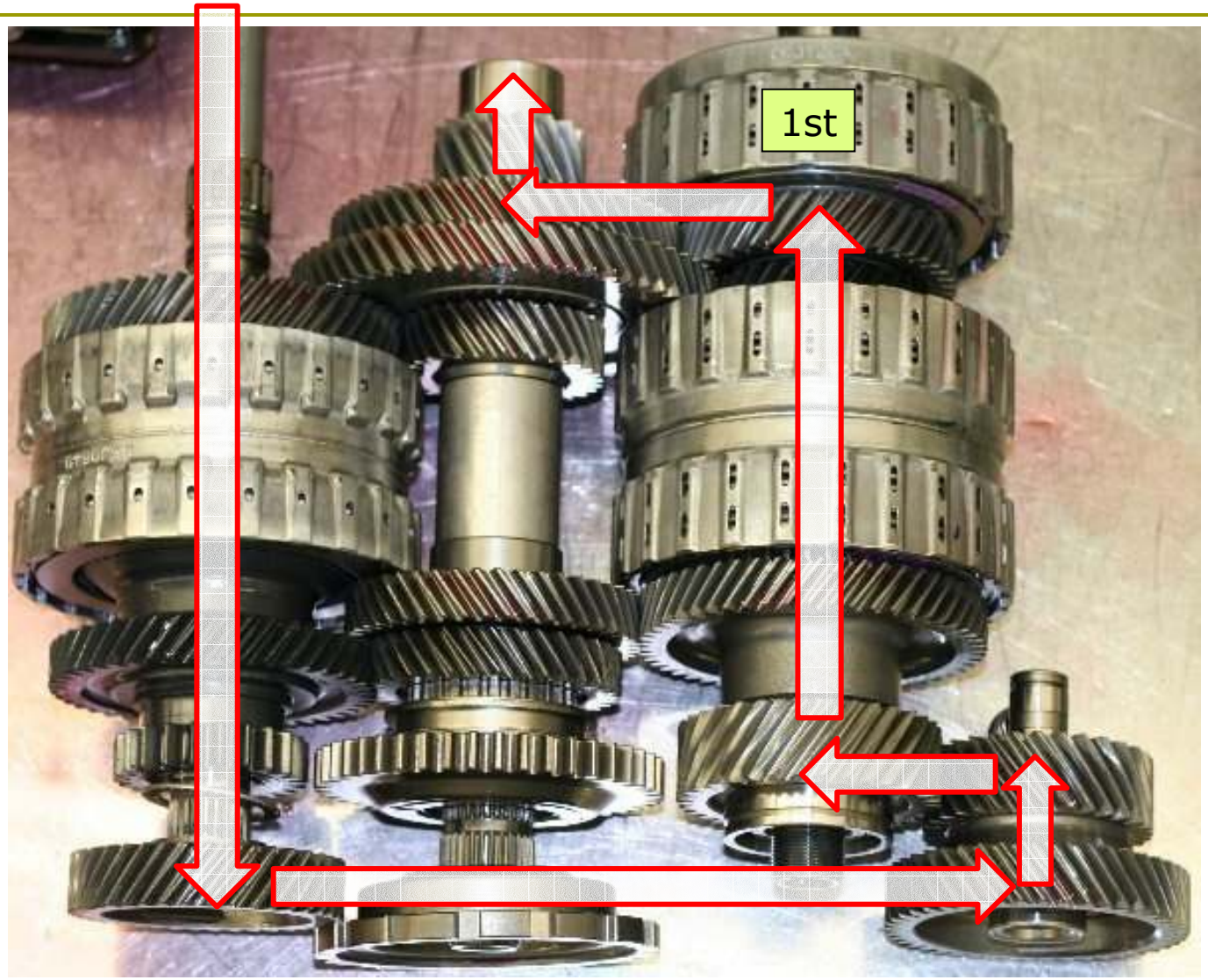
Honda CRV AWD

- Gearset
  - Mainshaft
  - Transfer Gear
  - Counter Shaft
  - Secondary Shaft

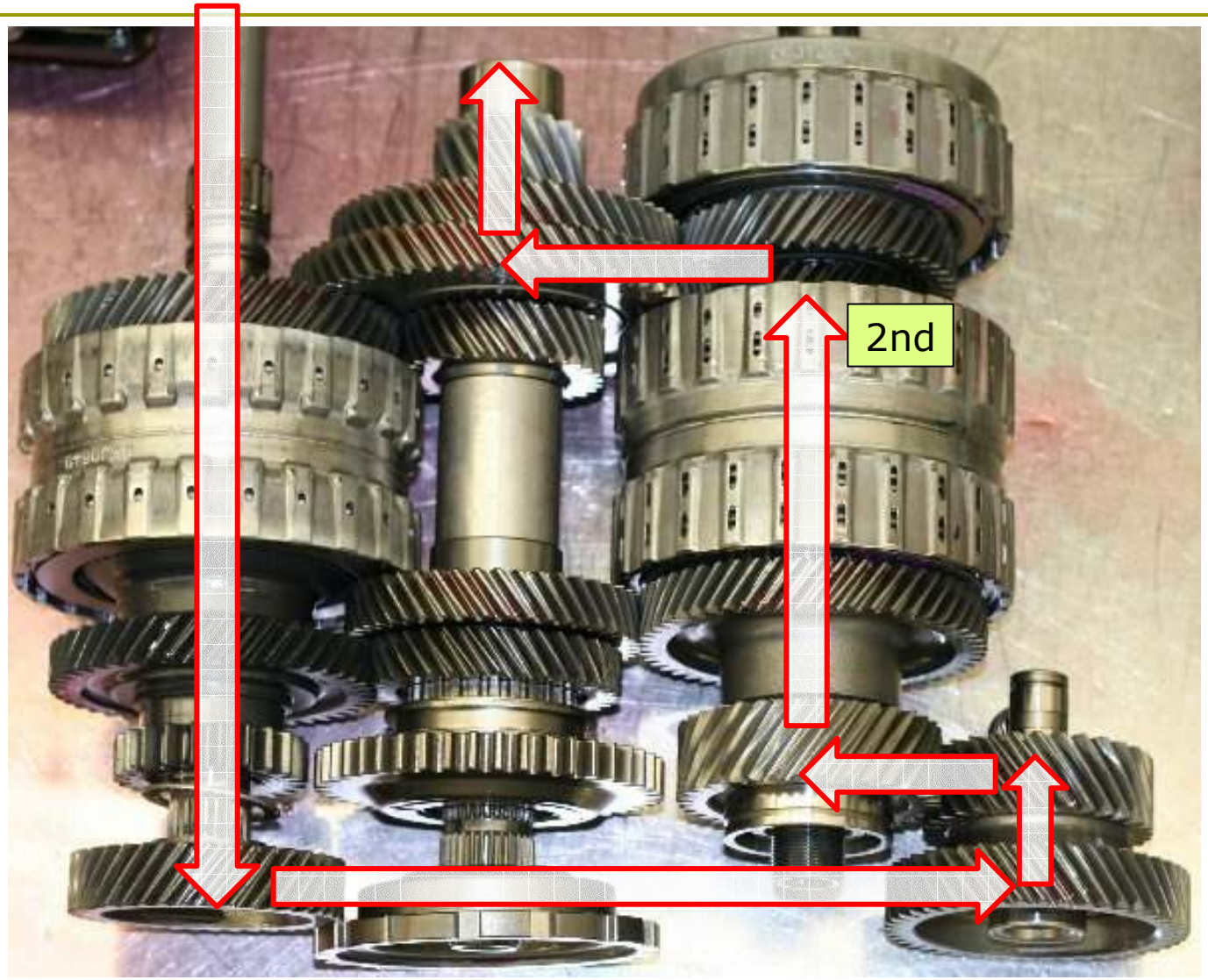
Honda CRV AWD



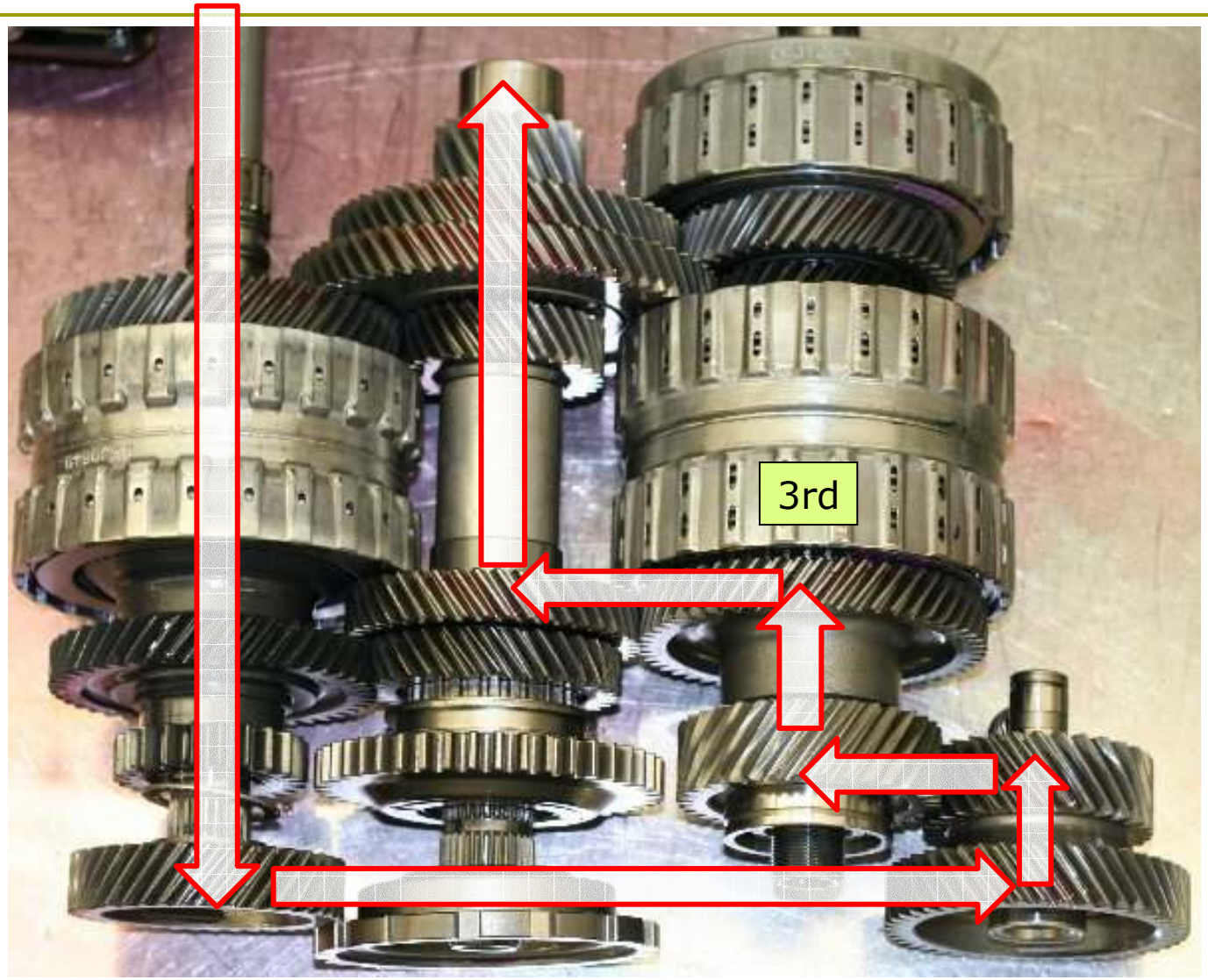
Honda CRV AWD: First Gear



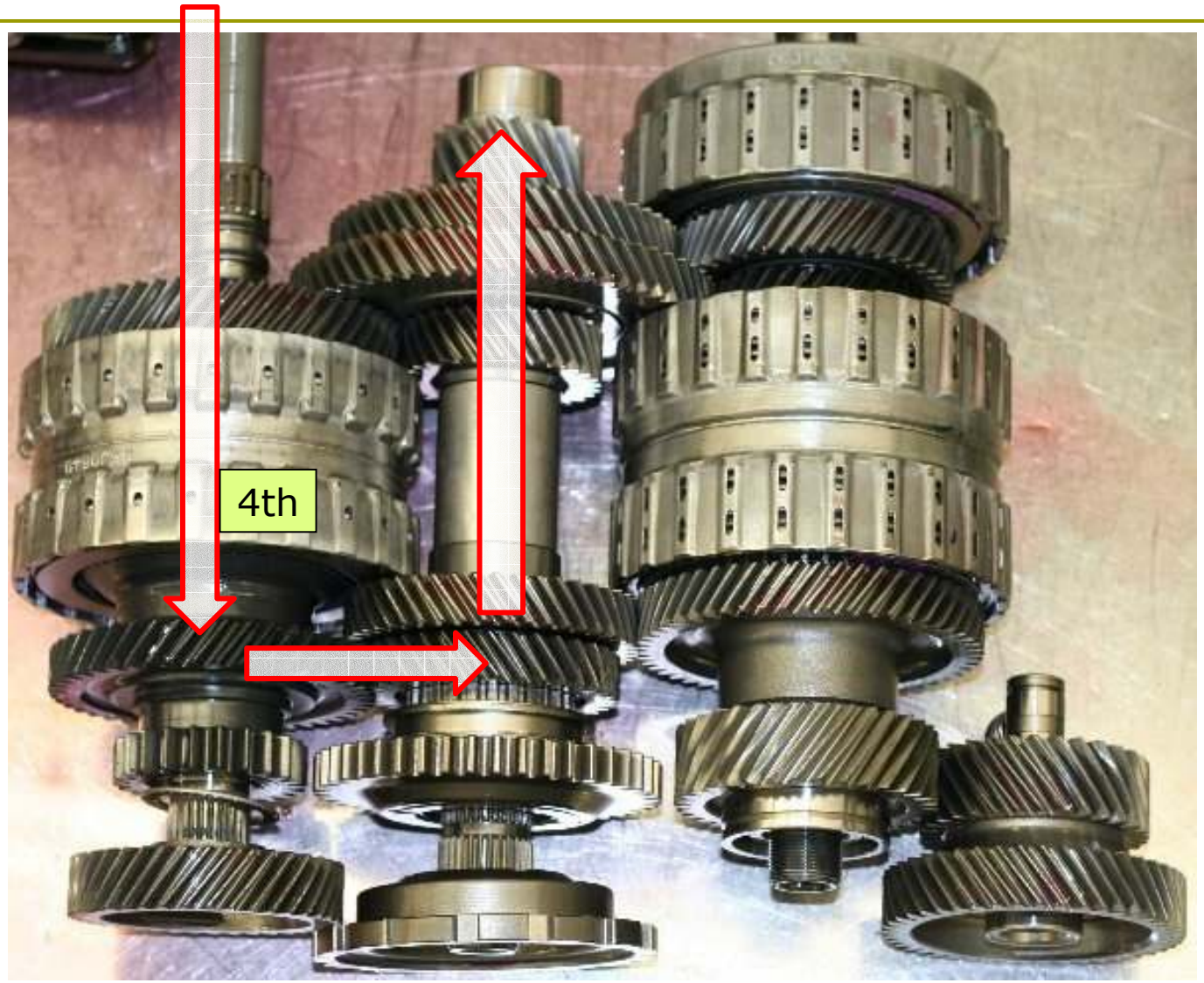
Honda CRV AWD: Second Gear



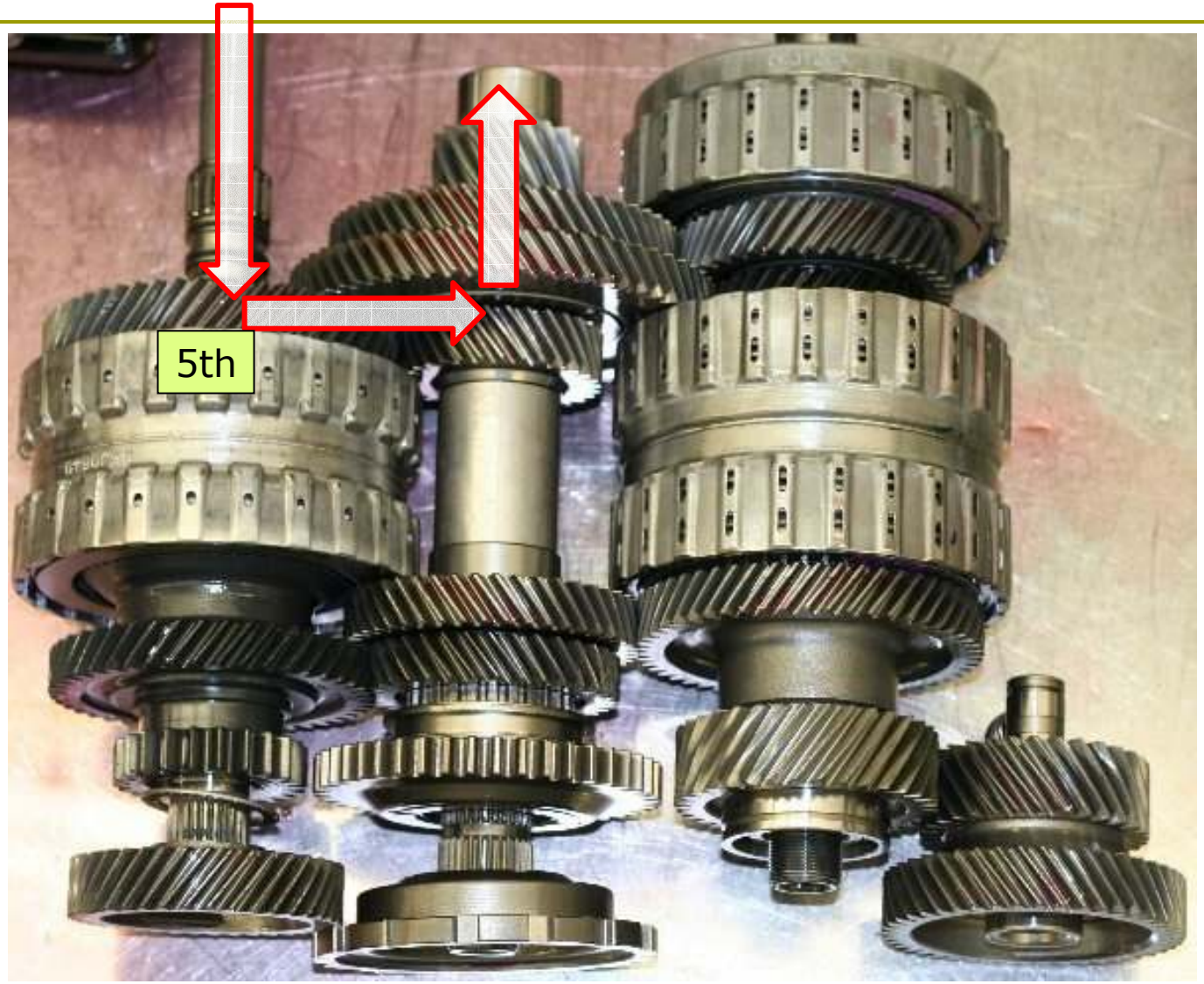
Honda CRV AWD: Third Gear



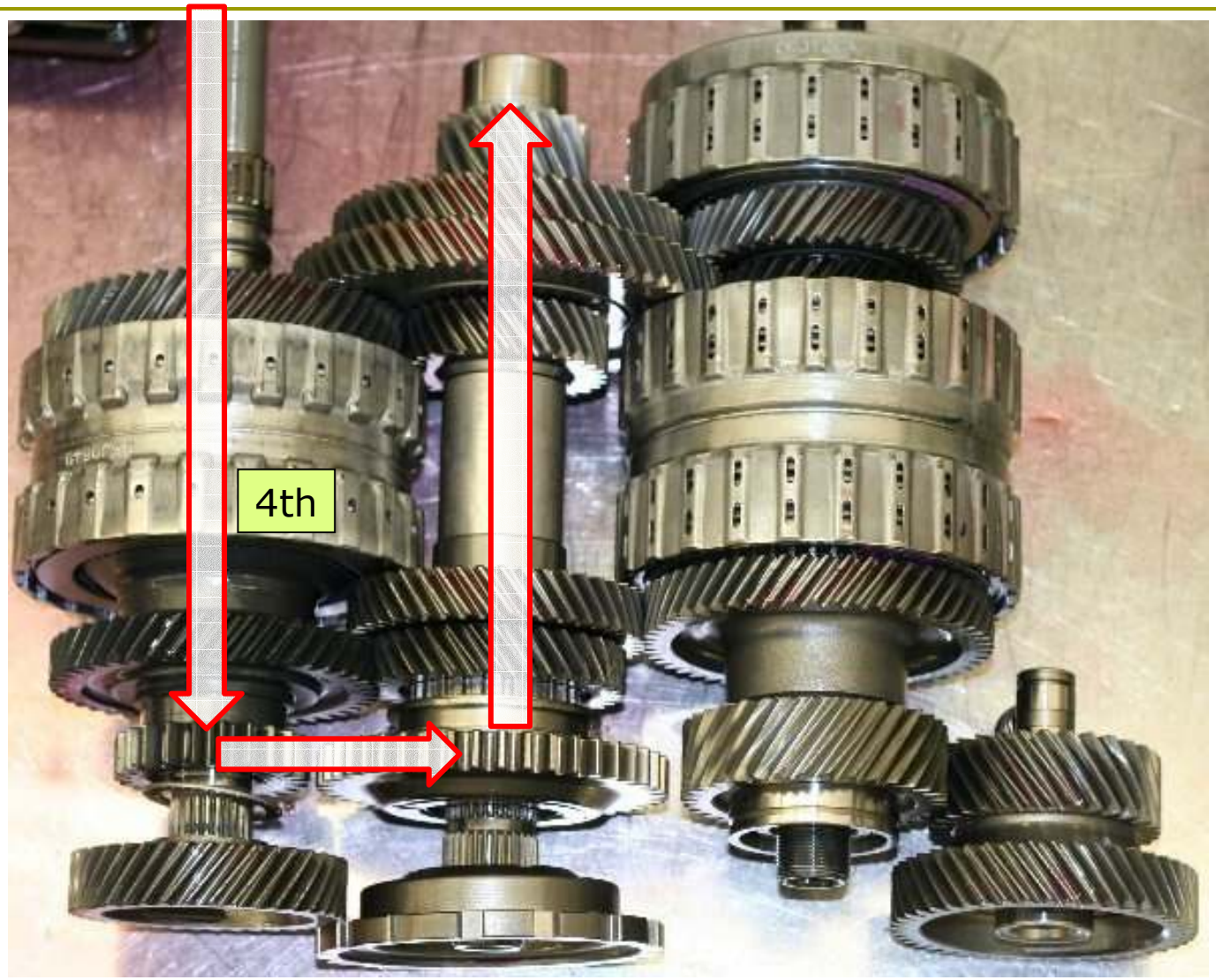
Honda CRV AWD: Fourth Gear



Honda CRV AWD: Fifth Gear

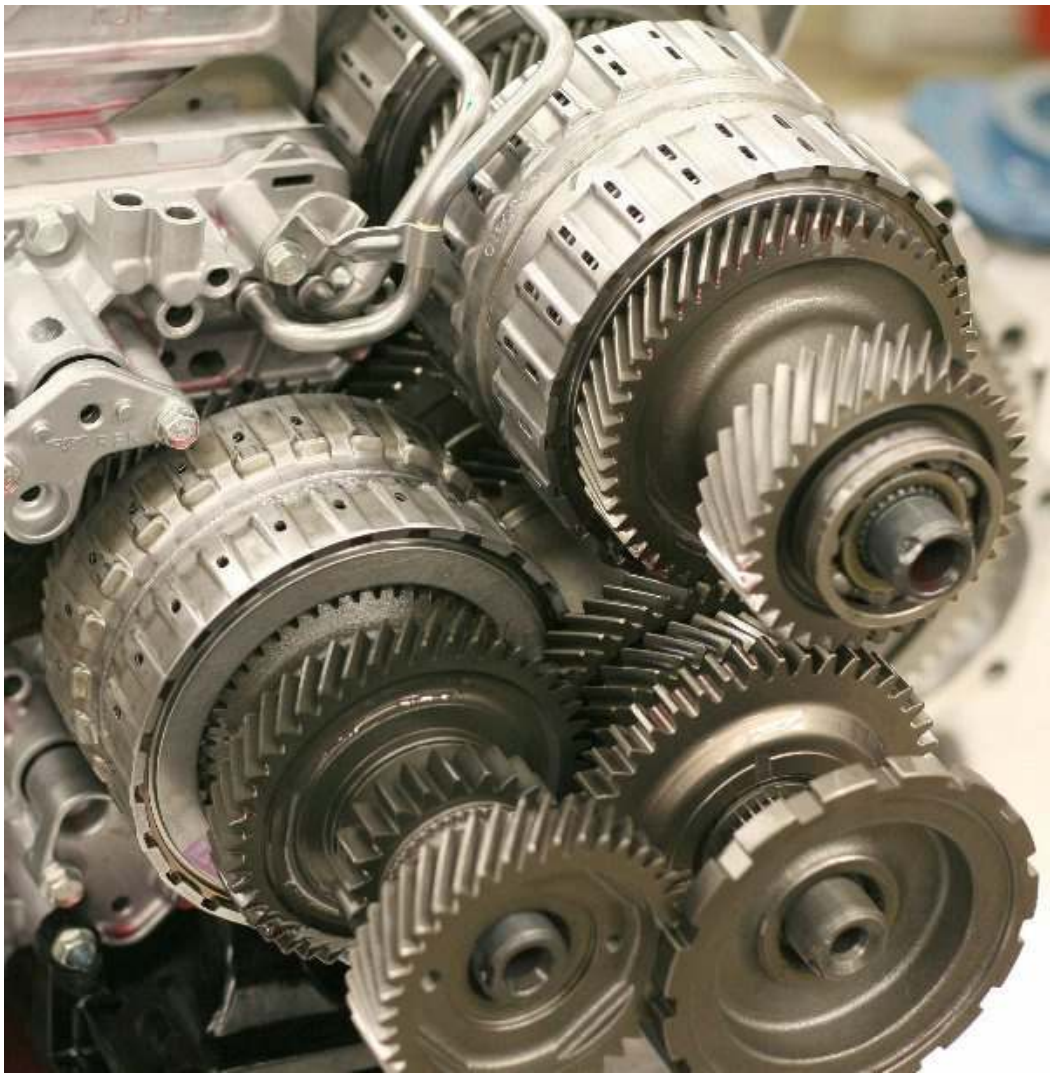


Honda CRV AWD: Rev Gear



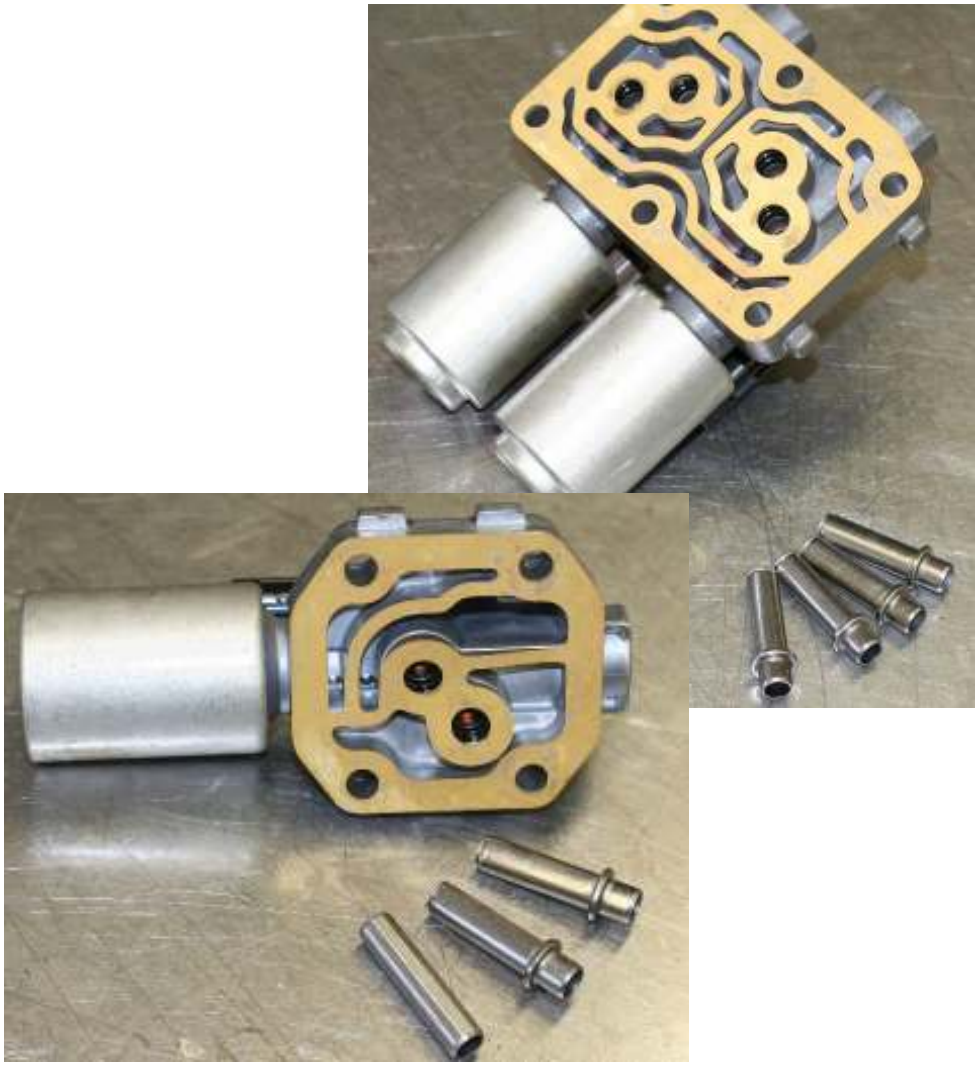
Honda CRV AWD

- Not near as many feed tubes to worry about
- Feed tubes are bolted to the VB



Honda CRV AWD

- CPC valves
  - CPC A has a vent tube
  - All other feed tubes are the same size and have a lip that pushes the o-ring against the CPC valve body

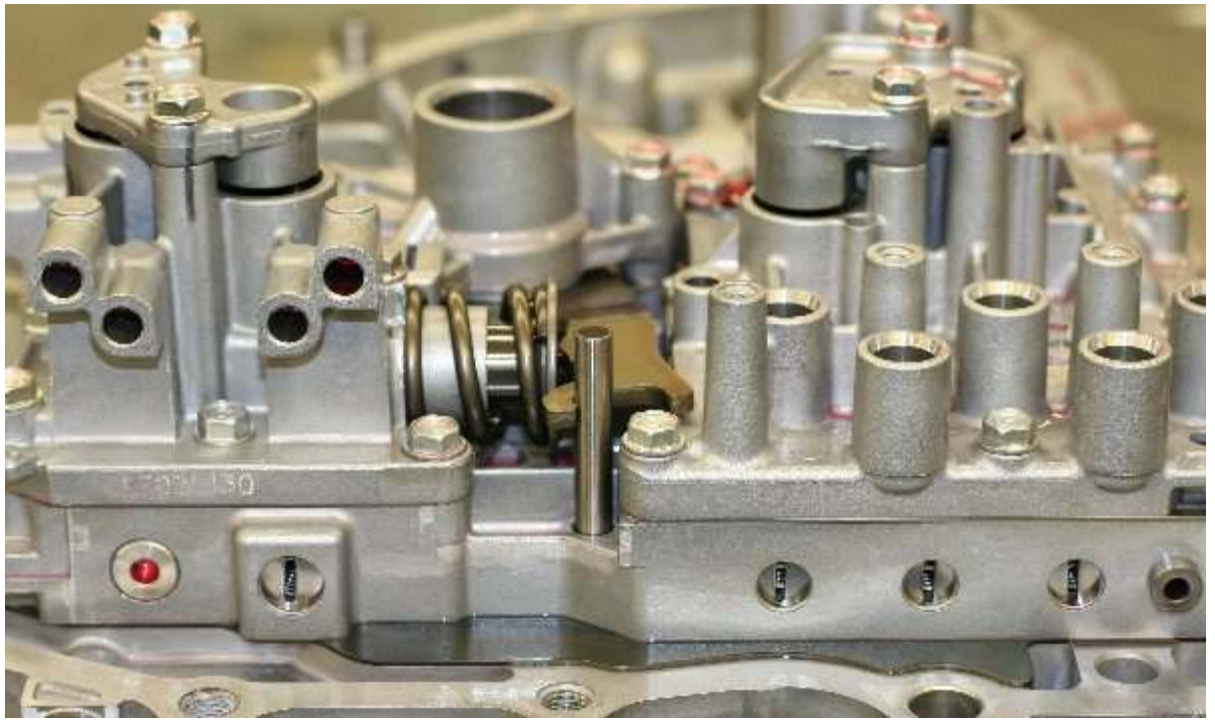


Honda CRV AWD

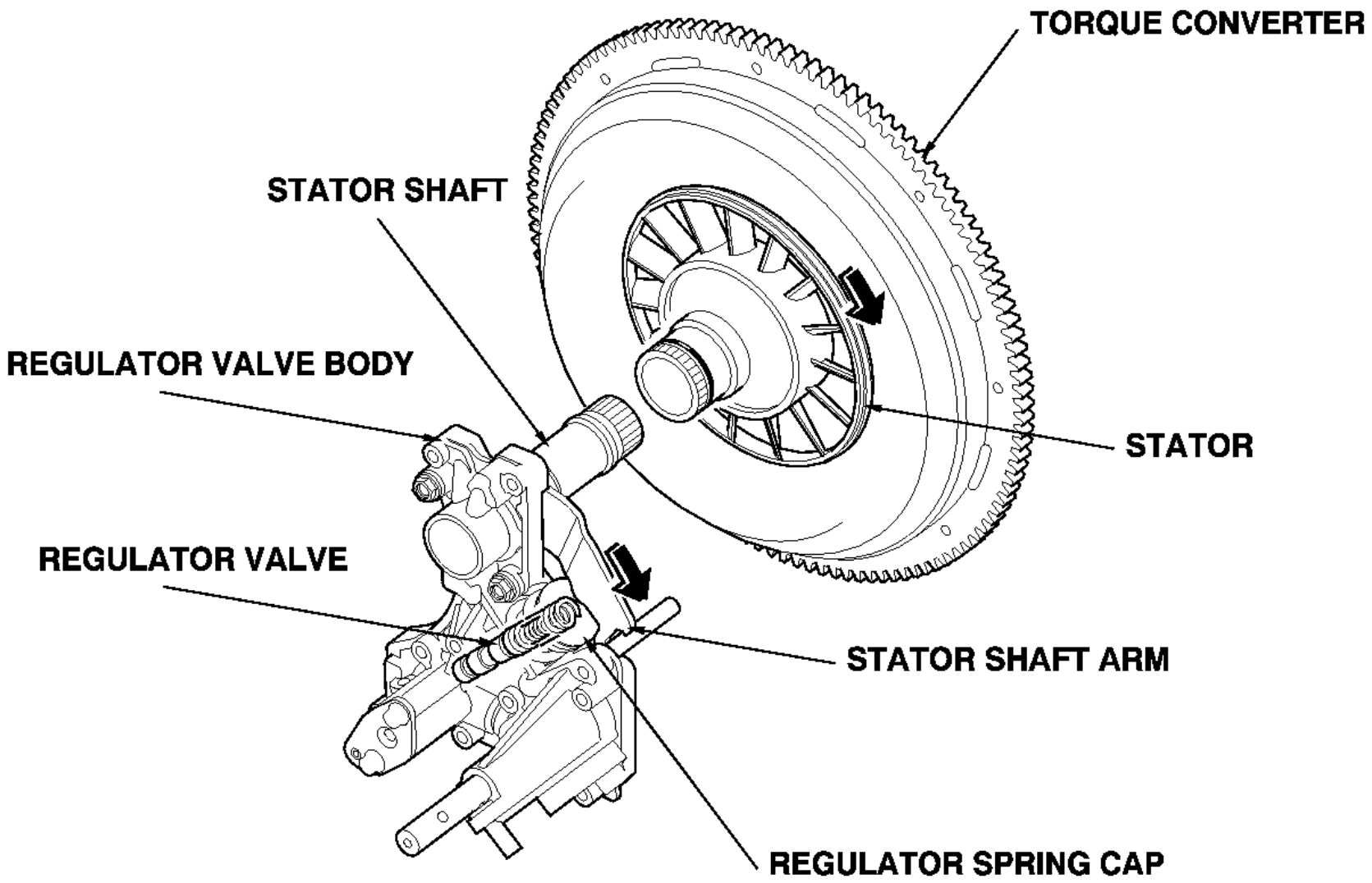
This lube tube surrounds the transfer gear

Honda CRV AWD

