YAMAHA

YZF-R1P
YZF-R1PC

SERVICE MANUAL

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SERVICE MANUAL

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NOTICE

This manual was produced by the Yamaha Motor Company, Ltd. primarily for use by Yamaha dealers and their qualified mechanics. It is not possible to include all the knowledge of a mechanic in one manual. Therefore, anyone who uses this book to perform maintenance and repairs on Yamaha vehicles should have a basic understanding of mechanics and the techniques to repair these types of vehicles. Repair and maintenance work attempted by anyone without this knowledge is likely to render the vehicle unsafe and unfit for use.

This model has been designed and manufactured to perform within certain specifications in regard to performance and emissions. Proper service with the correct tools is necessary to ensure that the vehicle will operate as designed. If there is any question about a service procedure, it is imperative that you contact a Yamaha dealer for any service information changes that apply to this model. This policy is intended to provide the customer with the most satisfaction from his vehicle and to conform to federal environmental quality objectives.

Yamaha Motor Company, Ltd. is continually striving to improve all of its models. Modifications and significant changes in specifications or procedures will be forwarded to all authorized Yamaha dealers and will appear in future editions of this manual where applicable.

NOTE:

- This Service Manual contains information regarding periodic maintenance to the emission control system. Please read this material carefully.
- Designs and specifications are subject to change without notice.

EAS00004

IMPORTANT MANUAL INFORMATION

Particularly important information is distinguished in this manual by the following.

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING Failure to follow WARNING instructions could result in severe injury or death to the motorcycle operator, a bystander or a person checking or repairing the motorcycle.

CAUTION: A CAUTION indicates special precautions that must be taken to avoid damage to the motorcycle.

NOTE: A NOTE provides key information to make procedures easier or clearer.

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HOW TO USE THIS MANUAL

This manual is intended as a handy, easy-to-read reference book for the mechanic. Comprehensive explanations of all installation, removal, disassembly, assembly, repair and check procedures are laid out with the individual steps in sequential order.

① The manual is divided into chapters. An abbreviation and symbol in the upper right corner of each page indicate the current chapter.
Refer to “SYMBOLS”.

② Each chapter is divided into sections. The current section title is shown at the top of each page, except in chapter 3 (“PERIODIC CHECKS AND ADJUSTMENTS”), where the sub-section title(s) appears.

③ Sub-section titles appear in smaller print than the section title.

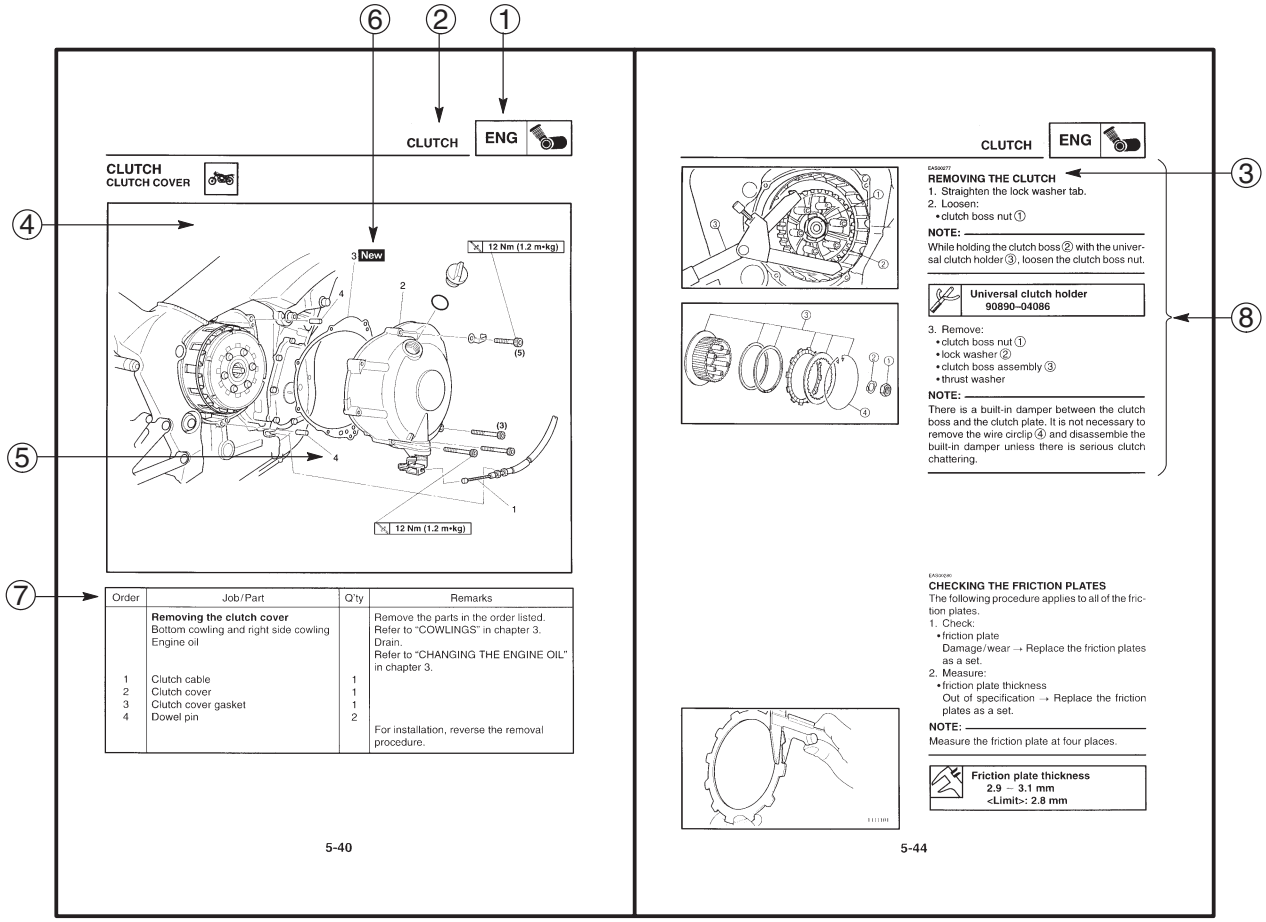
④ To help identify parts and clarify procedure steps, there are exploded diagrams at the start of each removal and disassembly section.

