2440

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TRAINING MANUAL
INDIANA 2440

E

SALES DEPARTMENT

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SUMMARY

INTRODUCTION

2 strokes, 4 strokes and rotary engines are supplied with two fluids (air and fuel) which flow through the carburetor.

The function of carburetor is to supply the engine with a sprayed, homogeneous and correctly balanced air/fuel mixture.

Consequently, you can distinguish two circuits in a carburetor: one air circuit and one fuel circuit.

AIR:

The circuit followed by air is composed of one or several air intakes at filter, the filter itself and the case of filter (large volume case in order to get a “smoothness” effect on fluid before inlet).

A pipe then links this filtering block to carburetor.

FUEL:

Fuel first flows through filters.

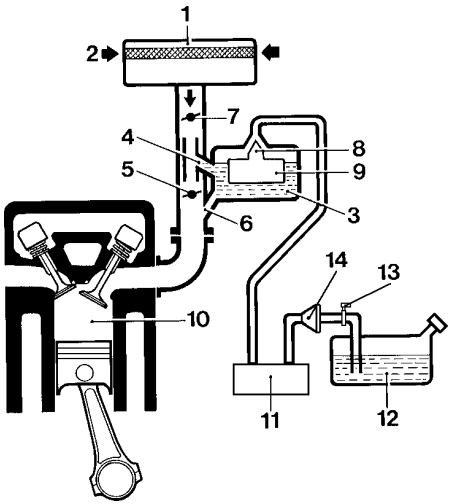
A sump filter is generally integrated in the fuel faucet and an independent filter is placed on the carburetor supplying pipe.

Fuel then finds on its way:
- the fuel pump
- the tank, a floater and a needle.

To get the necessary depression to pull fuel up to jet, the level in the tank must remain constant (function of the floater/needle set).

At the tank outflow, jet will calibrate the fuel flow and the diffuser will make the air/fuel mixture in order to get the necessary richness to have a good engine running whatever external temperature, altitude and speed are.

On motorcycles, this carburation is generally provided by one air intake and one carburetor for each cylinder.



1 - air filter
2 - air intake
3 - carburetor
4 - jet
5 - Throttle valve
6 - idle jet
7 - choke valve
8 - needle
9 - floater
10 - mixture suction by engine
11 - fuel pump
12 - tank
13 - faucet
14 - fuel filter

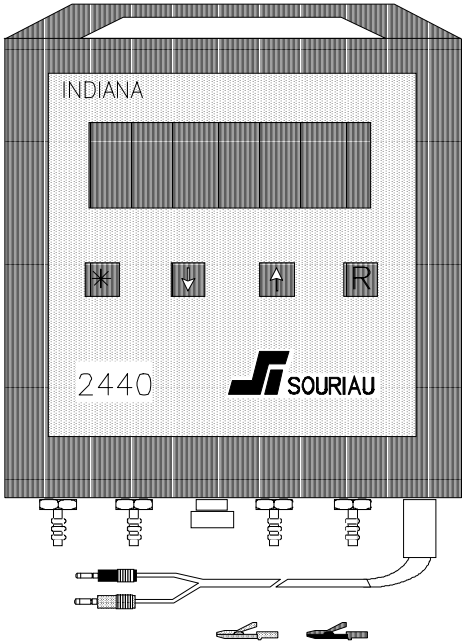
Connecting the INDIANA 2440 on the depression outlets on inlet manifolds, you can very simply:

- achieve DIAGNOSIS by analyzing the vacuum curves within the inlet manifolds
- SYNCHRONIZE the throttle valves
- ADJUST the mixture.

In this booklet, a method helping you to make the most of these possibilities is described.

Injection vehicles: the INDIANA 2440 gives you the same functions of diagnosis and synchronization but does not allow mixture adjustment (chapter 2-3).

1 - DESCRIPTION



The 2440 consists of a case with control keys and sealed front panel protecting a 60X240 dot display.

The entire device is enclosed in a protective rubber case.