- Pressure regulator works off of torque converter stator reaction
  - Directly measures engine torque input

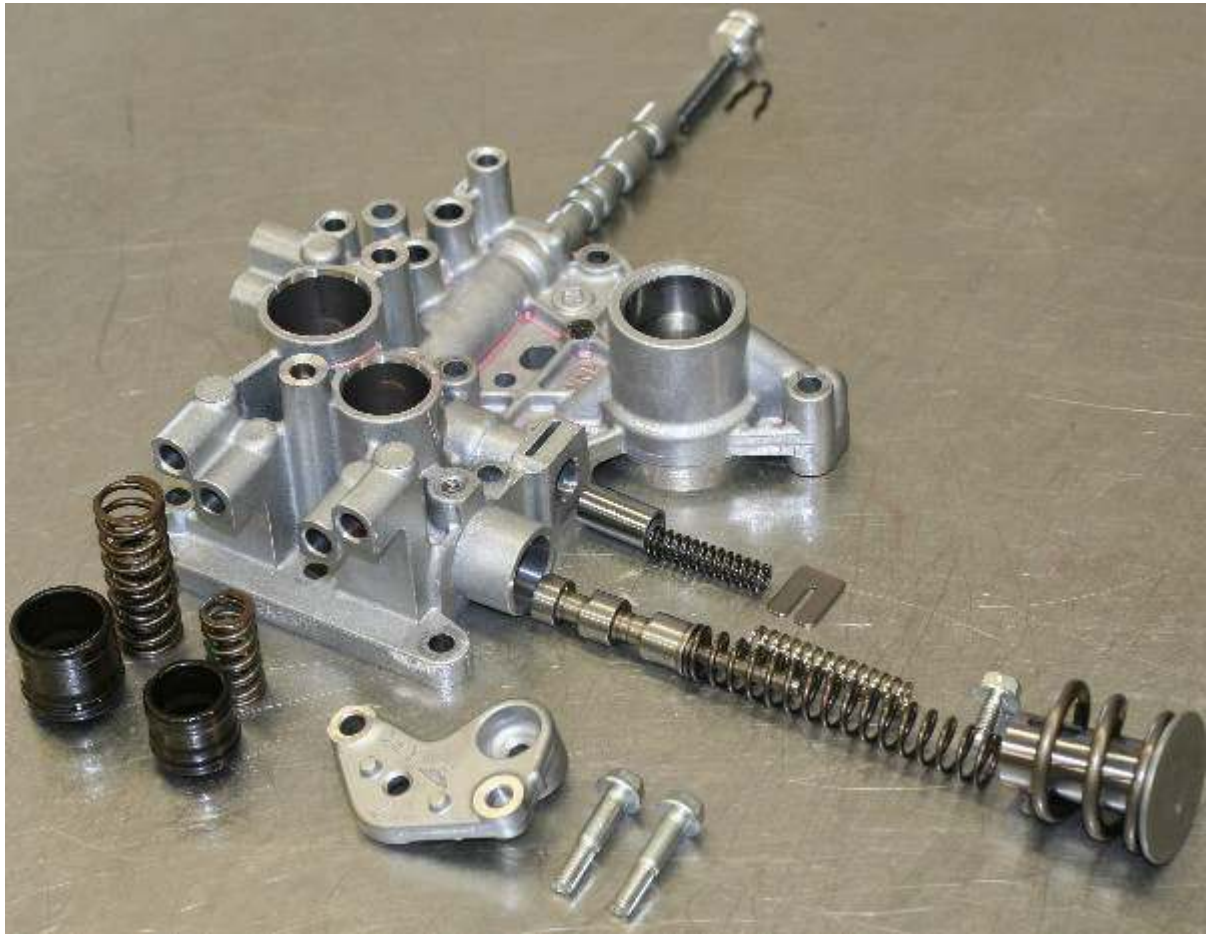


Honda CRV AWD



Honda CRV AWD

- Unique Bolts
  - Regulator
  - Accumulator covers



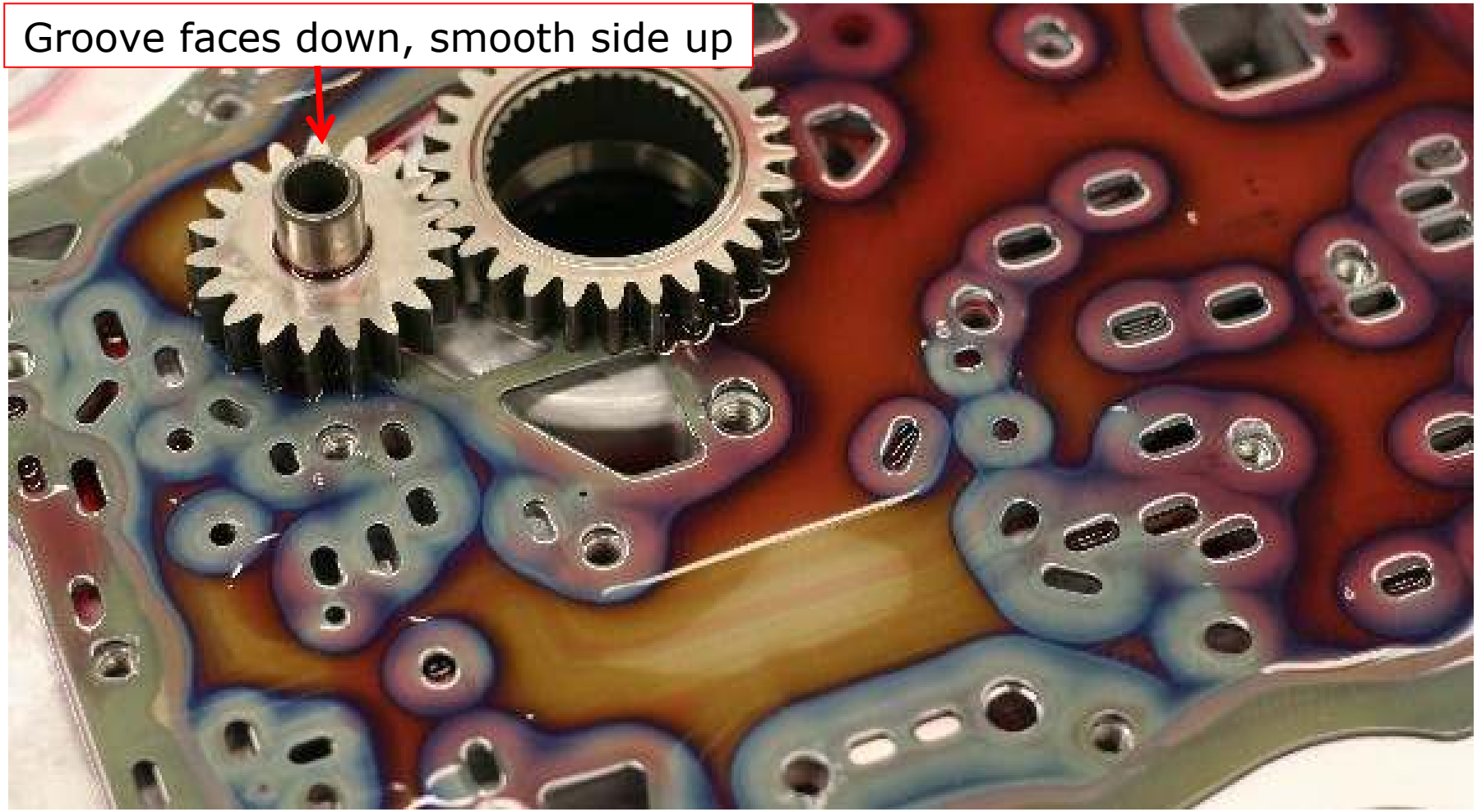
Honda CRV AWD

- Sleeve has large shoulder facing reverse idler gear

Honda CRV AWD

- The 5th gear on the mainshaft has a lip/ledge on the bearing that must seat in the pocket in the gear

Honda CRV AWD



Pressure switches

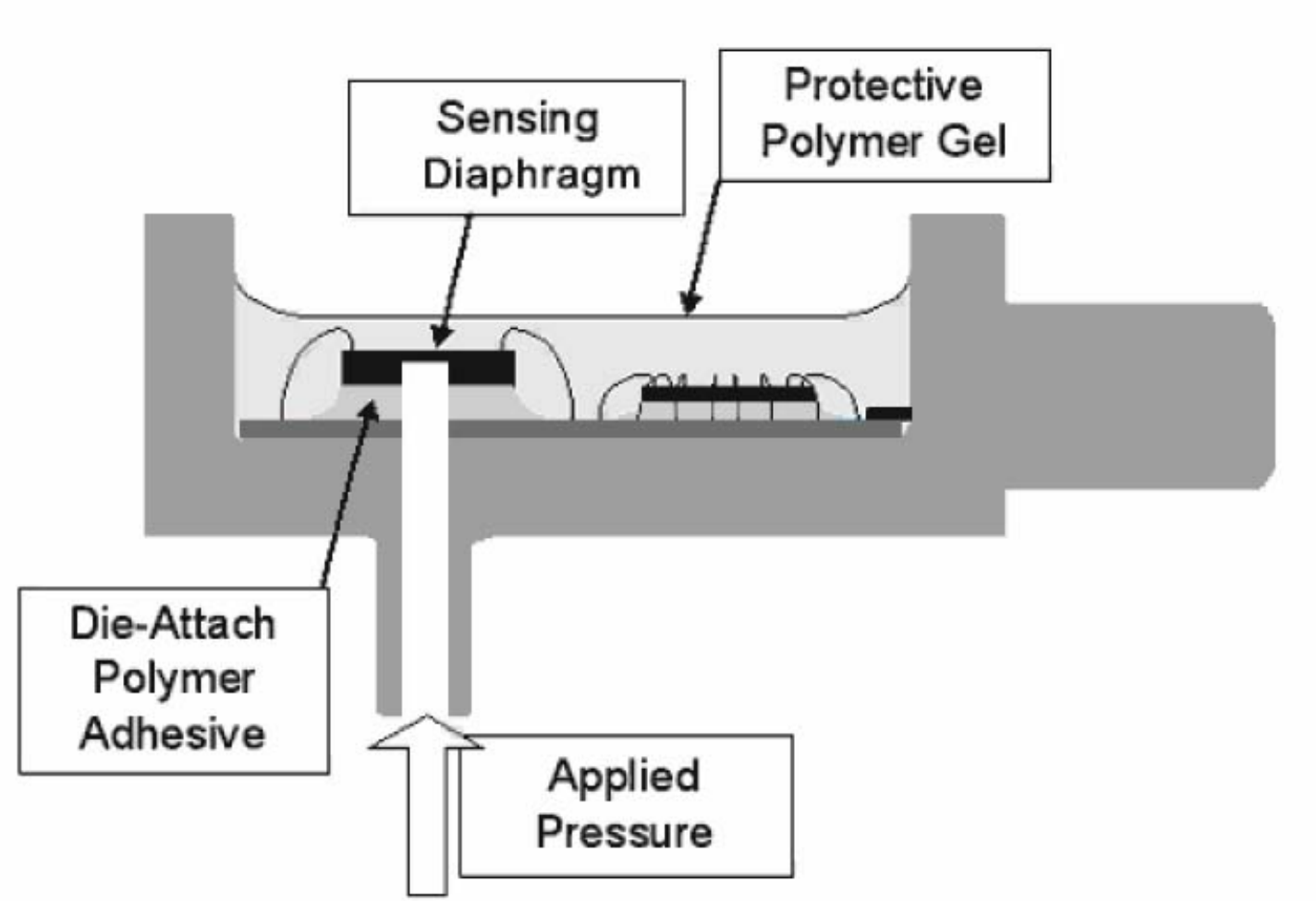
Fluke PV350

- Compatible with all Fluke and most popular DMMs
- Digital pressure and vacuum measurements in a single module
- Transducer sealed in 316 stainless steel compatible with variety of liquids and gases
- Measures vacuum to 76 cm Hg
- Displays results in English (psig of Hg) or metric (kPa or cm Hg) units
- Measures pressure to 3447 kPa (500 psig)
- One year warranty

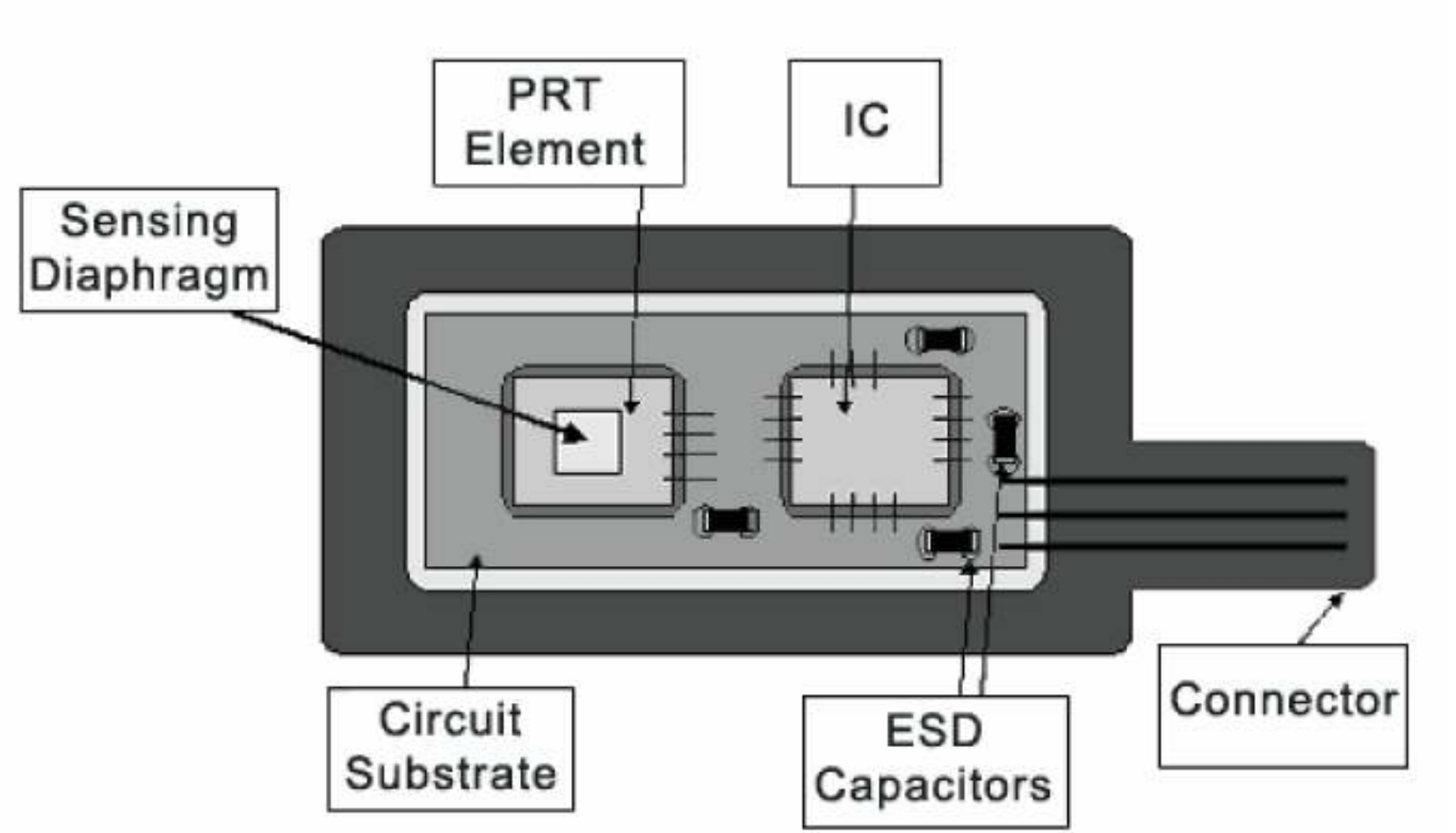
Other automotive applications for pressure sensors/transducers