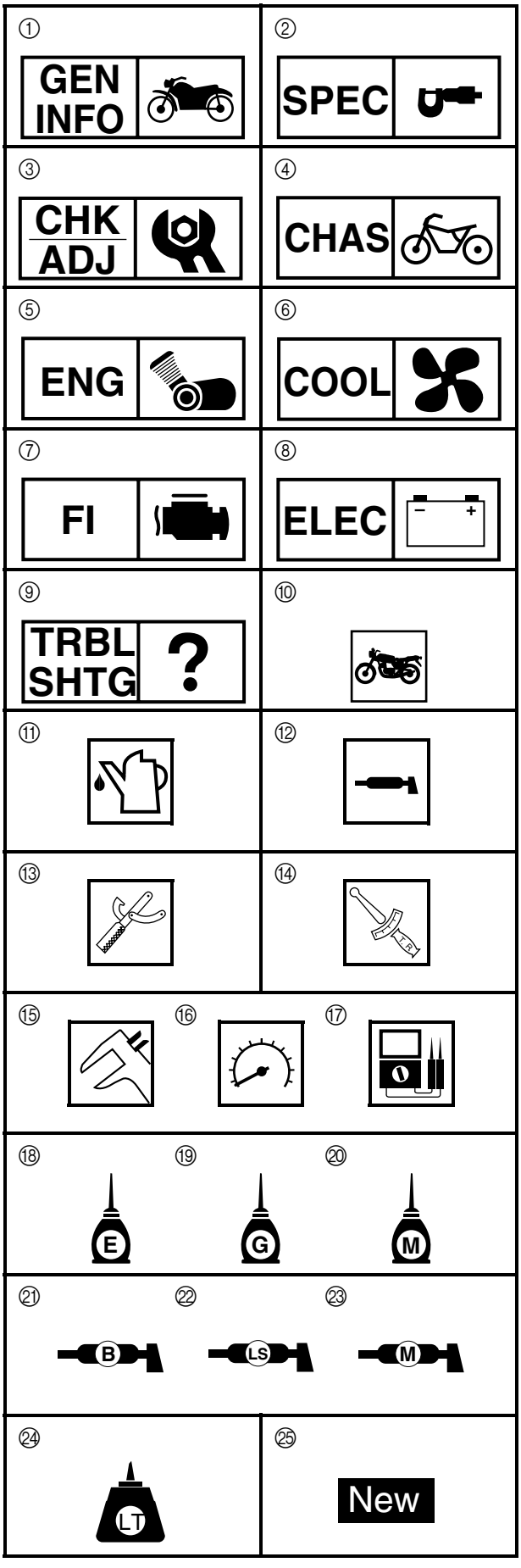
⑤ Numbers are given in the order of the jobs in the exploded diagram. A circled number indicates a disassembly step.

⑥ Symbols indicate parts to be lubricated or replaced.
Refer to “SYMBOLS”.

⑦ A job instruction chart accompanies the exploded diagram, providing the order of jobs, names of parts, notes in jobs, etc.

⑧ Jobs requiring more information (such as special tools and technical data) are described sequentially.





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SYMBOLS

The following symbols are not relevant to every vehicle.

Symbols ① to ⑨ indicate the subject of each chapter.

① General information
② Specifications
③ Periodic checks and adjustments
④ Chassis
⑤ Engine
⑥ Cooling system
⑦ Fuel injection system
⑧ Electrical system
⑨ Troubleshooting

Symbols ⑩ to ⑰ indicate the following.

⑩ Serviceable with engine mounted
⑪ Filling fluid
⑫ Lubricant
⑬ Special tool
⑭ Tightening torque
⑮ Wear limit, clearance
⑯ Engine speed
⑰ Electrical data

Symbols ⑱ to ㉓ in the exploded diagrams indicate the types of lubricants and lubrication points.

⑱ Engine oil
⑲ Gear oil
⑳ Molybdenum-disulfide oil
㉑ Wheel-bearing grease
㉒ Lithium-soap-base grease
㉓ Molybdenum-disulfide grease

Symbols ㉔ to ㉕ in the exploded diagrams indicate the following.

