

INDUSTRIAL ENGINES

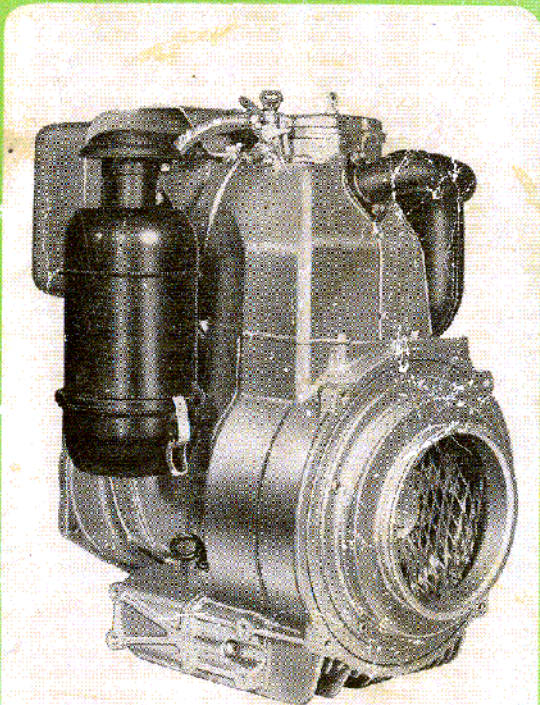
Magnus.Krampell

# DUCATI

## IS 16 - IS 18

*operation  
and maintenance  
directions*

2/5/2007



### DIESEL ENGINE

Each engine is supplied jointly with this hand-book

## WARRANTY CARD

All DUCATI ENGINES are accompanied with the "Warranty card,"

The contents of this hand-book is not binding; the DUCATI S.p.A. reserve the right to themselves, the essential features of the model here described and illustrated remaining unchanged, to make all changes in parts or fixtures supplied they should deem it suitable to improve purposes or for whichever need of technical or economical nature, without any engagement to opportunely bring this hand-book up-to-date.



**Dear Sir,**

*we are glad to welcome you among our customers, feeling sure you will appreciate the wonderful performances of DUCATI's industrial engines.*

*DUCATI's industrial engines are the outcome of long research and experience gained by DUCATI MECCANICA in the construction of small and average displacement four-stroke-cycle engines and small displacement two-stroke-cycle engines in the motorcycle and motor field.*

*Our industrial engines have different and varied applications.*

*They can be used for operating winches, aerograph compressors, road service compressors, refrigerators, lighting units, agricultural machines, building machines, dairy and oil mill machines, irrigation pumps, spraying pumps, washing pumps, draining pump, etc.*

*DUCATI's industrial engines have no competitors in the exiguity of running expenses (fuel and lubricant consumption).*

*To what above mentioned one has to add the proverbial and top quality of our engine making maintenance and repair costs practically paltry.*

*DUCATI's industrial engine operation is extremely easy.*

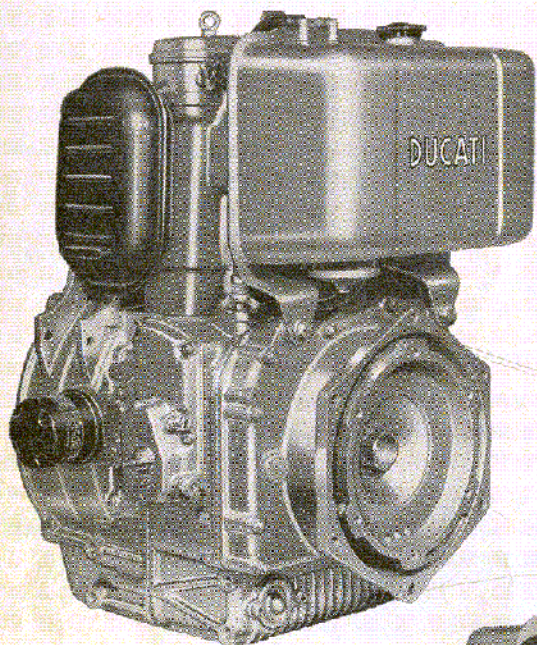
*The DUCATI MECCANICA do assure you that all engines supplied from their workshops have been carefully tested and therefore their mechanical components would not usually give rise to troubles of big importance, provided that directions herewith contained are carefully followed. Anyway we exhort you to apply to DUCATI's AFTER-SALES ASSISTANCE STATIONS or to WORKSHOPS OF DUCATI's SOLE AGENTS, for whichever overhaul or repair.*

*If you wish to keep your engine efficient, you must insist that DUCATI's ORIGINAL SPARE PART ARE USED when a repair is involving a replacement of parts.*

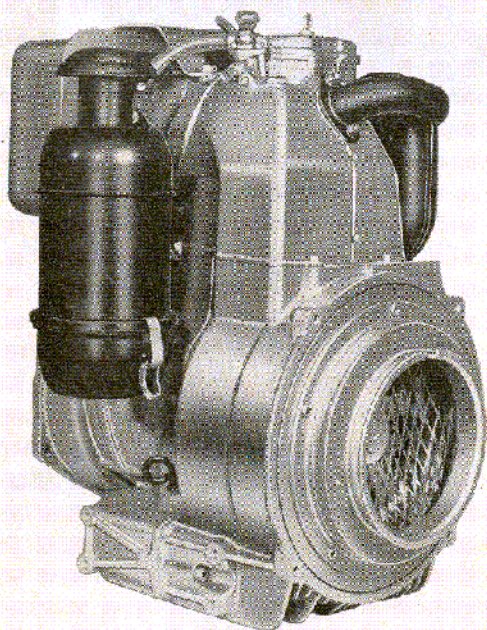
*Thanking you and congratulating you on your choice of this model, we wish you to be for many years proud to be in possession of a DUCATI INDUSTRIAL ENGINE.*

DUCATI MECCANICA S.p.A.





The engine photographed from the power take-off side.



The engine photographed from the start side.



## PREVIOUS STATEMENT

The aim of this hand-book is to enable the owner of a DUCATI's Diesel engine to make use of it in the best way.

You will find hereafter simple rules, suggestions, advice and information sufficient for putting anyone, even if unacquainted with technical knowledge, to make use of and keep for a long time the engine perfectly efficient. **The non-observance of these rules releases automatically the DUCATI MECCANICA from all engagements taken on at warranty stage.**

## DUCATI AFTER-SALES ASSISTANCE

When operations requiring a special technical skilfulness are needed, one has to apply to « Stazioni di Servizio Ducati » where skilled personnel and special equipment assure an effective assistance and repairs workmanlike performed.

You will be sure in this way that even a possible replacement of units or parts will be made making use of DUCATI's original parts, so that unforeseeable troubles will be prevented and interchangeability, operation and long life warranted.

## SPARE PARTS

All request of spare parts must be clear and the following data have to be specified:

- 1) Number of the part (making reference to the spare parts list).
- 2) Serial number of the engine, to be found on semicrankcase near the oil level stick.



## LEADING PARTICULARS OF THE ENGINE

in standard fabrication

110500

Type	— Vertical single-cylinder
Cycle	— Induced turbulence Diesel four stroke
Injection	— Direct injection Bosch method
Bore	— 95 mm
Stroke	— 95 mm
Displacement	— 673 cm <sup>3</sup>
Rotation (standard)	— counterclockwise from the power take-off side
Start	— pull start with winding string
Cooling	— forced air-cooling system by fan-fly-wheel
Dynamic equalizer	— crankcase built-in
Lubrication	— gear pump forced fed lubrication, oil filtering device with interchangeable cartridge, pressure oil by-pass valve
Air filter	— oil bath
Governor	— automatic centrifugal mass governor
Accelerator control	— designed for direct or remote control
Advance and lag device	— automatic
Starter device	— in order to make starting easier in special rigorous climates: directly designed on the suction pipe
Valve lifter	— remote control designed
Fuel tank	— equipped with built-in filter and interchangeable cartridge
Head	— made of aluminium alloy and special cast iron valve insert
Cylinder	— made of cast iron
Block	— made of die cast aluminium alloy
Connecting rod big end and main bearings	— assembled on bimetallic bushes
Driving shaft	— hardened steel monoblock; induction hardened crank pin and main journals
Connecting rod	— two-piece hardened steel
Piston	— of the self-thermal type made of heat-treated aluminium alloy
Weight (dry)	— about 95 kg.



