# KAW-PEDIA



Kawasaki

Let the good times roll.

# INTRODUCTION

The Kaw-Pedia works like an encyclopedia to explain the purpose, function and benefits of many of the technical features found on Kawasaki products. Please use it to improve your knowledge of Kawasaki products and refer to it when needed to help answer customer questions.

The Kaw-Pedia is divided into nine separate sections (Engine, Fuel System, Drive Train, Chassis, Hull, Suspension, Brakes, Wheels / Tyres, and Electrical). Each section is then presented in a logical order. For your information, an alphabetically arranged table has been added showing the Business Unit and year in which each feature was used.

Due to improvements in design and performance prior to and during production, in some models there may be minor differences between the actual product and the information presented in this publication. Illustrations in this publication are intended for reference use only and may not depict actual model components.

**Kawasaki Motors Europe NV**
**Technical Service Department**

**Copyright © 2010 Kawasaki Motors Europe N.V.**
All rights reserved. Subject to the exceptions provided for by law, no part of this publication may be reproduced and/or published in print, by photocopying, on microfilm, electronically or in any other way without the prior written consent of the copyright holders.

# KAW-PEDIA CONTENTS

## ENGINE


DUAL PLUG HEAD ..... 5
FOUR VALVE HEADS ..... 5
HOLLOW CAMS ..... 5
CAM CHAINS (ROLLER & SILENT) ..... 5
DUAL STAGE CAM CHAIN ..... 5
SIDE CAM CHAIN DRIVE ..... 6
AUTOMATIC CAM CHAIN TENSIONER ..... 6
OVERHEAD VALVES (OHV) ..... 6
DOUBLE OVERHEAD CAMS (DOHC) ..... 6
INDIVIDUAL ROCKER ARM SYSTEM (IRS) ..... 7
DIRECT ACTUATION VALVES ..... 7
VALVE INCLUDED ANGLE ..... 7
HYDRAULIC VALVE LASH ADJUSTERS (HLA) ..... 7
INCONEL VALVES ..... 8
COMPRESSION RATIO – VARIABLE ..... 8
CONTOURED CRANCASE COVERS ..... 8
NCC COATING ..... 8
ELECTROFUSION ..... 8
OPEN DECK CYLINDER ..... 9
BALANCER SYSTEM ..... 9
K-RECIPRO BALANCER (MULE 550) ..... 9
DIESEL ENGINE ..... 10
RUBBER ENGINE MOUNTS ..... 10
PULSED SECONDARY AIR SYSTEM ..... 10
KAWASAKI LOW EXHAUST EMISSION CATALYTIC CONVERTER SYSTEM (KLEEN) ..... 10
EXHAUST SYSTEM - DRY ..... 11
EXHAUST SYSTEM - SEMI-DRY ..... 11
SUPERLUBE OIL INJECTION – VARIABLE RATE ..... 11
KAWASAKI AUTOMATIC COMPRESSION RELEASE (KACR) ..... 11
KAWASAKI INTEGRATED POWERVALVE SYSTEM (KIPS) ..... 11
KIPS-D ..... 12
DUAL-OIL PUMPS ..... 12
LIQUID-COOLED OIL COOLER ..... 12
SEMI-DRY SUMP ..... 12
CURVED RADIATOR ..... 13
PRIMARY KICK-START ..... 13


## FUEL SYSTEM


CARBURETTOR ..... 14
CONSTANT VELOCITY CARBURETTOR ..... 14
POWER JET CARBURETTOR ..... 14
CRESCENT SLIDE CARBURETTOR ..... 15
FLAT SLIDE CARBURETTOR ..... 15
DIGITAL FUEL INJECTION ..... 15
RAM AIR INDUCTION ..... 15
SUPERCHARGER ..... 16
INTERCOOLER ..... 16
ACCELERATOR PUMP ..... 16
ELECTRIC FUEL PUMP ..... 16
THROTTLE LIMITER ..... 16
ELECTRONIC THROTTLE VALVE SYSTEM ..... 16
CAB FRAME AIR INTAKE ..... 17
CYCLONE AIR FILTER WITH RESTRICTION GAUGE ..... 17
SNORKEL AIR INTAKE ..... 17
REED VALVES ..... 17
CARBON FIBRE REED VALVES ..... 17
CRANKCASE REED VALVE INDUCTION ..... 17
HOT START SYSTEM ..... 18
STRAIGHT SHOT INTAKE ..... 18