- Manifold pressure (MAP)
- Fuel tank pressure
- Tire pressure monitoring
- Occupant Classification – weight sensing

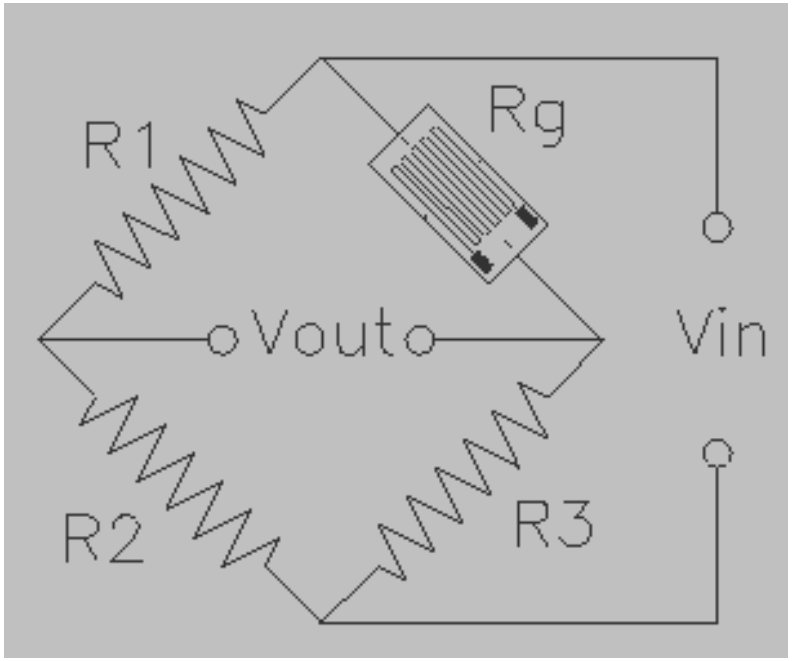
How Transducers Work

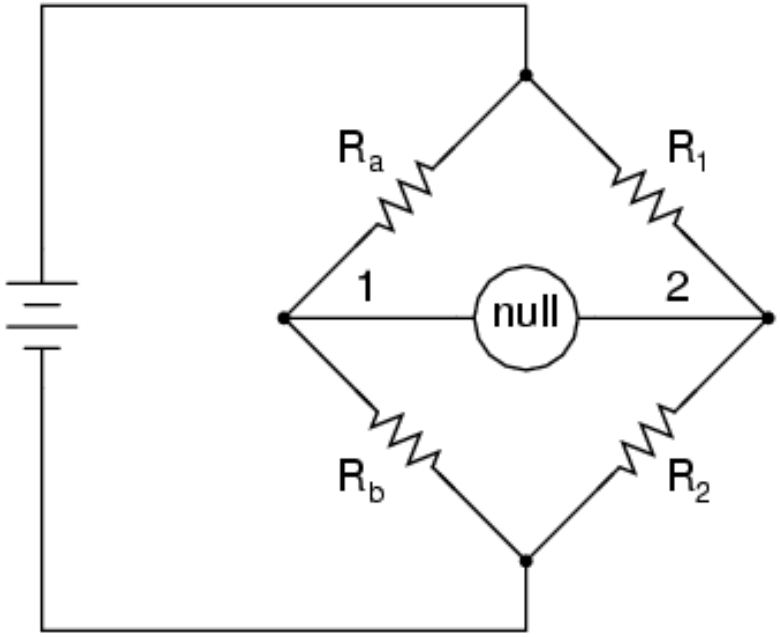


Piezo-resistive transducer

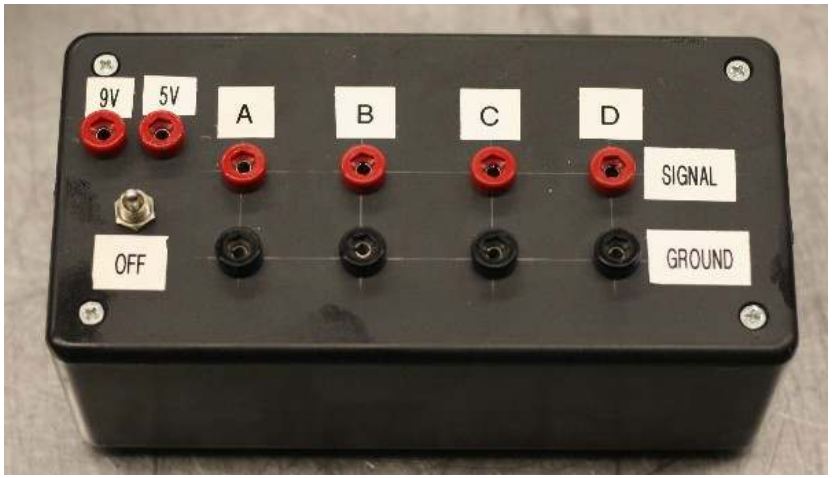


Wheatstone Bridge strain gauge

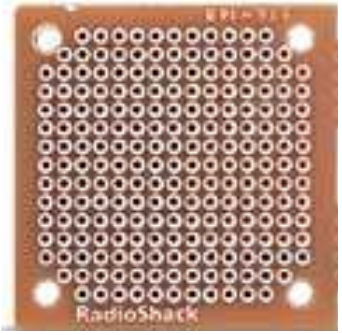




Pin-out box construction



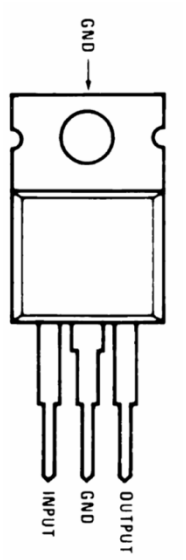

9V
5V
A
B
C
D
SIGNAL
GROUND

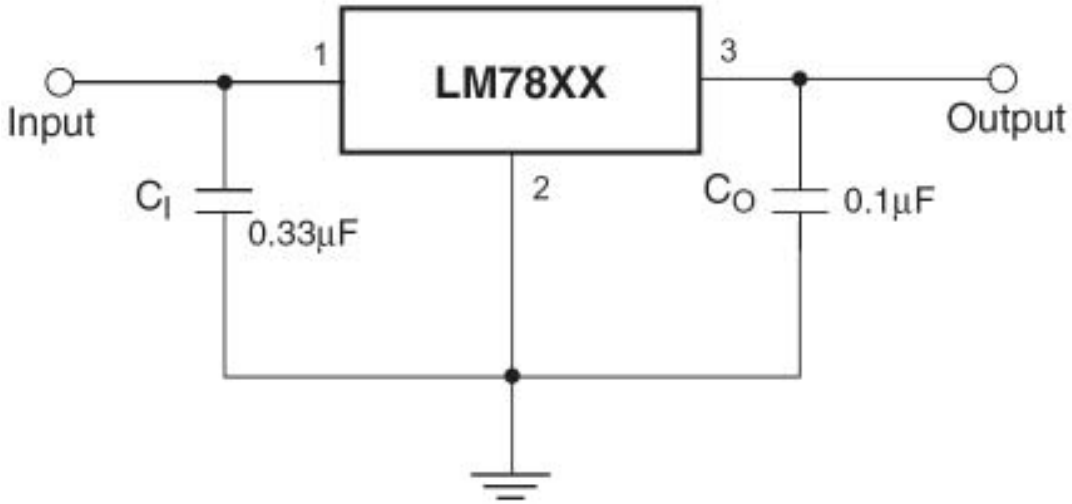

RadioShack


9 VOLTS
Energizer

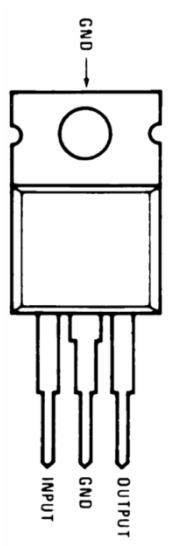

ACE ML
7805A

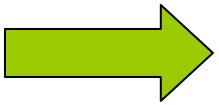
7805
5V fixed-voltage regulator

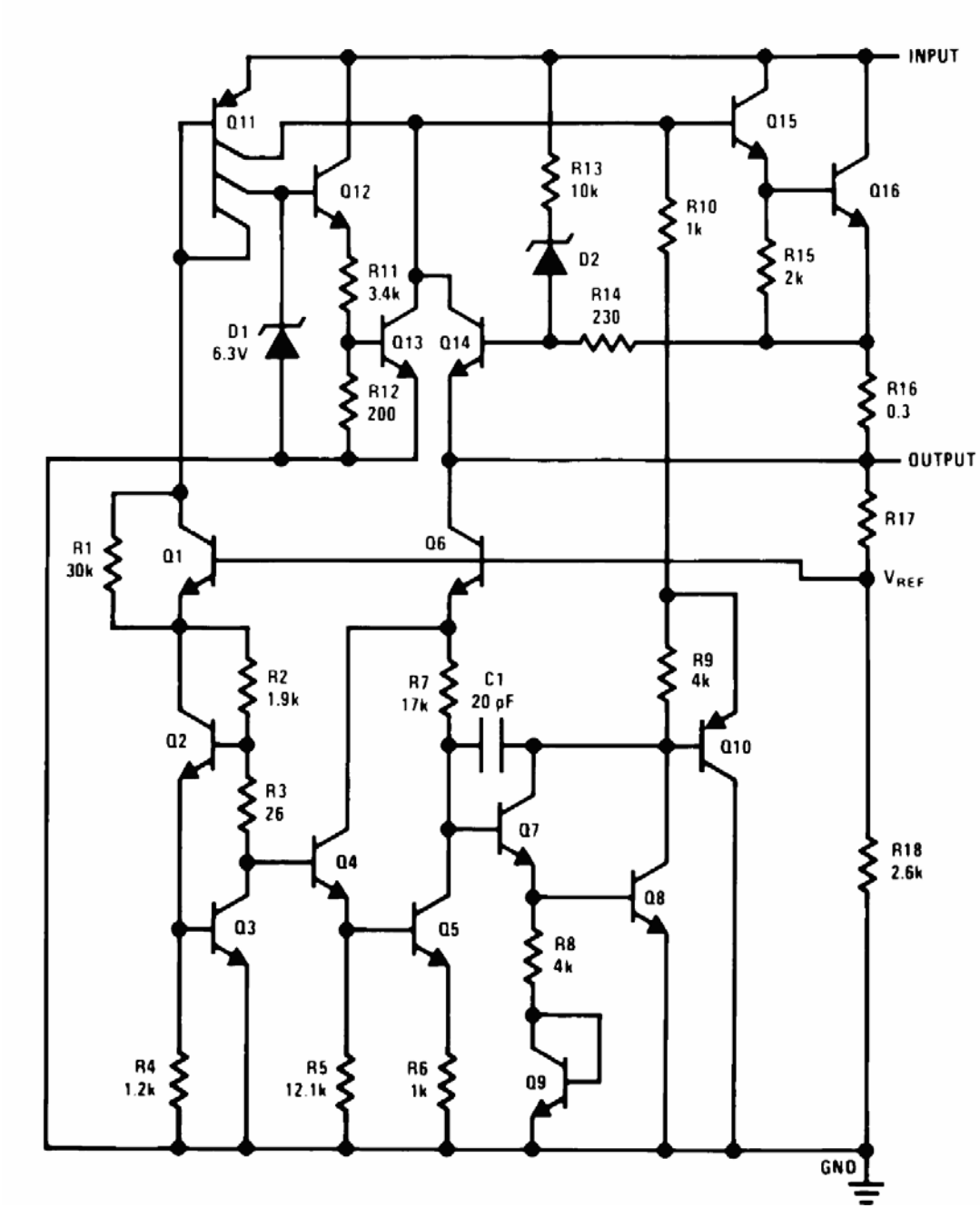




Looks just like a simple transistor, right?

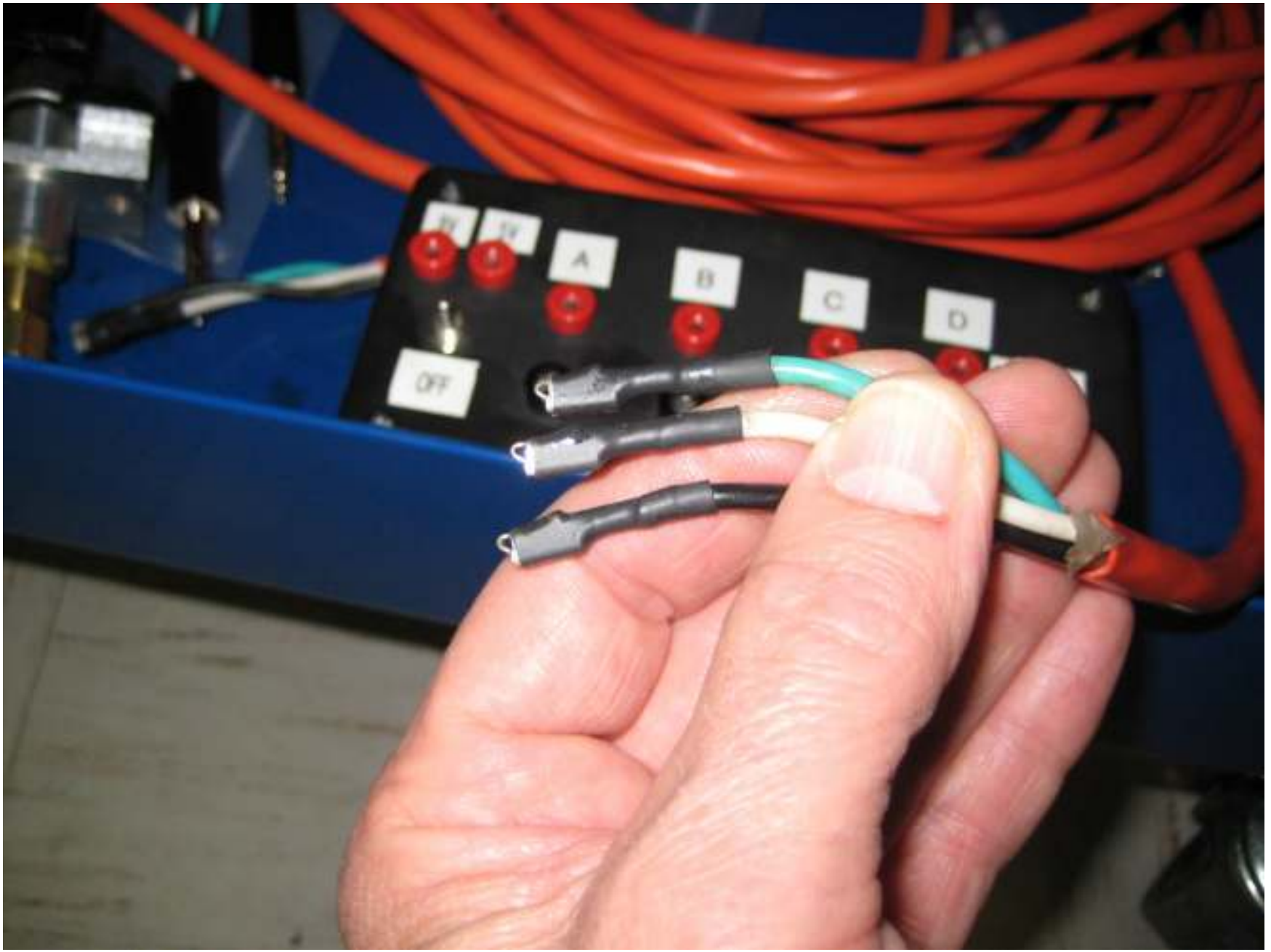






- Overcurrent protected
- Thermal protected
- Load regulated
- Line regulated


EVEREADY


A
B
C
D
OFF

parts list

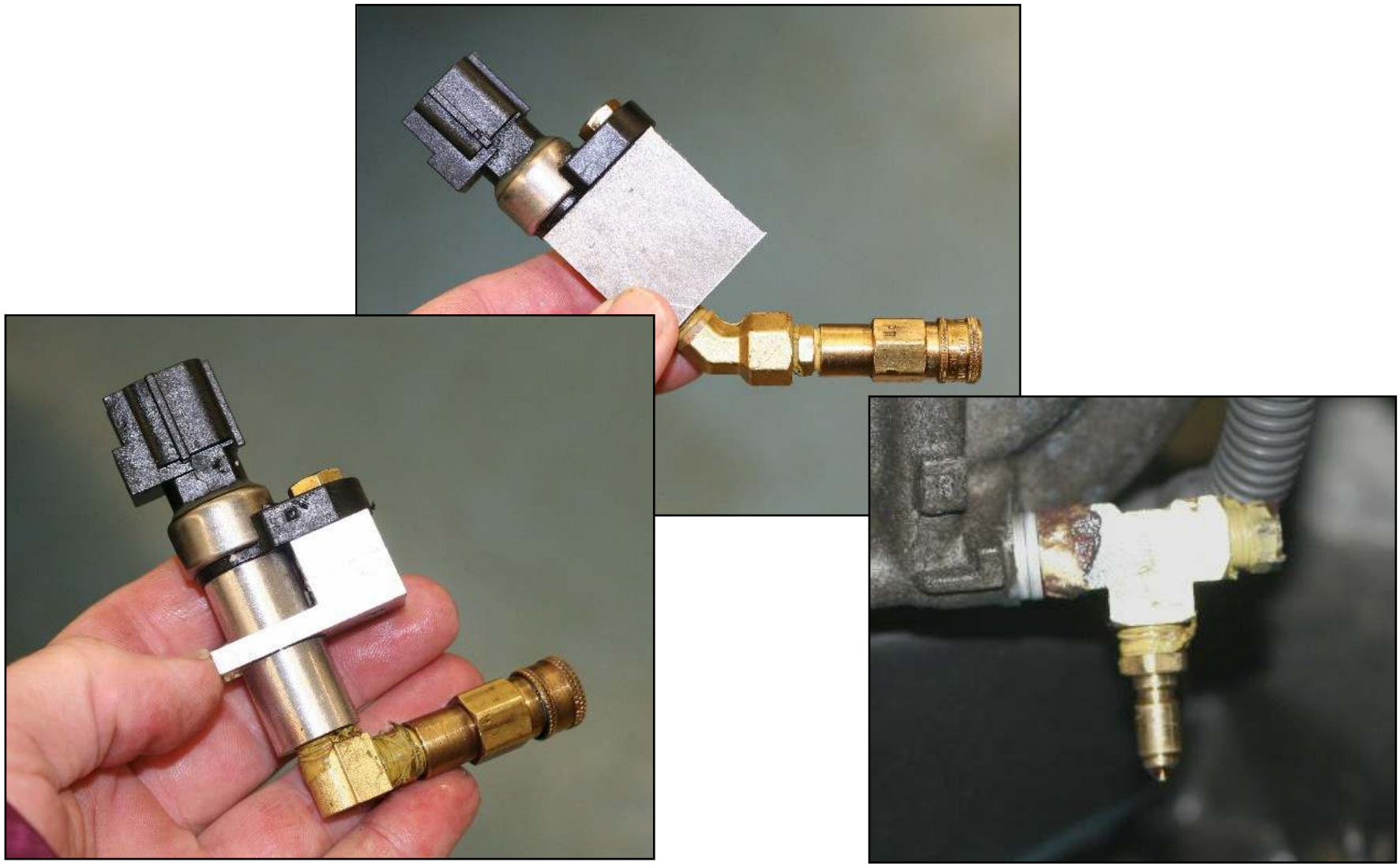
5V fixed-voltage regulator #7805	276-1770	$1.59
heat sink (optional)	276-1363	1.49
.1 microfarad capacitor (non-polarized)	272-1069	1.49
.22 microfarad capacitor (non-polarized)	272-1070	1.49
SPST toggle switch	275-645	2.99
banana jacks (or tip jacks for meter probes)	274-725	2.99 pr.
¼" stereo phone plugs	274-139	3.99 pr.
¼" stereo phone jacks	274-312	3.99 pr.
circuit board	276-148	1.99
project box	270-1805	3.79

- 9V battery clip
- 9V alkaline battery
- 22 gauge stranded hookup wire

Pressure Transducer Diagnostics

- Pressure testing using a DSO can provide more detail than a simple pressure gauge
- The ability to "record" the pressures gives a reference to refer back to
- Many uses other than transmissions
  - AC
  - Engine Compression
  - Fuel

Pressure Transducer Diagnostics



Pressure Transducer Diagnostics

http://www.hofmannfluidpower.com/
1-815-744-8300

1/8″ Body Size
Maximum 300 PSI

Sockets (Valved)

FNPT	Thread	Brass	Chrome	Electroless Nickel	Stainless
	1/8″	F1-M	F1-M-C *	F1-M-EN	F1-M-SS
	1/4″	F2-M	F2-M-C *	F2-M-EN	N/A

MNPT	Thread	Brass	Chrome	Electroless Nickel	Stainless
	1/8″	M1-M	M1-M-C *	M1-M-EN	M1-M-SS
	1/4″	M2-M	M2-M-C *	M2-M-EN	M2-M-SS

HOSE BARB	Hose I.D.	Brass	Chrome	Electroless Nickel	Stainless
	1/8″	N/A	N/A	N/A	N/A
	3/16″	S1-M	S1-M-C *	S1-M-EN	S1-M-SS
	1/4″	S2-M	S2-M-C *	S2-M-EN	S2-M-SS

REUSABLE	Reusable Hose End	Brass	Chrome	Electroless Nickel	Stainless
	3/16″ I.D. x 3/8″ O.D.	RK1-M	RK1-M-C *	RK1-M-EN	RK1-M-SS

TUBE CONNECTION	Tube O.D.	Brass	Chrome	Electroless Nickel	Stainless
	1/4″	M1-MIT	M1-MIT-C *	M1-MIT-EN	N/A

Plugs (1-Way/Unvalved)

FNPT	Thread	Brass	Chrome	Electroless Nickel	Stainless
	1/8″	FP1-M	FP1-M-C *	FP1-M-EN	FP1-M-SS
	1/4″	FP2-M	FP2-M-C *	FP2-M-EN	N/A

MNPT	Thread	Brass	Chrome	Electroless Nickel	Stainless
	1/8″	MP1-M	MP1-M-C *	MP1-M-EN	MP1-M-SS

TIP Configuration

Valve (Two-Way)

* Unvalved (Straight Thru)

Valved (One-Way)

Miniature Couplers
- One-way valved
- Two-way valved
- Straight thru

Valved Sockets
Only connect with one way or two way valved sockets.

* Must use a straight thru socket with a straight thru plug only, will not work with one-way or two-way valve plugs.