㉔ Apply locking agent (LOCTITE®)
㉕ Replace the part

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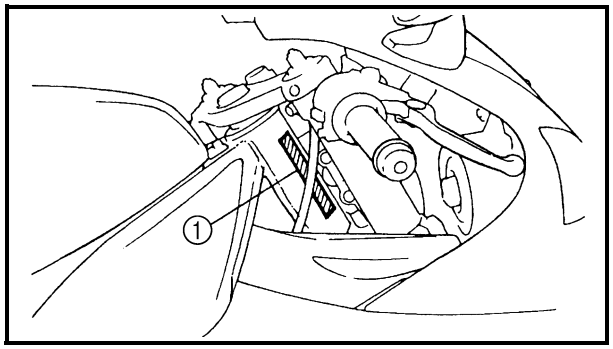

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GENERAL INFORMATION

MOTORCYCLE IDENTIFICATION

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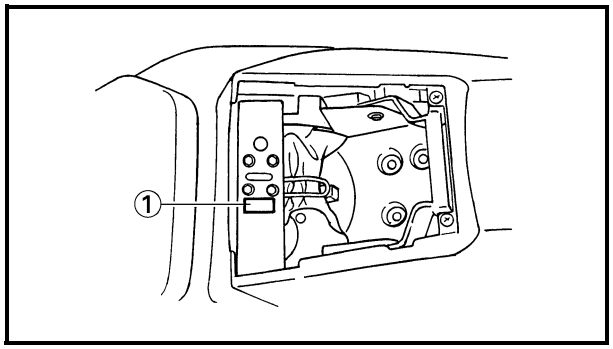
VEHICLE IDENTIFICATION NUMBER

The vehicle identification number ① is stamped into the right side of the steering head pipe.



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MODEL LABEL

The model label ① is affixed to the frame. This information will be needed to order spare parts.

FEATURES

OUTLINE OF FI SYSTEM

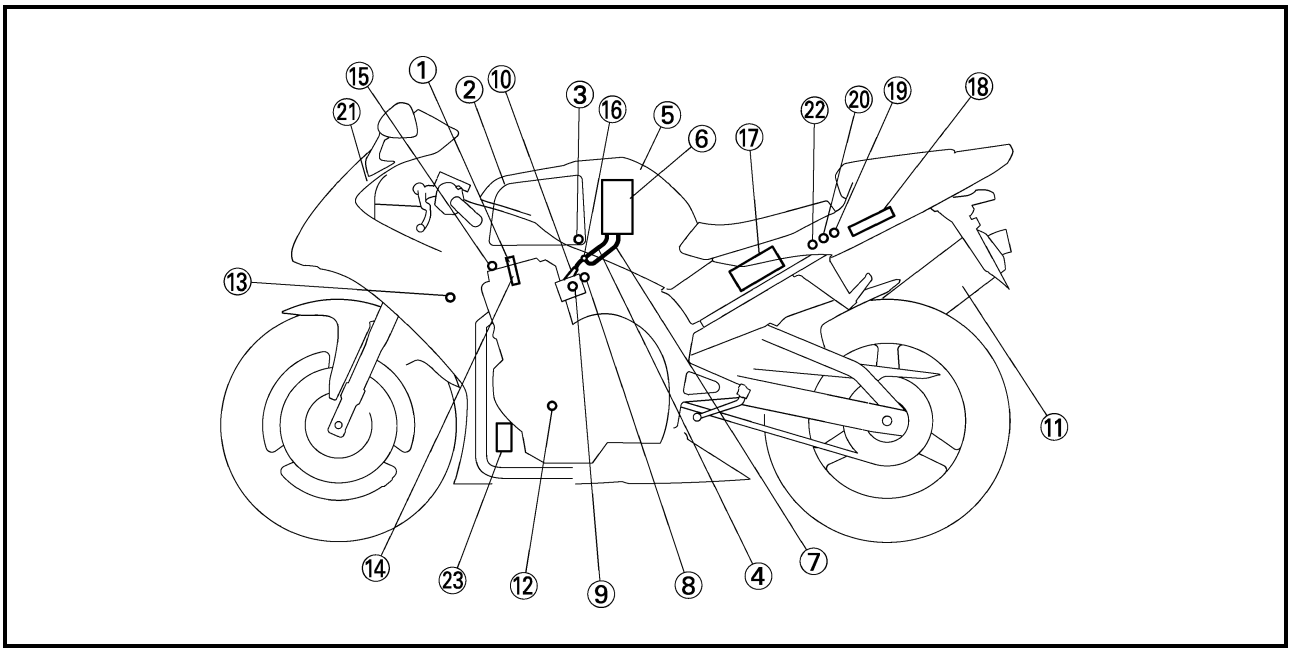
The main function of a fuel supply system is to provide fuel to the combustion chamber at the optimum air-fuel ratio in accordance with the engine operating conditions and the atmospheric temperature.

In the conventional carburetor system, the air-fuel ratio of the mixture that is supplied to the combustion chamber is created by the volume of the intake air and the fuel that is metered by the jet that is used in the respective chamber.

Despite the same volume of intake air, the fuel volume requirement varies by the engine operating conditions, such as acceleration, deceleration, or operating under a heavy load. Carburetors that meter the fuel through the use of jets have been provided with various auxiliary devices, so that an optimum air-fuel ratio can be achieved to accommodate the constant changes in the operating conditions of the engine.

As the requirements for the engine to deliver more performance and cleaner exhaust gases increase, it becomes necessary to control the air-fuel ratio in a more precise and finely tuned manner. To accommodate this need, this model has adopted an electronically controlled fuel injection (FI) system, in place of the conventional carburetor system. This system can achieve an optimum air-fuel ratio required by the engine at all times by using a microprocessor that regulates the fuel injection volume according to the engine operating conditions detected by various sensors.