## DRIVE TRAIN


PAPER-BASED FRICTION PLATES ..... 19

# KAW-PEDIA CONTENTS


BACK TORQUE LIMITING CLUTCH ..... 19
KNURLED CLUTCH PLATES ..... 19
DUAL AUTOMATIC CLUTCHES ..... 19
KAWASAKI AUTOMATIC POWER DRIVE SYSTEM (KAPS) ..... 19
EXTERNALLY ADJUSTABLE CVT ..... 20
BELT SERVICE / WARNING SYSTEM ..... 20
KAWASAKI ENGINE BRAKE CONTROL (KEBC) ..... 20
DUAL-RANGE SUB-TRANSMISSION ..... 20
ELECTRICALLY SELECTABLE 2WD/4WD ..... 20
FULL-TIME 4WD ..... 20
HI / LO RATIO SUB-TRANSMISSION ..... 20
DUAL MODE DIFFERENTIAL ..... 21
LIMITED-SLIP DIFFERENTIAL ..... 21
VARIABLE FRONT DIFFERENTIAL CONTROL ..... 21
POSITIVE NEUTRAL FINDER ..... 21
INVOLUTE SPLINES ..... 21
O-RING CHAIN ..... 21
X-RING CHAIN ..... 22
ECCENTRIC CHAIN ADJUSTER ..... 22
JET PUMP – AXIAL FLOW ..... 22
JET PUMP – MIXED FLOW ..... 23
ELECTRIC NOZZLE TRIM ..... 23
REVERSE ..... 23


## CHASSIS


PERIMETER FRAME ..... 24
BACKBONE FRAME ..... 24
CRADLE FRAME ..... 24
DIAMOND FRAME ..... 25
MONOCOQUE FRAME ..... 25
DETACHABLE SUB-FRAME ..... 26
LADDER FRAME ..... 26
RACK AND PINION STEERING ..... 26
ACKERMAN STEERING ..... 26
BUNGEE ATTACHMENTS ..... 26


## HULL


AUTOMATIC BILGE SYSTEM ..... 27
HULL CONSTRUCTION – CHOPPER OVER FOAM (COF) ..... 27
HAND LAID FIBREGLASS ..... 27
SHEET MOULDING COMPOUND (SMC) ..... 27
KAWASAKI SPLASH DEFLECTOR (KSD) ..... 27
FLUSH KIT ..... 28


## SUSPENSION


COMPRESSION DAMPING ..... 29
ADJUSTABLE COMPRESSION DAMPING ..... 29
ADJUSTABLE LOW & HIGH SPEED COMPRESSION DAMPING 29
PROGRESSIVE COMPRESSION DAMPING ..... 29
REBOUND DAMPING ..... 29
ADJUSTABLE REBOUND DAMPING ..... 29
PROGRESSIVE REBOUND DAMPING ..... 30
TEMPERATURE COMPENSATING REBOUND DAMPING SHOCKS ..... 30
SPRING PRELOAD ..... 30
SPRING PRELOAD ADJUSTMENT ..... 30
CARTRIDGE FORKS ..... 30
INVERTED FORKS ..... 31
AIR OIL SEPARATE / TWIN CHAMBER FORKS ..... 31
BIG PISTON FORK (BPF) ..... 31
SINGLE A-ARM INDEPENDENT FRONT SUSPENSION ..... 32
DOUBLE WISHBONE SUSPENSION ..... 32
MACPHERSON STRUT ..... 32
DE DION REAR SUSPENSION ..... 32
QUAD-LINK REAR SUSPENSION ..... 33
INDEPENDENT REAR SUSPENSION (IRS) ..... 33

# KAW-PEDIA CONTENTS


RIDE HEIGHT ADJUSTMENT ..... 34
UNI-TRAK® ..... 34

## BRAKES

ANTI-LOCK BRAKE SYSTEM (ABS) ..... 35
KAWASAKI ADVANCED COACTIVE-BRAKING TECHNOLOGY (K-ACT) ABS ..... 35
BALANCED ACTUATION CALIPER SYSTEM (BAC) ..... 35
OPPOSED MULTI-PISTON CALIPERS ..... 35
RADIAL MOUNTED CALIPERS ..... 35
MULTI-PAD CALIPERS ..... 35
BRAKE INSULATORS ..... 35
FLOATING DISC ..... 36
SEMI FLOATING DISC ..... 36
SEALED MULTI-PLATE BRAKE ..... 36
AUTOMATIC BRAKE ADJUSTER ..... 36