## THE MOST OUTSTANDING VALUES AND DATA

- a) **Fuel** Good quality gas oil (see on p. 13)  
standard tank capacity about 8 litres
- b) **Lubricant** Summer: over +20°C **AGIP** FE Diesel Oil  
Sigma SAE 40  
Winter: up to 0°C **AGIP** F. 1 Diesel Oil  
Sigma SAE 20  
Oil sump capacity about 3 kg.

- c) **Air filter and  
starter oil**

the same type as for the oil sump

- d) **r.p.m.**

no-load peak 3.150 r.p.m.

loaded peak 3.000 r.p.m.

no-load minimum running 900 r.p.m.

Permanent change as to the revolutions  
number owing to a sudden load disconnec-  
tion, meant as

$$\frac{nv-nc}{nm} \times 100 \text{ not over } 5\%$$

- e) **Top Dead Center value**

between the piston crown at the T.D.C.  
and cylinder upper wire 0,8 ± 0,1.

The above mentioned height can be obtain-  
ed by inserting one or more gaskets be-  
tween the cylinder and crankcase face.

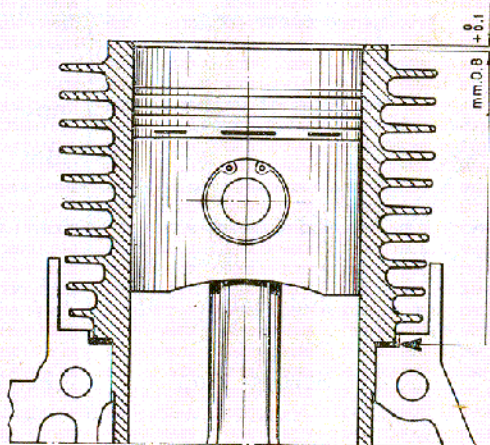


Fig. 1



f) **Timing:**

Cold clearances between valve and rocker: suction 0,20 mm  
 exhaust 0,20 mm

Control diagram with a clearance of **2 mm**:

Suction:

Opening 14° after T.D.C.

Closing 14° after B.D.C.

Exhaust:

Opening 14° before B.D.C.

Closing 14° before T.D.C.

g) **Injection**

P.S. (pumping start) overflowing: 25° ± before T.D.C.

Injector setting 240 ± 5 Kg/cm<sup>2</sup>.

h) **Fits and allowances:**

h1) Cylinder:

**IS 16**

∅ new-built liner

∅ liner 1st oversizing 95,5 mm

∅ liner 2nd oversizing 96 mm

} + 0,022

**IS 18**

100 mm

100,5 mm

101 mm

} + 0,022

○ Texture degree for following honings 1 ÷ 1,2 micron.

○ Max. allowed oversizing when worn out 0,2 mm over the nominal value.

h2) « S » distance between piston ring ends:

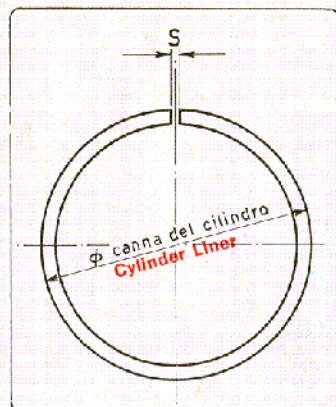


Fig. 2

Type of Piston Ring	« S » values in mm			
	new-built		max. wear	
	from	to	from	to
1st piston ring	0,35	0,55	0,80	0,90
2nd piston ring	0,35	0,55	0,80	0,90
Scrapper ring	0,25	0,40	0,80	1,00



h3) Clearance between piston pin and connecting rod bush:

new-built 0,026 ÷ 0,047

Max. allowable value when weared out 0,10 mm.

**i) Driving shaft:**

i1) Connecting rod pin diameter:

New-built	∅ 60	} 0 -0,019
1st undersizing	∅ 59,75	
2nd undersizing	∅ 59,50	

i2) Main bearing diameter:

New-built	∅ 56,00	} 0 -0,019
1st undersizing	∅ 55,75	
2nd undersizing	∅ 55,50	
3rd undersizing	∅ 55,25	
4th undersizing	∅ 55,00	

Resulting clearance (diametrically)

between shaft and bush:

0,045 ÷ 0,083

Max. clearance value when weared out:

0,200 mm

i3) Driving shaft axial clearance:

new-built

0,200 ÷ 0,400

max allowed value when weared out:

0,600 mm

**l) Bolts and nuts**

Connecting rod fastening nuts	5	kgm.
Head fastening nuts	6,9	kgm.
Flywheel fastening nuts	60	kgm.
Semi-crankcase fit screws M12	8,6	kgm.
Semi-crankcase fit screw M8	2,5	kgm.
Injector fastening nut	1	kgm.
Injector pump connector M18	5	kgm.



## ENGINE ILLUSTRATION

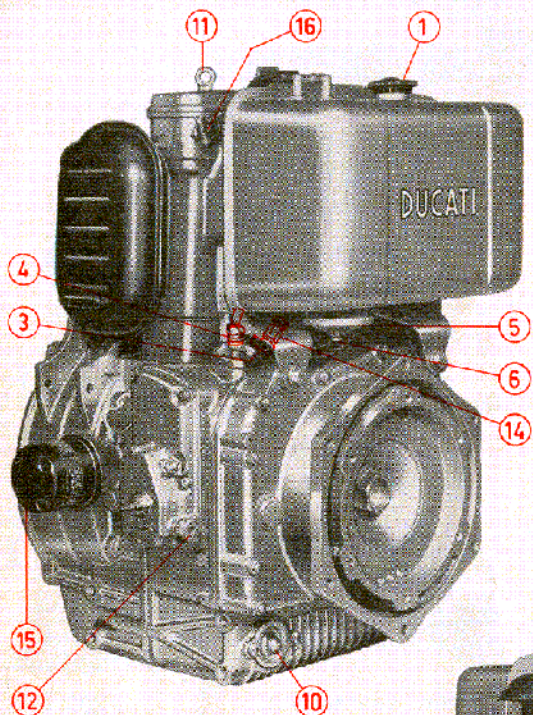
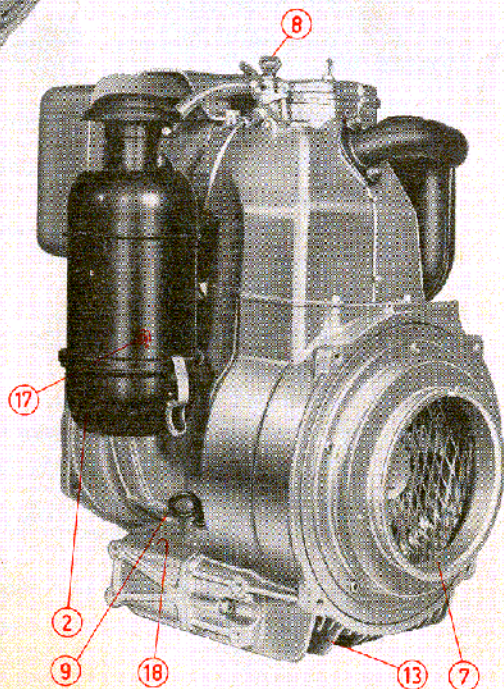