Device
- 4 depression inputs
- 1 power supply cable
- 4 control keys
- 1 fuse holder

Accessories
- storage case
- 2 alligator clips
- 4 rubber hoses (1 m)
- 1 rubber hose (10 cm)
- 1 derivation plastic “T”
- 2 spare fuses (300 mA temporized)

Dimensions : 210 x 250 x 55 mm
Weight : 2 Kg approximately
Power supply : 12 V DC only (9 to 17 V)

1.1 Available tests:

DIAGNOSIS - analysis of depression curves in each cylinder.
- simultaneous measurement of minimum and maximum depressions.

BALANCING - differential measurement of depression in relation to a reference cylinder.
- simultaneous bargraph display of 1 to 4 depressions.

TUNING - mixture adjustment with expanded scale differential tachometer

1.1.1 Getting ready:

- Connect the 4 rubber hoses on the depression inlets on the 2440 and on the depression outlets on the motorcycle.

- Connect the power supply cable to the battery of the vehicle to be controlled or to an external energizer (12 V exclusively).

red plug : + battery
black plug : - battery
protected device in case of wrong polarity

The INDIANA is ready to work.

1.1.2 Basic operation:

- It may be necessary to prepare the vehicle to access to depression outlets or to adjustment screws (remove fuel tank, install fuel feed, etc...)

- Because the unit references curves in filling order, it is better to connect in the same order hoses to the depression inlets on inlet manifolds.

- Use of nozzles, as well as a “T” and a 10 cm hose can be necessary (e.g. BMW fuel pressure regulator).

- Select the language using the (🡻) key.

- Confirm with the (✸) key.

If the engine is not a 4 stroke one

- Press the (↑) key to move the cursor to the selection line (4 strokes, 2 strokes, rotary).
- Press (✸) to scroll the selection.
- Select one test pressing the (↓) key.

1.1.3 Operation (main menu):

RUN THE ENGINE

After the language selection, a table appears on the screen (see below).

In this table you find:

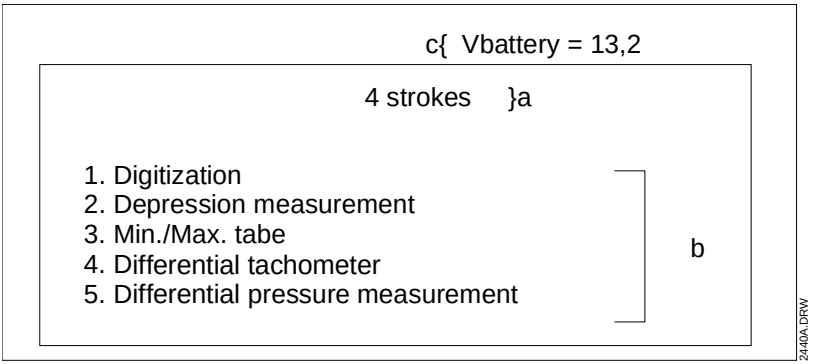
a) the engine selection (4 strokes, 2 strokes, rotary)

b) the list of available tests

c) battery voltage

Check the correct functioning of alternator and regulator according to the procedure given in the manufacturer manual (maximum voltage, lights off, maximum speed / minimum voltage, lights on, minimum speed).

The voltage should be between 13.2 and 15.2 V .



2- THE DIFFERENT TESTS: (for example: 4 cylinder, 4 stroke engine)

2.1 Diagnostic functions

- Digitization
- Maxi/mini table

2.1.1 Digitization:

This test shows the depression curve of each cylinder measured on inlet manifold.

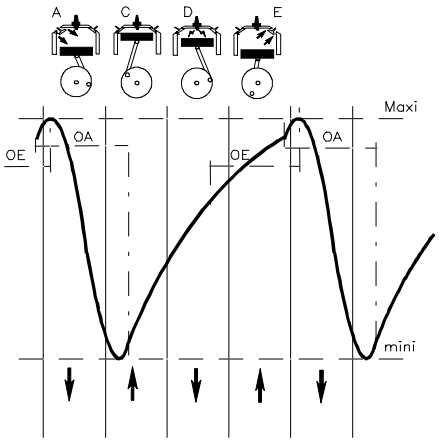
If you memorize this curve, the screen displays the same curve in a static state, the RPM and the Maxi/Mini depression which will help the user to detect the 3 major fault types.

