

# LAB - Bear Engine Analyser

Students: 1. \_\_\_\_\_ Date: \_\_\_\_\_  
 2. \_\_\_\_\_ Block: \_\_\_\_\_  
 3. \_\_\_\_\_

Fill in each box with the appropriate information. Place checks (✓) where applicable. Be sure to have Instructor's initials before moving on to the next step.

VEHICLE IDENTIFICATION			
Year:		Make:	
Model:		Colour:	
Displacement:	[ci][L][cc]	Transmission:	[manual] [automatic]
No. of cyl:		Firing order:	
Ignition Type:	[Points] [Electronic] [DIS]	Base Timing:	deg: RPM:
Battery CCA:		Advance Ignition Timing	deg: RPM:

SYSTEM INVESTIGATION	
1	<p>The Bear Engine Analyser (<i>scope</i>) is a computer based testing device that can help determine the condition of the engine and it's support systems.</p> <p>The <i>scope</i> has the ability to diagnose problems, however, it is important that the technician has both strong mechanical knowledge and diagnostic abilities to ensure an accurate diagnosis.</p> <p>In order for the <i>scope</i> to provide accurate results, it is imperative that you follow instructions thoroughly and accurately. In order to diagnose problems correctly, it is imperative that you fill out each section thoroughly and accurately. If you are in doubt about anything, ask your instructor for help.</p>

PREPARATION			
2	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> Check service manual for the correct specifications regarding your vehicle   <input type="checkbox"/> Engine must be up to proper operating temperature.   <input type="checkbox"/> Place fender covers on the vehicle to protect the paint.         </td> <td style="width: 50%; vertical-align: top;"> <p><b>Safe work practices are vital working around a running engine.</b></p> <p><b>Keep fingers and tools AWAY from moving parts.</b></p> <p><b>Keep the hoses and cords and connectors of the scope AWAY from moving parts.</b></p> </td> </tr> </table> <input type="checkbox"/> Proper ventilation is essential as the engine will be running for most tests - exhaust extraction should be hooked up  <input type="checkbox"/> Position the scope in a location where the screen can be seen from the driver's seat  <input type="checkbox"/> With the machine OFF, connect the following leads to the motor:	<input type="checkbox"/> Check service manual for the correct specifications regarding your vehicle  <input type="checkbox"/> Engine must be up to proper operating temperature.  <input type="checkbox"/> Place fender covers on the vehicle to protect the paint.	<p><b>Safe work practices are vital working around a running engine.</b></p> <p><b>Keep fingers and tools AWAY from moving parts.</b></p> <p><b>Keep the hoses and cords and connectors of the scope AWAY from moving parts.</b></p>
<input type="checkbox"/> Check service manual for the correct specifications regarding your vehicle  <input type="checkbox"/> Engine must be up to proper operating temperature.  <input type="checkbox"/> Place fender covers on the vehicle to protect the paint.	<p><b>Safe work practices are vital working around a running engine.</b></p> <p><b>Keep fingers and tools AWAY from moving parts.</b></p> <p><b>Keep the hoses and cords and connectors of the scope AWAY from moving parts.</b></p>		

- ◆ Large POS and NEG clamps at rear: Battery POS and NEG
- ◆ Medium RED and WHITE alligator clips: Battery POS and NEG
- ◆ Small WHITE alligator clip: Battery POS
- ◆ Small BLACK alligator clip: Ignition Coil NEG
- ◆ GREEN cable clamp: Cylinder #1 High Tension Wire
- ◆ YELLOW cable clamp: Ignition Coil High Tension Wire
- ◆ WHITE cable clamp: Battery cable (arrows away from post)
- ◆ ORANGE Vacuum hose: To manifold vacuum
- ◆ Exhaust probe: In Tailpipe

**STOP!**

**INSTRUCTOR'S INITIALS:**

**SETUP**

<b>3</b>	<input type="checkbox"/> Turn on the Machine and the HC Pump. <input type="checkbox"/> Select SPECIFICATIONS from the menu screen <input type="checkbox"/> You can "enter specs from disk" if your car is 1990 or older. <input type="checkbox"/> If your car is not listed and you know the specs, enter the customer and vehicle specs. <input type="checkbox"/> While some generic specs are listed to the right, your results will be much more accurate if you enter specs unique to your vehicle. <input type="checkbox"/> Take note of the key pads you will use. They are RED, GREEN and YELLOW. <input type="checkbox"/> The most common buttons are [CONTINUE] [ENTER]	<b>General Specs that might work:</b> Minimum regulator voltage: 13.8 Maximum regulator voltage: 14.8 Cranking Voltage: 9.6 Cranking Current: 4cyl=150;6cyl=180;8cyl=200 Minimum Dwell: 0.0 Maximum Dwell: 99.0 Minimum Ballast Resistance: 0.0 Maximum Ballast Resistance: 9.9 Minimum Primary Resistance: 0.8 Maximum Primary Resistance: 1.0 Magnetic Probe: 135 Plug Gap: 0.04
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**TESTING**

**4** Start the engine

<b>P R I M</b>	<p><b>[3] PRIMARY CIRCUIT TEST</b> Tests the condition of the coil and trigger device</p> <p>Dwell: _____ Degrees</p> <p>Ballast Resistance: _____ Ohms</p> <p>Primary Resistance: _____ Ohms</p>
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High resistance indicates a faulty connection or component  
Low resistance indicates a faulty component or faulty wiring

Which parts are within spec?