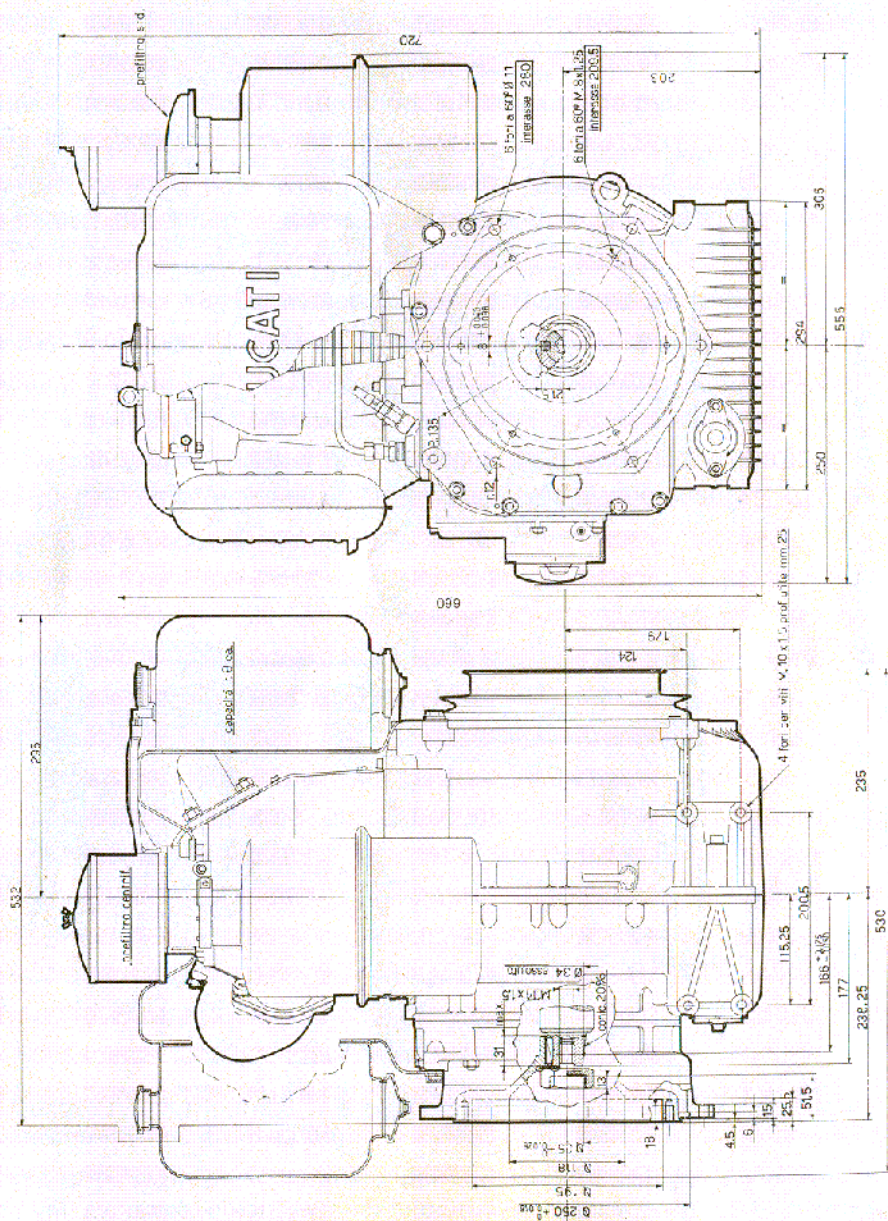
Fig. 3

- 1) Fuel supply plug
- 2) Air filter
- 3) I.P. feed connector
- 4) I.P. delivery pipe connector
- 5) Fuel filter
- 6) Fuel filter fastening screw
- 7) Starting pulley
- 8) Starter plug
- 9) Oil supply plug with level stick
- 10) Oil filter
- 11) Lifting eyebolt
- 12) Accelerator control ring nut
- 13) Oil drain plug (auxiliary)
- 14) Automatic deareator
- 15) Oil filter cartridge
- 16) Valve Lifter
- 17) Oil pressure gauge
- 18) Part number





# OVER-ALL DIMENSIONS - Self-drive type







## FUEL

The fuel requirements for this engine are the ones provided for all other direct injection Diesel engines. The fuel to be used is the « gas oil » of a specific weight from 0,820 to 0,850 kg/1.

We strongly exhort our customers to get their fuel supplies from qualified dealers; the consumption slightness does not justify expedients of a speculative character.

Anyway it is almost impossible that the gas oil drawn from drums or pumps is quite free from impurities or suspended water.

Though the engine tank is equipped with a high efficient cleaner, customers are specifically advised against making use of fuel which had not been previously « DECANTED ».

The following simple measures should therefore be taken:

- a) When transferring the fuel try to keep it free from dust.
- b) Never draw the fuel to be directly used from a drum having been rolled a short time before.
- c) A rather sound method for the fuel « decantation » is shown in fig. 4. Of the two cocks the metallic drum is equipped with, cock n. 1 shall be used only to periodically drain impurities. The purified fuel shall be drawn from cock n. 2.

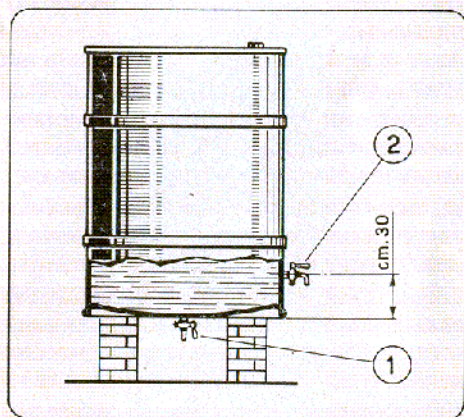


Fig. 4 - FUEL DECANTATION DRUM

- 1) Drain cock
- 2) Purified fuel cock

Customers furthermore are advised against drawing the fuel before 24 hours from the drum filling.

We urge again our customers the necessity of supplying the engine with fuel as much clean as possible: the presence in it of impurities is almost always the sole cause of severe damages to the injection equipment.

## DIRECTIONS FOR THE FIRST STARTING

With reference to fig. n. 3 act as follows:

- 1) Fill up the oil through inlet plug 9 making use of the fuel according to qualities and quantities provided for on p. 7 item b. During the filling care to have the engine as much horizontal as possible. Check always that the oil level is not exceeding the two notches on the measuring stick.
- 2) Let in the oil in a right quantity into the air filter pan.
- 3) Fill up the tank fuel, having care to stop the filling when the fuel is 3 ÷ 3,5 cm from the filler rim.
- 4) Always as regards the first starting, the injection pipe must be filled in the following way:
  - 4a) Set the accelerator drive to **MAXIMUM** position.
  - 4b) Wind up the start string on pulley 7 in the **clockwise** direction. Then pull the string slightly up to notice that piston is resisting (T.D.C.) then allow back pressure to back rotate the driving shaft, wind up the string again, then repeat the operation (an average of 6-8 times) up to notice the peculiar **creaking** denoting that the injector is running.  
**WARNING!** This operation is required only should the tank accidentally empty.
- 5) **Start**
  - 5a) Set the accelerator drive to the intermediate position.
  - 5b) Have the start pulley to rotate by hand in the counterclockwise direction up to the compression ratio makes it possible.
  - 5c) Wind up the string in the **clockwise** direction.
  - 5d) At this point have the string **STRONGLY pulled**.  
If the above mentioned few rules are followed the star will take place at the first or second pull.



**6) Start in highly severe climate**

In order to make the start easier with a **cold** engine under severe climates, act as follows:

- 6a) Remove the cap from the starter fig. 5 position 1.
- 6b) Pour the oil (of the same type as the one used for the engine) into the sump in an amount equal to about the volume of the sump itself.
- 6c) Position the starter plug again.
- 6d) At this point the same starting operations provided for at item 5 (5a - 5b - 5c - 5d) must be repeated.