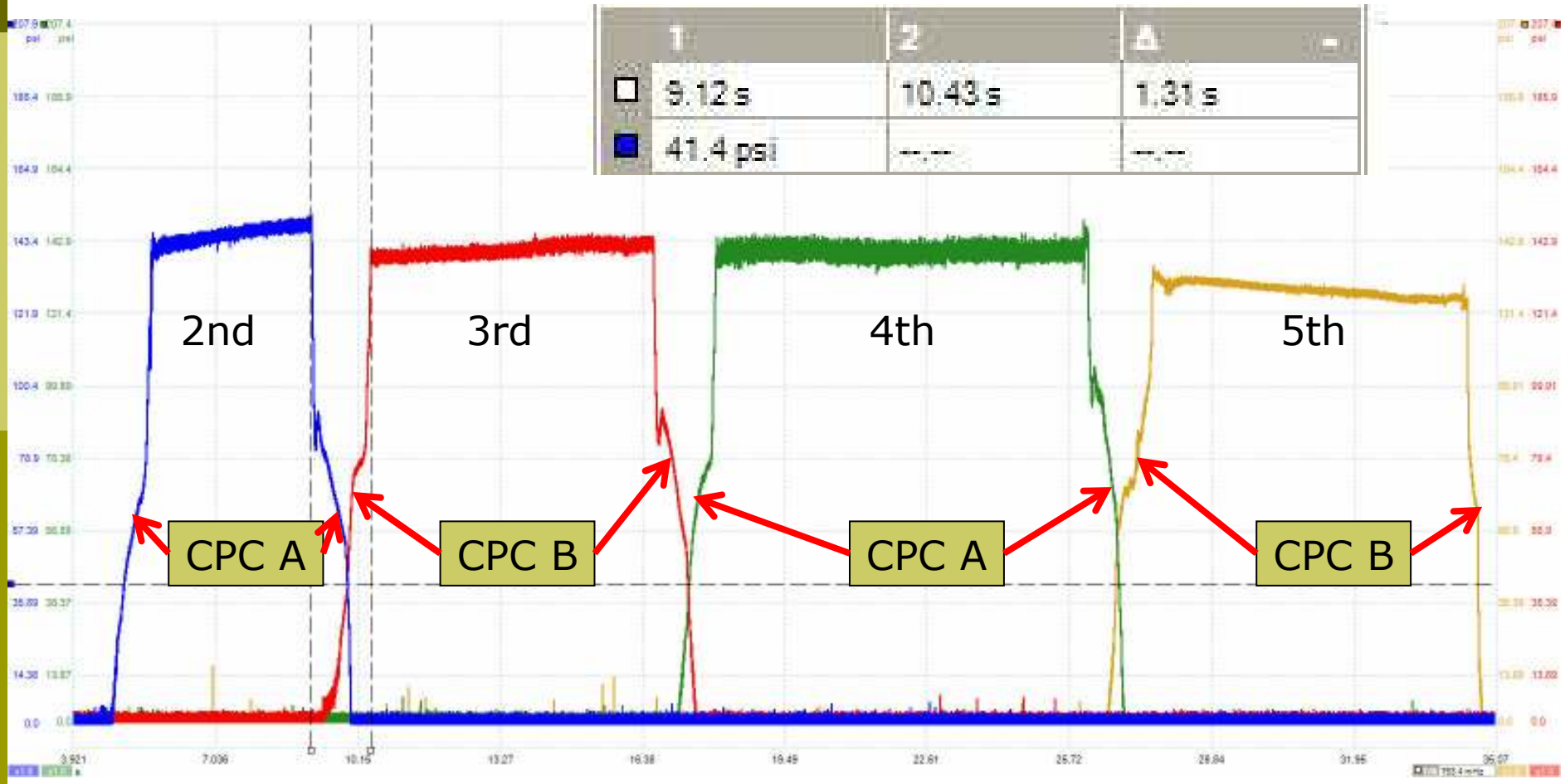
VALVED SOCKET SPECS

Brass Sockets
Brass Body
Brass Sleeve
440 Stainless Balls
302 Stainless Springs
Nickel Plated Brass Valve
Viton Seal

Chrome Sockets
Chrome Plated
Brass Body
Chrome Plated
Brass Sleeve
440 Stainless Balls
302 Stainless Springs

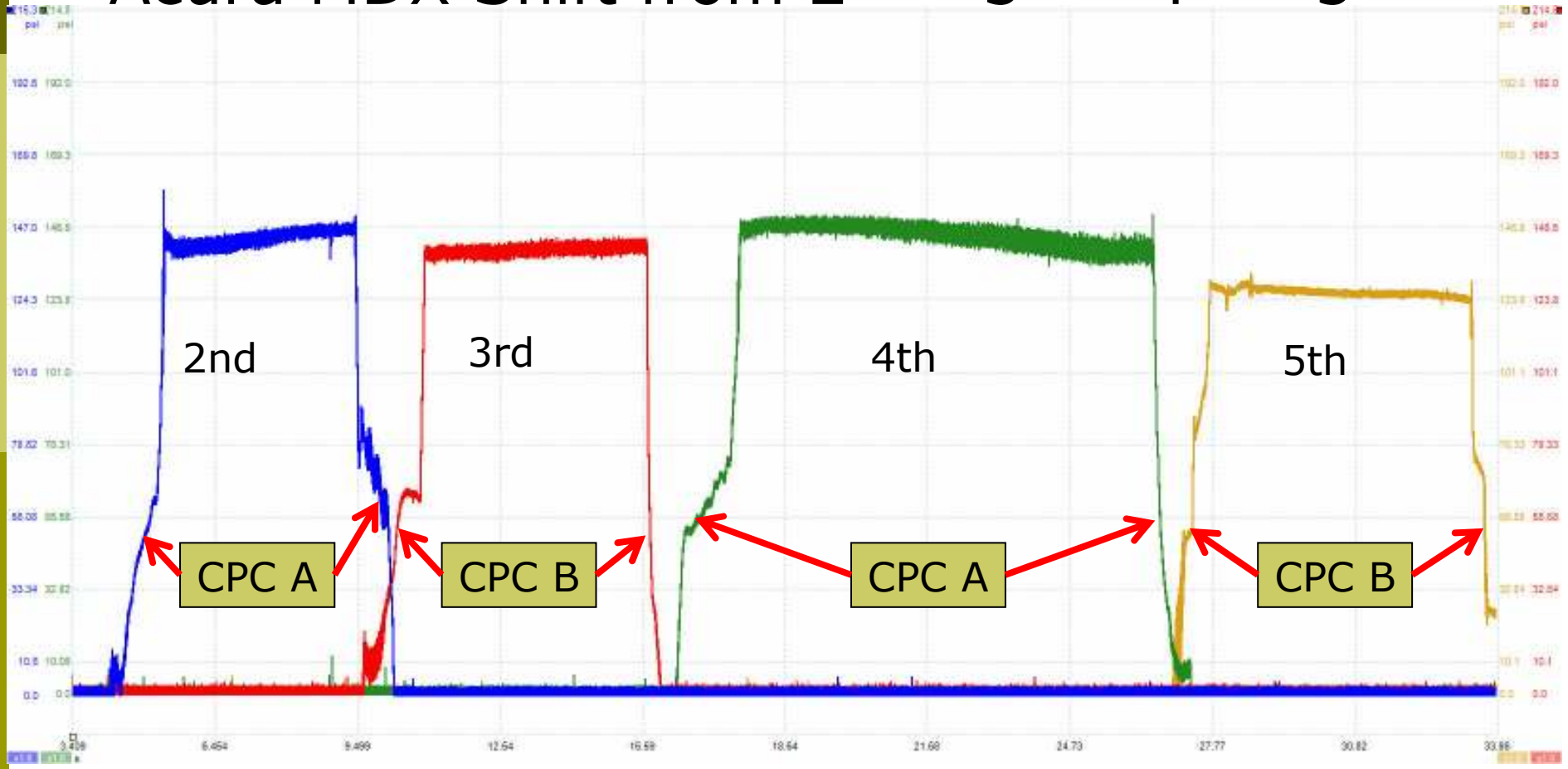
Pressure Transducer Diagnostics

Acura MDX Shift from 2nd – 3rd – 4th – 5th



Pressure Transducer Diagnostics

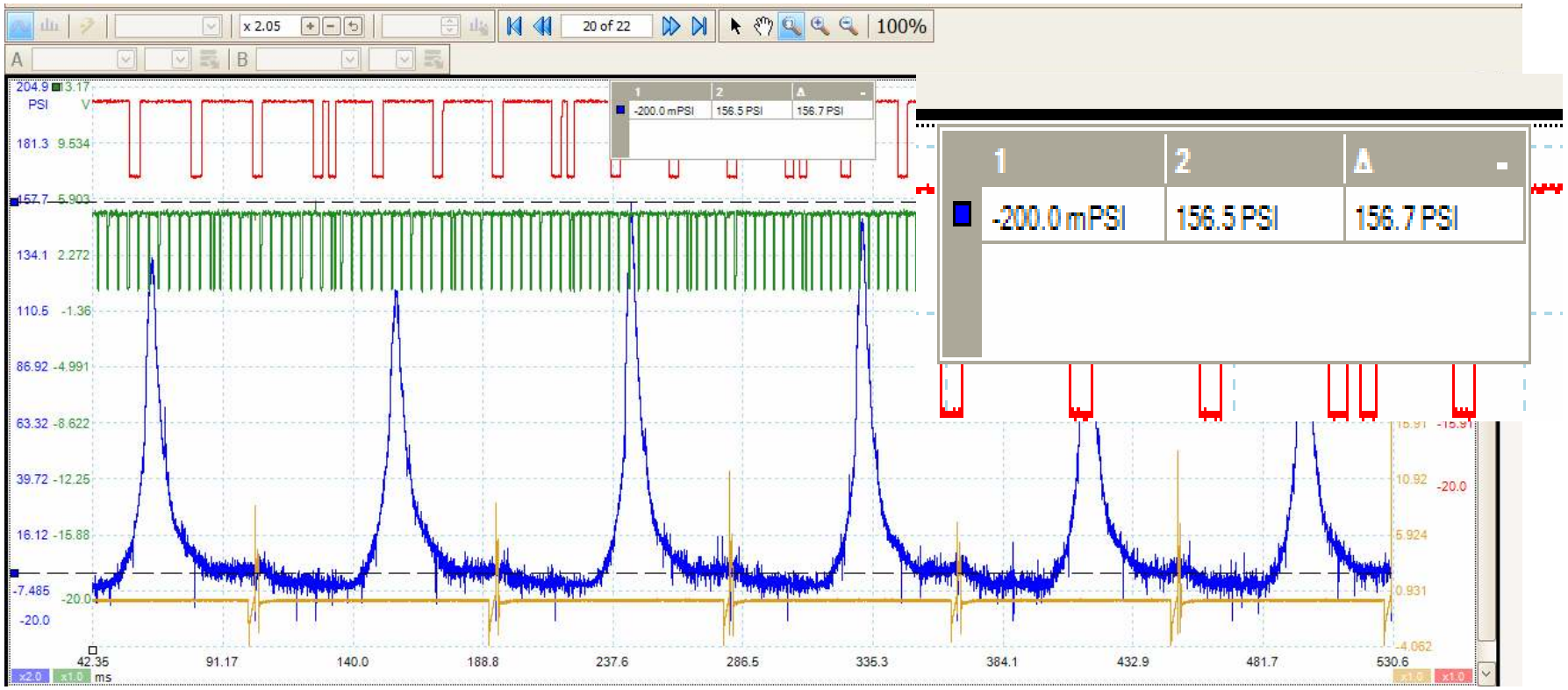
Acura MDX Shift from 2nd – 3rd – 4th – 5th



Engine Mechanical

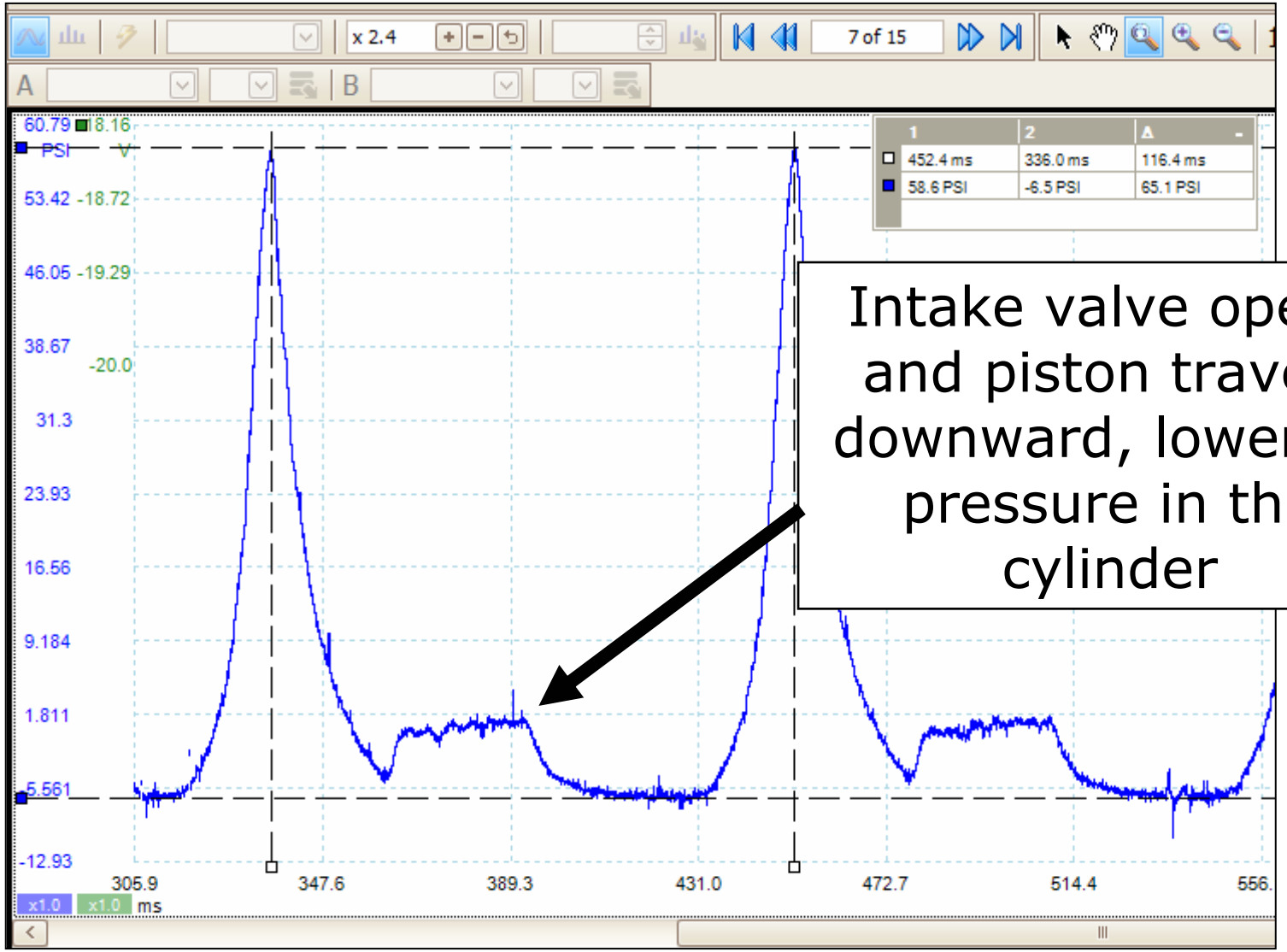
- Running (Dynamic) Compression Test
  - Less pressure than cranking compression due to engine speed and air restriction

Engine Mechanical



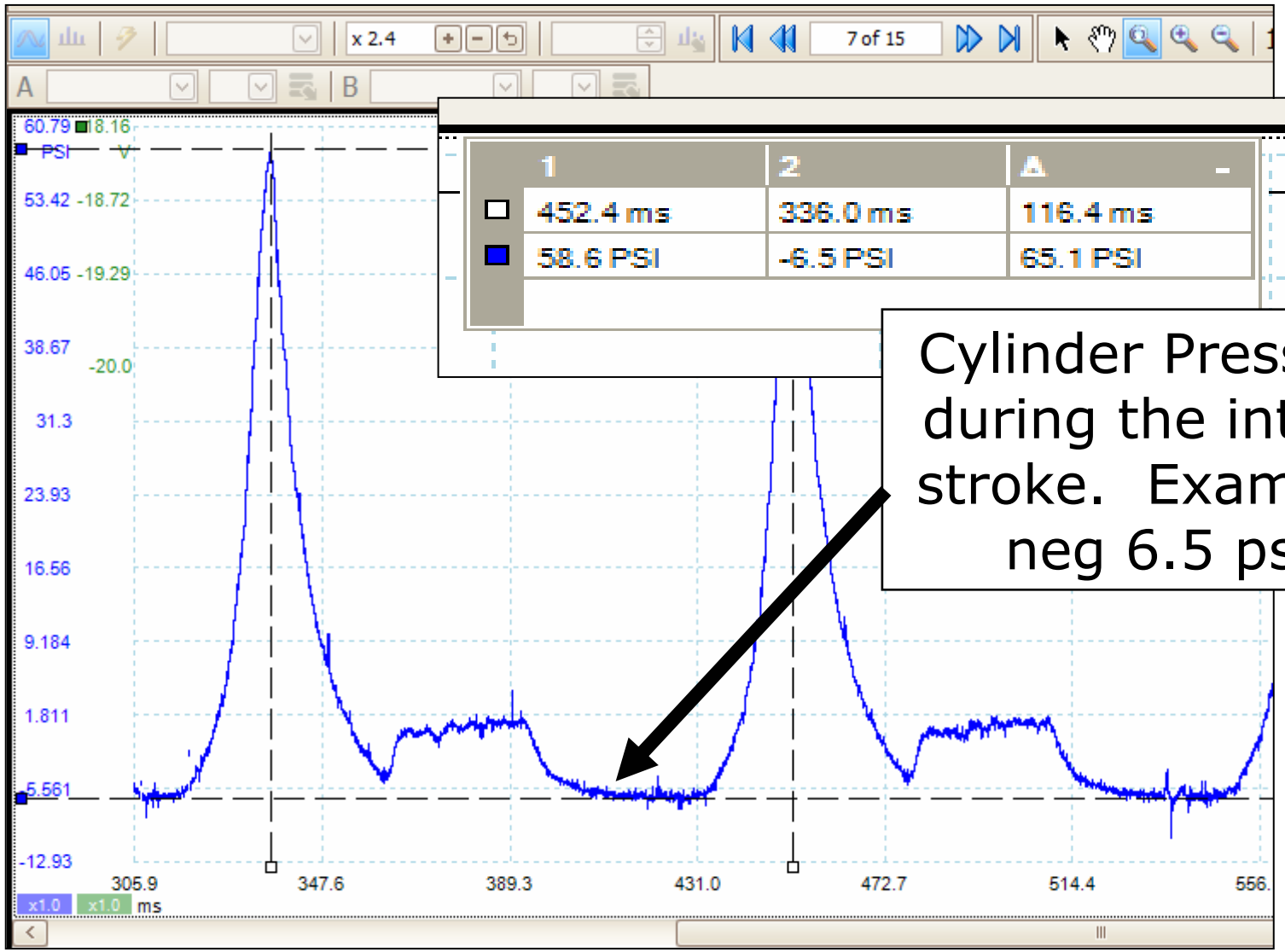
- Snap Throttle
  - Shows response to air entering and leaving the combustion chamber
  - The closest you'll ever get to cranking compression

Engine Mechanical: Four Strokes



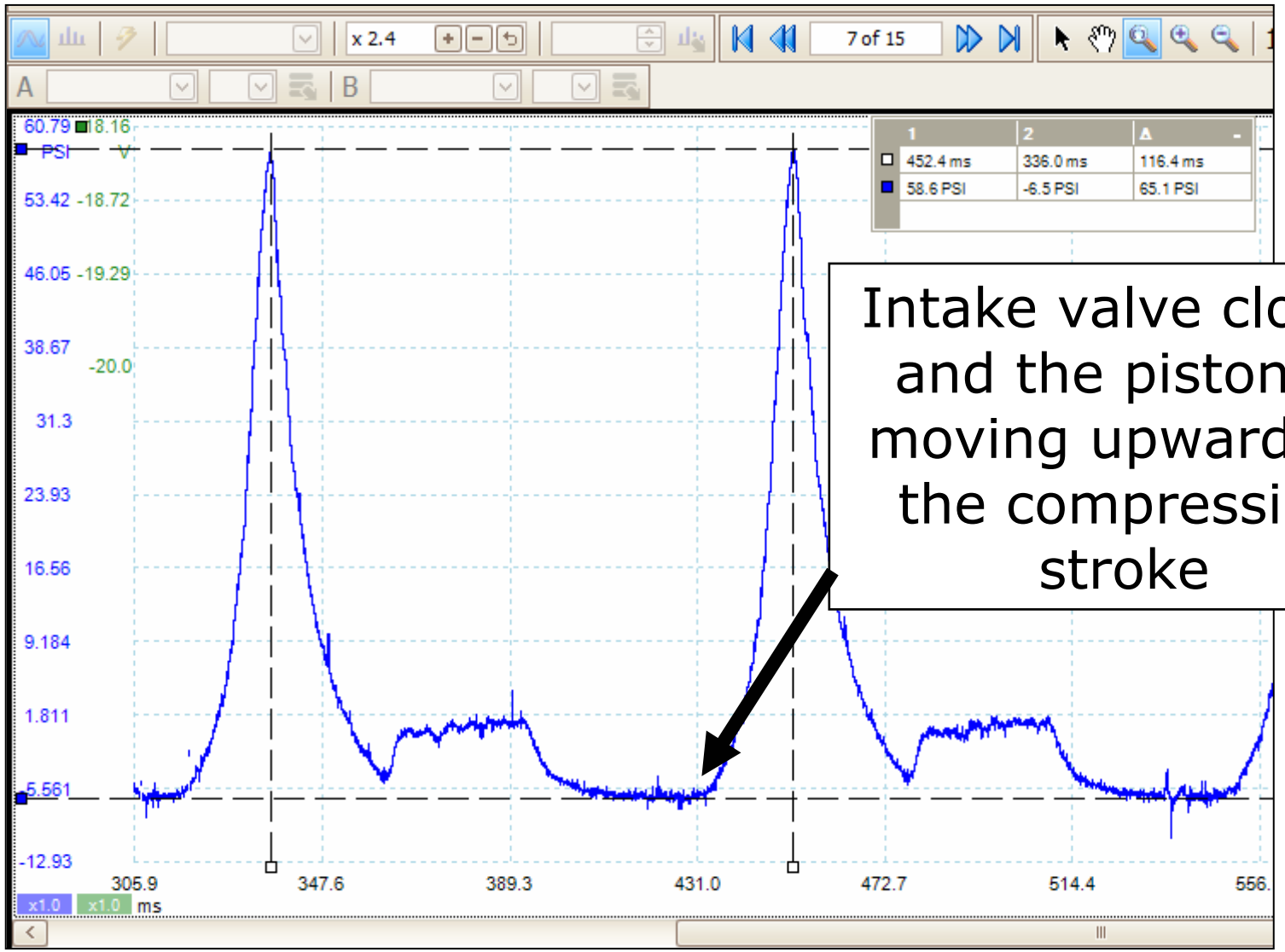
Intake valve opens and piston travels downward, lowering pressure in the cylinder