After having the curves of each cylinder scrolled on the screen with the (🡻) key, the 4 curves are displayed simultaneously.

These curves can point up a fault on one of cylinders with a simple visual comparison.

- induction leak
- faulty inlet valve
- faulty exhaust valve

Each fault's typical curve is presented below:



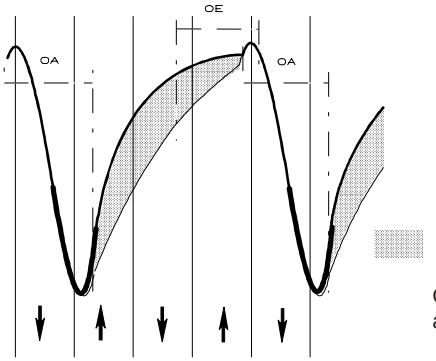
OA: inlet valve opening time
OB: exhaust valve opening time

Typical normal depression curve in an inlet manifold for a good condition cylinder

*** Induction leak**

If a leak is detected on the carburetor or inlet manifold, a specific curve appears.

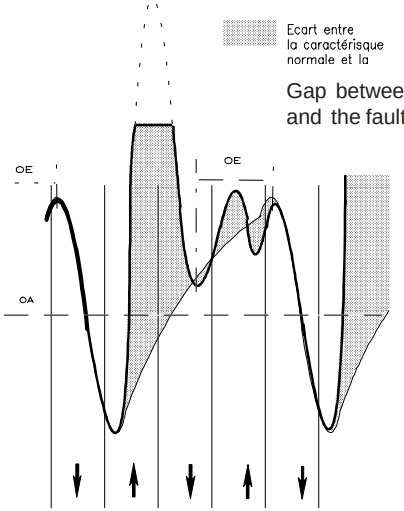
This faulty leak brings a too fast rise of depression in the corresponding cylinder.



Gap between the typical curve and the faulty curve

*** Faulty inlet valve:**

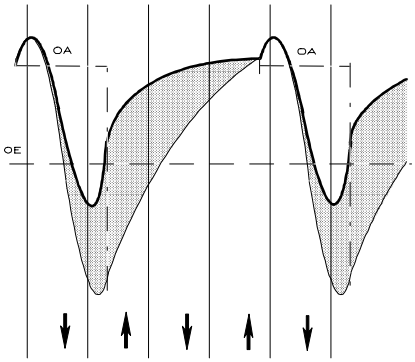
In a 4 stroke cycle, if an inlet valve is not airtight, an important and abnormal superpressure appears on the curve during the compression phase.



Gap between the typical curve and the faulty curve

*** Faulty exhaust valve:**

During the inlet cycle, the INDIANA detects a depression less important than it should be because the exhaust valve is not airtight, leading to a faster rise to atmospheric pressure during other cycles.



Gap between the typical curve and the faulty curve

PRACTICAL HANDLING

-The cursor is on the choice n°1; if it is not the case, use the arrows (↑ or ↓) to move the cursor.
- Press (✸) to confirm
- The table here below appears and displays the depression curve of cylinder n°1.

Maxi	**mBar**		a curve appears in that area as soon as a depression is applied on the corresponding way
Mini	**mBar**		
R.P.M.	**tr/min**		
(↓) N°=1			
(↑) Memory	**on** / **off**	■	

2440B.DRW

- Press the key (↑) (memory on), the curve of this cylinder is memorized and can be analyzed.
  On the left side of the screen, the RPM and the mini/maxi pressures of the memorized curve are displayed.

- To check cylinder n°2, press the key (↑) (memory off) which deactivates the memory.

- Press the key (↓) to scroll the inlet depression curves from cylinders n°1, 2, 3 and 4.

- Press the key (↓) once again.
  A screen n°1 2 3 4 displays the four curves simultaneously in a static state.

- To jump to the main menu, press key (✱).

2.1.2 Maxi/mini table

This table displays, in dynamic, the maximum and minimum pressures, compared to vacuum for each way, and the RPM.
It allows you to compare one cylinder from each other.

This test is also a diagnostic function, but in this table we only quickly compare with figuring, the two extreme points of each curve.
This way, you can detect a fault, mainly comparing “min” figures.