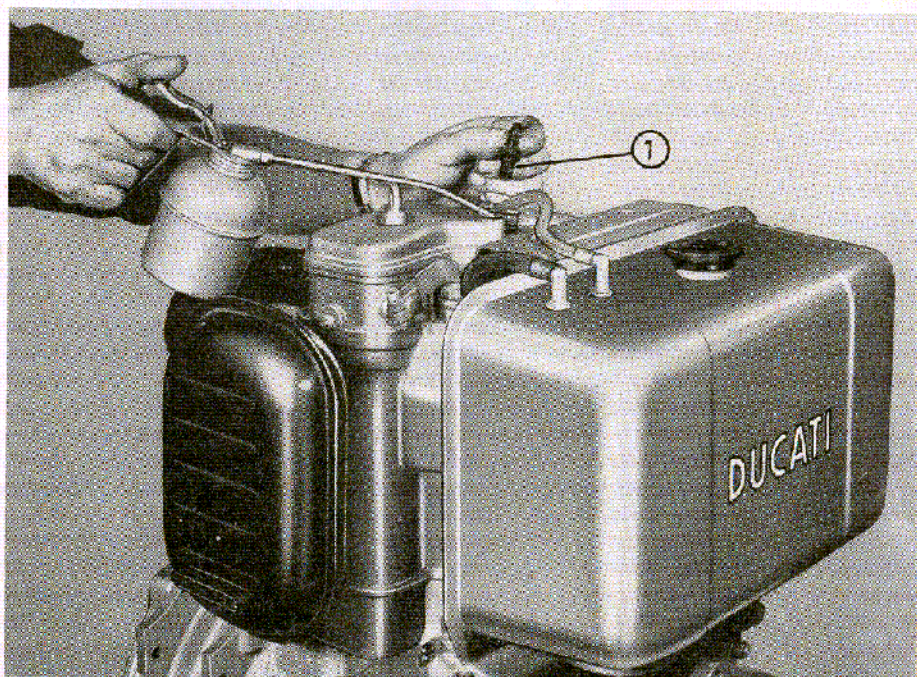
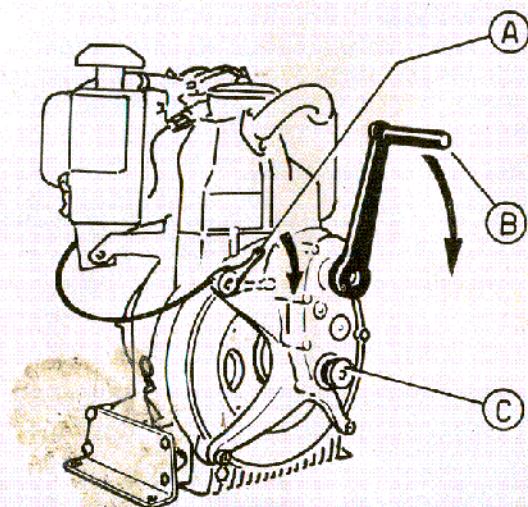


Fig. 5



## CRANK START (fig. 6)



### Assembly

Before setting about to assemble the crank starting unit, take care — in the case it had not been carried out — to remove the starting pulley 7 fig. 3 paying attention to assemble the net again securing it to the flywheel by the same pulley fastening screws and inserting some washers.

### Start Fig. 6

After that all previous steps have been carried out according to directions on pages 14 ÷ 15, act as follows:

- 1) Insert the valve lifter 16 fig. 3 keeping lever A depressed.
- 2) Drive pivot C and simultaneously rotate crank B in the clockwise direction for 1/4 of rotation up to have pivot C engaged.
- 3) Have the engine running in the clockwise direction as much quickly as possible (not less than 120 r.p.m.) by means of Crank B. Once the flywheel has reached a suitable speed, disengage the valve lifter always having the crank rotating and set lever A to OUT position. If the move is rightly carried out, the engine will easily start.





## **INSTALLATION (fig. 7)**

The standard supply of the dynamotor electric start unit does not include: the decompression remote control lever A), warning light B), start key C), battery E), and electric cables.

As regards electrical connections conform to fig. 7.

Secure the voltage regulator D) in a position possibly free from vibrations; it is advisable to secure it to the battery box, preferably arranged as shown in the figure, with the terminals downwards.

**Dont forget to ground the regulator.**

## **START (fig. 7)**

After that start preliminary steps have been carried out as provided for on pages 14 : 15. for starting the engine equipped with dynamotors act as follows:

- 1) Insert the decompression pulling lever A) down.
- 2) Turn key C) and the engine will start running. Let it accelerate for a few seconds, then release decompression taking lever A on **OUT** position.
- 3) When the engine is running let the key free: it will return to its original position.  
Never reset the key while the engine is running; in this way the load control operated by warning light B) will be cut out.

**IT IS THEREFORE EXTREMELY IMPORTANT:**

**WHILE THE ENGINE IS RUNNING THE KEY MUST BE ON.**

**WHILE THE MOTOR IS STOPPING THE KEY MUST BE OUT.**

- 4) Check the battery charge warning light B). While the engine is running the light must be out. This means that the dynamotor is charging the battery regularly. If the warning light is still **ON** while the engine is running, this means that the dynamotor is not charging and therefore the system must be inspected.

**WARNING: THE ENGINE SHALL NEVER BE STOPPED BY OPERATING DECOMPRESSION LEVER A).**



## ENGINE STOP (fig. 8)

### a) Direct control

- a1) Screw knurled knob n. 1 up to reach the minimum speed then go on in screwing up to notice that the head of stick n. 2 is somewhat projecting.
- a2) At this point rotate knob 3 in the clockwise direction up to have the engine stopped.

### b) Remote control with STOP

Set the accelerator lever to the « minimum » then rotate it to the « stop » position. Should the stop fail to take place, unscrew further on register 4, or screw ring nut 1 and rotate the knob as specified at a2).

Warning: when connecting the remote control cable, pay attention that the accelerator lever is in the running position, beyond the minimum, in order to allow the full excursion of the gears.

- c) In both cases it is advisable to never have the engine stopped all of a sudden when it is running loaded: let it running at reduced speed and load for about 5 minutes.

**IMPORTANT:** Never make use of the decompressor lever for stopping the engine.

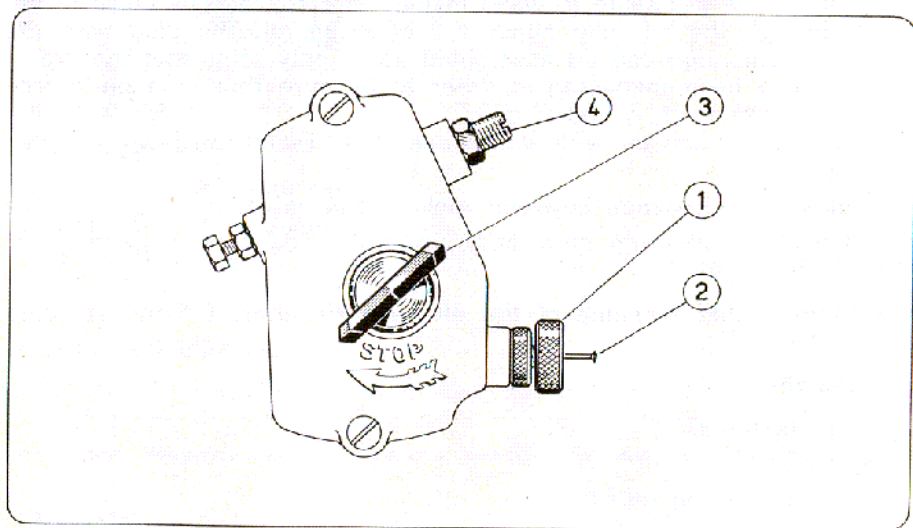


Fig. 8

## RULES FOR A RIGHT OPERATION OF THE ENGINE DURING ITS FIRST RUNNING PERIOD

### Connection with the machine:

In addition to the usual recommendations concerning a right assembly mainly from the alignment point of view, it is essential that the **drive ratios are such as to allow** the engine to reach the max. number of revolutions for which DUCATI designed it. In this working conditions the exhaust gas shall appear **practically colourless**.

### Running-in

In order to get a right settlement of the driving members the rules hereinafter must be followed:

#### For a period not lesser than 50 hours:

- a) Never have the engine to run over 70% of the standard load.
- b) Avoid all sudden pickups.
- c) If the engine is cold, let it running at a low speed for a few minutes before to insert the load.
- d) After the first 20 hours, remove plug 10 (fig. 3) to which the filtering cartridge is secured. Let all the oil flow out. Clean the cartridge and wash it with clean oil.