Engine Mechanical

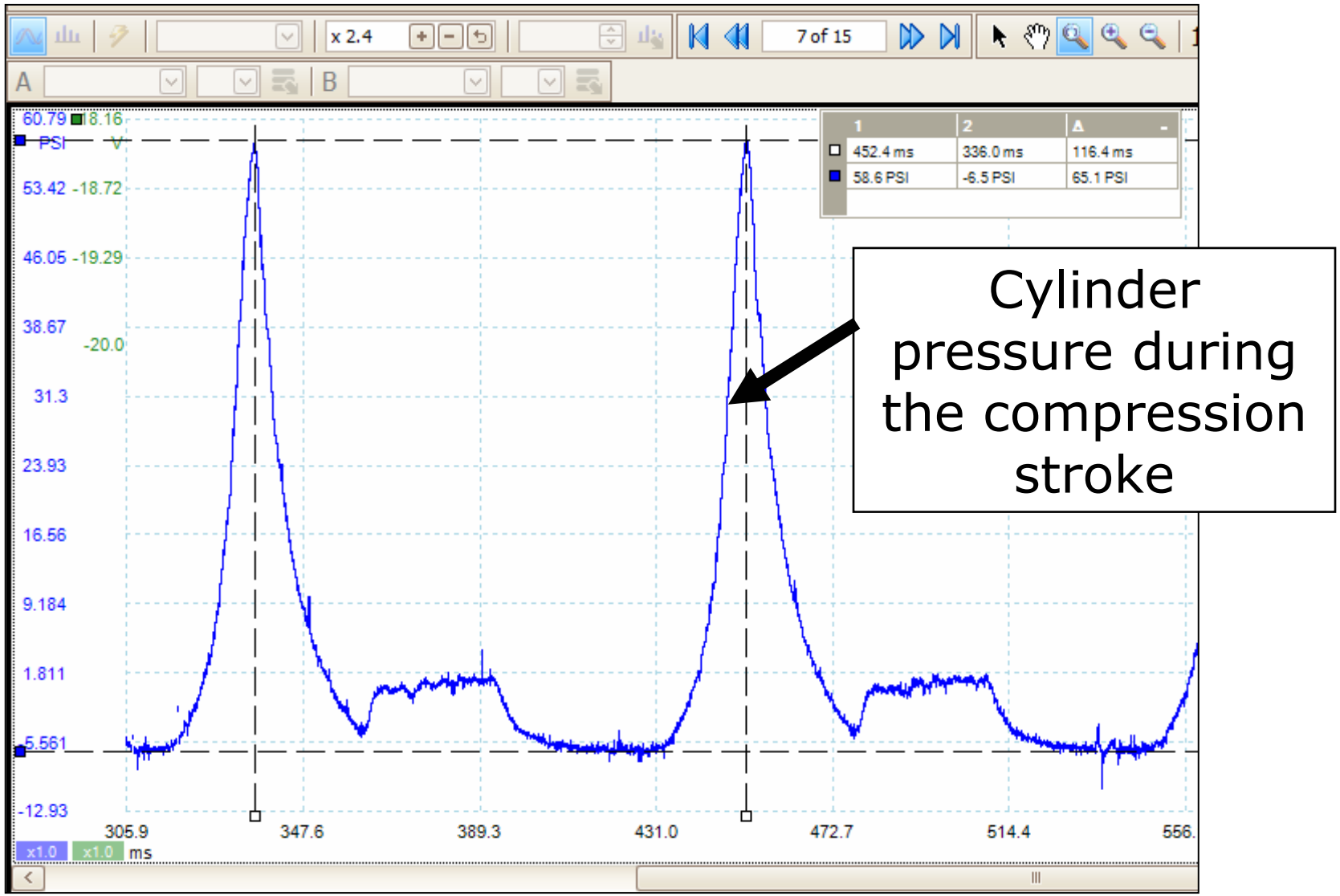


Cylinder Pressure during the intake stroke. Example, neg 6.5 psi

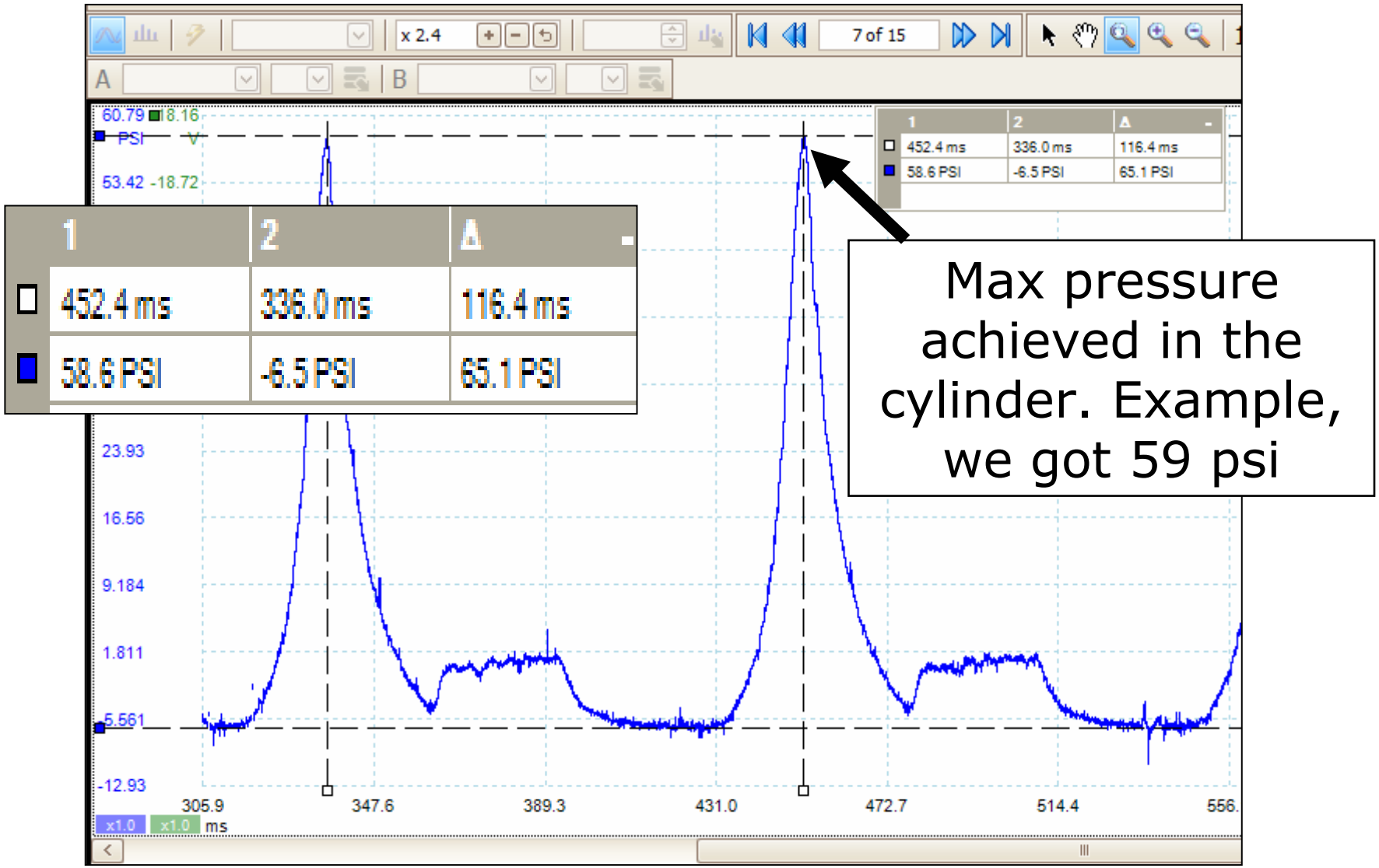
Engine Mechanical



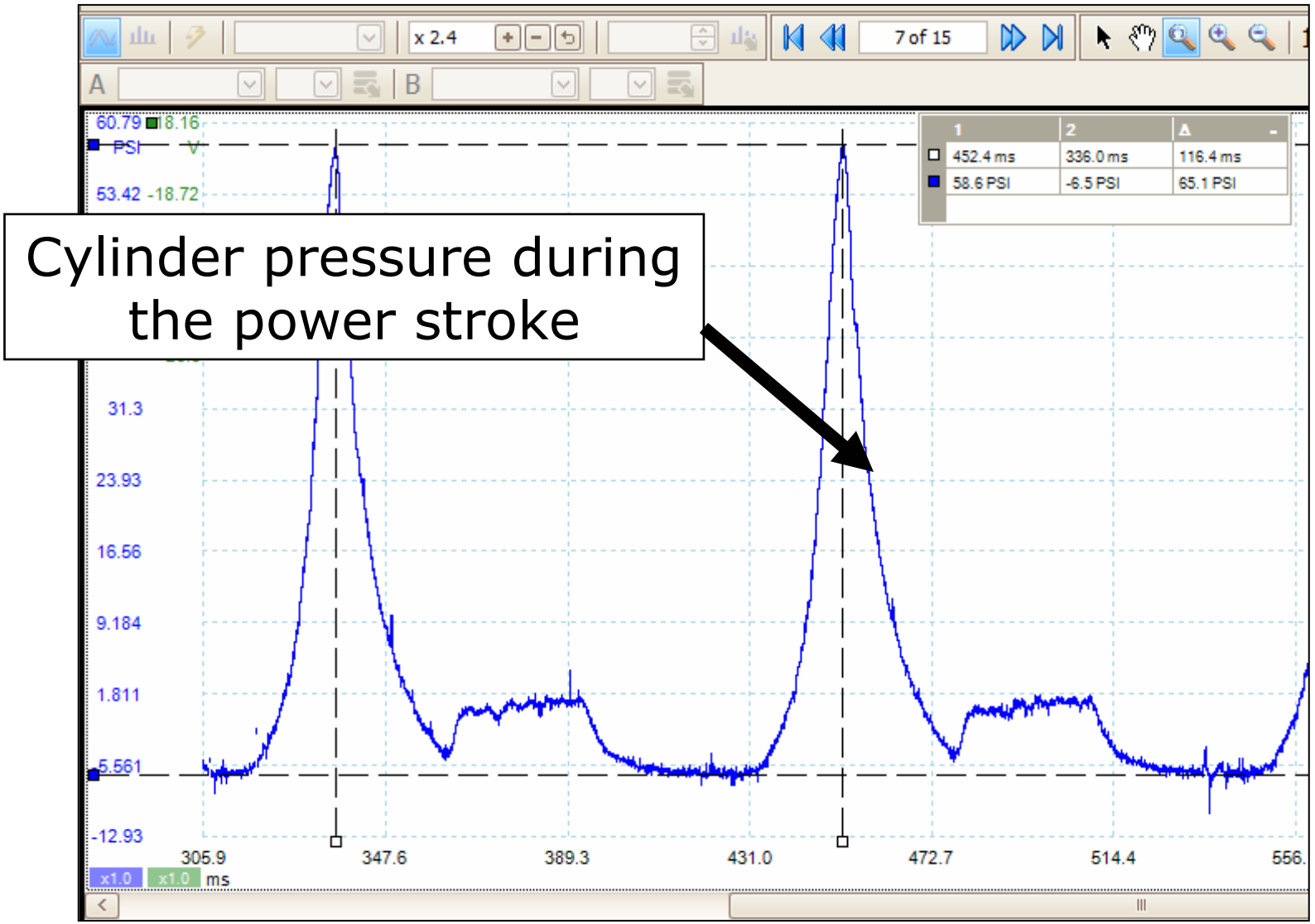
Engine Mechanical



Engine Mechanical

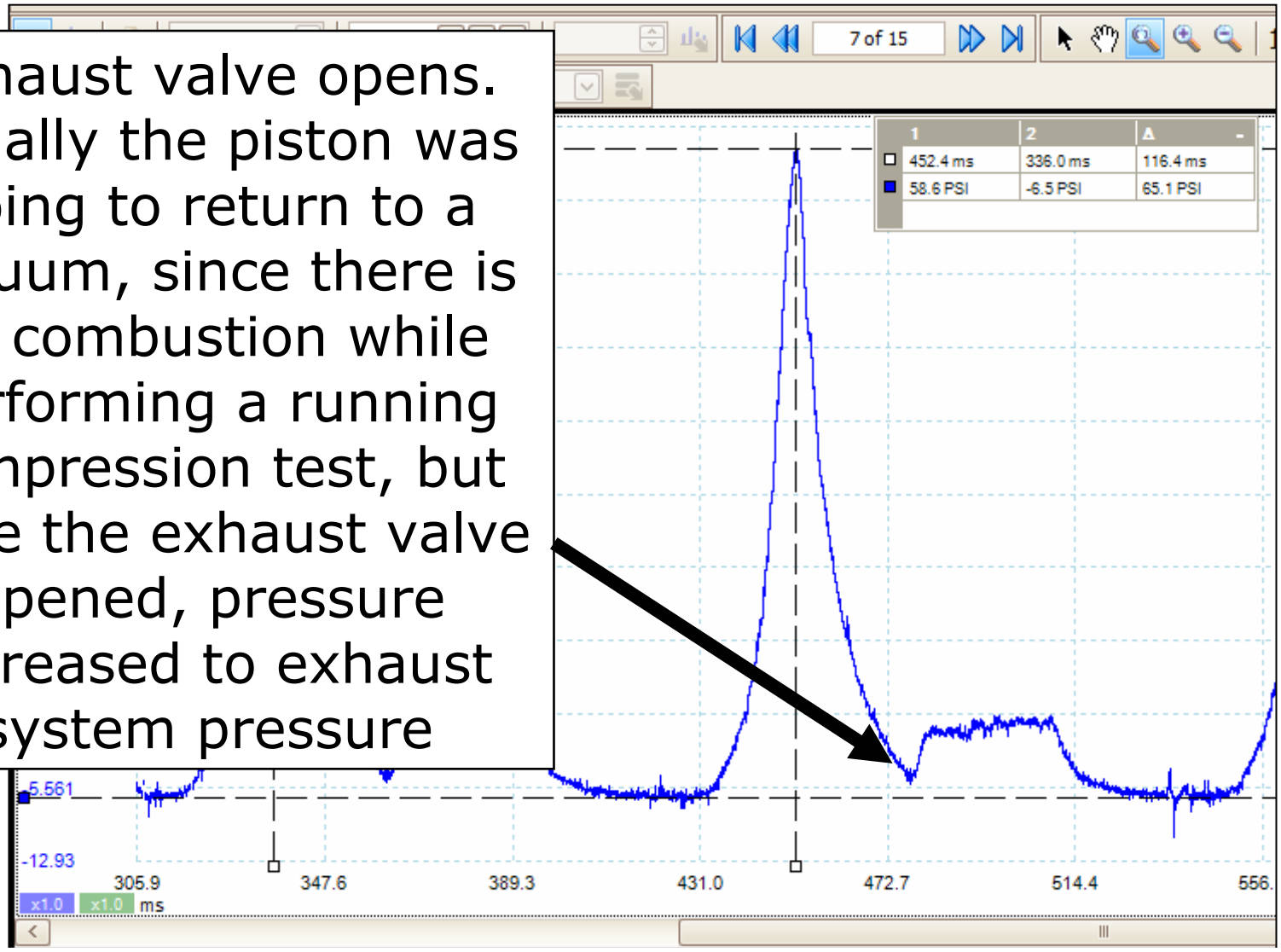


Engine Mechanical

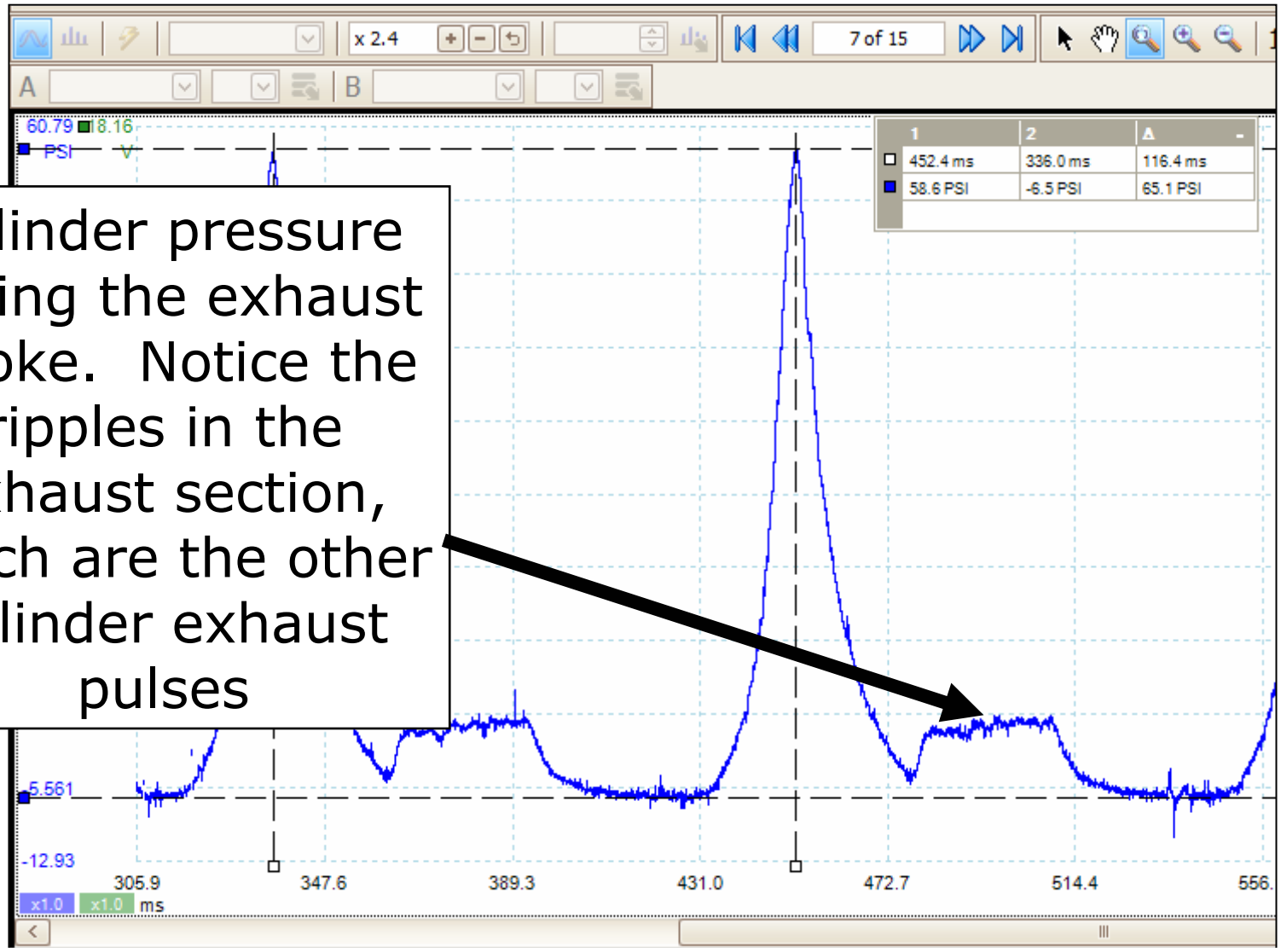


Engine Mechanical

Exhaust valve opens. Initially the piston was going to return to a vacuum, since there is no combustion while performing a running compression test, but since the exhaust valve opened, pressure increased to exhaust system pressure

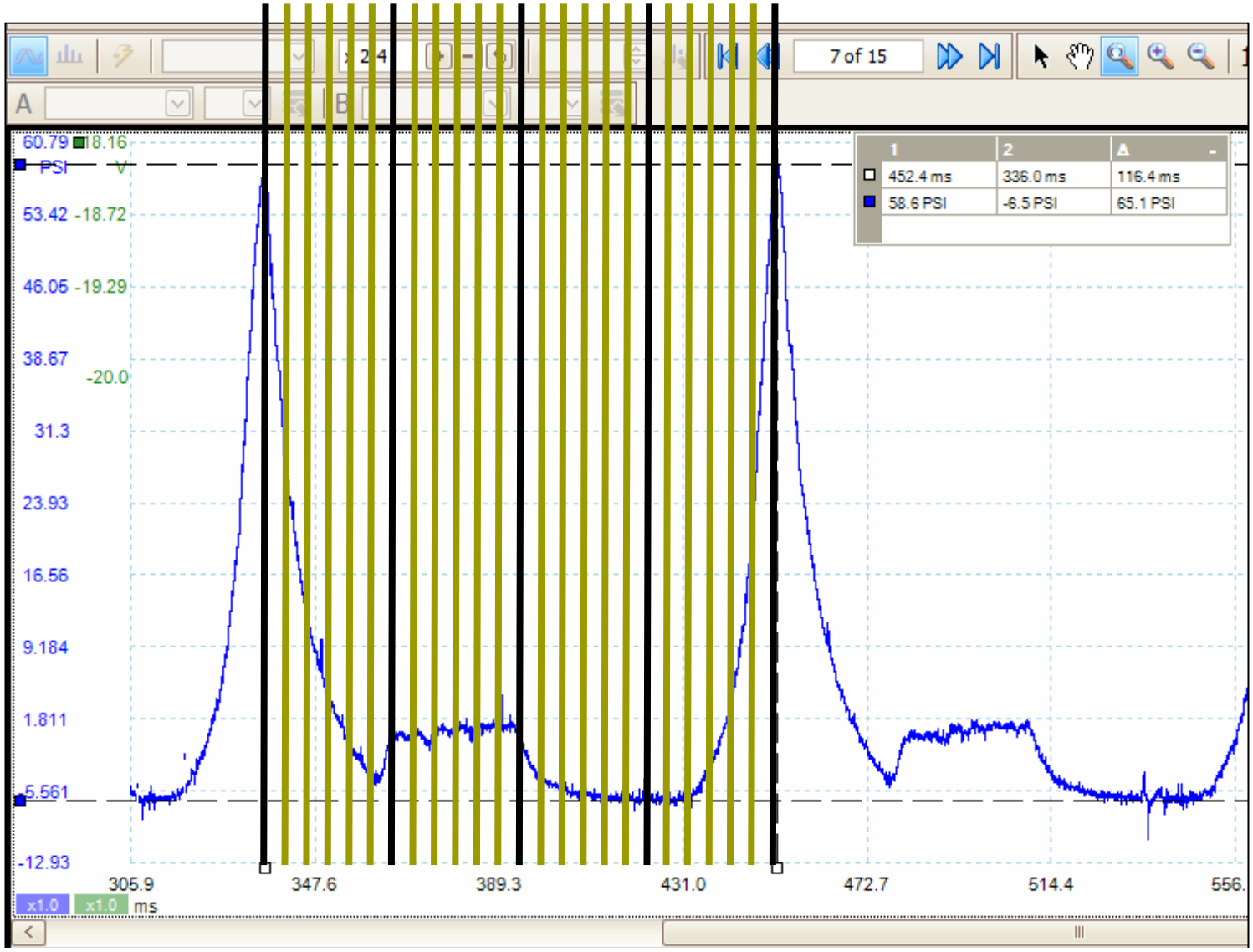


Engine Mechanical



Cylinder pressure during the exhaust stroke. Notice the ripples in the exhaust section, which are the other cylinder exhaust pulses

Engine Mechanical



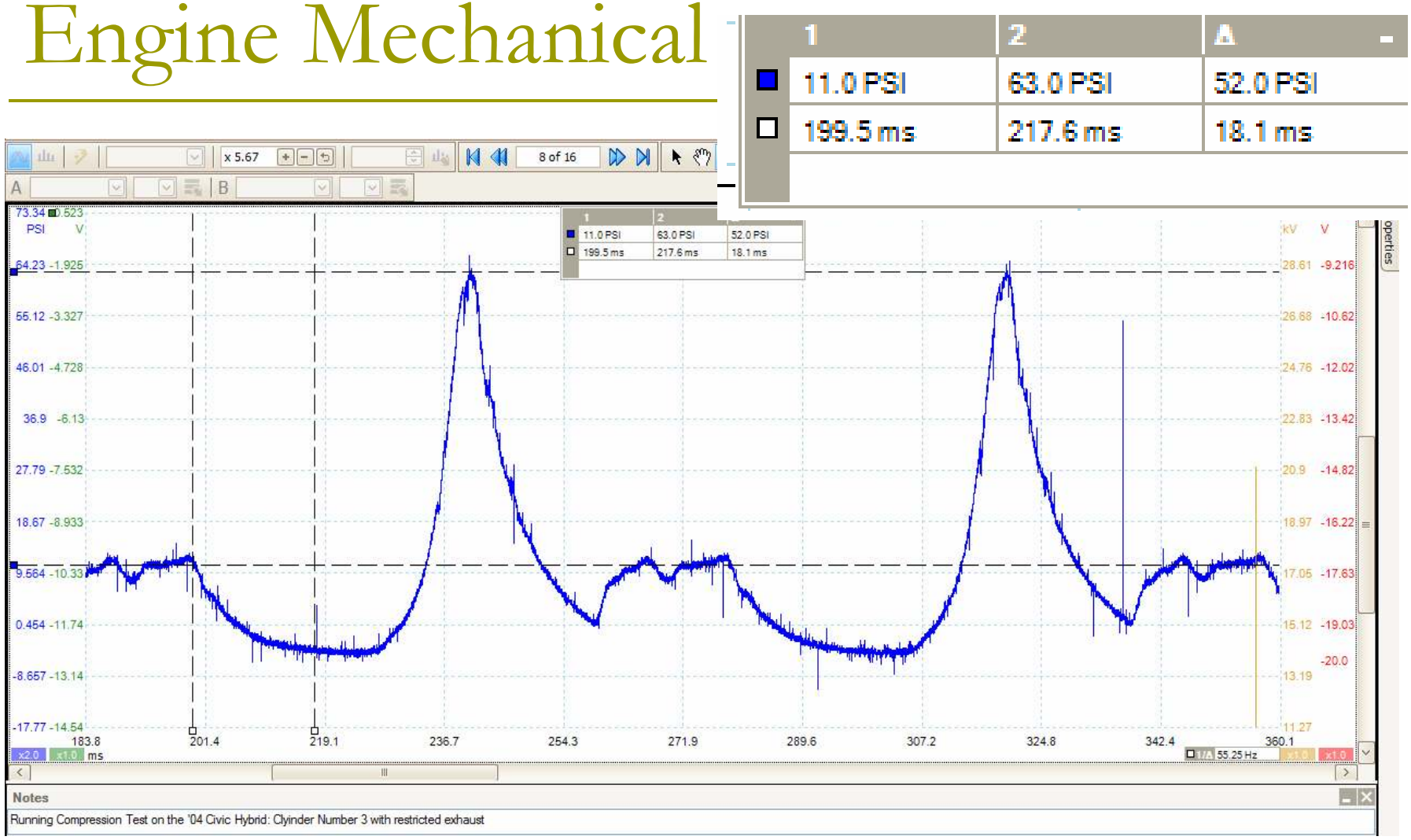
Engine Mechanical

- Why don’t we have real high compression numbers when the engine is running compared to when it cranking?
- Why doesn’t the “Snap Throttle” generate more than cranking on a properly running (naturally aspirated) engine?

Engine Mechanical

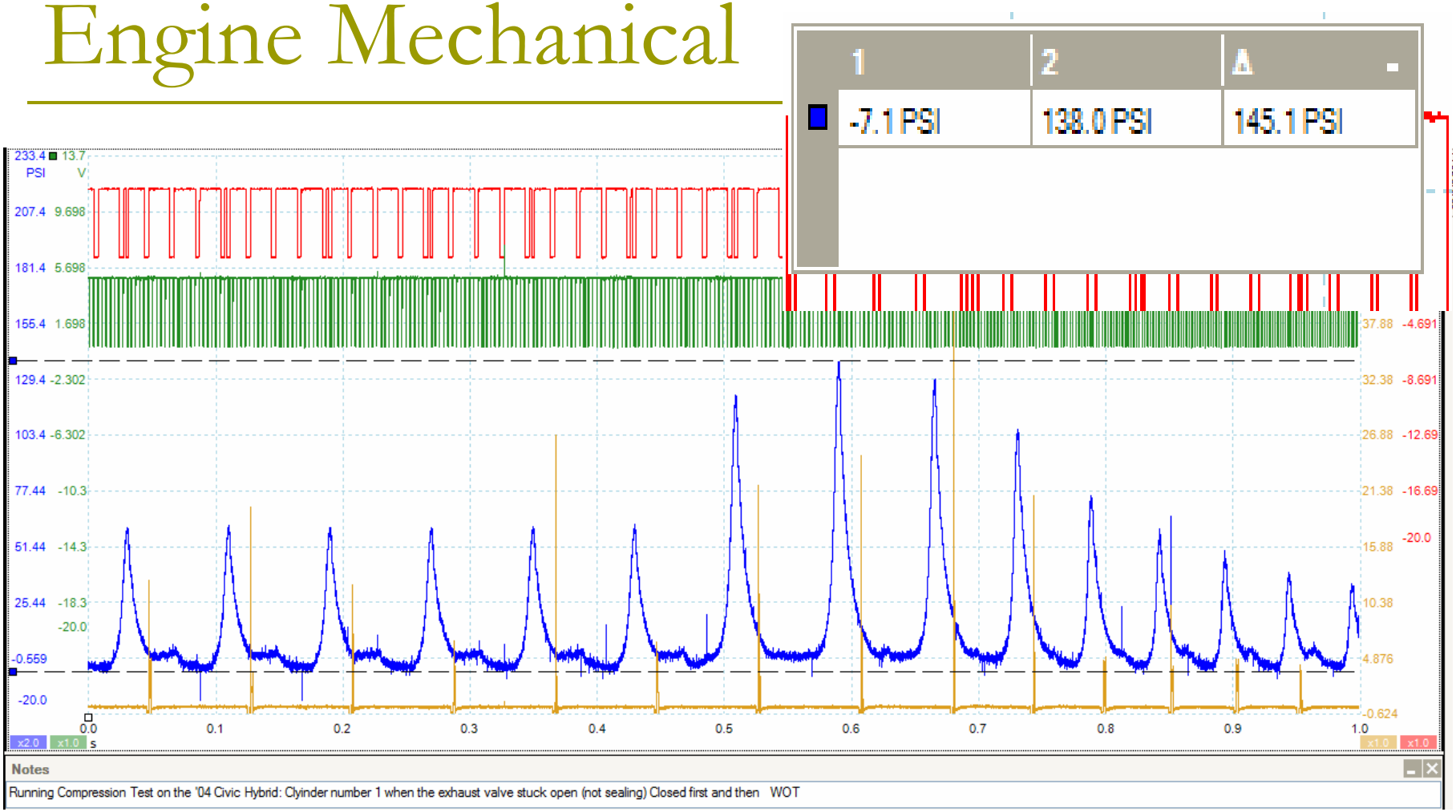
- Why don't we have real high compression numbers when the engine is running compared to when it cranking?
  - With the throttle closed and the nature of atmospheric air, the piston cannot draw in a "complete" charge
  - Volumetric efficiency: Which is how efficient an engine can fill its cylinder volume (displacement)
    - 75 – 80% at WOT is typical
    - 100% on supercharged or turbo charged vehicles