PRACTICAL HANDLING

- You are in the main menu, if not press (✱).

- Press key (↓) to move cursor n°3 downward.

- Press key (✱) to confirm.

- The mini/maxi table is instantaneously displayed.

Min. et Max. Table 1280 RPM

mBar	N°1	N°2	N°3	N°4
Max.	1000	1005	990	1001
Min.	390	401	392	383

2440C.DRW

In that table, one of the cylinders shows a reduced amplitude which can mean a bad synchronization of throttle valves.

Those two functions (digitization and Mini/Maxi table) achieve a fast and easy control of the "condition" of the engine analyzing the depression curves and their values.

2.2 Throttle valves synchronization function:

On the INDIANA 2440, two functions propose the balancing of throttle valves on carburetor or injection engines:

- differential pressure measurement
- depression measurement

2.2.1 Differential pressure measurement:

This test allows you to adjust the synchronization of throttle valves with the help of two kinds of results, graphical and numerical, on the same screen.

Each cylinder must be in ideal phase with the reference cylinder determined by the manufacturer for an optimal engine efficiency.

- Variation of pressure (in mBar) in comparison with the determined reference cylinder,
- A graphical scale corresponding to variations of pressure in comparison with the same reference cylinder (with a positive or negative direction),

are displayed.

This tuning is made at the idle speed given by the manufacturer and displayed on the upper right side of each screen.

PRACTICAL HANDLING

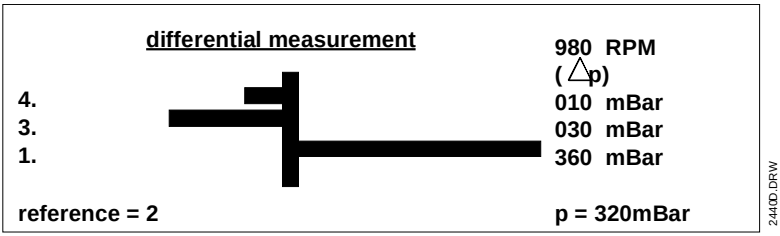
- You are in the general menu; if not press (✸).

- Press the (🡻) key to move the cursor downward on n°5.

- Press the (✸) key to confirm.

- Press the (🡹 or 🡻) to select the cylinder used as reference.

- To confirm, press (✸) (in our example below, cylinder n°2 is the reference).



The pressure gaps are -10 and -30 mbar on cylinders n°4 and 3, +360 mbar on cylinder n°1.

* 320 - 10 = 310 mbar
* 320 - 30 = 290 mBar
* 320 + 360 = 680 mbar on cylinder n°1

This table allows you to balance pressures in comparison with the selected reference cylinder.

In case of large difference on one of the cylinders (in our example, cylinder n°1 mainly), you will have to adjust the air intake screw on the corresponding cylinder.

The objective is to obtain a ΔP as close as possible of zero for each cylinder.

2.2.2 Depression measurement:

This second screen allows you to adjust depressions of each cylinder displaying the 4 ways.

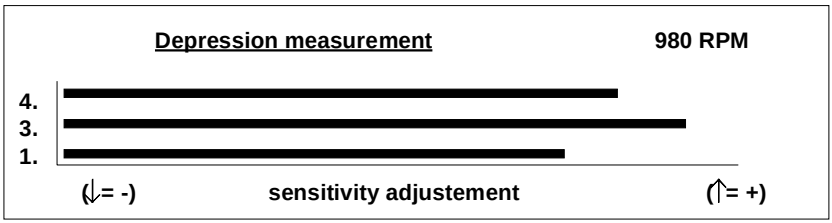
In this way, you can rapidly compare the length of each bar.

PRACTICAL HANDLING

- You are in the main menu, if not press (✸).

- Move cursor on n°2 and press (✸) to validate.

Input n°2 unplugged: no measure on 2



- For an optimal graphic sensitivity, use the full screen pressing the (↑ or ↓) keys.
  A comfortable visualization of the difference of pressure will so be improved

After air adjustment (4-3-1), the balancing must be correct.