It should be advisable to wash inside the crankcase by pouring into it through the oil inlet about 1/2 of wash oil. The plug with the proper cartridge can be assembled again only after that the crankcase has been inspected in order to be sure that it is quite free from residual oil or wash oil.

Replace existing oil with a new one up to reach the level provided for.

- e) Adjust the clearance between rockers and valves.
- f) Check that securing nuts, head and bolts and nuts in general are duly festened.

**Disassembly and cleaning of the oil bath air filter,** (of the standard supply type) fig. 9.

#### Disassembly:

- a) open fasteners 4
- b) slip cup 5
- c) remove filtering unit 2

#### Re-assembly:

- a) insert the filtering unit



- b) draw near the cup and check the right positioning of the gasket.
- c) tight the fasteners.

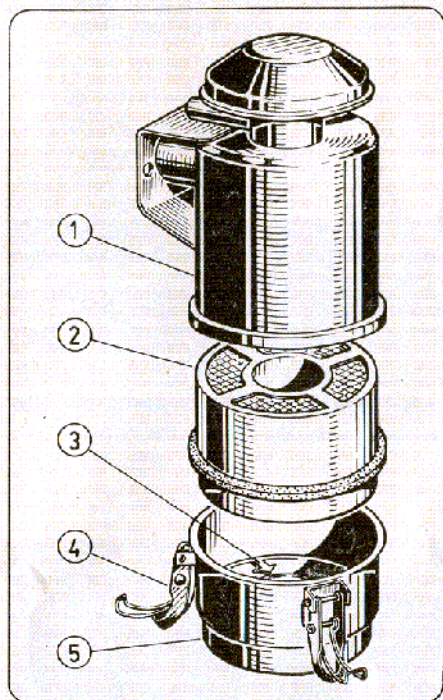


Fig. 9

**DISASSEMBLY OF THE SUCTION AIR FILTER**

- 1) Filter body
- 2) Filtering unit
- 3) Oil level gauge
- 4) Fasteners
- 5) Oil cup

**Cup cleaning**

- a) drain all existing oil
- b) wash carefully with wash oil
- c) wipe off with a clean cloth
- d) fill up the cup with fresh oil up to reach the level index without exceeding it.

**Filtering unit cleaning**

In order to remove from it all impurities dip it again and again into clean gas oil. Then dry it by an air throw directed on the upper part.  
**Important - Never start the engine if the filtering unit is not perfectly dry.**

**WARNING!**

The net pre-cleaner too must be cleaned by removing all foreign matters occluding its holes.

It is furthermore advisable to clean the inside wall of filter body 1 with a clean cloth.

**Important** - The periodical inspection of the oil level within the cup must be carried out after one hour at least from the engine stopping.

### Fuel filter cleaning (fig. 10)

Act as follows:

- a) unscrew screw 1
- b) remove cap 3
- c) slip cartridge 6

Clean carefully the inside of cap 3 and wash with clean gas oil. Replace the existing cartridge by a new one if remarkable stoppages are noticed (never try to clean the existing cartridge).

ASSEMBLE again operating in the opposite way having care that:

- a) gasket 4 is in a good state, clean and perfectly inserted into its seat.
- b) washer 2 is in a good state.

**WARNING** - The engine life and its efficiency greatly depend on the frequency and care by which the above mentioned operations are carried out.

### Cleaning the cylinder radiant mass

It may happen that the cooling fins are in part or completely clogged up with dust, mould and other foreign matters such as for instance grass, etc. owing to environmental conditions in which the engine is running.

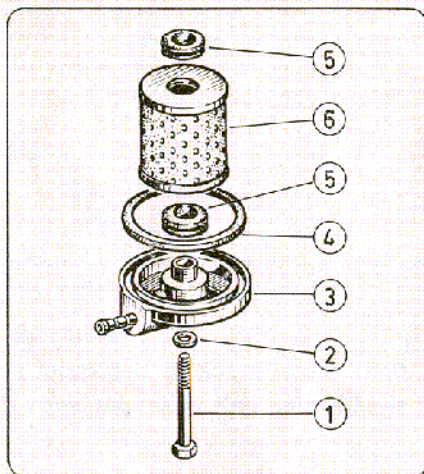


Fig. 10 - FUEL FILTER

- 1) Locking bolt
- 2) Gasket
- 3) Filter cap
- 4) Cap gasket
- 5) Gas rings
- 6) Filtering cartridge



It is easy to realize how much the engine is likely to suffer from an inadequate cooling.

The head and cylinder fins need therefore to be frequently inspected in order to make sure that they are quite clean.

If necessary, remove the rings binding the cylinder in order to carefully clean the radiant unit.

**Warning:** the start pulley and relative protecting grill too must be periodically inspected to cleaning purposes.

The same applies to the spaces between the fan blades and the fan itself.

### ADJUSTMENT OF ROCKER CLEARANCE

The ENGINE BEING COLD, act as follows (fig. 11):

- a) set the engine in compression stroke (T.D.C.)
- b) unloose lock nut 2
- c) act on adjusting screw 1
- d) restore the exact clearances, by means of thickness gauges, up to get the following values:  
SUCTION 0,20 mm  
EXHAUST 0,20 mm
- e) screw down lock nut 2 and check again.

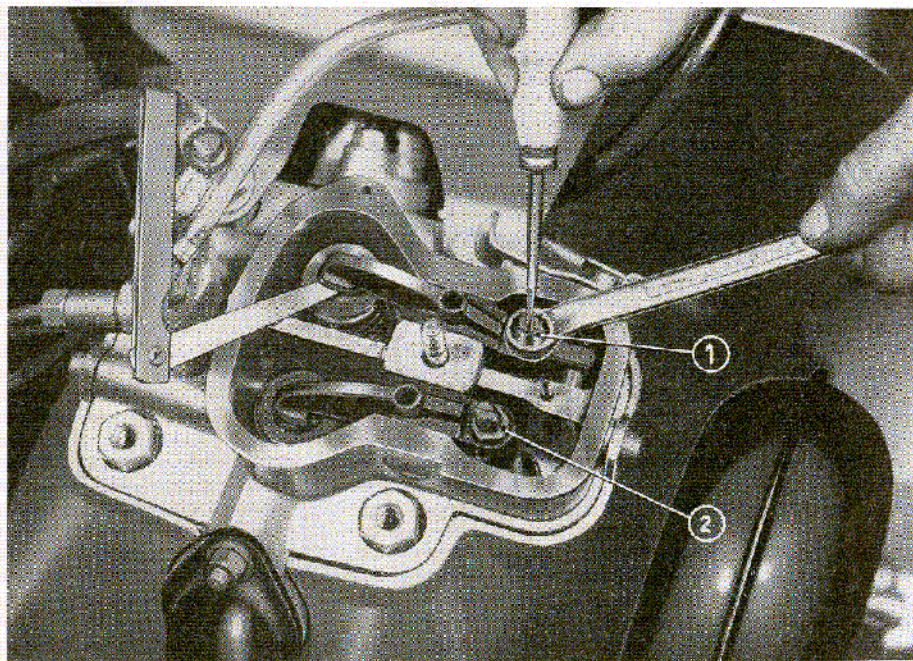


Fig. 11



## FIDUCIAL MARKS FOR THE PISTON ASSEMBLY

The position of the explosion chamber is shifted with respect to the piston axis.

In order to prevent mistakes an arrow has been engraved on the piston crown.

At assembly stage the arrow must be turned towards the flywheel.