Engine Mechanical



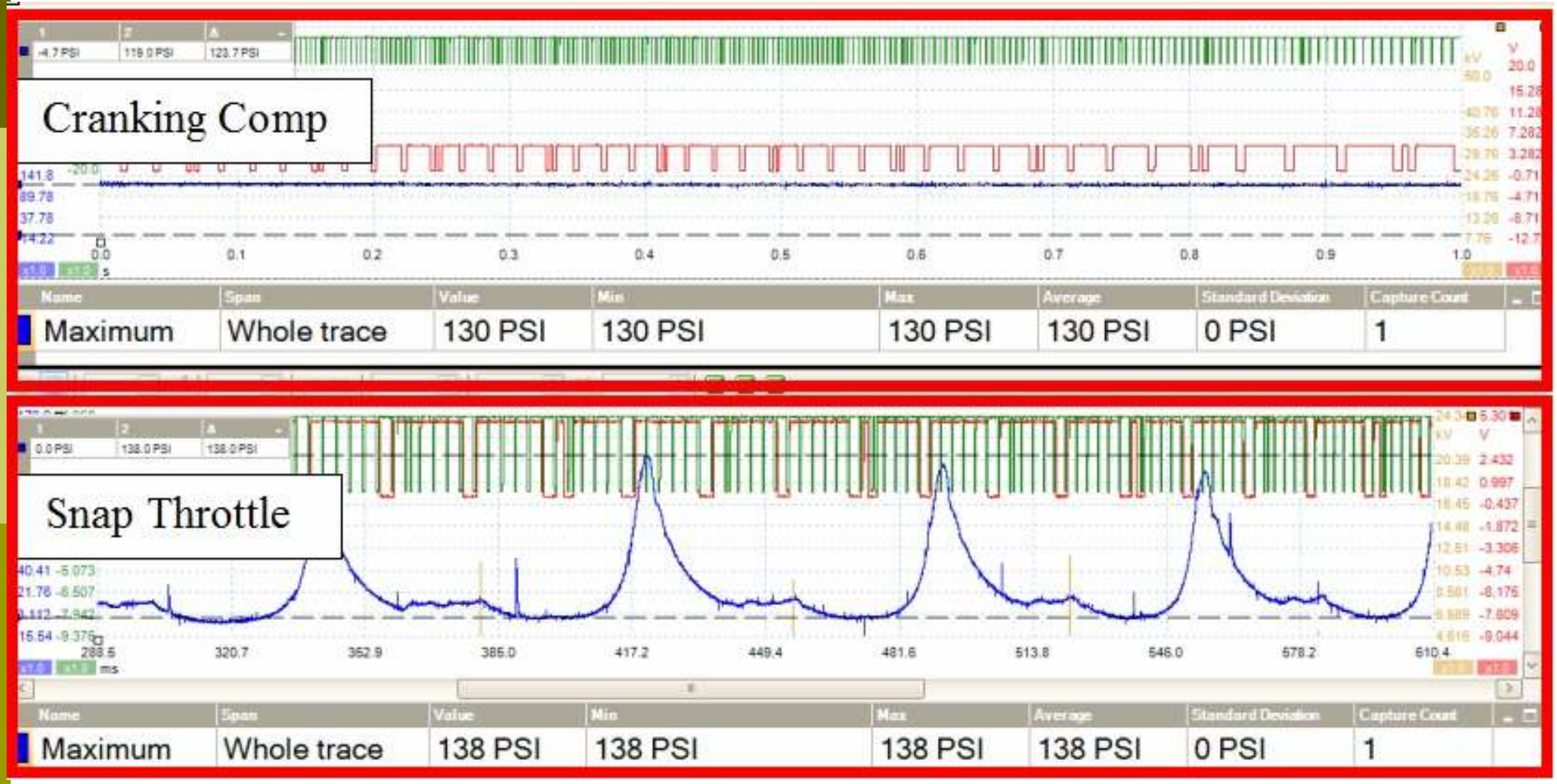
Restricted exhaust: idle

Engine Mechanical



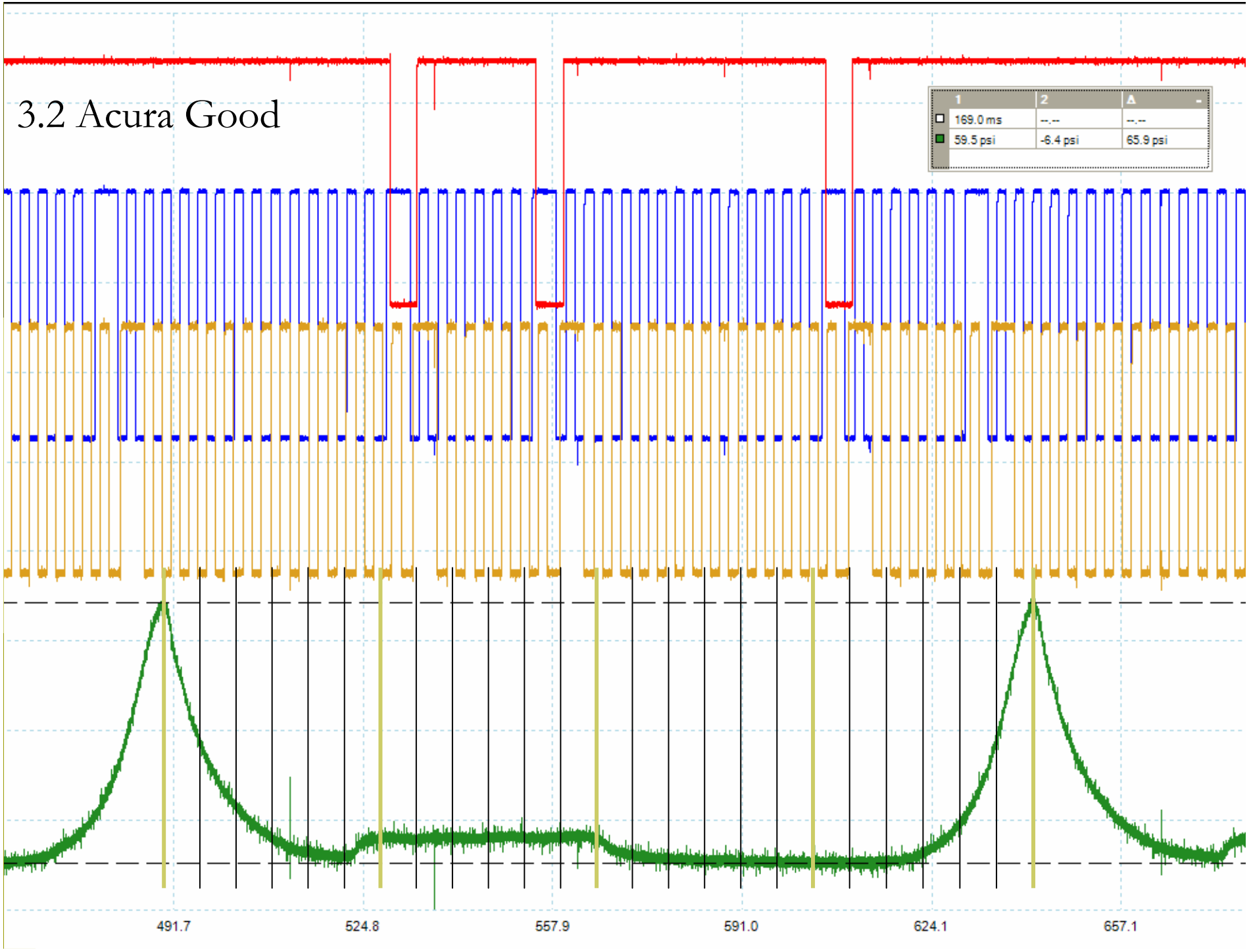
Restricted exhaust: snap throttle

Engine Mechanical

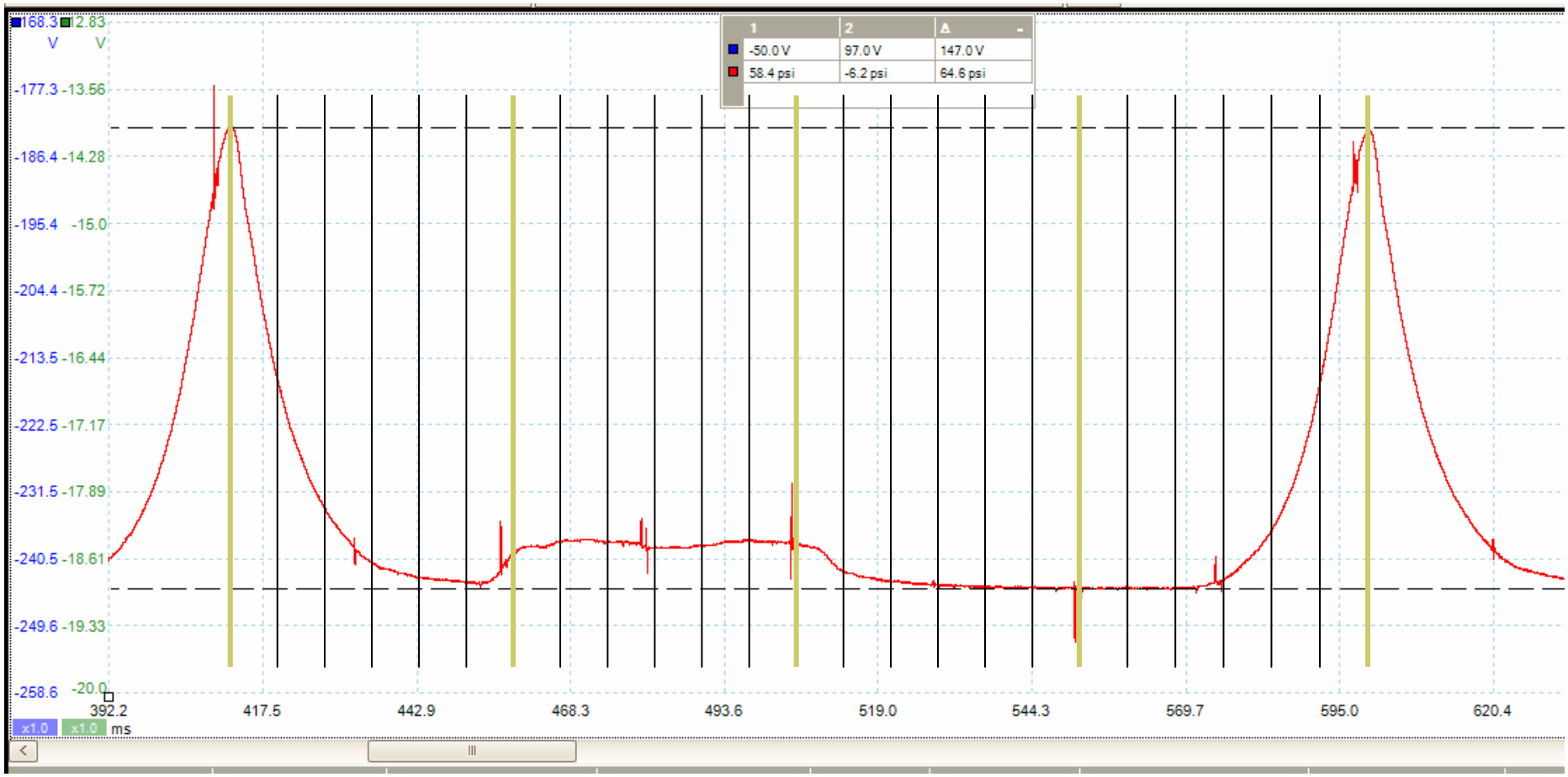


Restricted exhaust: comparison

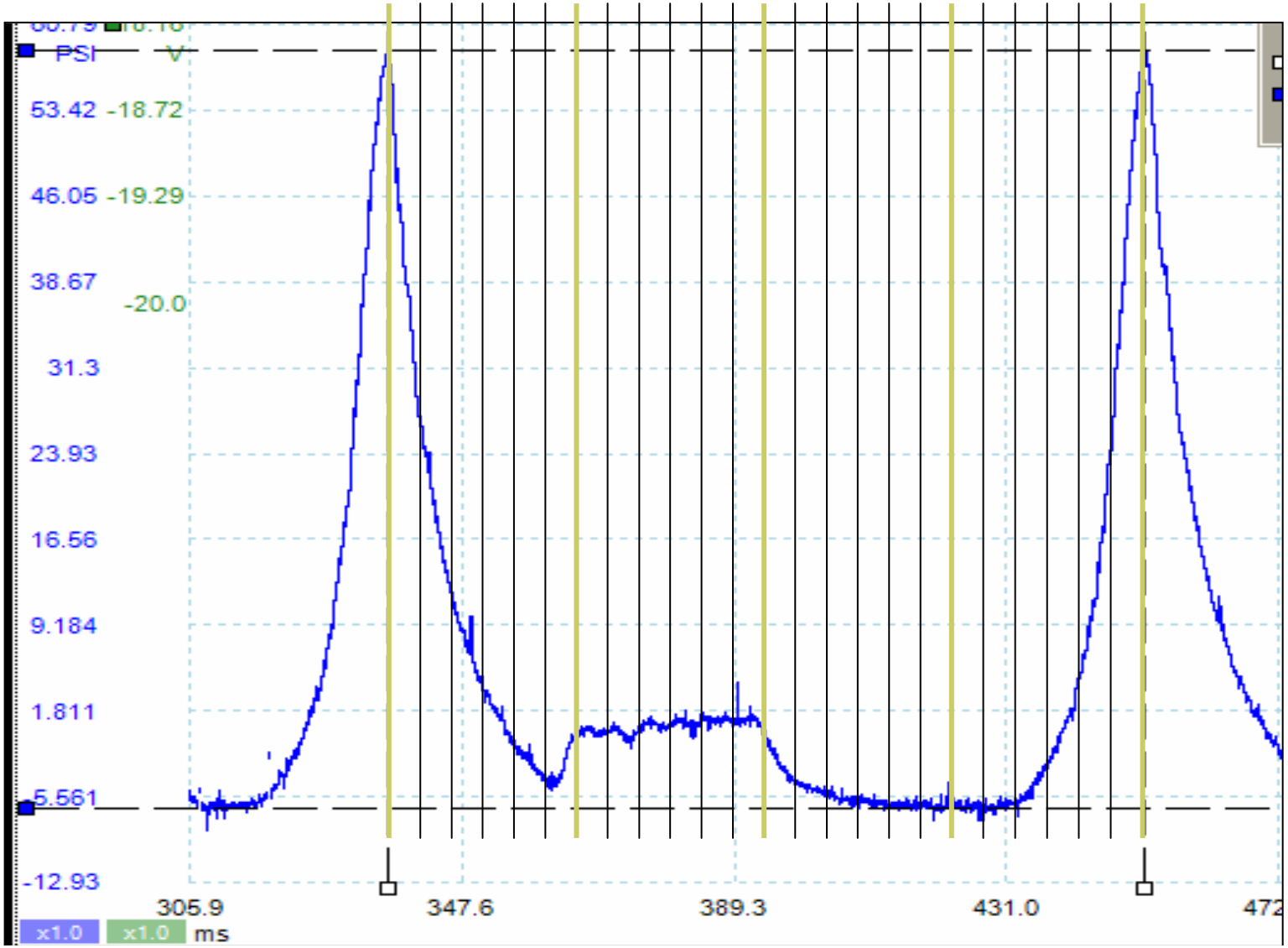
3.2 Acura Good



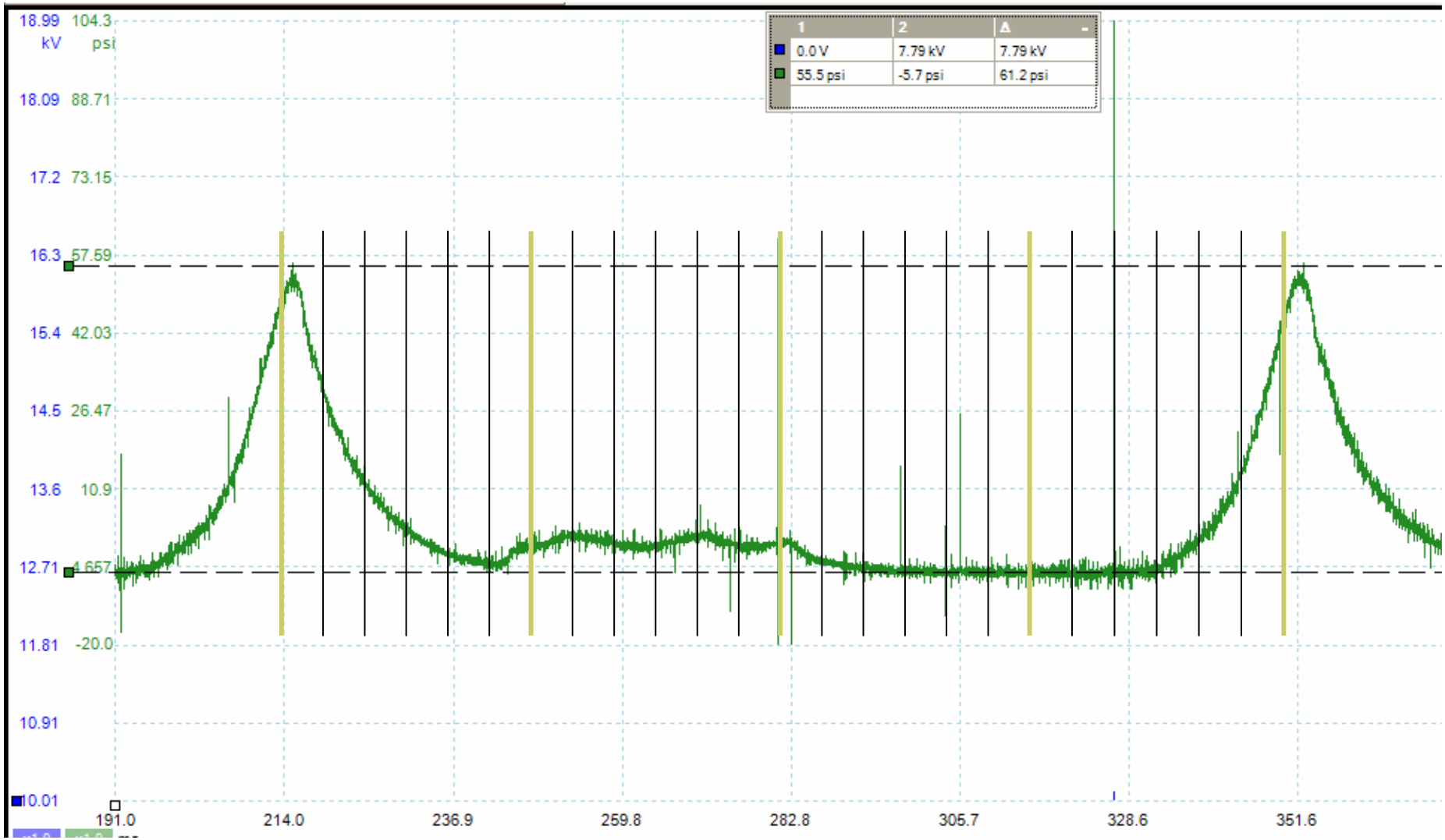
5.7 Hemi 300C 05’