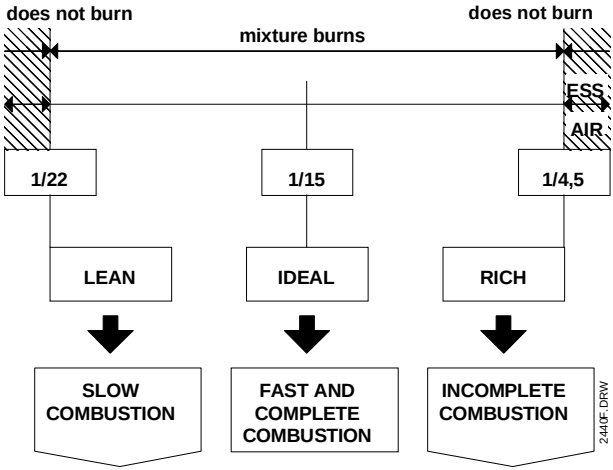
In order to control this adjustment, check the simultaneous displacement of bars on a brusque acceleration.

This will confirm a good balancing in acceleration phase.

2.3 Mixture adjustment function

In the conditions of combustion of mixture in the engine (T° and pressure) and considering a normal filling ratio of cylinders, the ideal mixture is 1/15.

About 1g of gas for 15g of air



- bad efficiency
- engine overheating
- pollution (NOx)

- bad efficiency
- consumption
- pollution (CO)

EFFICIENCY

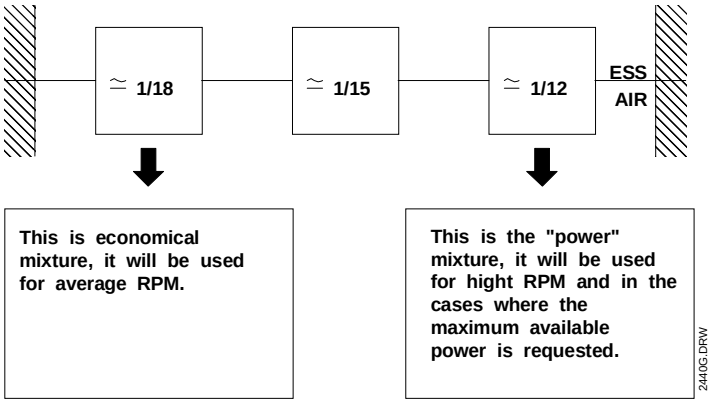
- To get the full potential power

- The whole gas must be burnt, requires a light excess of air

POWER

- The propagation speed of present in each particle of gas flame in the cylinder must be as high as possible

- Needs a light excess of gas



That is why, in our maximum RPM adjustment function, when maximum RPM has been reached, RPM must be reduced of about 10 RPM making the mixture leaner.

The differential tachometer function in the 2440 is a way derived from mixture adjustment, because we are looking for a maximum RPM without touching the accelerator and consequently looking for an improved air/gas mixture.

PRACTICAL HANDLING

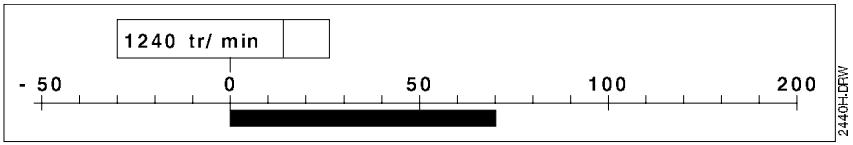
- You are in the general menu.

- Move the cursor on n°4 and press (✸) to confirm.

- Adjust the idle speed to the one recommended by the manufacturer.

- Press (🡻) after stabilization of RPM.
  From that moment, tachometer remains locked on the selected idle speed.
  Differences of RPM are displayed on the bargraph from -50 to +200 RPM.

- Adjust the mixture screw on cylinder n°1, looking for increasing the RPM.

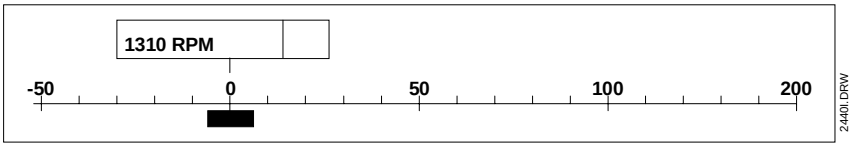


Ex : 1240 + 70 = 1310 RPM

Rotation speed is the one displayed on the top frame, + or - the number of RPM showed on the bargraph.