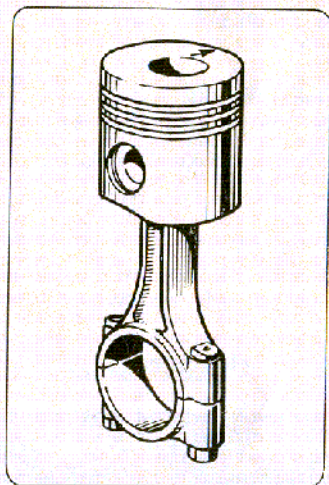


Fig. 12

### LOCATING the T.D.C. (top dead center) and P.S.P. (pumping starting point) (fig. 13)

On the upper part of the surfaces of the jacket and semicrankcase — flywheel side — there are two locating spots: spot 1, red, and spot 2, black. Spot 3 is engraved on the flywheel.

When spot 3 is coinciding with spot 1 the P.S. (pumping start) must take place.

On the contrary, when spot 3 is coinciding with spot 2 the piston is at the T.D.C.

### P.S. Check (pumping start or overflowing)

**Warning:** This check shall be carried out **only** if the injector pump or the tappet set must be replaced, or should the brass gaskets — originally fitted under the flange of the injector pump itself — be mislaid or appear worn when the pump is disassembled.

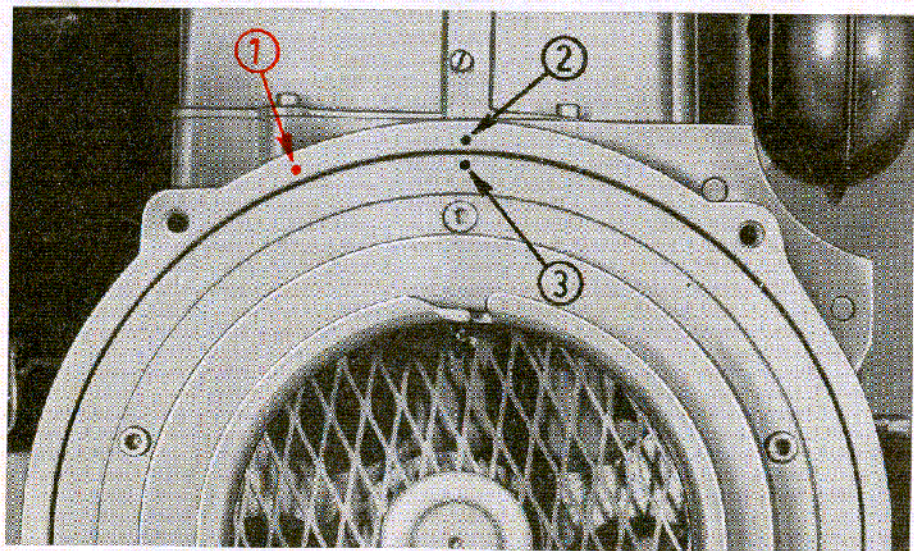
These operations must be carried out by **specialized** workshops or by DUCATI after-sales service.



**Procedure:**

- a) Disengage the pump injection tube.
- b) Set spot 3 approximately 3 cm before spot 1, in compression stroke of course.
- c) Remove the delivery connector, spring, filler and valve (but not its seat), see fig. 15.
- d) Screw the connector again and set the injector pump control lever in the INTERMEDIATE position as to the positions of « STOP » and « MAX. DELIVERY ».
- e) Rotate slowly the flywheel in the running direction up to the fuel stops appearing on the connector surface.
- f) This very instant spots 3 and 1 MUST PERFECTLY COINCIDE. Should this condition fail to take place, « increase » or DECREASE little by little the thickness of the gaskets (or gasket) located under the injector pump fastening flange, according to the need, that is if the exact point of the static start of the delivery must be DELAYED or ADVANCED.
- g) At this point the valve, spring, filler, connector, etc. can be assembled again.

As regards the connector, make sure that the rubber ring is in its seat and in a good state. Otherwise replace it at once.



**Fig. 13 - FIDUCIAL MARKS FOR T.D.C. AND PUMPING START**

- 1) Pumping start (P.S.)
- 2) Top Dead Center (T.D.C.)
- 3) Flywheel fiducial mark.



## 1) CHECK OF THE ENGINE PERFECT EMPLACEMENT (TIMING)

When the engine has been disassembled, at re-assembly stage, the piston being in T.D.C. and COMPRESSION stroke, make sure that the mark on the crankcase is perfectly coinciding with the index engraved on the camshaft gear, as shown in fig. 14.

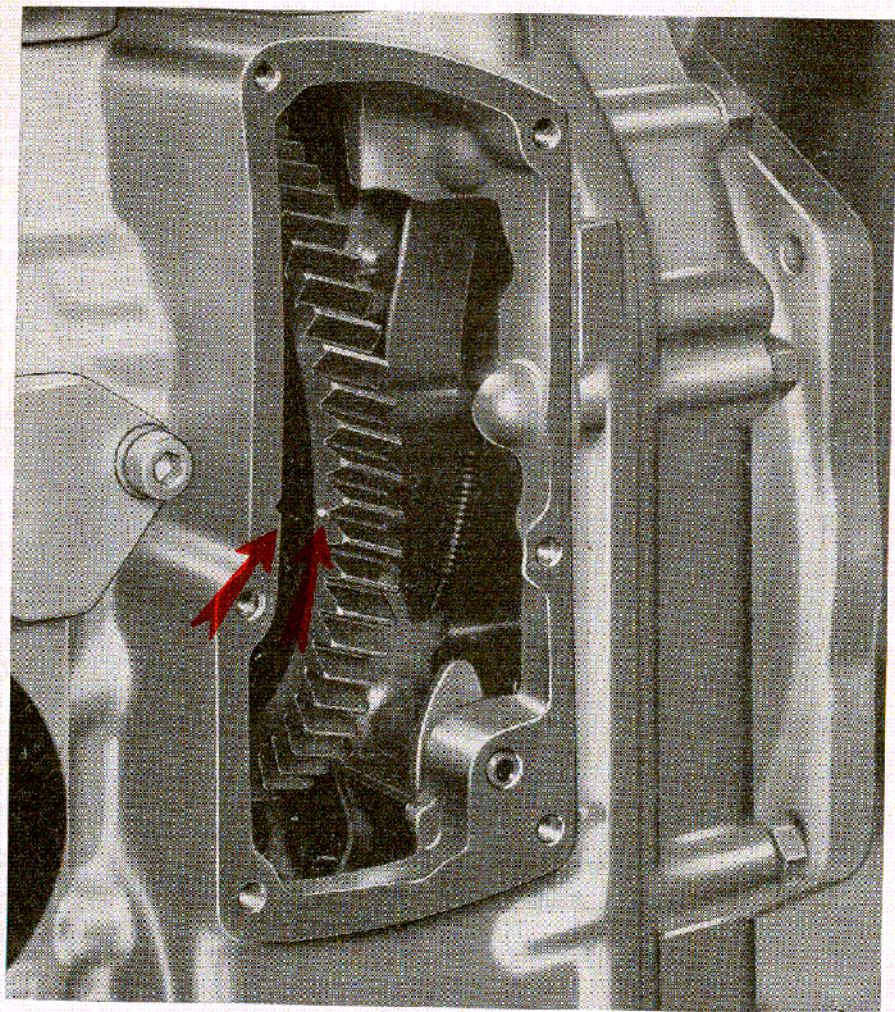


Fig. 14



## 2) DRIVING SHAFT CHECK AND CLEANING

Every time the driving shaft is disassembled for checking its possible wear, wash it carefully with gasoline before carrying out measurements.

Before assembling it again the lubrication pipe plugs must be unscrewed in order to remove **completely** all impurities resulting from the effect of the centrifugal force.

The oil inflow holes must be carefully washed by means of wash oil and compressed air blowed. At assembly stage the driving shaft shall appear **perfectly** cleaned.

### Injection system overhaul

In the case of irregularities being noticed in the running of both INJECTOR PUMP and INJECTOR (wear of the pumping element, bad seal of the valve or nozzle needle, hole occlusions, etc.) it is advisable to apply to **specialized workshops**.

In fact only a skilled personnel with available special equipment is in a position to carry out all restoration or replacement operations.