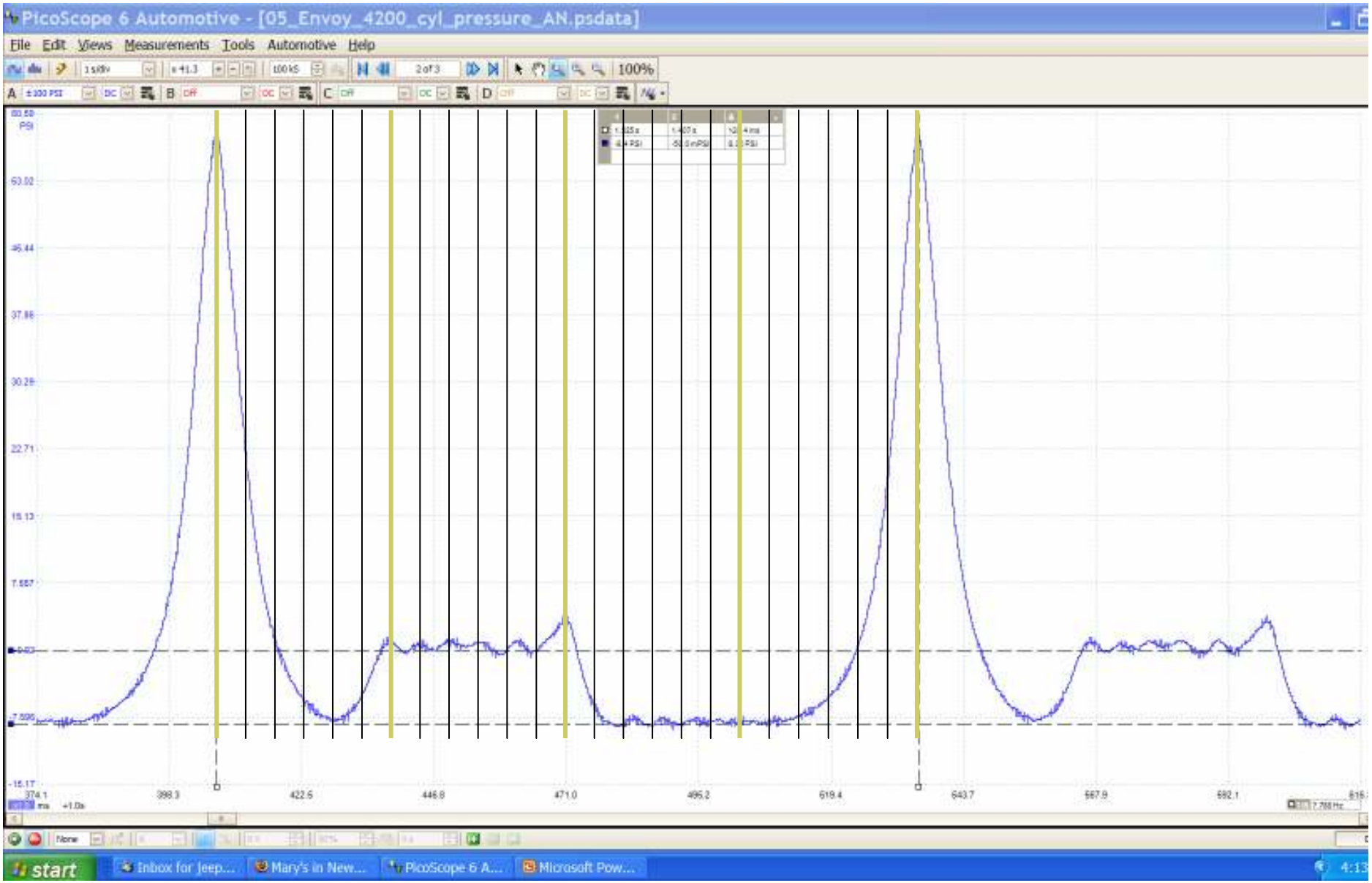
Good Civic Hybrid 1.5L



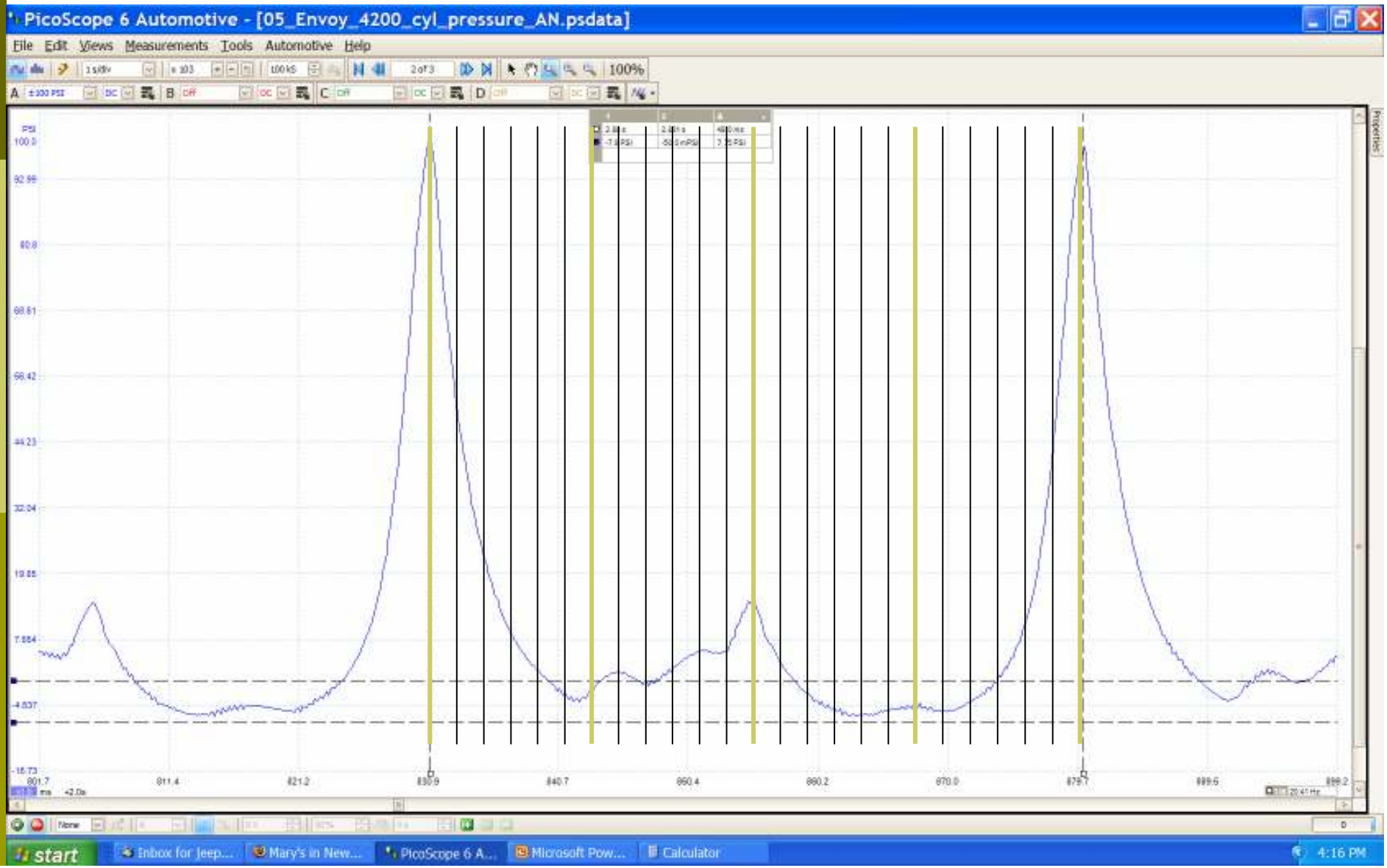
94 Blazer 4.3L



05 Envoy at about 937 RPM

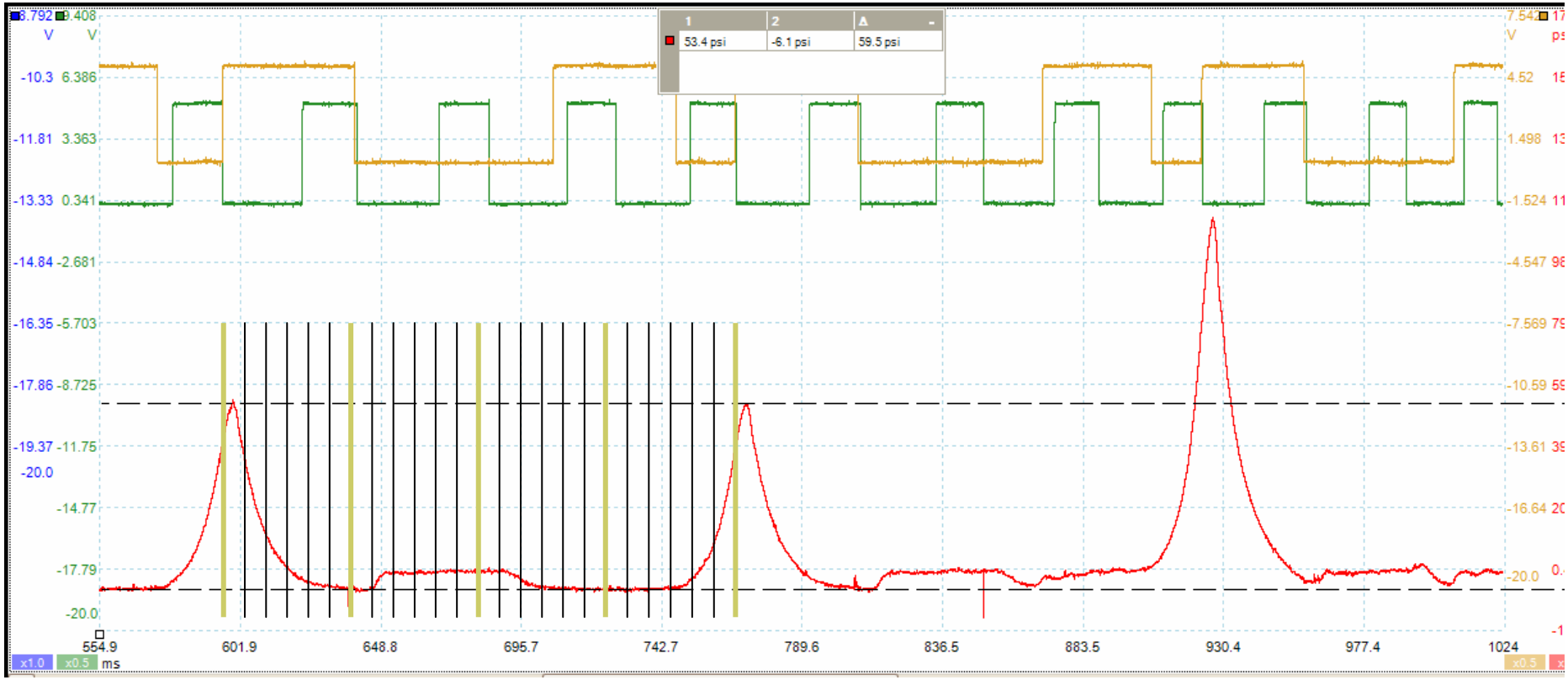


05 Envoy at about 2450 RPM



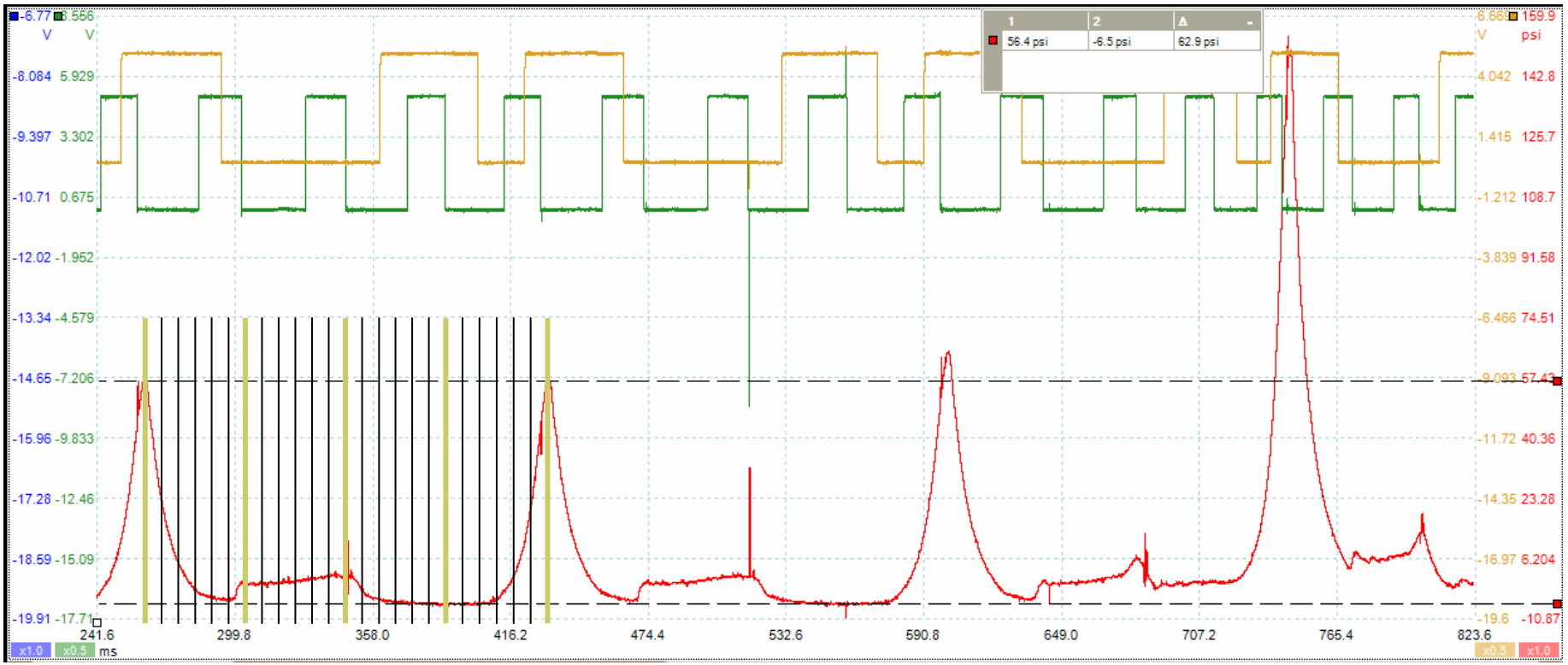
Mitsubishi 2.0

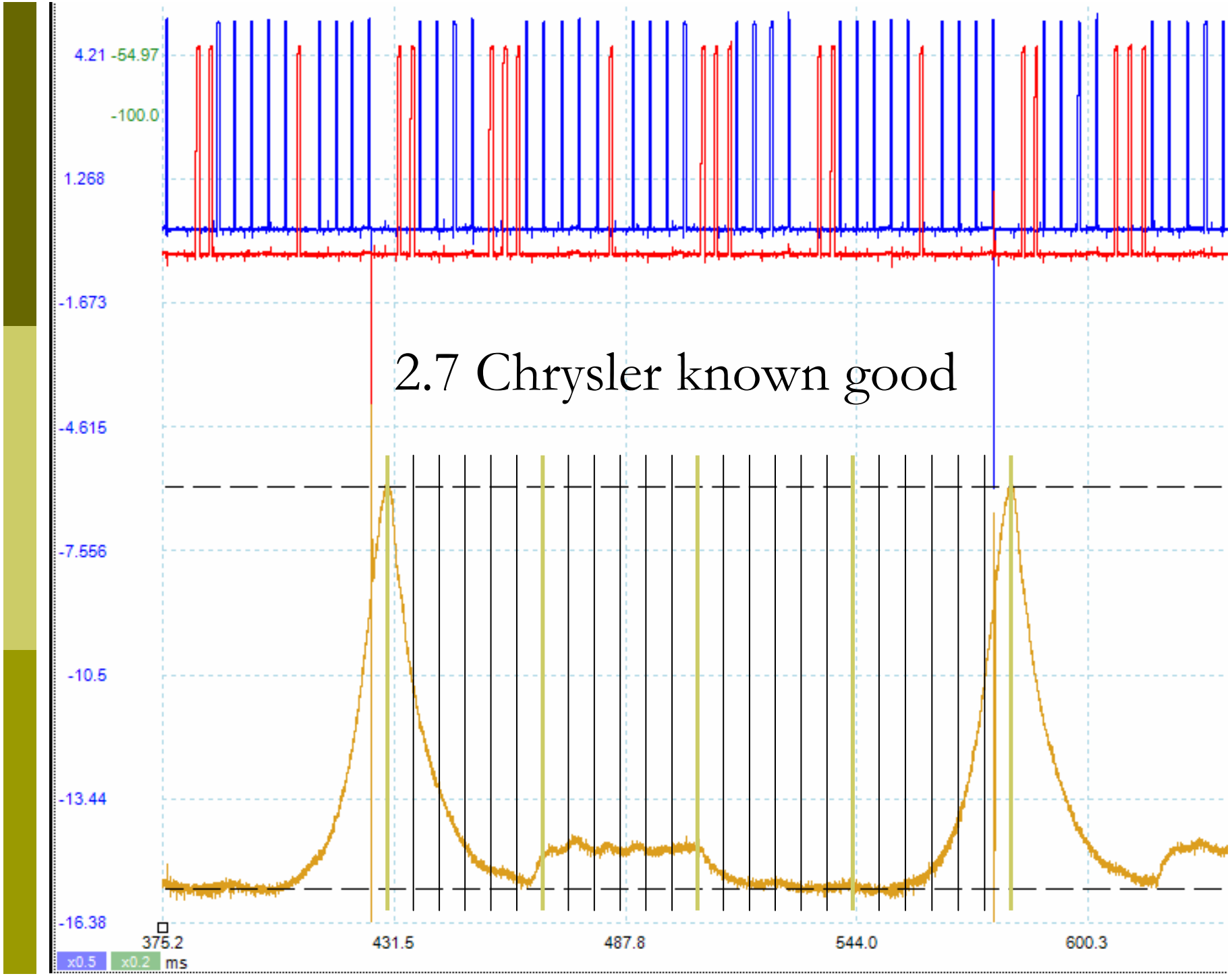
Cam Timing Retarded



Mitsubishi 2.0

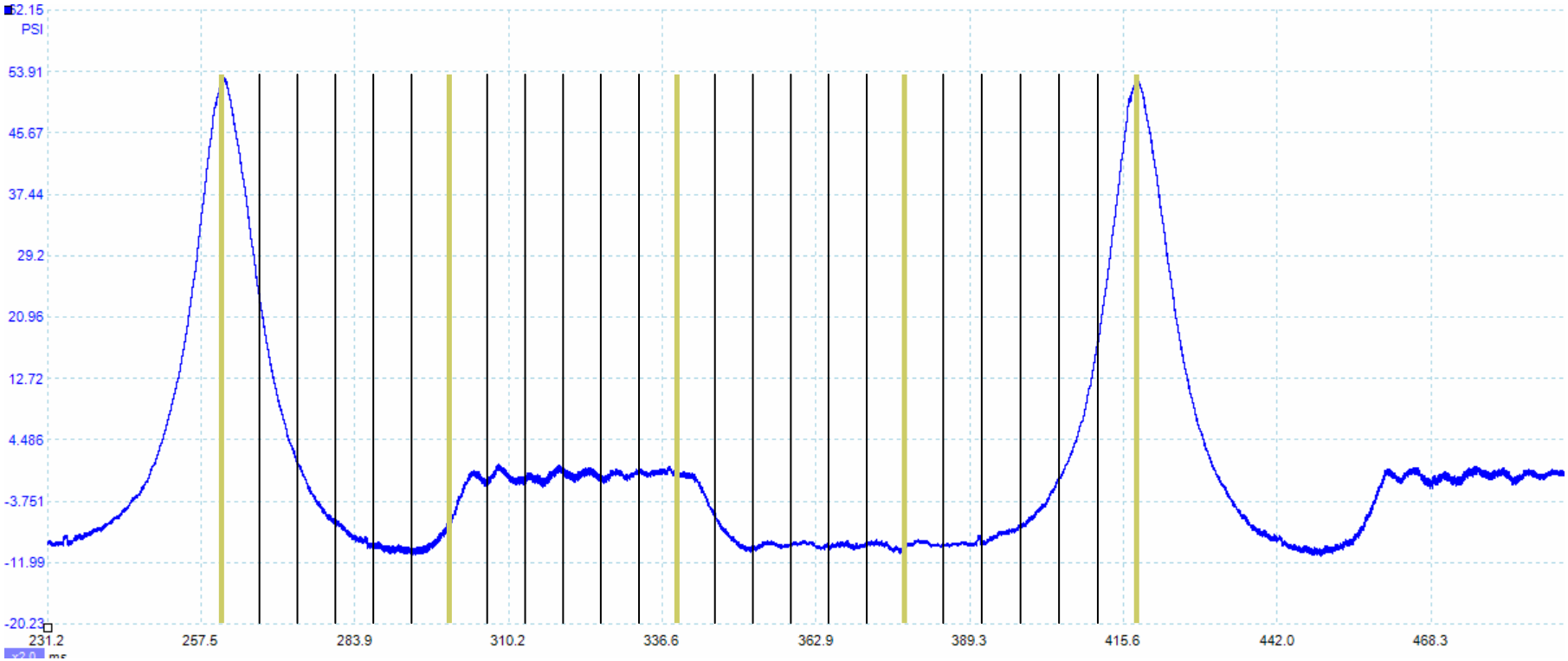
This engine has excessive exhaust backpressure, but the cam is in time





2.7 Chrysler known good

2.7 Chrysler: What do you think?



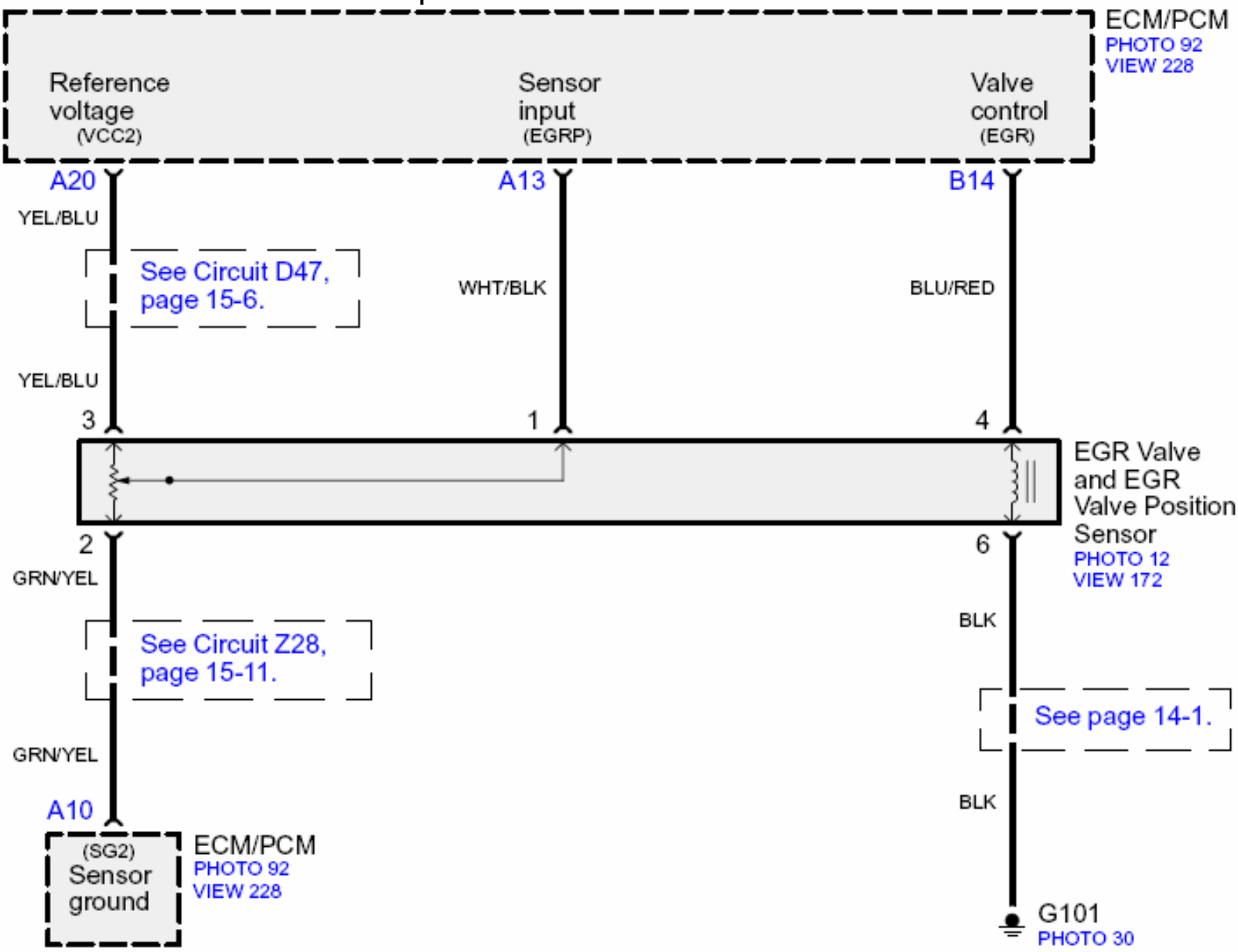
EGR Systems

- Exhaust Gas Recalculation
  - Reduction in combustion chamber temperature
  - Reduction in Nox
  - Improve fuel mileage
- Introduce some exhaust gas (inert) with the A/F charge
  - During cruise and off idle
  - Less A/F, lower temp

EGR Monitoring

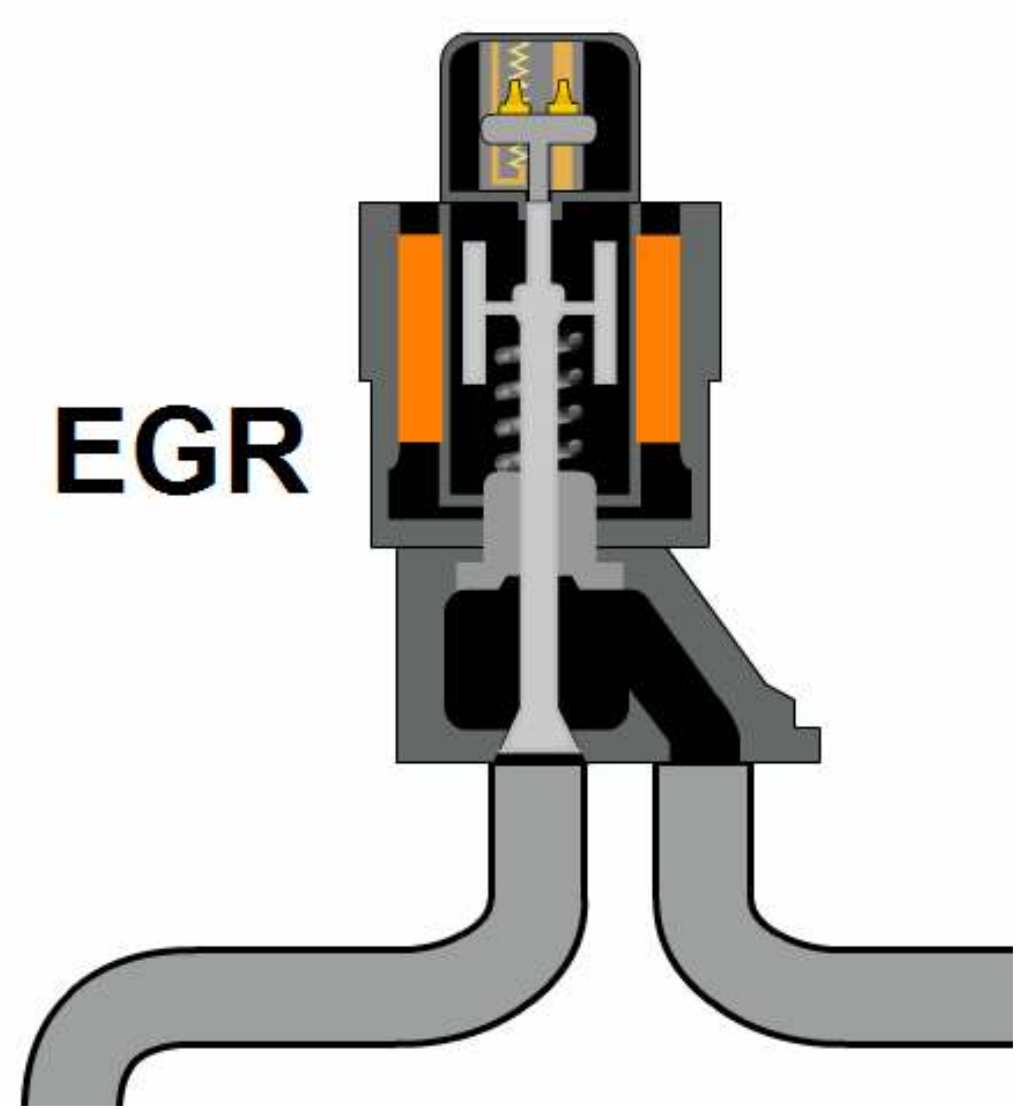
- Flow
  - Pressure feedback
  - MAP/MAF change
  - Position Sensor
  - Temperature
- Controls
  - Electronics

Example Honda Civic 1.7L 2001



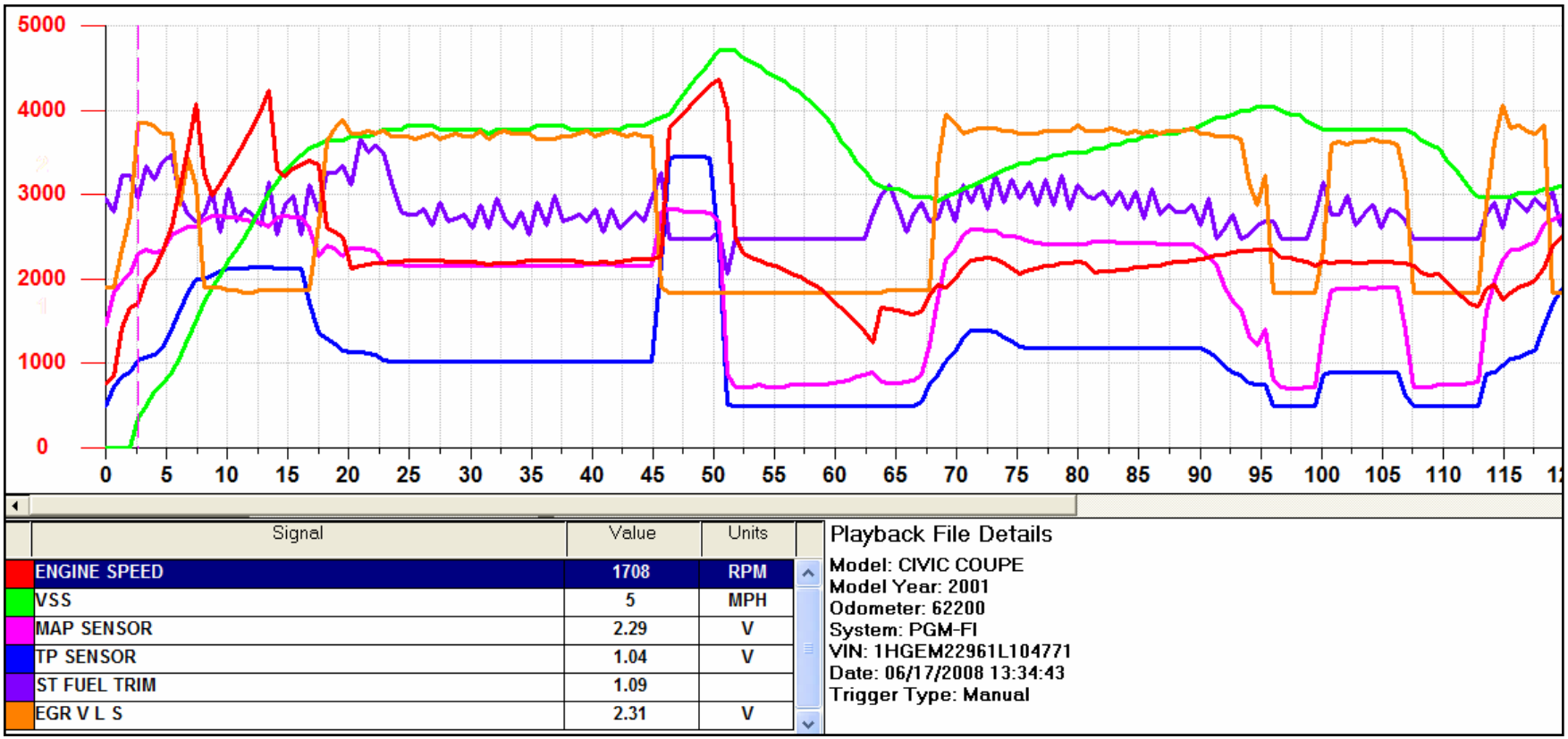
EGR Systems

- EGR valve has a three wire position sensor to inform on pintle position
- The coil is PWM by the PCM to match the desired lift calculated by the PCM
- The pintle allows exhaust gases to enter the intake