The adoption of the FI system has resulted in a highly precise fuel supply, improved engine response, better fuel economy, and reduced exhaust emissions. Furthermore, the air induction system (AI system) has been placed under computer control together with the FI system in order to realize cleaner exhaust gases.



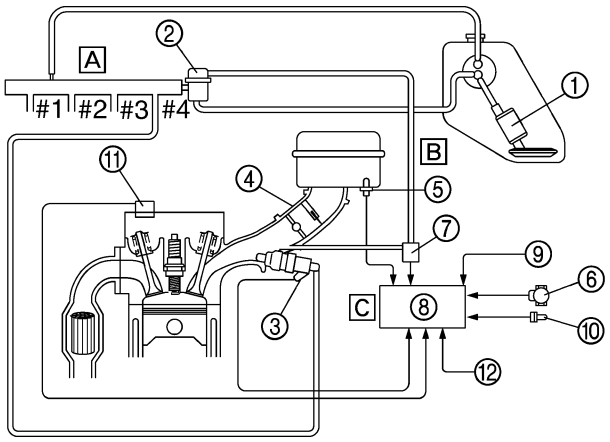
① Ignition coil
② Air filter case
③ Intake temperature sensor
④ Fuel delivery hose
⑤ Fuel tank
⑥ Fuel pump
⑦ Fuel return hose
⑧ Intake air pressure sensor
⑨ Throttle position sensor
⑩ Fuel injector
⑪ Catalytic converter
⑫ Crankshaft position sensor
⑬ Coolant temperature sensor
⑭ Spark plug
⑮ Cylinder identification sensor
⑯ Pressure regulator
⑰ Battery
⑱ ECU
⑲ Atmospheric pressure sensor
⑳ Fuel injection system relay
㉑ Engine trouble warning light
㉒ Lean angle cut-off switch
㉓ Air cut-off valve

FI SYSTEM

The fuel pump delivers fuel to the injector via the fuel filter. The pressure regulator maintains the fuel pressure that is applied to the injector at only 284 kPa (2.84 kg/cm^2, 40.4 psi) higher than the intake manifold pressure. Accordingly, when the energizing signal from the ECU energizes the injector, the fuel passage opens, causing the fuel to be injected into the intake manifold only during the time the passage remains open. Therefore, the longer the length of time the injector is energized (injection duration), the greater the volume of fuel that is supplied. Conversely, the shorter the length of time the injector is energized (injection duration), the lesser the volume of fuel that is supplied.

The injection duration and the injection timing are controlled by the ECU. Signals that are input from the throttle position sensor, crankshaft position sensor, intake air pressure sensor, atmospheric pressure sensor, intake temperature sensor and coolant temperature sensor enable the ECU to determine the injection duration. The injection timing is determined through the signals from the crankshaft position sensor and the cylinder identification sensor. As a result, the volume of fuel that is required by the engine can be supplied at all times in accordance with the driving conditions.

Illustration is for reference only.



① Fuel pump
② Pressure regulator
③ Fuel injector
④ Throttle body
⑤ Intake temperature sensor
⑥ Throttle position sensor
⑦ Intake air pressure sensor
⑧ ECU
⑨ Atmospheric pressure sensor
⑩ Coolant temperature sensor
⑪ Cylinder identification sensor
⑫ Crankshaft position sensor
A Fuel system
B Air system
C Control system

Fuel control block

The fuel control block consists of the following main components:

	Component	Function
Control block	ECU	Total FI system control
	Throttle body	Air volume control
	Pressure regulator	Fuel pressure detection
Sensor block	Intake air pressure sensor	Intake air pressure detection
	Atmospheric pressure sensor	Atmospheric pressure detection
	Coolant temperature sensor	Coolant temperature detection
	Intake temperature sensor	Intake temperature detection
	Throttle position sensor	Throttle angle detection
	Cylinder identification sensor	Reference position detection
	Crankshaft position sensor	Crankshaft position detection and engine RPM detection
	Speed sensor	Speed detection
Actuator block	Injector	Fuel injection
	Fuel pump	Fuel feed
	Air Induction system, air cut valve	Induction of secondary air

An engine trouble warning light is provided on meter panel.

COMPONENTS

ECU (Electronic Control Unit)

The ECU is mounted underneath the seat. The main functions of the ECU are ignition control, fuel control, self-diagnosis, and load control.

- ECU's internal construction and functions

  The main components and functions of the ECU can be broadly divided into the following four items:

  A. Power supply circuit

  The power supply circuit obtains power from the battery (12 V) to supply the power (5 V) that is required for operating the ECU.