## WHEELS/TYRES

STRAIGHT-PULL SPOKES ..... 37
BUTTED SPOKES ..... 37
RADIAL TYRES ..... 37

## ELECTRICAL

CAPACITOR DISCHARGE IGNITION (CDI) ..... 38
DIRECT CURRENT CDI (DC-CDI) ..... 38
DIGITAL CAPACITOR DISCHARGE IGNITION (DIGITAL CDI) ..... 38
ACCELERATION COMPENSATING CAPACITOR DISCHARGE IGNITION (AC-CDI) ..... 38
TRANSISTOR CONTROLLED BREAKERLESS IGNITION (TCBI) ..... 38
DIGITAL TRANSISTOR CONTROLLED BREAKERLESS IGNITION (DIGITAL TCBI) ..... 39
EXCITED FIELD ALTERNATOR ..... 39
CONTROLLER AREA NETWORK (CAN) ..... 39
ENGINE TEMPERATURE PROTECTION ..... 39
MAGNETO AND TRANSISTOR IGNITION ..... 39
IGNITION LOCKOUT ..... 40
IGNITION TIMING MAP ..... 40
KAWASAKI IGNITION MANAGEMENT SYSTEM (KIMS) ..... 40
IMMOBILISER SYSTEM ..... 40
KAWASAKI SMART STEERING (KSS) ..... 40
KAWASAKI THROTTLE RESPONSIVE IGNITION CONTROL (K-TRIC) ..... 41
LAMP CHECK CIRCUIT ..... 41
LCD INSTRUMENTATION ..... 41
LED REAR LAMP ..... 41
PERMANENT MAGNET ALTERNATOR ..... 41
SELF-EXCITING ALTERNATOR ..... 41
QUARTZ HALOGEN HEADLIGHT ..... 42
REV LIMITER ..... 42
SELF-CANCELLING TURN SIGNAL ..... 42
SEMI-KEYLESS IGNITION ..... 42
SMART LEARNING OPERATION (SLO) ..... 42
SPARK LOSS CONTROL ..... 43
STARTER LOCKOUT ..... 43

## ENGINE

### DUAL PLUG HEAD

**Features:**

- Dual spark plugs are sometimes used on large displacement, large-bore engines, such as the VN1600 series, which have long fuel burn times because of their large combustion chambers. Starting the fuel burning at two points increases the rate of combustion, meaning heat and pressure build in a shorter time. Instead of a single coil for each pair of cylinders, the igniter simultaneously fires two coils and four spark plugs. Two of the plugs fire in the cylinder that is at TDC (Top Dead Centre) compression and the remaining two fire in the cylinder that is at TDC exhaust.

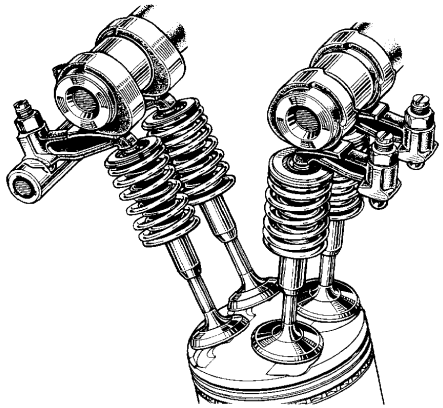
**Benefits:**

- Dual plugs decrease the fuel burn time, increase power and reduce the engine's fuel octane requirement which reduces the likelihood of engine damaging detonation.

### FOUR VALVE HEADS

**Features:**

- Putting the most air and fuel into the cylinder possible produces the best power and torque. One way to do this is to open many large valves letting the air and fuel fill the cylinder.
- Improvements in metallurgy have allowed the use of very large valve openings with very small (4 mm diameter) and light weight valve stems.