### DESCRIPTION OF THE FUEL INJECTION SYSTEM

It is of the « Bosch system » type with the INJECTOR PUMP housed into the block and directly driven by the camshaft, and the INJECTOR of the multiple holes type, fit on the head and nozzle ends **directly** facing the combustion chamber.

#### a) INJECTOR PUMP:

It is of the type corresponding to « BOSCH PFE 1 Q 70/14 » and consists of two distinct pieces (fig. 15):

THE TAPPET UNIT housed into a proper seat on the crankcase.  
THE PUMP flange-mounted and fastened to the block by two screws.

The flow is controlled by means of a pin lever directly engaged in the slit of the governor lever.



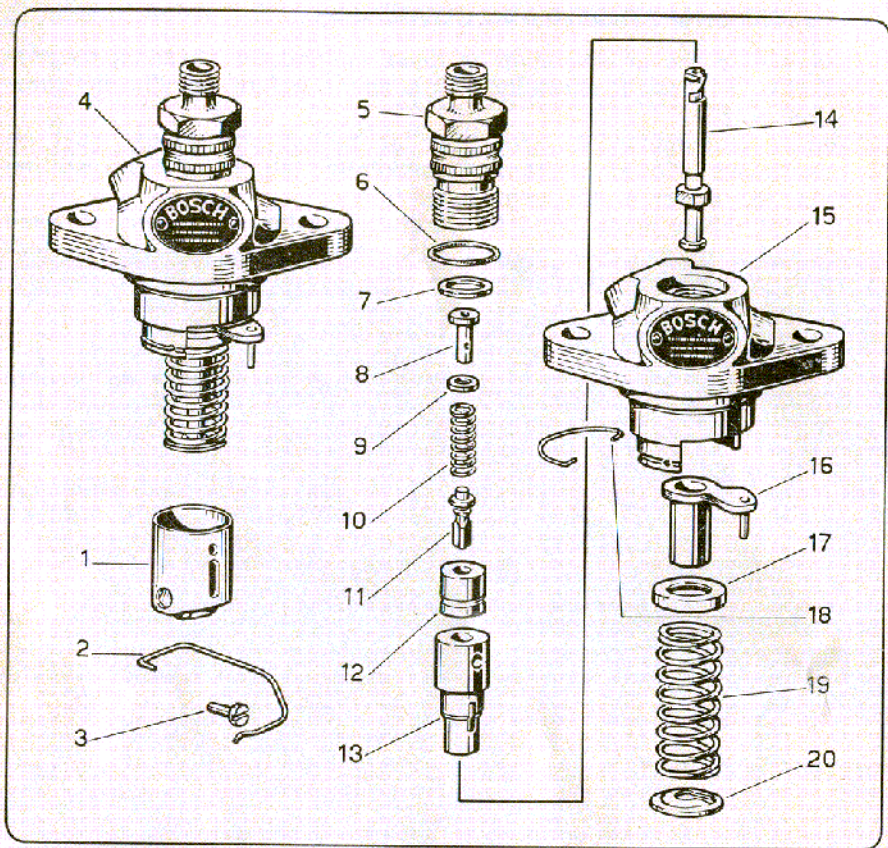


Fig. 15

- |                            |                                    |
|----------------------------|------------------------------------|
| 1 - Tappet unit            | 11 - Valve                         |
| 2 - Tappet lock spring     | 12 - Valve seat                    |
| 3 - Dowel (for the tappet) | 13 - Cylinder                      |
| 4 - Pump unit              | 14 - Pumping element               |
| 5 - Delivery connector     | 15 - Pump body                     |
| 6 - Grommet (OR)           | 16 - Pumping element control lever |
| 7 - Copper gasket          | 17 - Upper cap                     |
| 8 - Filler                 | 18 - Lock spring                   |
| 9 - Thickness washer       | 19 - Spring                        |
| 10 - Valve spring          | 20 - Lower cap                     |

**Important!** - When assembling the pump on the engine make sure that the pin of lever 16 is correctly engaged in the slit of the governor control lever.



## b) INJECTOR

If of the BOSCH type

KBAL 80 . . . . . for the INJECTOR UNIT

DLA 150 . . . . . for the NOZZLE

If of the CIPA type:

CKBL 90 JB - 2045 . . . . . for the INJECTOR UNIT

VH - 15097 . . . . . for the NOZZLE

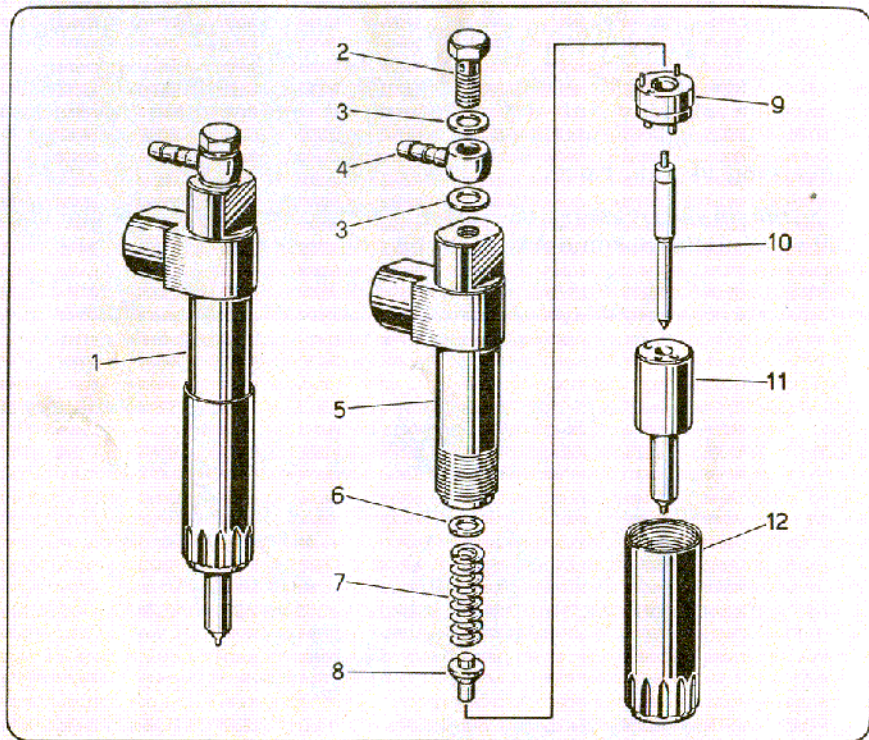


Fig. 16

Fig. 16 shows the section view of the unit. The various elements are referred to as follows:

- |                        |                  |
|------------------------|------------------|
| 1 - Injector unit      | 7 - Spring       |
| 2 - Refuse hollow bolt | 8 - Spring cap   |
| 3 - Seal wash          | 9 - Plug nut     |
| 4 - Refuse connector   | 10 - Needle      |
| 5 - Nozzle body        | 11 - Nozzle body |
| 6 - Thickness washer   | 12 - Ring nut    |

**N.B.** - The right value of the needle lift « setting » is restored by increasing or decreasing the thickness of washer 6.

**a) Governing of max. r.p.m.**

With reference to fig. 17, the governing is carried out by acting on screw 1: make sure that the max. engine IDLING speed is from 3.150 to 3.200 r.p.m.

The above mentioned screw has been originally governed and plumbed at the MANUFACTURER WORKSHOPS.

Only in exceptional and therefore unlikely cases, that is if the governor running conditions would appear modified owing to accidental causes (spring replacement, etc.) the user is allowed to have seals removed and new governings operated.

In the case of hand drive the knurled knob 2 jointly with wash 3 allows to steadily set the governing at intermediate revolutions.

**b) Governing of min. r.p.m.**

It is obtained by acting on screw 4 in such a way as to get about 900 revolutions per minute (Fig. 17).