  B. Input interface circuits

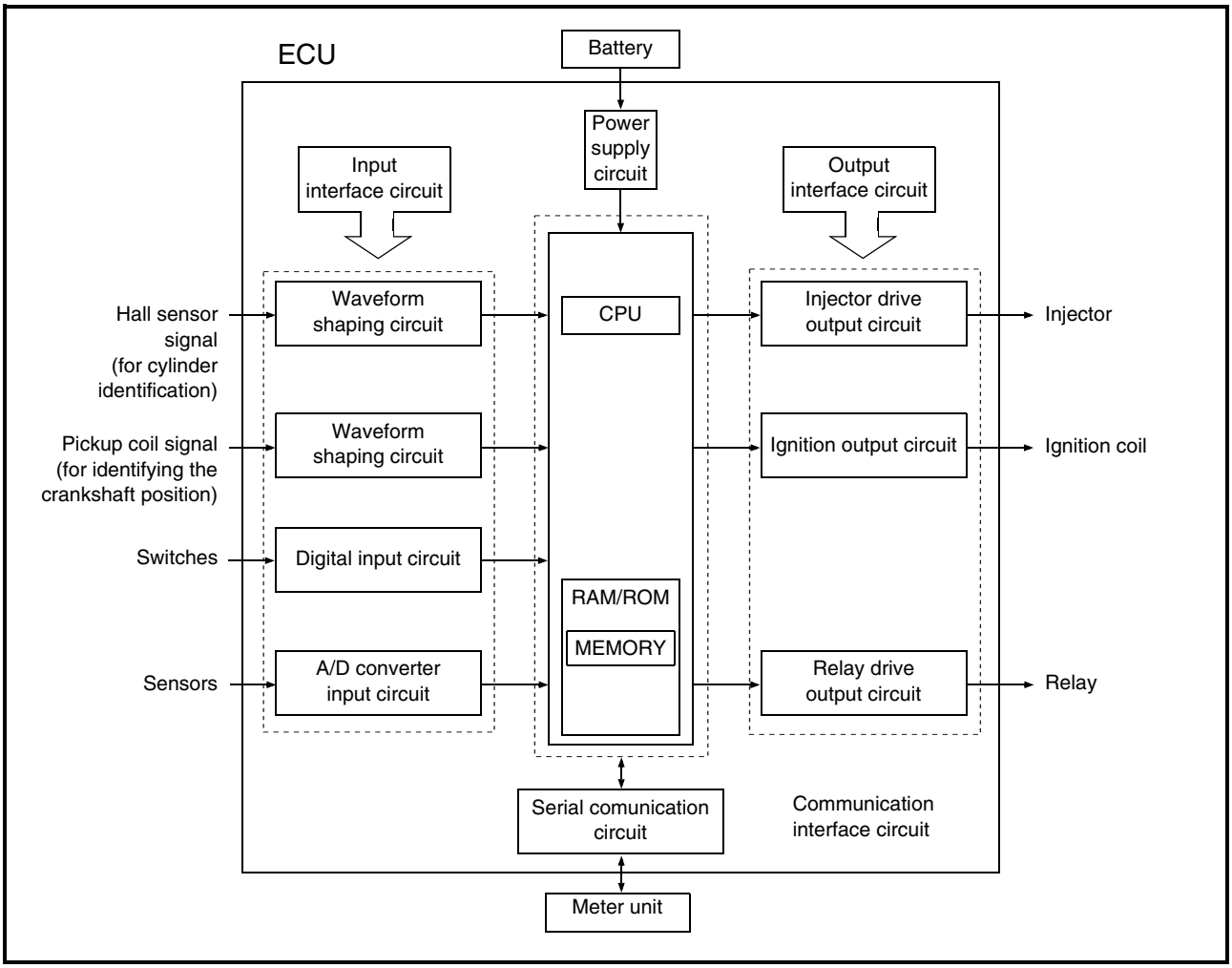
  The input interface circuits convert the signals output by all the sensors into digital signals, which can be processed by the CPU, and input them into the CPU.

  C. CPU (Central Processing Unit)

  The CPU determines the condition of the sensors in accordance with the level of the signal that is output by the respective sensor. Then, the signals are temporarily stored on the RAM in the CPU. Based on those stored signals and the basic processing program on the ROM, the CPU calculates the fuel injection duration, injection timing, and ignition timing, and then sends control commands to the respective output interface circuits.

  D. Output interface circuits

  The output interface circuits convert the control signals output by the CPU into actuating signals for the respective actuators in order to actuate them. They also output commands to the indicator and relay output circuits as needed.



- Ignition control
  The ignition control function of the ECU controls the ignition timing and the duration of ignition energizing. The ignition timing control uses the signals from the throttle position sensor (to detect the angle of the throttle), and the crankshaft position sensor and speed sensor (to detect the speed of the engine). This control establishes an ignition timing that suits the operating condition of the engine through compensations made to the basic ignition timing control map. The ignition energizing duration control establishes the energizing duration to suit the operating conditions by calculating the energizing duration in accordance with the signal received from the crankshaft position sensor and the battery voltage.
- Fuel control
  The fuel control function of the ECU controls the injection timing and injection duration. The injection timing control controls the injection timing during the starting of the engine and the injection timing during the normal operation of the engine, based on the signals received from the crankshaft position sensor and the cylinder identification sensor. The injection duration control determines the duration of injection based on the signals received from the atmospheric pressure sensors, temperature sensors, and the position sensors, to which compensations are made to suit various conditions such as the weather, atmospheric pressure, starting, acceleration, and deceleration.
- Load control
  The ECU effects load control in the following manner:
  1. Stopping the fuel pump and injectors when the motorcycle overturns
     The ECU turns OFF the fuel injection system relay when the lean angle cut-off switch is operated.
  2. Operating the headlight illumination relay
     The ECU controls the headlight relay 2 in accordance with the engine speed as required by the daytime illumination specification.
  3. Operating the radiator fan motor in accordance with the coolant temperature
     The ECU controls the radiator fan motor relay ON/OFF in accordance with the coolant temperature.
  4. Operating the AI system solenoid valve
     The ECU controls the energizing of the solenoid valve in accordance with the driving conditions.
- Self-diagnosis function
  The ECU is equipped with a self-diagnosis function to ensure that the engine control system is operating normally. The ECU mode functions include a diagnosis mode in addition to the normal mode.
  Normal mode
  - To check for any blown bulbs, this mode illuminates a engine trouble warning light while the main switch is turned ON, and while the starter switch is being pressed.
  - If the starting disable warning is activated, this mode alerts the rider by blinking the engine trouble warning light while the start switch is being pressed.
  - If a malfunction occurs in the system, this mode provides an appropriate substitute characteristic operation, and alerts the rider of the malfunction by illuminating an engine trouble warning light. After the engine is stopped, this mode displays a fault code on the clock LCD.