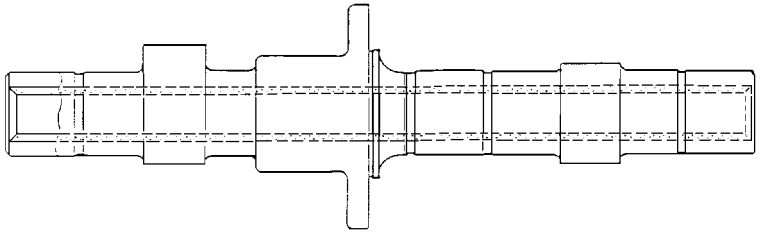
**Benefits:**

- Air and fuel enter the combustion chamber with less restriction improving torque and power.

### HOLLOW CAMS

**Features:**

- To reduce the weight of the engine, camshafts are hollow. The cam blank is cast around a steel tube which reinforces the shaft.



**Benefits:**

- The hollow cams reduce the weight of the engine for better all around performance while maintaining a reliable valve operating mechanism.

### CAM CHAINS (ROLLER & SILENT)

**Features:**

- On Kawasaki motorcycles the crankshaft turns the overhead camshaft(s) with either roller or silent chains. Roller cam chains are used on competition oriented motorcycles where more chain noise is tolerated. The roller chain consumes slightly less power than the silent chain leaving more power available to drive the rear wheel.

**Benefits:**

- For the customer with a competition motorcycle, a roller chain uses less horsepower to keep the engine running for improved performance. For street motorcycles the silent chain provides a quieter ride with less noise intruding on the riding experience.

### DUAL STAGE CAM CHAIN

**Features:**

- Dual-overhead cam heads have traditionally been bulky due to the large size of the cam sprockets. The crankshaft turns the cams through a chain and the large sprockets cut the crank rpm in half for correct valve timing.

- Dual-stage cam drive places a reduction sprocket half way up the cylinder which is chain driven by the crank. Small sprockets on the cams are chain driven from the reduction sprocket. In addition to making a more compact and less top-heavy engine, dual-stage cam drive allows the cams to be placed very close together to reduce the valve included angle. (*see* VALVE INCLUDED ANGLE)

**Benefits:**

- Dual-stage cam drive cylinder head(s) are lighter and more compact lowering the centre of gravity of the engine and the whole motorcycle for easier handling and better cornering.

### SIDE CAM CHAIN DRIVE

**Features:**

- Previous engines had the cam chain drive sprockets in the centre of the crankshaft. Kawasaki engineers moved the cam chain drive to the end of the crankshaft making two important gains. The crankshaft does not have a main bearing on each side of the drive sprocket, eliminating one main bearing and crankshaft journal, reducing the weight and width of the engine. When the sprocket is centred on the crankshaft, the sprocket must be larger than the crankshaft journal. The large sprocket size on the crankshaft requires the sprockets on the cams be large to maintain the 2:1 cam speed reduction. Placing the sprocket on the end of the crankshaft allows the drive sprocket to be small reducing the size and weight of the camshaft sprockets and head. Small camshaft sprockets centralize the mass of the motorcycle and further reduce the weight of the engine.

**Benefits:**

- Reducing the engine size makes a compact power unit with weight close to the centre of gravity of the motorcycle producing responsive handling. Reducing the engine weight improves the handling, acceleration and braking performance of the motorcycle.

### AUTOMATIC CAM CHAIN TENSIONER

**Features:**

- Cam chains require tension at all times to maintain correct valve timing. The automatic cam chain tensioner maintains the correct tension and compensates for the increased chain length due to gradual wear. This is accomplished by a spring that pushes the tensioner plunger out against the cam chain guide, keeping the chain tension correct. A pawl and ratchet prevent the tensioner plunger from being pushed in when chain loads are high.

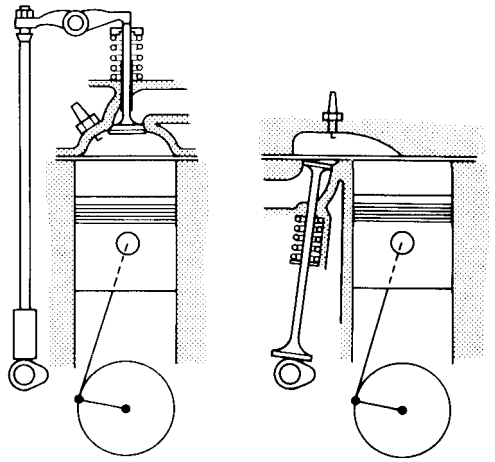
**Benefits:**

- The cam chain maintains correct tension at all times to provide consistent performance without any maintenance expense. The chain operates quietly for increased riding comfort.

### OVERHEAD VALVES (OHV)

**Features:**

- Overhead valve engines place the valves in the cylinder head over the top of the piston and the camshaft is located in the crankcase. Push rods transfer lift to rocker arms that open the valves. Compared to flathead engines with valves beside the piston in the cylinder, overhead valve engines can flow more fuel mixture into the combustion chamber and the compression ratio can be raised without detonation. Overhead valve engine cylinders cool more uniformly resulting in tighter piston clearances and lower oil consumption.



**Benefits:**

- Overhead valve engines produce power more efficiently with less oil consumption. More uniform cooling means the engines last longer and run quieter.

### DOUBLE OVERHEAD CAMS (DOHC)

**Features:**

- Individual camshafts are placed in the cylinder head and operate the intake and exhaust valves. One cam opens the intake valves and the second cam opens the exhaust valves. Placing the cams in the head

allows for optimum placement of the valves for more efficient combustion. Dual camshafts simplify valve actuation, allow for a lightweight compact valve actuation system and are suited for high rpm use.

**Benefits:**

- Dual-overhead cams are light and compact for less valve train inertial mass and provide consistent valve timing at high rpm. Dual-overhead camshaft heads remain the standard for efficient power and torque production.

## INDIVIDUAL ROCKER ARM SYSTEM (IRS)

**Features:**

- IRS is an alternative to direct actuation valves. There is a lobe on the camshaft and a light weight rocker arm for each valve. When changing the valve clearance the rocker can be quickly slid to one side exposing the clearance shim in the top of the valve spring retainer. (*see* DIRECT ACTUATION VALVES)

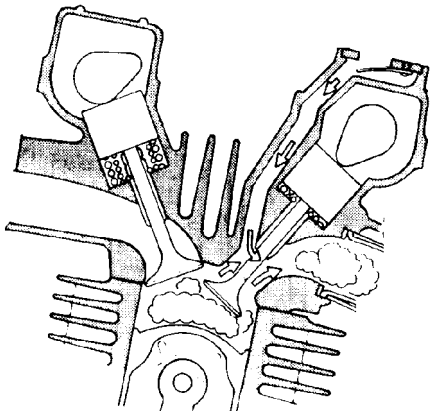
**Benefits:**

- The lighter valve train is able to run reliably at higher RPMs for more horsepower. IRS costs less to maintain due to the quick clearance adjustment procedure.

## DIRECT ACTUATION VALVES

**Features:**

- The camshaft is located directly over the valve. A tappet carrying the valve clearance adjustment shim slides in a bore in the cylinder head and fits over the end of the valve stem. The rotating cam pushes on the tappet which opens the valve.



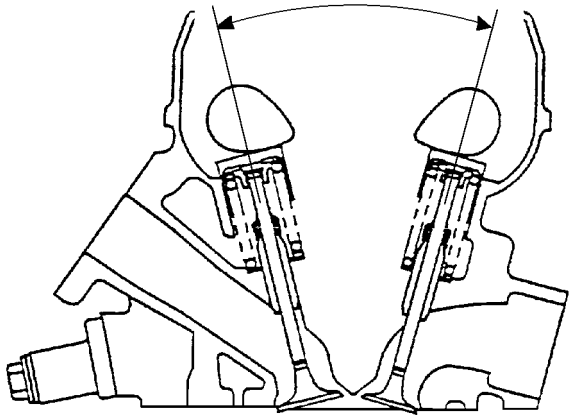
**Benefits:**

- Direct actuation lowers inertial mass and provides consistent valve timing.
  Valve sealing and valve guide oil sealing are improved by eliminating the rocking motion applied to the valve stem.

## VALVE INCLUDED ANGLE

**Features:**

- Valve included angle is the angle between the intake and exhaust valve stems. As the angle is reduced, the roof of the combustion chamber can be brought down closer to the top of the piston. Combined with straight-shot intake ports, the narrow valve included angle permits compression ratios to exceed 12:1.