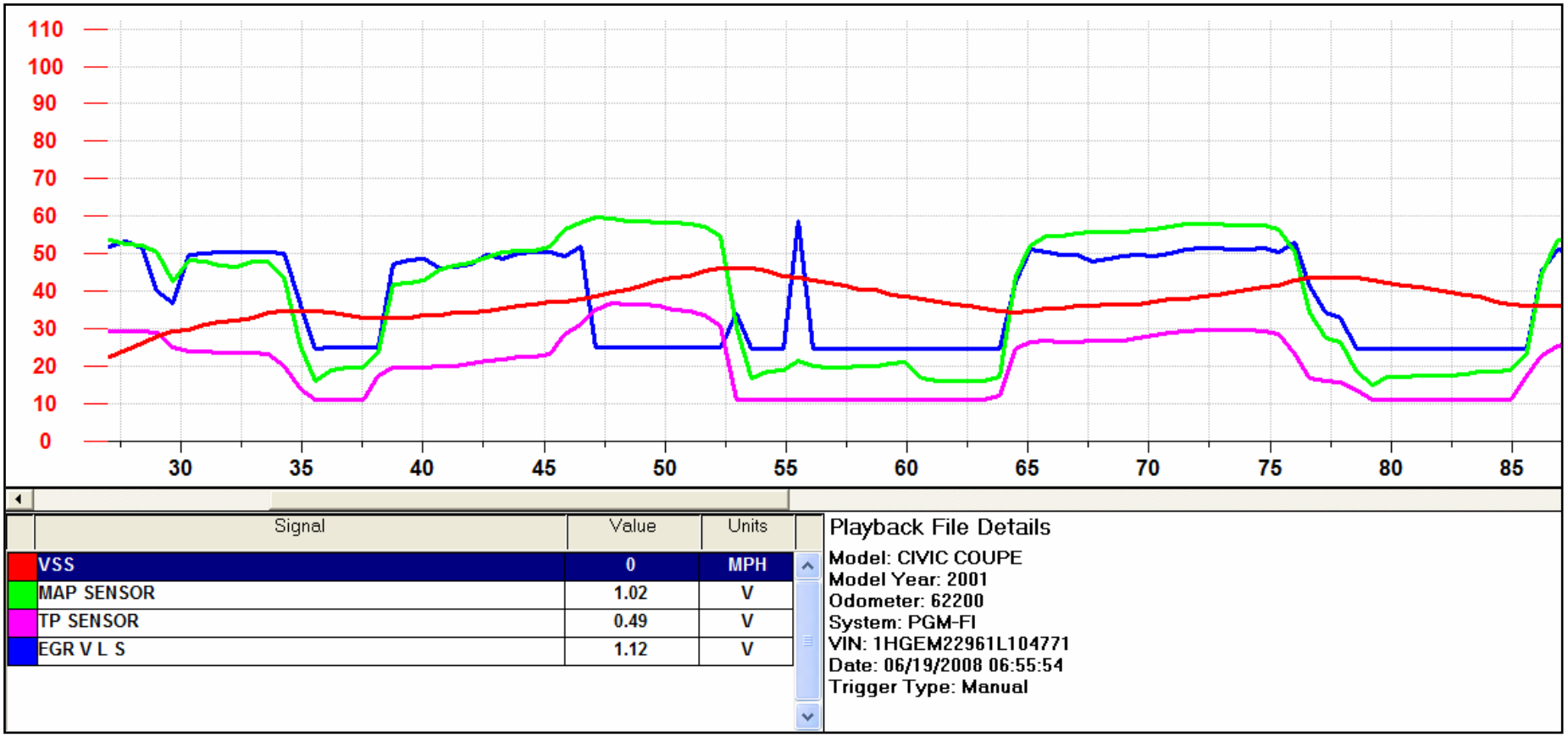
EGR Systems

Look at when the EGR is commanded. At idle, there is no EGR; at cruise, EGR is modulated ON; at higher throttle position, EGR is removed. The PCM is calibrated to know approximately how much EGR is entering the cylinder and how much injector pulse width is needed to achieve proper A/F control. The O2 sensor then fine tunes the system.

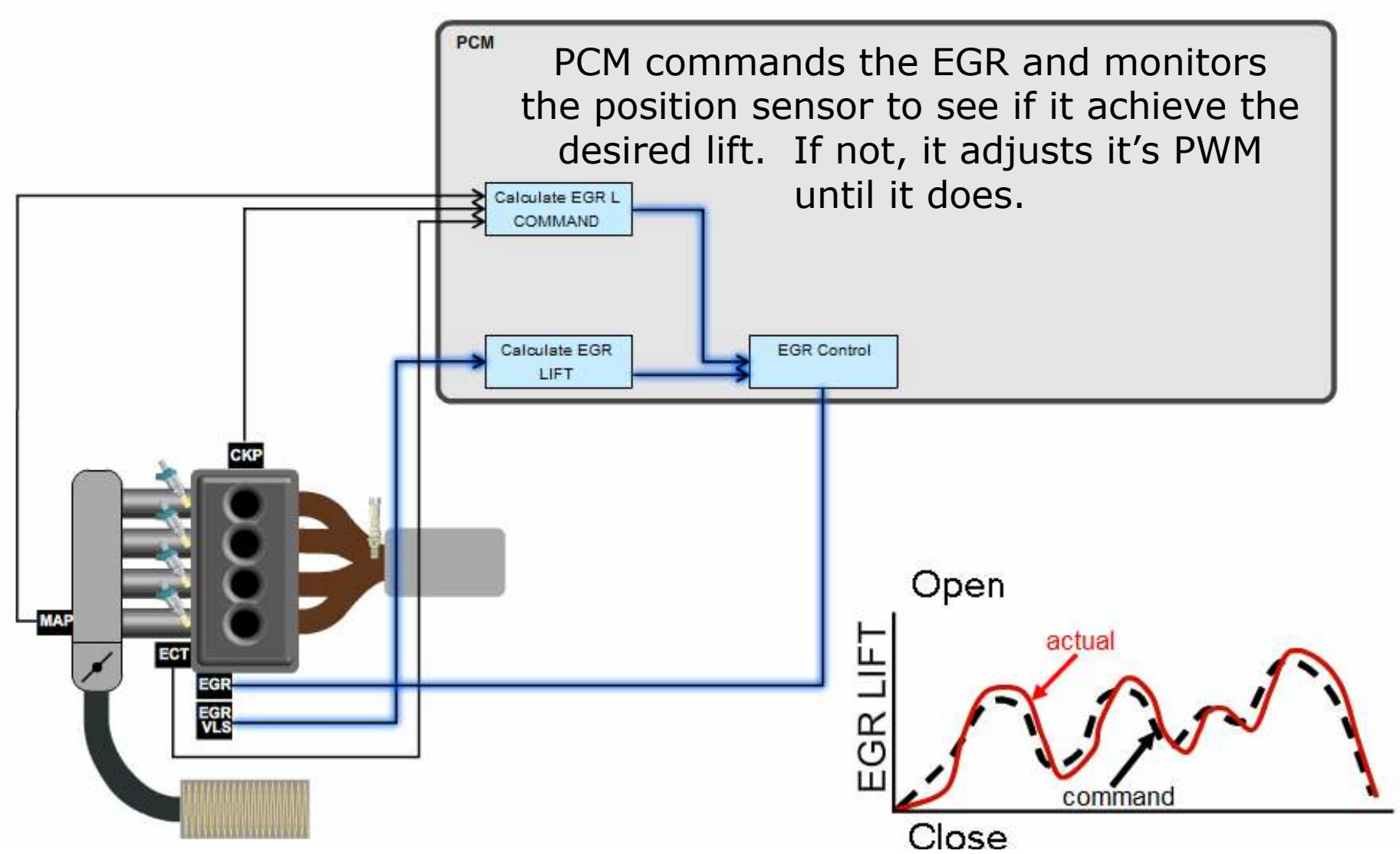


EGR Systems

Can you tell where the diagnostic monitor for flow took place?

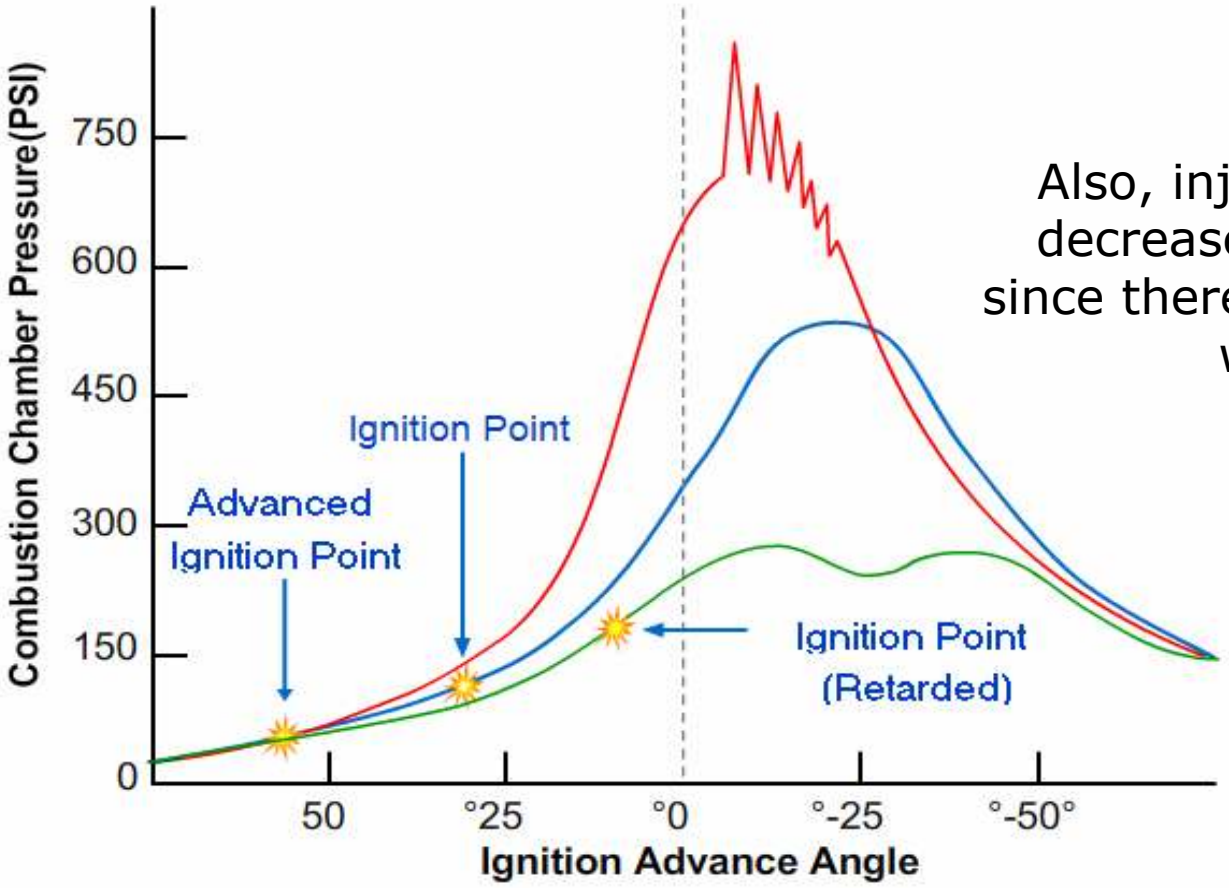


EGR Systems


PCM
PCM commands the EGR and monitors the position sensor to see if it achieve the desired lift. If not, it adjusts it's PWM until it does.
Calculate EGR L COMMAND
Calculate EGR LIFT
EGR Control
CKP
MAP
ECT
EGR
EGR VLS
Open
EGR LIFT
actual
command
Close

EGR Systems

With EGR, the ignition timing can be advanced a bit, since there's less A/F in the cylinder and lower pressure and combustion pressure rise.



Also, injector pulse width is decreased during EGR flow, since there's less oxygen to mix with the fuel

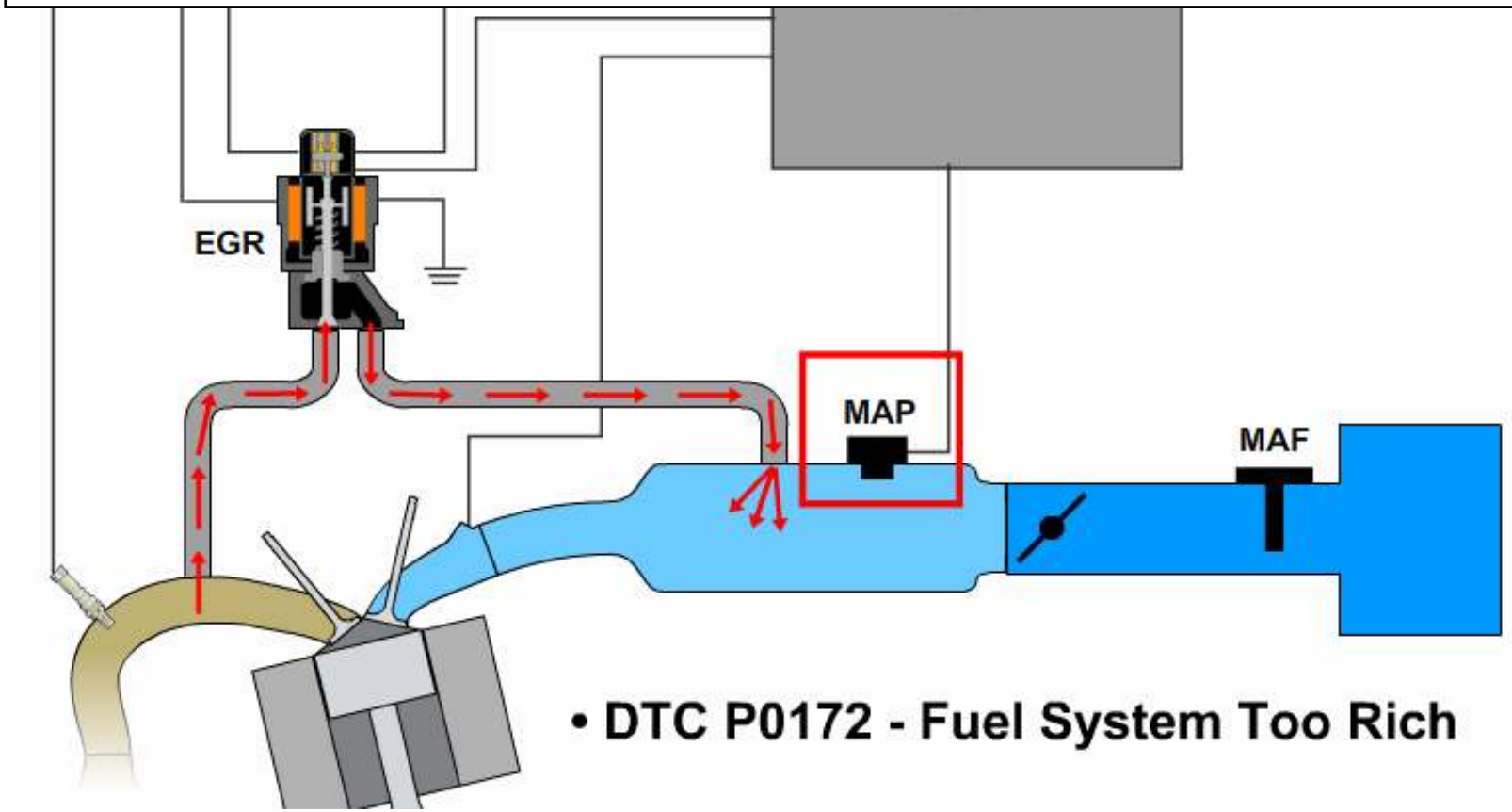
EGR Systems

TYPICAL MONITORED SYSTEMS ON HONDA VEHICLES

Model Year / Applicable DTCs		1996 – 2004	2003 - **current**	2006 - **current**
P0401	**EGR Insufficient**	O	O	O
P1491	**EGR Valve Insufficient Lift**	O		
P1498	**EGR Valve position sensor circuit high voltage**	O		
P0404	**EGR Valve circuit range/performance problem**		O	O
P2413	**EGR System Malfunction**		O	O
P0406	**EGR Valve position sensor circuit high voltage**		O	O
P0400	**EGR System Leak Detected**			O

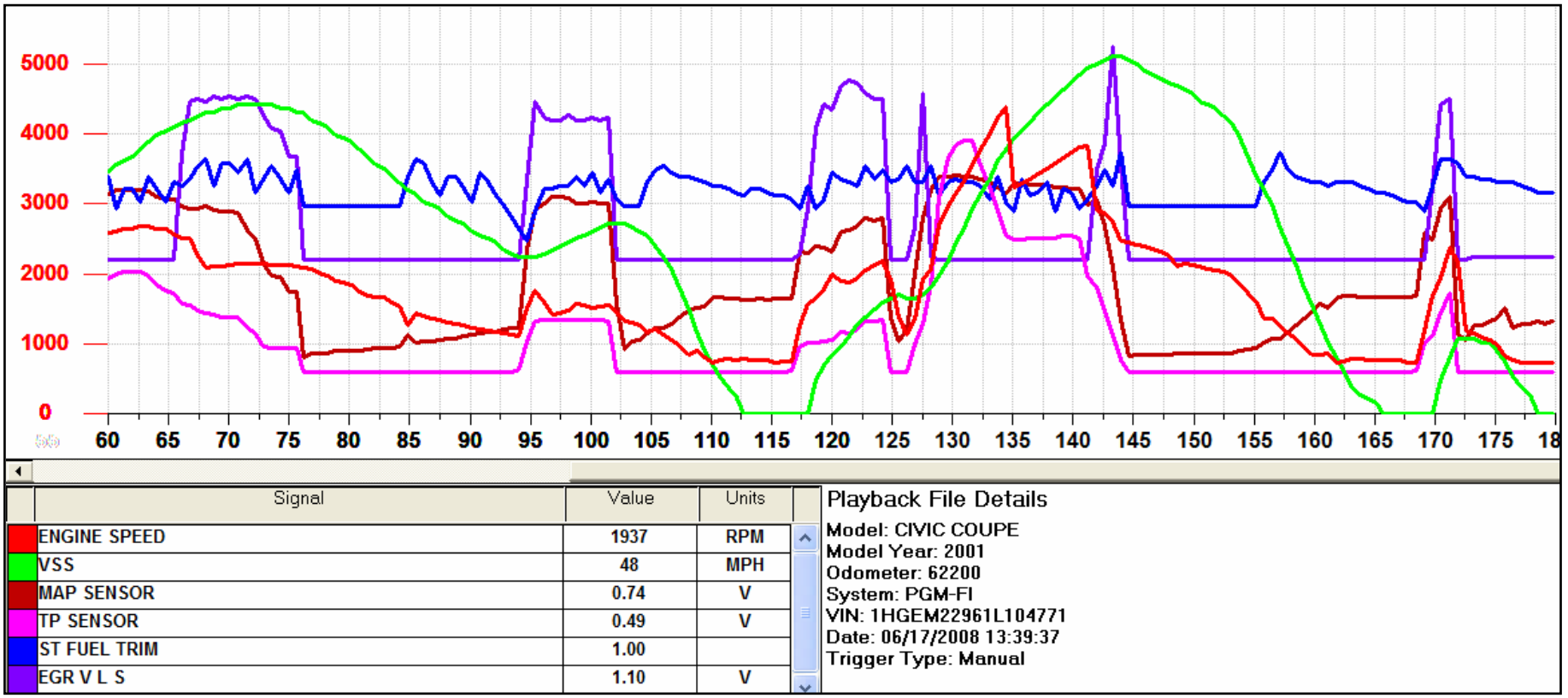
EGR Systems

A leaking EGR valve may cause negative fuel trims or O2 DTCs on MAP vehicles. MAF vehicles do not see the Fuel Trim change with EGR leaks



EGR Systems

Even though this is a functional engine and EGR, you can see the STFT go a little positive after each time EGR turns ON. This shows that the EGR is flowing and the PCM has slightly over compensated it's "base" calibrations for EGR flow. It's nothing it can't handle, but it does show flow.



EGR Systems

- Typical scan tool values on <u>normally</u> operating vehicle
  - EGR VLS is around 1.2v when closed
  - Fuel trim is based around Lambda

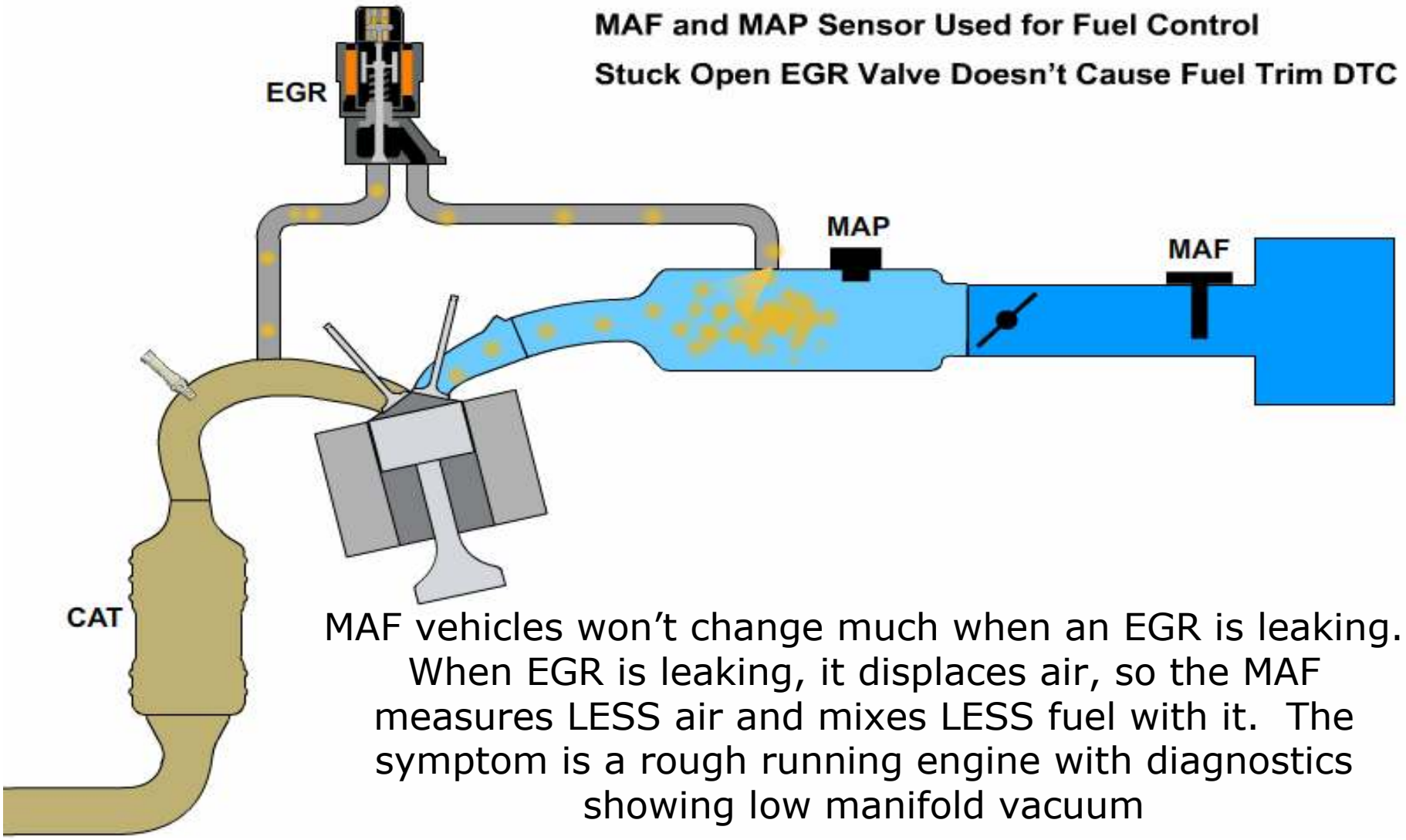
Signal	Value	Units
ENGINE SPEED	684	RPM
MAP SENSOR	0.86	V
ST FUEL TRIM B1	1.11	
LT FUEL TRIM B1	1.05	
ST FUEL TRIM B2	1.04	
LT FUEL TRIM B2	1.03	
EGR L COMMAND	0	
EGR LIFT	0	
EGR V L S	1.16	V

EGR Systems

- Does this show a problem?
- EGR Leak
  - MAP voltage increase, showing an increase in pressure (decrease in vac)
  - PCM increases injector PW because it thinks it's under load (but it's not)
  - O2 sensors indicate rich
  - Fuel trims correct by trimming lean
  - Might set a Rich O2 code

Signal	Value	Units
ENGINE SPEED	684	RPM
MAP SENSOR	1.08	V
ST FUEL TRIM B1	0.77	
LT FUEL TRIM B1	0.79	
ST FUEL TRIM B2	0.82	
LT FUEL TRIM B2	0.78	
EGR L COMMAND	0	
EGR LIFT	0	
EGR V L S	1.32	V

EGR Systems



MAF vehicles won't change much when an EGR is leaking. When EGR is leaking, it displaces air, so the MAF measures LESS air and mixes LESS fuel with it. The symptom is a rough running engine with diagnostics showing low manifold vacuum

EGR Systems

	2003	2004	2005	2006	2007	2008
Accord SULEV	O	O	O	O	O	O
Accord L4			O	O	O	O
Accord V6						O
Accord IMA			X	X	X	
Accord VCM2						O
Civic				O	O	O
Civic IMA				X	X	X
Civic Si				O	O	O
CRV					O	O
Element						
Fit						
Odyssey					X	X
Odyssey VCM2						O
Pilot						X
Ridgeline						
S2000						
MDX					X	X
RDX					O	O
RL						
TL					X	X
TSX						O

O	MAF Sensor Used for Fuel Control
X	MAF Sensor Installed but Not Used for Fuel Control
	MAF Sensor Not Installed

EGR Systems

- Slightly stuck open EGR
  - Rough Idle
  - Rough Running engine
  - Surge
- Gross Leak
  - Stalling
  - Surging
  - Poor acceleration
  - Random misfires
  - DTC (misfire, lean)