  Diagnosis mode
  - In this mode, a diagnostic code is input into the ECU through the operation of the operating switch on the meter, and the ECU displays the values output by the sensors or actuates the actuators in accordance with the diagnostic code. Whether the system is operating normally can be checked by observing the illumination of the engine trouble warning light, the values displayed on the meter, or the actuating state of the actuators.

Fuel pump

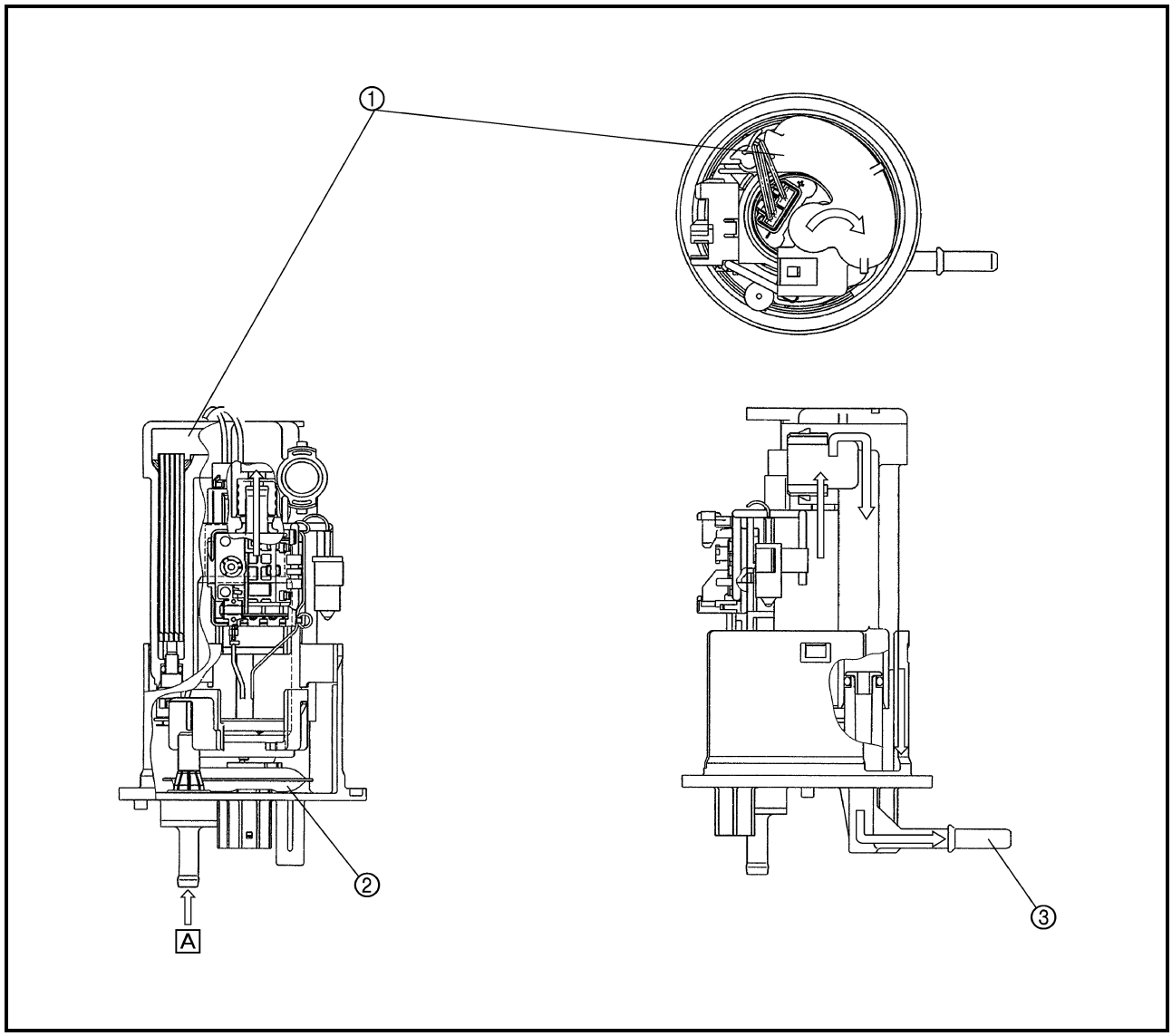
The fuel pump, which is mounted in the fuel tank, draws the fuel directly from the tank and pumps it to the injector.