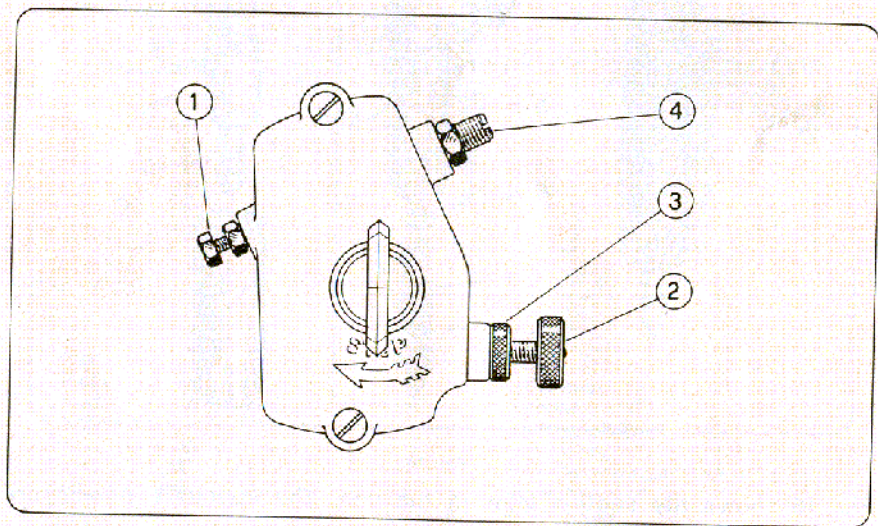


Fig. 17



## DISASSEMBLY AND ASSEMBLY RULES

Owing to the extreme simplicity of construction of the engine a normal experience in motors and a proper equipment are sufficient.

All operations must be carried out with the utmost care, keeping in mind also the directions specified in the previous pages, and above all care for cleanliness.

On our part we suggest the following:

- 1) Remove all fixtures (tank, suction manifold, silencer, start pulley, pipes, air conveying fittings, etc.).
- 2) Remove the flywheel making use of a puller suited to engage the threaded holes provided for the start pulley fastening.
- 3) Remove head and cylinder, slip the rods from the rockers, rod protecting tubes, tappets, remove the injector pump too, (pay attention that the adjustment thicknesses are not mislaid!) the feeding pump (if any) **or the cap closing its opening.**
- 4) Put immediately a clean cloth around the hole housing the cylinder in order to protect the rest surface from possible impacts and subsequent dents from the connecting rod.
- 5) Remove the timing system cover after that the power take-off key has been disconnected.
- 6) Take off the flywheel side key, then (after that all connecting screws have been removed) separate the two semi-crankcases beating moderately by means of a plastic mallet on the driving shaft end.
- 7) Slip the driving shaft unit.
- 8) In the case that the semi-crankcase camshaft must be disassembled, first of all remove the timing system gear by unscrewing the four screws fastening it (fig. 18).

Operate in the opposite way when **assembling again**.

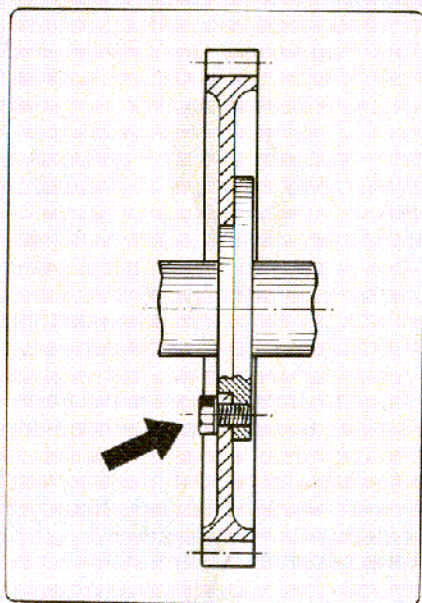


Fig. 18

### **Routine maintenance**

Every:

- a) 10 hours and anyway before the engine start: check the oil level into the pan.  
Air filter cleaning, inspection and oil replacement in the cup.  
N.B. - This last operation must be carried out more frequently according to the environment dust degree.
- b) 80 hours Oil replacement in the engine.
- c) 120 hours Valve clearance adjustment.
- d) 200 hours Cleaning of fins in cylinder, head and fan, start pulley and protecting grill.  
N.B. - For the maintenance frequency refer to what specified at a).  
Replace the screwing cartridge in the oil filter.
- e) 300 hours Check and replacement (if needed) of the fuel cleaner.  
Check the oil filter into the pan and replace the cartridge if necessary.
- f) 500 hours Injector cleaning and setting.
- g) 1000 hours Inspection of the injector pump.



## TROUBLES - CAUSES - REMEDY

Trouble complained	The most outstanding sign	Probable cause	Remedy	See on page:
The engine fails to start	Regular compression	Presence of air within the injection circuit Clogged fuel cleaner Ill-suited fuel Exceedingly viscous oil Timing out-of-phase Too low room temperature Faulty seal of the nozzle The governor lever is jammed	Check the seal of all feeding and injector pipes and connections, respectively The cartridge must be cleaned and replaced, if necessary Replace it Replace it as specified Check Make use of « STARTER » Have it checked	14 22 13 7 26 15 27-28-29
	The compression is failing or reduced	Valves do not slide freely into the guides Valves fail to close Valves fail to seal Faulty seal between head and cylinder Faulty seal of piston rings	Lubricate stems with some Diesel oil and if required disassemble them for removing limes, if any Clearances must be adjusted Grind in valves Check the locking of nuts and the condition of faying surfaces Check the conditions of piston, piston rings, cylinder	23 9 8

Trouble complained	The most outstanding sign	Probable cause	Remedy	See on page:
After the start the engine stops	Irregular bursts	<p>The fuel is failing</p> <p>Presence of air in the injection circuit</p> <p>Presence of water in the fuel</p> <p>Partly clogged fuel cleaner</p>	<p>Fill the tank</p> <p>Check the seal of all feeding and injector pipes and connectors, respectively.</p> <p>Clean the tank and cleaner and then fill with decanted fuel</p> <p>Clean and if necessary replace the cartridge</p>	<p>14</p> <p>13</p> <p>22</p>
Faulty combustion	Black smoke at the exhaust pipe	<p>Overload</p> <p>Clogged air filter</p> <p>Injection unit in faulty conditions</p>	<p>Check the coupling ration between engine and machine</p> <p>Clean according to directions</p> <p>Have the nozzle and pump checked</p>	<p>20</p> <p>20</p> <p>27-28-29</p>
Blue smoke at the exhaust pipe	Blue smoke at the exhaust pipe	<p>The engine is not yet sufficiently broken in</p> <p>The engine has been cold loaded</p> <p>Oil consumption through the valve stems</p> <p>Oil consumption owing to a faulty fit between piston and cylinder</p>	<p>Don't worry, follow running in rules</p> <p>Reduce the load and await for a few minutes</p> <p>Check the clearance between stem and valve guide, as well as the wear state of rubber fittings</p> <p>Check that piston rings are free</p> <p>Check the wear of piston, cylinder and piston rings.</p> <p>Make sure that oil level is not exceedingly high</p>	<p>20</p> <p>8</p> <p>14</p>



Trouble complained	The most outstanding sign	Probable cause	Remedy	See on page:
The engine stops suddenly	Rotation by hand is impossible	Piston seizure	Remove mesh areas and smooth them with an Arkansas stone. Should the damage appear severe, replace the piston and recondition the cylinder	8
Knocking	Higher knocking than usual	The injection pressure is defective Faulty seal in the nozzle needle An exceeding clearance in the bushing of connecting rod end	The injector needs to be set at the right value. Have the nozzle checked and if necessary replace it by a new one Face the shaft and replace the bush	8 29 9
Oil dripping from the engine	Noise	Exceeding clearance in valves	Set to the right value	23
	The trouble is appearing almost suddenly	The diaphragms or the breather device seat located on the rocker inspection cover are worn or anyhow fail to seal	Remove them, check and replace them if required	



**DUCATI** MECCANICA S. p. A. - 40100 BOLOGNA  
(BORGO PANIGALE) CASELLA POSTALE 313

TELEFONO N. 405049 - TELEGRAMMI "DUCATIMEC., - BOLOGNA - TELEX 51492