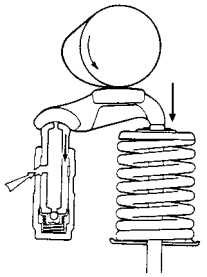
**Benefits:**

- High compression ratios and improved thermal efficiency deliver more horsepower per litre.

## HYDRAULIC VALVE LASH ADJUSTERS (HLA)

**Features:**

- The lash adjuster automatically maintains zero valve clearance under all temperature conditions using hydraulic pressure.



**Benefits:**

- The engine runs more smoothly throughout the rev range, is quieter, more durable and never needs valve adjustment.

## INCONEL VALVES

**Features:**

- Inconel valves are high grade valves typically used in marine or high performance engines. They are made of an alloy of chromium, iron, titanium and nickel.

**Benefits:**

- Inconel valves are highly resistant to high temperatures and corrosion.

## COMPRESSION RATIO – VARIABLE

**Features:**

- 2-stroke models with KIPS list variable compression ratios. The variable compression ratio is a result of KIPS altering the exhaust port height. The compression ratio of 2-stroke engines is figured by calculating the volume of the cylinder above the exhaust port. Since KIPS alters exhaust port height, the compression ratio will be higher when the valve is closed and the exhaust port height is lower. The compression ratio will be lower at high rpm when the valve is open and the exhaust port height is higher.

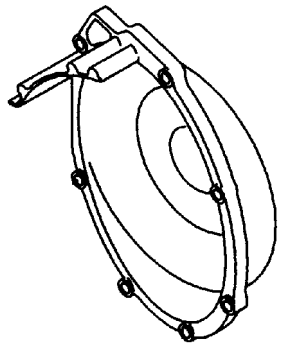
**Benefits:**

- Engineers set the compression ratio based on the design of the engine and type of fuel available to provide the best performance for the conditions.

## CONTOURED CRANCASE COVERS

**Features:**

- New advancements in computer-aided design have allowed the shape and thickness of the crankcase covers to be optimised for reduced noise transmission. Areas of the covers subject to harmonic resonance are gradually changed in thickness to prevent sympathetic vibration. The shape and mating surfaces are also changed to reduce noise.



**Benefits:**

- The rider hears less of the lower engine and transmission noise and experiences a more enjoyable ride

## NCC COATING

**Features:**

- Nickel Ceramic Composite or NCC is a plating process for reducing wear. Two additions are made to the composite depending on the application: silicon carbide or boron nitride. The silicone carbide with a hardness comparable to diamond is very wear resistant and transfers heat well. The boron nitride forms plates similar to graphite that slide over each other and are very slippery.

**Benefits:**

- Parts coated with NCC have superior wear resistance and low friction even when the normal lubricant is washed away.

## ELECTROFUSION

**Features:**

- The electrofusion treatment starts with placing the aluminium cylinder in a heated vacuum chamber. Fine wires of molybdenum and steel are suspended in the bore and a high voltage is passed through them. The resulting metal particles bond to the cylinder in a hard, porous film. Being porous, the electrofusion cylinder holds oil so the piston always rides on a film of oil for better sealing and less wear.

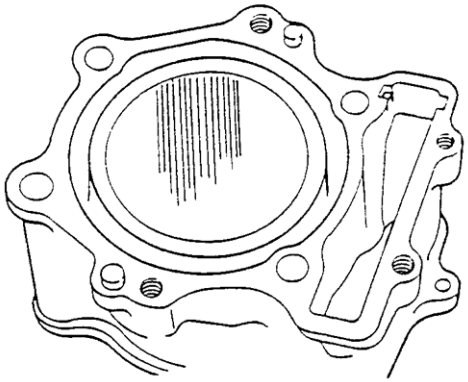
**Benefits:**

- Electrofusion resists wear and seizure. Rapid heat transfer permits higher compression ratios for increased power. It allows the use of closer tolerances and leaner carburation for better fuel economy and lower exhaust emissions.

## OPEN DECK CYLINDER

**Features:**

- The deck at the top of the cylinder is open because the ribs that support the cylinder liner have been moved down, leaving the water jacket to completely surround the cylinder top. With the hottest part of the cylinder immersed in coolant, heat is removed from the cylinder more efficiently. This allows the Compression ratio to be raised without risk of detonation.



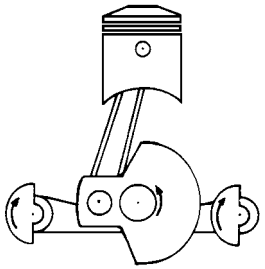
**Benefits:**

- Removing more heat and raising the Compression ratio increases power and torque, and reduces fuel consumption.

## BALANCER SYSTEM

**Features:**

- The engine balancer system consists of rotating balancer weights which minimise primary (horizontal) and secondary (vertical) vibrations caused by the engine's rotating parts.



**Benefits:**

- Less vibration reduces wear on the vehicle and reduces rider fatigue.

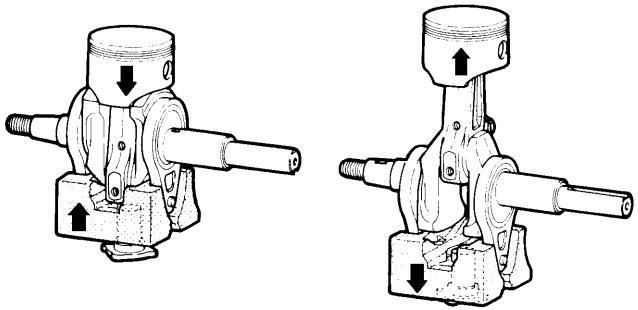
## K-RECIPRO BALANCER (MULE 550)

**Features:**

- K-Recipro balancing has a counterweight that reciprocates in line with and opposite the piston. A bushing in the weight lets it slide on a fixed guide shaft to maintain perfect alignment with the piston. Perfect alignment makes the K-Recipro balancer smoother than the systems used by other manufacturers.

**Benefits:**

- Smooth engine operation reduces operator fatigue. Less vibration is easier on the operator and easier on the entire vehicle, reducing wear and maintenance.



## DIESEL ENGINE

**Features:**

- A diesel engine uses compression of the intake charge to ignite the mixture. Diesel engines have very high compression ratios and very heavy-duty construction. Diesel fuel is usually the fuel of choice for agricultural, construction, and other commercial equipment.

**Benefits:**

- The diesel engine has outstanding fuel efficiency. The engine's heavy construction results in incredible durability. Using the same diesel fuel as other equipment on the farm or job site means the operator does not have to have a separate fuel supply for the MULE.

## RUBBER ENGINE MOUNTS

**Features:**

- The rubber engine mounting system consists of two rubber dampers of different densities which absorb and isolate engine vibration. These are located at the front engine mounts.

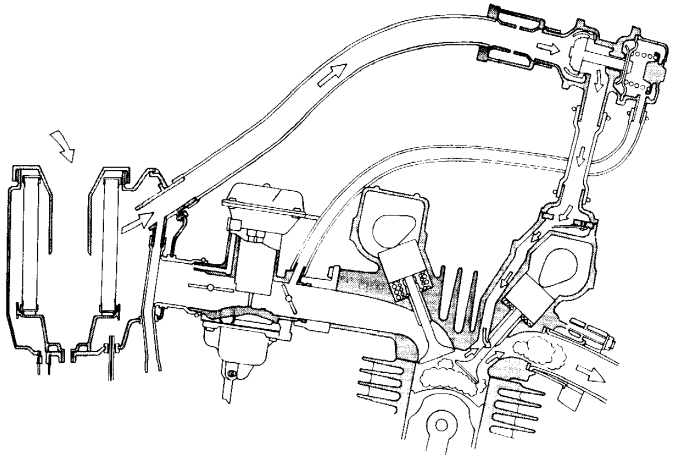
**Benefits:**

- Less engine vibration offers more rider comfort and greater life of electrical components.

## PULSED SECONDARY AIR SYSTEM

**Features:**

- The pulsed secondary air system feeds air through a reed valve to the exhaust port of each cylinder. This extra air in the exhaust system decreases two pollutants: carbon monoxide and unburned hydrocarbons. A vacuum operated valve shuts off the pulsed secondary air syste during deceleration to prevent back-firing in the mufflers. Kawasaki call this type of system Kawasaki Clean Air System or KCA.



**Benefits:**

- Kawasaki can avoid excessively lean carburation for good power, driveability, and cold starting characteristics while ensuring compliance with emission requirements.