A filter that is provided in the fuel pump prevents any debris in the fuel tank from entering the fuel system downstream of the pump.

The pump consists of a pump unit, electric motor, filter, and valves.

The pump unit is a Wesco type rotary pump that is connected to the motor shaft.

A relief valve is provided to prevent the fuel pressure from rising abnormally if the fuel hose becomes clogged. This valve opens when the fuel pressure at the discharge outlet reaches between 440 ~ 640 kPa (4.4 ~ 6.4 kg/cm^2, 62.6 ~ 91.0 psi), and returns the fuel to the fuel tank.



① Fuel filter
② Fuel inlet strainer
③ Outlet
A Fuel

Pressure regulator

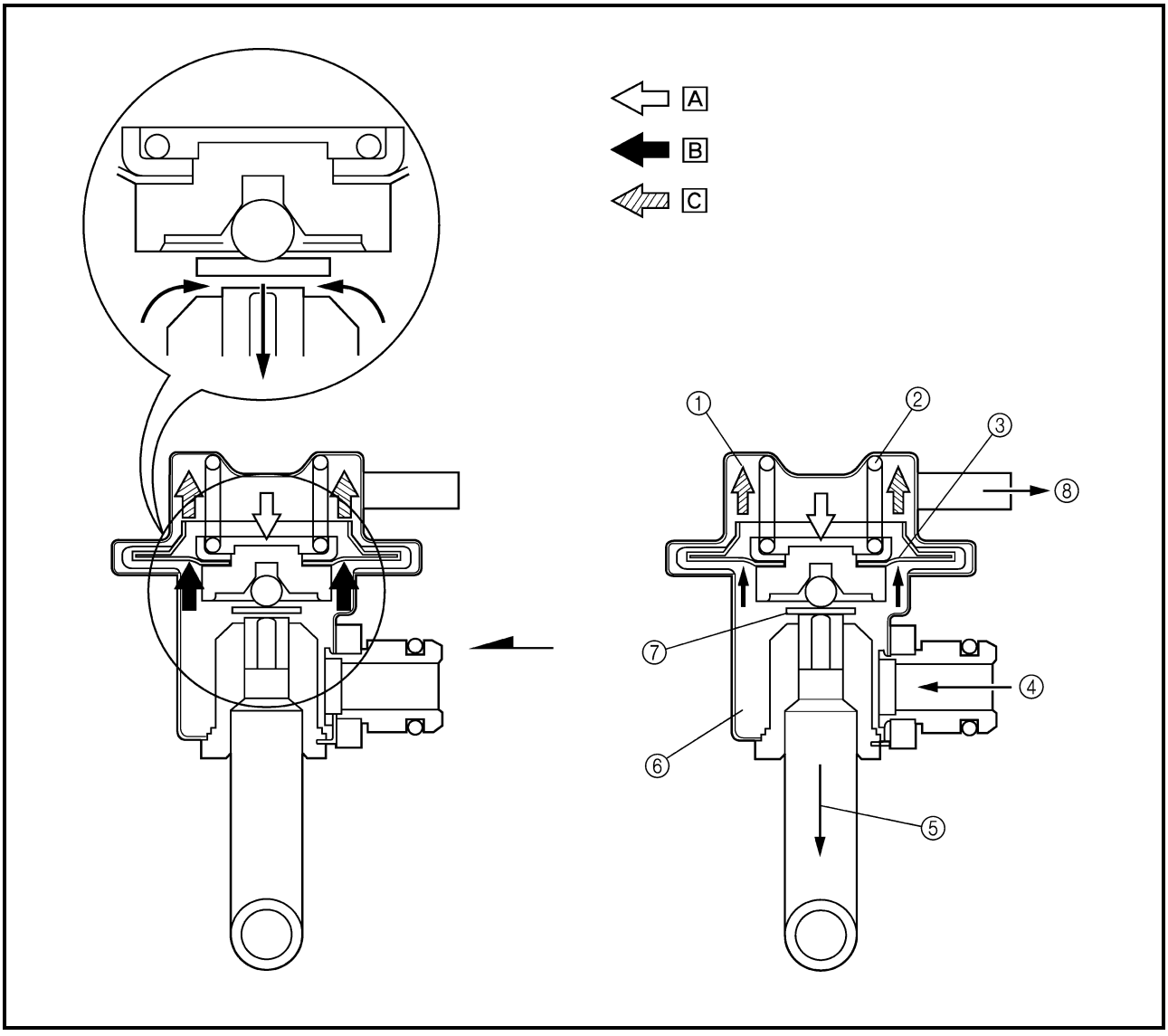
It regulates the fuel pressure that is applied to the injectors that are provided in the cylinders in order to maintain a constant pressure difference with the pressure in the intake manifold.

The fuel that is delivered by the fuel pump fills the fuel chamber through the fuel inlet of the regulator and exerts pressure on the diaphragm in the direction for opening the valve.

A spring that is provided in the spring chamber exerts pressure on the diaphragm in the direction for closing the valve, in contrast to the pressure of the fuel. Thus, the valve cannot open unless the fuel pressure overcomes the spring force.

An intake vacuum is applied to the spring chamber via a pipe. When the pressure of the fuel exceeds the sum of the intake vacuum and the spring force, the valve that is integrated with the diaphragm opens, allowing the fuel to return from the fuel outlet to the fuel tank, via the fuel return hose.

As a result, because the intake vacuum fluctuates in accordance with the changes in the operating conditions in contrast to the constant volume of fuel supplied by the pump, the valve opening/closing pressure also changes to regulate the return fuel volume. Thus, the difference between the fuel pressure and the intake manifold pressure remains constant at a prescribed pressure.

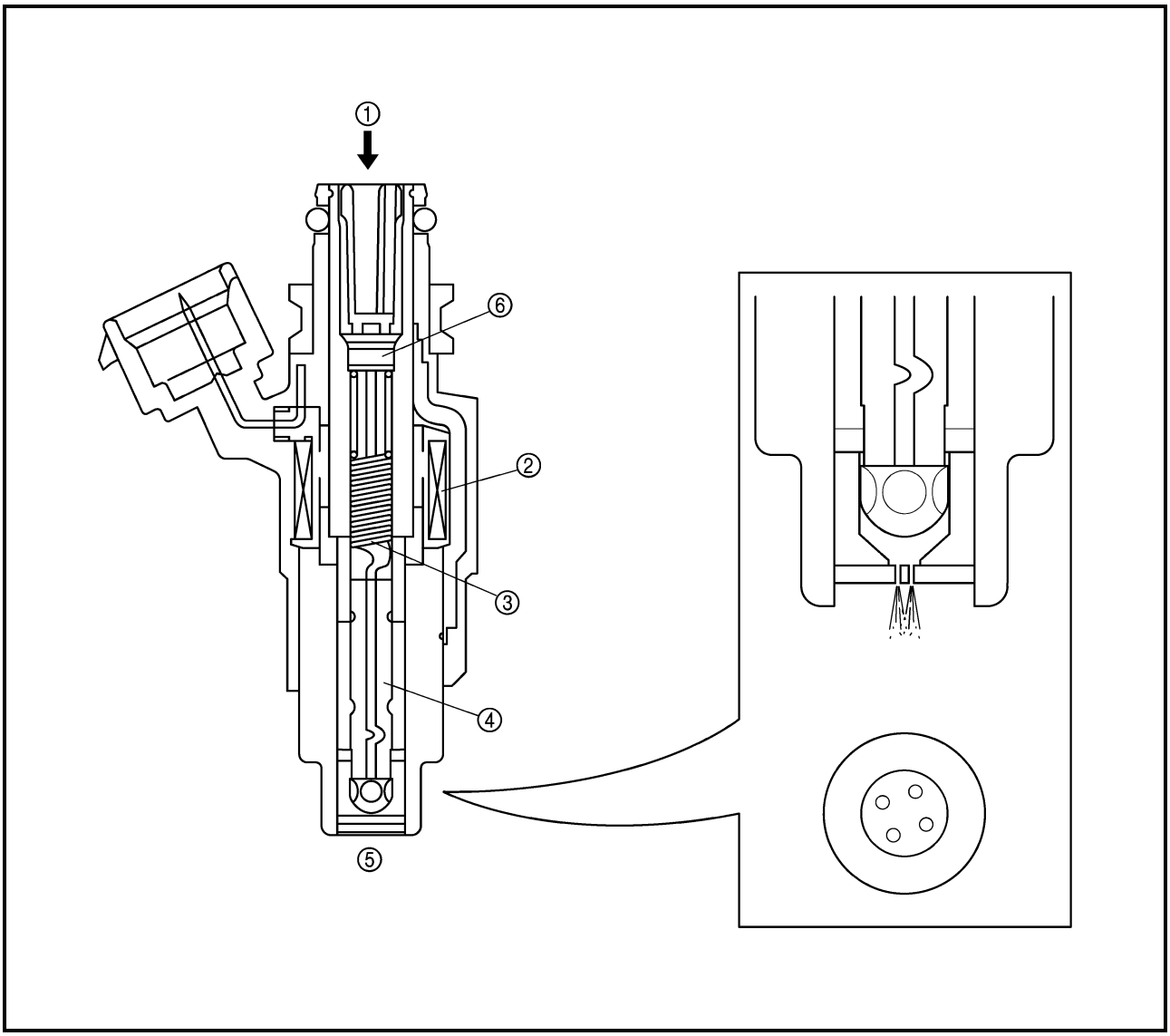


① Spring chamber
② Spring
③ Diaphragm
④ Fuel inlet
⑤ Fuel return
⑥ Fuel chamber
⑦ Valve
⑧ Intake manifold vacuum pressure
A Spring pressure
B Fuel pressure
C Vacuum pressure

Fuel injector

Upon receiving injection signals from the ECU, the fuel injector injects fuel. In the normal state, the core is pressed downward by the force of the spring, as illustrated. The plunger that is integrated with the bottom of the core keeps the fuel passage closed.

When the current flows to the coil in accordance with the signal from the ECU, the core is drawn upward, allowing the flange that is integrated with the plunger to move to the spacer. Since the distance of the movement of the needle is thus kept constant, the opening area of the fuel passage also becomes constant. Because the pressure difference of the fuel to the intake manifold pressure is kept constant by the pressure regulator, the fuel volume varies in proportion to the length of time the coil is energized. The injector that has been recently adopted has a four-hole type injection orifice that enhances the atomization of fuel and improves combustion efficiency.



① Fuel
② Coil
③ Core
④ Plunger
⑤ Inject
⑥ Flange