S  
E  
C  
O  
N  
D  
A  
R  
Y

**[4] SECONDARY KV** Checks all aspects of the secondary side of the ignition

Follow the screen prompts and insert your results here:

CYL	BURN TIME	BURN KV	AVG KV	$\Delta$ KV	SNAP KV	CKT GAP KV
1						
2						
3						
4						
5						
6						
7						
8						

Analyse your results here:

**BURN TIME** The spark length in milliseconds

- Ideal is around 1.5ms
- Low reading (~0.5ms) indicates high resistance (ie: wide plug gap)
- High reading (~2.0) indicates low resistance (ie: narrow or shorted plug gap)

**BURN KV** The spark intensity

- Varies inversely as BURN TIME

**AVERAGE KV** Voltage required to jump the gap

- If BURN TIME is low, AVERAGE KV will be low
- Low reading indicates a path of high resistance

**$\Delta$ KV** Difference between minimum and maximum spark voltages

- 2 - 3KV is acceptable
- Zero reading indicates partial combustion or spark plug problem
- High reading (~8KV) indicates a faulty a high tension wire, or rotor

**SNAP KV** Voltage required when engine is under load

- Should be higher
- No increase indicates a faulty high tension lead or plug
- High reading indicates you are maxing out your coil. Should be less than 75% coil capacity

**CKT GAP KV** Voltage required to overcome ALL gaps in the circuit

- All readings high indicate faulty cap and rotor or coil wire
- Some readings high indicate faulty spark plug or high tension lead

What parts are likely a problem?

**STOP!**

INSTRUCTOR'S INITIALS:

I  
G  
N  
I  
T  
I  
O  
N

**[5] IGNITION PATTERNS**      *Compares the voltages at each cylinder live-time.*

*Try each of the displays, and record your observation*

**SEQUENTIAL**      *The default display, which shows each cylinder's firing one at a time.  
Press EXPAND on the keypad to show more of the display*

**RASTER**      *Displays all cylinder's firing vertically for comparing voltage over time*

*Which cylinder(s) is consistently different than the others? How does it differ?*

\_\_\_\_\_

**PARADE**      *Displays all the cylinder's firing horizontally for comparing voltage highs and lows*

*Which cylinder(s) is consistently different than the others? How does it differ?*

\_\_\_\_\_

**STOP!**

INSTRUCTOR'S INITIALS:

C  
R  
A  
N  
K  
I  
N  
G

**[7] CRANKING TEST**      *Tests the condition of the starting system as well as a ~relative~ compression test*

*Selecting this test will kill the running engine (don't worry)*

*Crank to restart and record your results:*

Cyl#:            1        2        3        4        5        6        7        8

COMP%:      \_\_\_\_\_

Cranking Volts:      \_\_\_\_\_ Volts

Cranking Current:      \_\_\_\_\_ Amps

Cranking Vacuum:      \_\_\_\_\_ inHg

Cranking Speed:      \_\_\_\_\_ RPM

Cranking Dwell:      \_\_\_\_\_ Degrees

Coil Input Volts:      \_\_\_\_\_ Volts

Hydrocarbons:      \_\_\_\_\_ Ppm

Are the cranking amps within spec?      \_\_\_\_\_

Which cylinder(s) are more than 10% lower than the highest reading?      \_\_\_\_\_

P  
O  
W  
E  
R  
  
C  
H  
E  
C  
K

**[8] POWER CHECK**

Tests the contribution of each cylinder to the engine

Computer controlled engines should have their idle air control disconnected as well as the Oxygen sensor, otherwise the computer will try to "adjust" the engine to compensate for the test procedure.

- Press a cylinder number in the key pad
- Let the numbers stabilize, then press CLEAR (Don't wait too long)
- Record your results below
- Wait for the HC to stabilize before going on to the next cylinder

CYL#	RPM CHANGE	VACUUM	HC
1			
2			
3			
4			
5			
6			
7			
8			

Which cylinders are contributing the least? \_\_\_\_\_

**STOP!**

INSTRUCTOR'S INITIALS:

--

C  
H  
A  
R  
G  
I  
N  
G

**[17] CHARGING SYSTEM TEST**

Tests the charging system

- Rev engine to over 2000rpm and hold
- Computer will load the charging system and record the results

Alternator Output: \_\_\_\_\_ Amps

Regulator Voltage: \_\_\_\_\_ Volts

Diode waveform should be a smooth, unbroken series of hoops (topside of a tight sinewave)

B  
A  
T  
T  
E  
R  
Y

**[18] BATTERY TEST**

Tests battery condition

- Place amp probe around the LARGE test clamps on the battery
- Engine should be off

OPEN CKT V: \_\_\_\_\_ Amps

LOAD VOLTAGE: \_\_\_\_\_ Volts

**STOP!**

INSTRUCTOR'S INITIALS:

**USE THE FOLLOWING TESTS FOR FINE-TUNE**

A  
D  
J  
U  
S  
T  
M  
E  
N  
T

**(2) ADJUSTMENT SCREEN** Provides a number of displays for tuning purposes

ENGINE SPEED = This is the RPM of the engine

CARBON MONOXIDE = High indicates incomplete combustion. CO should vary inversely

HYDROCARBONS = High indicates rich condition

CARBON DIOXIDE = Indicates efficiency of the engine. Should be approx 15%

OXYGEN (O2)= High indicates poor combustion

High HYDROCARBONS and CARBON MONOXIDE and OXYGEN indicate a mechanical problem.

M  
I  
S  
S

**(6) CYLINDER MISS RECALL** Allows a missfire situation to be recorded  
Results can be played back  
This will help you isolate a cylinder missfire

R  
O  
U  
G  
H

**(13) ROUGH IDLE** This is a narrow-range tachometer  
Allows small fluctuations in idle speed to be analysed  
This will help you tune to a very smooth idle

A  
N  
A  
L  
Y  
S  
I  
S

**ANALYSIS**

Based on the information you gathered in the test, make accurate recommendations for maintenance/repair/further testing of the vehicle

**STOP!**

INSTRUCTOR'S INITIALS: