



**FH601D FH641D**  
**FH680D FH721D**

# **4–stroke air-cooled v-twin gasoline engine**

# **Service Manual**

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All information contained in this publication is based on the latest product information available at the time of publication. Illustrations and photographs in this publication are intended for reference use only and may not depict actual model component parts.

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### LIST OF ABBREVIATIONS

A	ampere(s)	lb	pound(s)
ABDC	after bottom dead center	m	meter(s)
AC	alternating current	min	minute(s)
ATDC	after top dead center	N	newton(s)
BBDC	before bottom dead center	Pa	pascal(s)
BDC	bottom dead center	PS	horsepower
BTDC	before top dead center	psi	pound(s) per square inch
°C	degree(s) Celsius	r	revolution
DC	direct current	rpm	revolution(s) per minute
F	farad(s)	TDC	top dead center
°F	degree(s) Fahrenheit	TIR	total indicator reading
ft	foot, feet	V	volt(s)
g	gram(s)	W	watt(s)
h	hour(s)	Ω	ohm(s)
L	liter(s)		

**Read OWNER'S MANUAL before operating.**

## EMISSION CONTROL INFORMATION

To protect the environment in which we all live, Kawasaki has incorporated crankcase emission (1) and exhaust emission (2) control systems (EM) in compliance with applicable regulations of the United States Environmental Protection Agency and California Air Resources Board.

### 1. Crankcase Emission Control System

A sealed-type crankcase emission control system is used to eliminate blow-by gasses. The blow-by gasses are led to a breather chamber through the crankcase and from there to the air cleaner.

Oil is separated from the gasses while passing through the inside of the breather chamber from the crankcase, and then returned to the bottom of crankcase.

### 2. Exhaust Emission Control System

The exhaust emission control system applied to this engine consists of a carburetor and an ignition system having optimum ignition timing characteristics.

The carburetor has been calibrated to provide lean air/fuel mixture characteristics and optimum fuel economy with a suitable air cleaner and exhaust system.

## TAMPERING WITH EMISSION CONTROL SYSTEM PROHIBITED

Federal law and California State law prohibits the following acts or the causing thereof: (1) the removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new engine for the purpose of emission control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the engine after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed below:

Do not tamper with the original emission related part:

- Carburetor and internal parts
- Spark plugs
- Magneto or electronic ignition system
- Fuel filter element
- Air cleaner elements
- Crankcase
- Cylinder heads
- Breather chamber and internal parts
- Intake pipe and tube

# Foreword

This manual is designed primarily for use by trained mechanics in a properly equipped shop. However, it contains enough detail and basic information to make it useful to the owner who desires to perform his own basic maintenance and repair work. A basic knowledge of mechanics, the proper use of tools, and workshop procedures must be understood in order to carry out maintenance and repair satisfactorily. Whenever the owner has insufficient experience or doubts as to his ability to do the work, all adjustments, maintenance, and repair should be carried out only by qualified mechanics.

In order to perform the work efficiently and to avoid costly mistakes, read the text, thoroughly familiarize yourself with the procedures before starting work, and then do the work carefully in a clean area. Whenever special tools or equipment are specified, do not use makeshift tools or equipment. Precision measurements can only be made if the proper instruments are used, and the use of substitute tools may adversely affect safe operation.

To get the longest life out of your engine:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki engine parts. Genuine parts provided as spare parts are listed in the Parts Catalog.
- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

## How to Use This Manual

In preparing this manual, we divided the product into its major systems. These systems became the manual's chapters. All information for a particular system from adjustment through disassembly and inspection is located in a single chapter.

The Quick Reference Guide shows you all of the product's system and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

The Periodic Maintenance Chart is located in the General Information chapter. The chart gives a time schedule for required maintenance operations.

If you want spark plug information, for example, go to the Periodic Maintenance Chart first. The chart tells you how frequently to clean and gap the plug. Next, use the Quick Reference Guide to locate the Electrical System chapter. Then, use the Table of Contents on the first page of the chapter to find the Spark Plug section.

Whenever you see these WARNING and CAUTION symbols, heed their instructions! Always follow safe operating and maintenance practices.

### **⚠ WARNING**

**This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.**

### **CAUTION**

**This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.**

This manual contains four more symbols (in addition to WARNING and CAUTION) which will help you distinguish different types of information.

### **NOTE**

○ *This note symbol indicates points of particular interest for more efficient and convenient operation.*

- Indicates a procedural step or work to be done.
- Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a WARNING, CAUTION, or NOTE.
- ★ Indicates a conditional step or what action to take based on the results of the test or inspection in the procedural step or sub-step it follows.

In most chapters an exploded view illustration of the system components follows the Table of Contents. In these illustrations you will find the instructions indicating which parts require specified tightening torque, oil, grease or a locking agent during assembly.

# General Information

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# 1-2 GENERAL INFORMATION

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## Before Servicing

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Before starting to service the engine, carefully read the applicable section to eliminate unnecessary work. Photographs, diagrams, notes, cautions, warnings, and detailed descriptions have been included wherever necessary. Nevertheless, even a detailed account has limitations, a certain amount of basic knowledge is required for successful work.

### Especially note the following:

- (1) **Dirt**

Before removal and disassembly, clean the engine. Any dirt entering the engine, carburetor, or other parts, will work as an abrasive and shorten the life of engine. For the same reason, before installing a new part, clean off any dust or metal filings.
- (2) **Battery Ground**

Remove the ground (—) lead from the battery before performing any disassembly operations on the equipment. This prevents:
  - (a) the possibility of accidentally turning the engine over while partially disassembled.
  - (b) sparks at electrical connections which will occur when they are disconnected.
  - (c) damage to electrical parts.
- (3) **Tightening Sequence**

Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them evenly, in a staggered sequence. This is to avoid distortion of the part and/or causing gas or oil leakage. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter of a turn and then remove them. Where there is a tightening sequence indication in this Service Manual, the bolts, nuts, or screws must be tightened in the order and method indicated.
- (4) **Torque**

When torque values are given in this Service Manual, use them. Either too little or too much torque may lead to serious damage. Use a good quality, reliable torque wrench.
- (5) **Force**

Common sense should dictate how much force is necessary in assembly and disassembly. If a part seems especially difficult to remove or install, stop and examine what may be causing the problem. Whenever tapping is necessary, tap lightly using a wooden or plastic-faced mallet. Use an impact driver for screws (particularly for the removal of screws held by a locking agent) in order to avoid damaging the heads.
- (6) **Edges**

Watch for sharp edges, especially during major engine disassembly and assembly. Protect your hands with gloves or a piece of thick cloth when lifting the engine or turning it over.
- (7) **High-Flash Point Solvent**

A high-flash point solvent is recommended to reduce fire danger. A commercial solvent commonly available in North America is Standard solvent (generic name). Always follow manufacturer and container directions regarding the use of any solvent.
- (8) **Gasket, O-Ring**

Do not reuse a gasket or O-ring once it has been in service. The mating surfaces around the gasket should be free of foreign matter and perfectly smooth to avoid oil or compression leaks.
- (9) **Liquid Gasket, Non-Permanent Locking Agent**

Follow manufacturer's directions for cleaning and preparing surfaces where these compounds will be used. Apply sparingly. Excessive amounts may block engine oil passages and cause serious damage. An example of a non-permanent locking agent commonly available in North America is Loctite Lock'n Seal (Blue).
- (10) **Press**

A part installed using a press or driver, such as a journal, should first be coated with oil on its outer or inner circumference so that it will go into place smoothly.
- (11) **Ball Bearing**

When installing a ball bearing, the bearing race which is affected by friction should be pushed by a suitable driver. This prevents severe stress on the balls and races, and prevents races and balls from being dented. Press a ball bearing until it stops at the stop in the hole or on the shaft.
- (12) **Oil Seal and Grease Seal**

Replace any oil or grease seals that were removed with new ones, as removal generally damages seals. When pressing in a seal which has manufacturer's marks, press it in with the marks facing out. Seals should be pressed into place using a suitable driver, which contacts evenly with the side of seal, until the face of the seal is even with the end of the hole.
- (13) **Seal Guide**

A seal guide is required for certain oil or grease seals during installation to avoid damage to the seal lips. Before a shaft passes through a seal, apply a little oil, preferably high temperature grease on the lips to reduce rubber to metal friction.
- (14) **Circlip, Retaining Ring**

Replace any circlips and retaining rings that were removed with new ones, as removal weakens and deforms them. When installing circlips and retaining rings, take care to compress or expand them only enough to install them and no more.

## Before Servicing

(15) Cotter Pin

Replace any cotter pins that were removed with new ones, as removal deforms and breaks them.

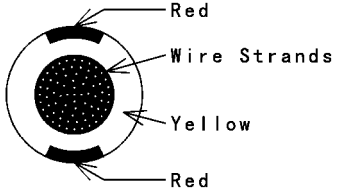

(16) Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the rubbing surfaces have an adequate lubricative film. During assembly, oil or grease (whichever is more suitable) should be applied to any rubbing surface which has lost its lubricative film. Old grease and dirty oil should be cleaned off. Deteriorated grease has lost its lubricative quality and may contain abrasive foreign particles.

Don't use just any oil or grease. Some oils and greases in particular should be used only in certain applications and may be harmful if used in an application for which they are not intended. This manual makes reference to molybdenum disulfide grease (MoS<sub>2</sub>) in the assembly of certain engine parts. Always check manufacturer recommendations before using such special lubricants.

(17) Electrical Wires

All the electrical wires are either single-color or two-color and, with only a few exceptions, must be connected to wires of the same color. On any of the two-color wires there is a greater amount of one color and a lesser amount of a second color, so a two-color wire is identified by first the primary color and then the secondary color. For example, a yellow wire with thin red stripes is referred to as a "yellow/red" wire; it would be a "red/yellow" wire if the colors were reversed to make red the main color.

Wire (cross-section)	Color Indicated on the Wire	Color Indicated on the Wiring Diagram
	Yellow/Red	

6B020601W1 C

(18) Replacement Parts

When there is a replacement instruction, replace these parts with new ones every time they are removed. There replacement parts will be damaged or lose their original function once removed.

(19) Inspection

When parts have been disassembled, visually inspect these parts for the following conditions or other damage. If there is any doubt as to the condition of them, replace them with new ones.

Abrasion	Crack	Hardening	Warp
Bent	Dent	Scratch	Wear
Color change	Deterioration	Seizure	

(20) Specifications

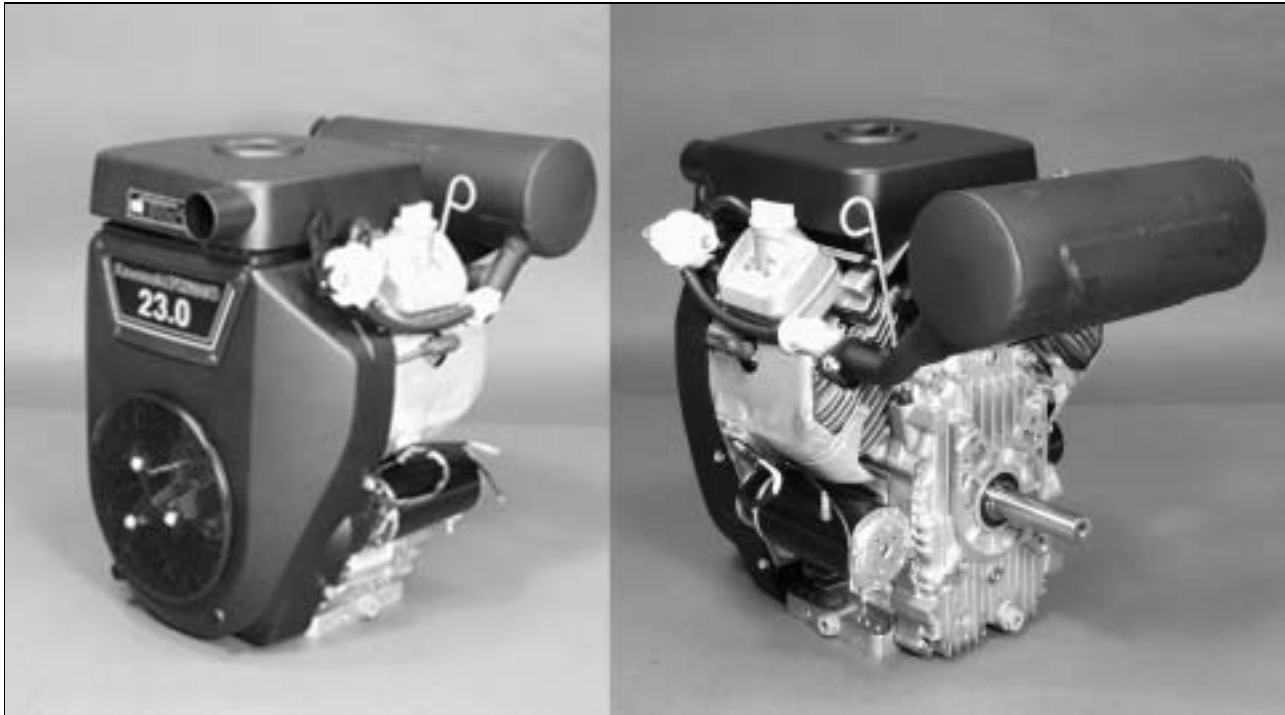
Specification terms are defined as follows:

"Standards" show dimensions or performances which brand-new parts or systems have.

"Service Limits" indicate the usable limits. If the measurement shows excessive wear or deteriorated performance, replace the damaged parts.

# 1-4 GENERAL INFORMATION

## Model Identification



### Cylinder Number Designation:

No.1 Cylinder is on the electric starter side.

No.2 Cylinder is on the oil filter side.



## GENERAL INFORMATION 1-5

### General Specifications

Items	FH601D, FH641D, FH680D, FH721D
Type of engine	Forced air-cooled, horizontal shaft, OHV, 4-stroke gasoline engine.
Cylinder layout	90° V-Twin
Bore x Stroke	75.2 mm x 76 mm (2.96 in x 2.99 in)
Piston displacement	675 mL (41.19 cu. in)
Direction of rotation	Counterclockwise facing the PTO shaft
Compression release	Automatic compression release
Low idle speed	1550 rpm
Fast idle speed	3600 rpm
Ignition system	Transistorized-fly wheel magneto
RFI	Per Canada and U.S.A. requirements
Starting system	Electric starter
Charging system	12 V - 13 amps with regulator
Spark plug	NGK BPR4ES
Carburetor	Float type, fixed main jet, two barrel
Fuel pump	Diaphragm type pulse pump
Air cleaner	Dual stage element, dry type
Governor	Flyweight all speed governor
Lubrication system	Pressure feed by positive displacement pump
Oil filter	Cartridge type full flow filter
Oil pressuer switch	ON-OFF switch
Oil capacity	1.6 L (1.7 US-qt)...(when engine is completely dry)
Cooling system	Forced air cooling by fan
Dimensions (L x W x H ): without muffler	442 mm x 430 mm x 491 mm (17.4 in x 16.9 in x 19.3 in)
Dry weight: without muffler	44.5 kg (98.1 lb)

Specifications subject to change without notice.

# 1-6 GENERAL INFORMATION

## Periodic Maintenance Chart

To ensure satisfactory operation over an extended period of time, any engine requires normal maintenance regular intervals. The Periodic Maintenance Chart below shows periodic inspection and maintenance items and suitable intervals. The bullet mark (•) designates that the corresponding item should be performed at that interval.

Some adjustments require the use of special tools or other equipment. An electronic tachometer will facilitate setting idle and running speeds.

OPERATION	INTERVAL						
	Daily	First 8 hr.	Every 25 hr.	Every 50 hr.	Every 100 hr.	Every 200 hr.	Every 300 hr.
Check or clean air intake screen	•						
Check and add engine oil	•						
Check for fuel and oil leakage	•						
Check for loose or lost nut and screw	•						
Check battery electrolyte level	•						
Clean air cleaner foam element (1)			•				
Clean air cleaner paper element (1)					•		
Clean dust and dirt from cylinder and cylinder head fins (1)					•		
Tighten nut and screws					•		
Change engine oil		•			•		
Clean and re-gap spark plugs					•		
Check and clean oil cooler fins (FH721D engines).					•		
Change Oil filter						•	
Change air cleaner paper element (1)						•	
♦ Check and adjust valve clearance							•
♦ Clean and lap valve seating surface							•
♦ Clean combustion chamber							•

(1): Service more frequently under dusty conditions.

♦: These items must be performed with the proper tools. See your authorized Kawasaki Engine Dealer for service, unless you have the proper equipment and mechanical proficiency.

**Torque and Locking Agent**

The following tables lists the tightening torque for the major fasteners, and the parts requiring use of a non-permanent locking agent or liquid gasket.

Letters used in the "Remarks" column mean:

**L** : Apply a non-permanent locking agent to the threads.

**M** : Apply a molybdenum disulfide lubricant (grease or oil) to the threads, seated surface, or washer.

**O** : Apply an oil to the threads, seated surface, or washer.

**S** : Tighten the fasteners following the specified sequence.

**SS** : Apply silicone sealant.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
<b>Fuel System:</b>				
Choke Valve Screw	◆0.95	◆0.097	◆8.4 in·lb	◆=L
Throttle Valve Screws	◆0.95	◆0.097	◆8.4 in·lb	◆=L
Plug, Main Jet	18	1.8	13	
Drain Screw (Carburetor)	2.0	0.2	18 in·lb	
Fuel Shut Off Solenoid Valve (Carburetor)	19	1.9	14	
Float Chamber Mounting Screw (Carburetor)	4.0	0.4	35 in·lb	
Governor Arm Clamp Nut	7.8	0.8	69 in·lb	
Governor Shaft Plate Screws	2.0	0.2	17 in·lb	
Carburetor and Intake Pipe Mounting Bolts and Nuts	5.9	0.6	52 in·lb	
Intake Manifold Mounting Bolts	5.9	0.6	52 in·lb	
Air Cleaner Body Mounting Bolts	5.9	0.6	52 in·lb	
Control Panel Mounting Bolts	5.9	0.6	52 in·lb	
<b>Cooling System:</b>				
Screen Bolts	5.9	0.6	52 in·lb	
Engine-shroud Bolt (M8: on Cylinder Head)	6.9	0.7	61 in·lb	
Engine-shroud Bolts (M6)	5.9	0.6	52 in·lb	
<b>Engine Top End:</b>				
Cylinder Head Bolts	◆28	◆2.8	◆21	◆=S
Valve Clearance Lock Screws	6.9	0.7	61 in·lb	
Connecting Rod Big End Cap Bolts	◆9.8	◆1.0	◆87 in·lb	◆=O
Rocker Arm Bolts	28	2.8	21	
Rocker Cover Mounting Bolts	6.9	0.7	61 in·lb	
Muffler Flange Nuts	15	1.5	11	
Spark Plugs	22	2.2	16	

# 1-8 GENERAL INFORMATION

## Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
<b>Lubrication System:</b>				
Engine Drain Plugs (Plastic)	6.9	0.7	61 in·lb	
Engine Drain Plug (Metal)	20	2.0	14.5	
Engine Drain Plug Joint (Plastic)	17	1.7	12	
Engine Drain Plug Joint (Metal)	39	4.0	29	
Oil Pressure Switch	◆9.8	◆1.0	◆87 in·lb	◆=SS
Oil Pump Cover Plate Mounting Bolts	5.9	0.6	52 in·lb	
Oil Filter (see Page 5-6)	in the text	←	←	
<b>Camshaft/Crankshaft:</b>				
Crankcase Cover Bolts	◆25	◆2.6	◆19	◆=S
Breather Chamber Cover Bolts	5.9	0.6	52 in·lb	
<b>Electrical System:</b>				
Stator Coil Screws	3.4	0.35	30 in·lb	
Flywheel Bolt	56	5.7	41	
Fan Housing Bolts (M8)	6.9	0.70	61 in·lb	
Fan Housing Bolts (M6)	5.9	0.6	52 in·lb	
Screen Bolts	5.9	0.6	52 in·lb	
Regulator Screws	3.4	0.35	30 in·lb	
Ignition Coil Bolts	5.9	0.6	52 in·lb	
Starter Motor Mounting Bolts	15	1.5	11	
Spark Plugs	22	2.2	16	

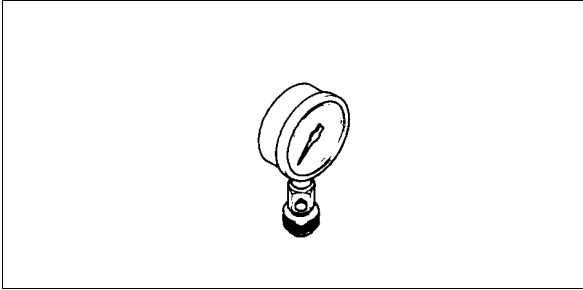
The table below, relating tightening torque to thread diameter, lists the basic torque for the bolts and nuts. Use this table for only the bolts and nuts which do not require a specific torque value. All of the values are for use with dry solvent-cleaned threads.

### Basic Torque for General Fasteners

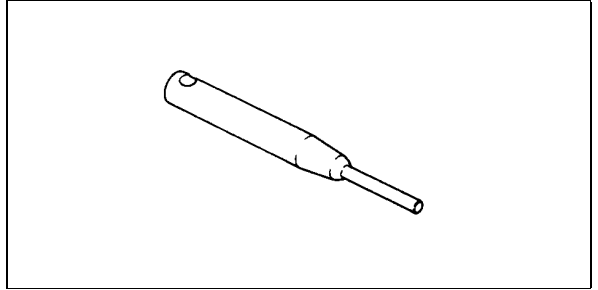
Threads dia (mm)	Torque		
	N·m	kg·m	ft·lb
4	2.0	0.2	17 in·lb
5	3.4	0.35	30 in·lb
6	5.9	0.6	52 in·lb
8	15	1.5	11

**Special Tools**

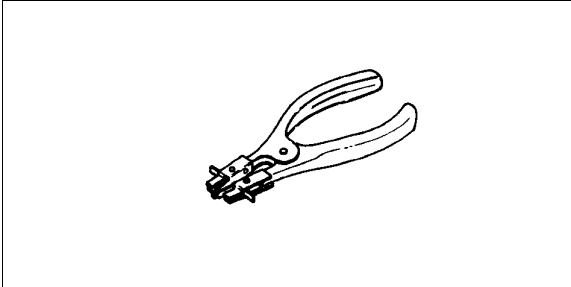
**Compression Gauge: 57001-221**



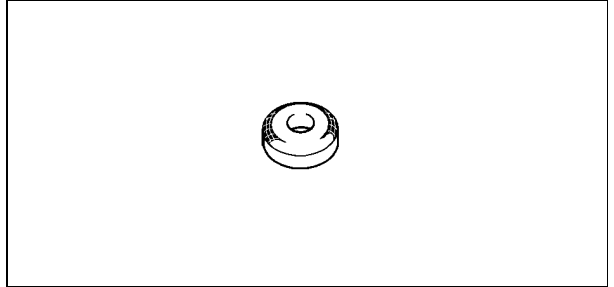
**Valve Seat Cutter Holder Ø6: 57001-1360**



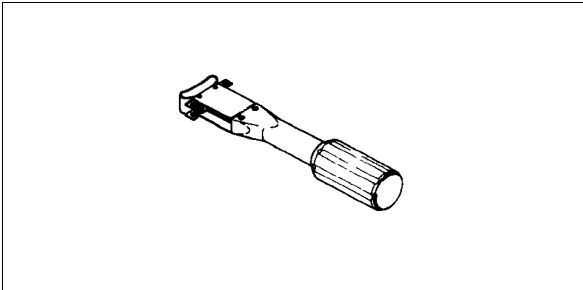
**Piston Ring Pliers: 57001-115**



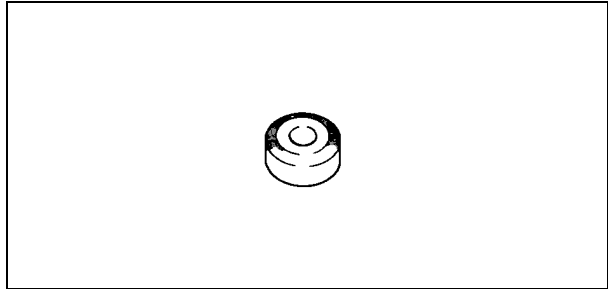
**Valve Seat Cutter, 45° - φ35.0 : 57001-1116**



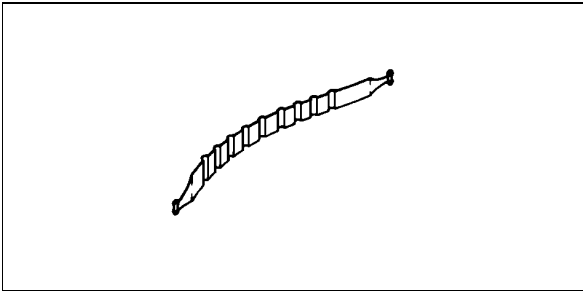
**Piston Ring Compression Grip: 57001-1095**



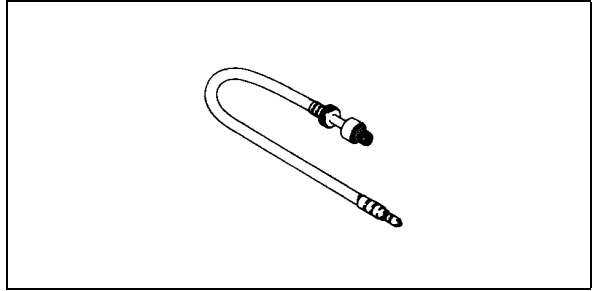
**Valve Seat Cutter, 32° - φ33.0 : 57001-1199**



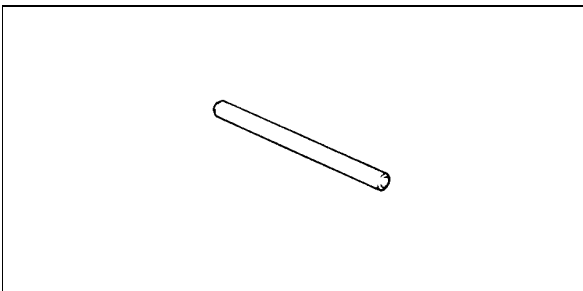
**Piston Ring Compression Belt, Ø67 -Ø79: 57001-1097**



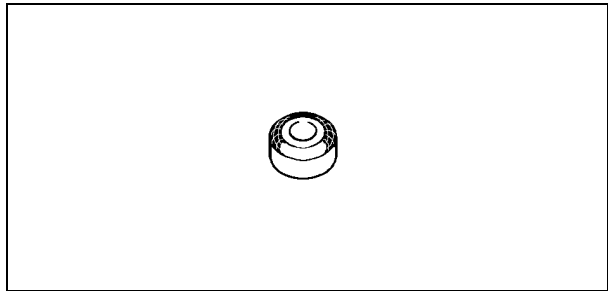
**Compression Gauge Adapter M14 x 1.25: 57001-1159**



**Valve Seat Cutter Holder Bar: 57001-1128**



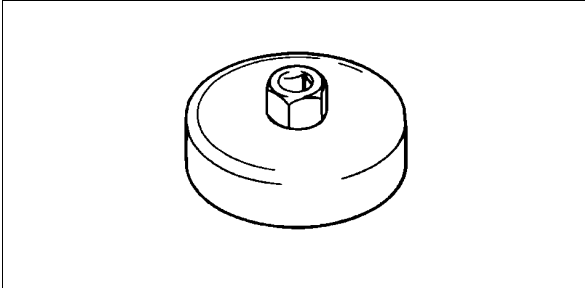
**Valve Seat Cutter, 32° - φ30 : 57001-1120**



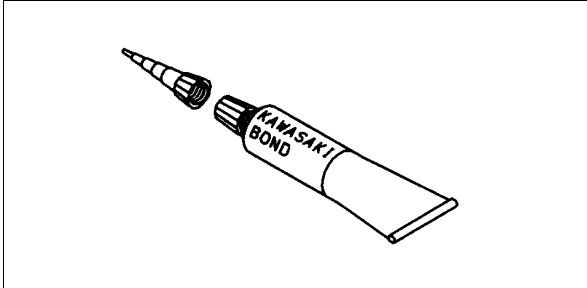
# 1-10 GENERAL INFORMATION

## Special Tools

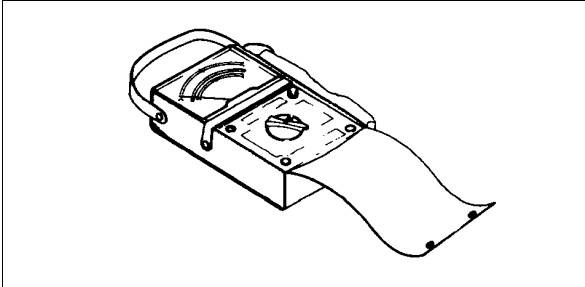
Oil Filter Wrench : 57001-1249



Kawasaki Bond (Silicone Sealant) : 56019-120



Hand Tester: 57001-1394



# Fuel System

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