- If you do not have a gas analyzer, reduce the RPM of 10 RPM MAKING THE MIXTURE LEANER.
  With a gas analyzer adjust the CO rate to the standard recommended by the manufacturer.

- Unlock tachometer pressing the (✸) key.
  The new idle speed will be displayed in the top frame (1310 RPM).



- Adjusting the idle screw, bring the engine back to the recommended idle speed.

- On cylinder n°2, follow the same procedure as on cylinder n°1.

This function on the INDIANA 2440, allows you to rapidly and easily reach the optimization of carburation.

Nevertheless, bikes with injection systems can not be adjust this way, the electronic calculator automatically correcting modifications of mixture.

In your workshop, the INDIANA 2440 plays an important part in the logical process of maintenance: oil change, spare parts change (spark plugs, filters, etc...) and tunings.

- Quick check of valves and leak with the **test n°1** digitization.

- Valves condition checking with the “Min/Max” table in **test n°3.**

- Charging circuit and idle speed checking.

- Throttle valves balancing with both **tests n°5 and n°2.**

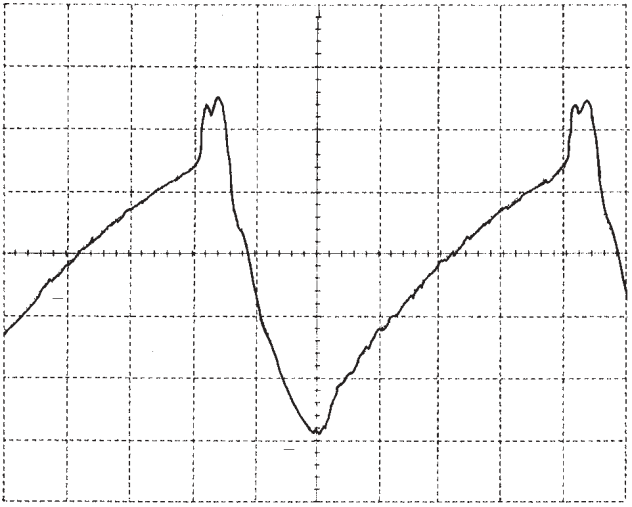
- Mixture adjustment with **test n°4.**

3- REPRESENTATIVE EXAMPLES

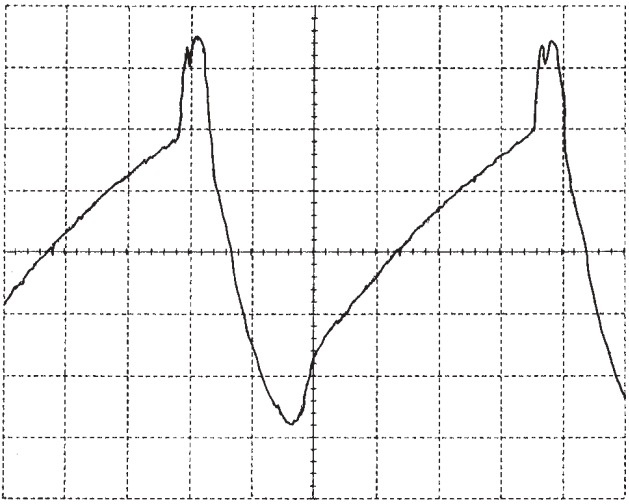
Different types of engines :

- 4 cylinder V-type engine
- 4 cylinder in line engine
- 2 cylinder V-type engine

3-1 normal curves:

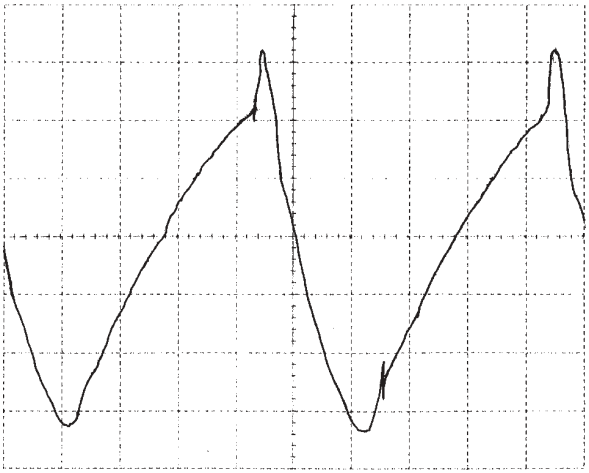


HONDA
VFR 750
(FL)
Max depression : 1012
Min depression : 478
RPM : 1100



HONDA
CBR 900

Max depression : 1031
Min depression : 478
RPM : 1150

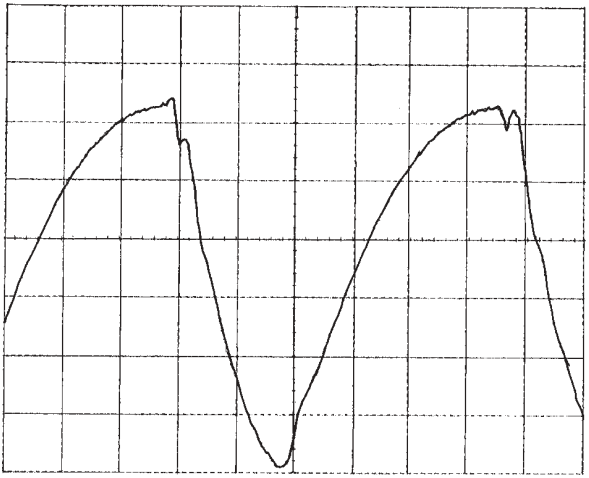


HONDA
XRV 750
Africa twin

Max depression : 1016
Min depression : 494
RPM : 1050

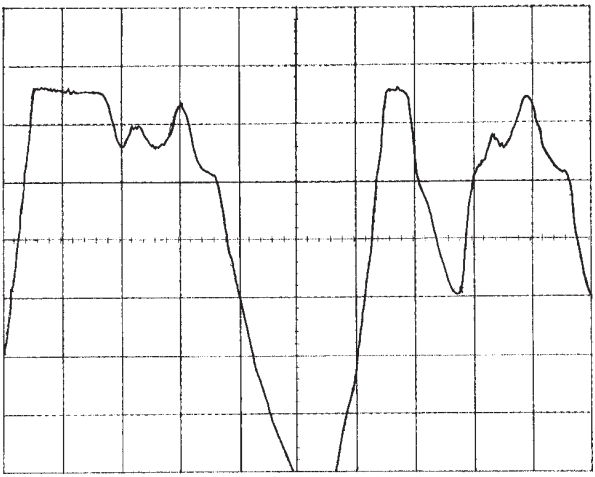
3-2 Faulty curves:

Those curves are typical of different kinds of faults on an HONDA XRV 750 Africa Twin.
Their aspects remain valid on other types of engines.



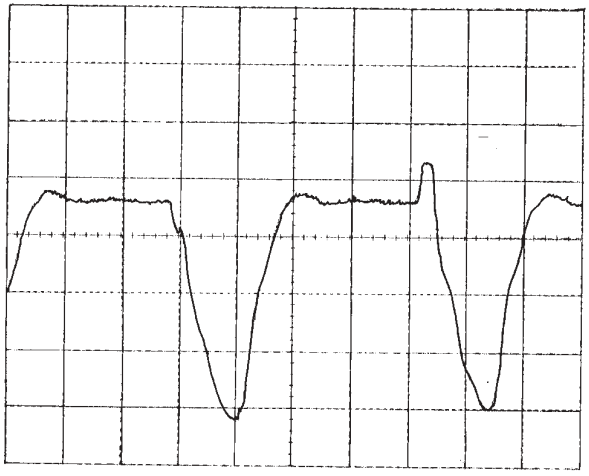
INDUCTION LEAK

Max depression : 1015
Max depression : 494
RPM : 1000



INLET VALVE
ALWAYS OPEN

Max depression : 1080
Min depression : 461
RPM : 960



EXHAUST VALVE
ALWAYS OPEN

Max depression : 1021
Min depression : 647
RPM : 1100