## KAWASAKI LOW EXHAUST EMISSION CATALYTIC CONVERTER SYSTEM (KLEEN)

**Features:**

- Kawasaki has been a leader in the field of emission control, first developing the KCA System then the KLEEN system. KLEEN is a catalytic converter system that comes in one or two types: a honeycomb catalyser system located in the muffler (denoted by an 'H' at the end of the model code), or a punched pipe catalyser system located just upstream of the muffler (denoted by a 'P' at the end of the model code).

**Benefits:**

- Both systems operate by oxidising carbon monoxides and hydrocarbons in the exhaust and converting them into harmless carbon dioxide and water. Remarkably, the systems significantly reduce exhaust emissions without any adverse effect on the performance for which Kawasaki motorcycles are famous.

## EXHAUST SYSTEM - DRY

**Features:**

- The exhaust system must be cooled for several reasons: to reduce engine compartment temperature for rider comfort and to reduce engine intake temperature and to prevent damage to the flexible joint connecting the expansion chamber to the muffler (water box).
- A dry exhaust system utilises a water jacket in the expansion chamber and flexible joint to control the exhaust system temperature. Some water enters the muffler that also helps control noise levels. Water could be introduced into the expansion chamber to mix with the exhaust gas, but this method reduces power output.

**Benefits:**

- The dry exhaust system found on some highperformance Jet Ski watercraft models obtains maximum exhaust system efficiency for greater power output.

## EXHAUST SYSTEM - SEMI-DRY

**Features:**

- To keep the engine compartment cool for maximum power output, the exhaust system has a water jacket around it. Before the exhaust goes out the tailpipe, the water from the jacket joins it to cool the exhaust gases coming out the back of the boat. To keep power output up, the exhaust gases stay as hot as possible for as far through the exhaust system as possible. The semi-dry exhaust system does this by dumping the water into the exhaust flow just before the gases go into the waterbox muffler.

**Benefits:**

- The semi-dry exhaust system keeps the engine compartment cool for maximum horsepower. At the same time, it cools the exhaust gases as they enter the water box muffler, cooling it as well. The system is light, durable, corrosion resistant and simple, and it delivers the power.

## SUPERLUBE OIL INJECTION – VARIABLE RATE

**Features:**

- An oil pump drawing from an oil tank supplies oil to the two-stroke engine intake. The output of the crankshaft-driven pump is varied depending on the rpm of the engine and the position of the throttle.

**Benefits:**

- This system uses less oil than conventional lubricating systems. Less oil use means a cleaner running engine, less visible exhaust emissions, and lower running costs.

## KAWASAKI AUTOMATIC COMPRESSION RELEASE (KACR)

**Features:**

- When the engine is rotated during starting, KACR automatically holds the exhaust valve(s) slightly open as the piston nears TDC (Top Dead Centre). Once the piston passes TDC, the exhaust valve(s) closes. This releases some of the cylinder compression that causes resistance during starting. Once the engine begins to run the valves operate normally. KACR is used on both kick-start and electric start 4-stroke models.

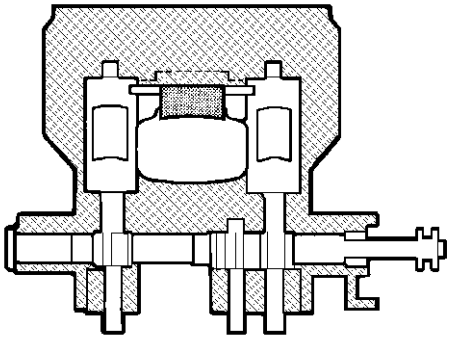
**Benefits:**

- KACR makes the engine easier to start for both kick-start and electric start models, and eliminates the need for a manual compression release.

## KAWASAKI INTEGRATED POWERVALVE SYSTEM (KIPS)

**Features:**

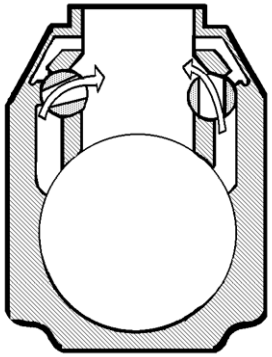
- 2-stroke engines with KIPS have an rpm sensing governor that opens and closes as many as three exhaust port valves. At low rpm, the valves close off part of the exhaust port, shortening exhaust duration and improving low end power. At high rpm, the valves open and increase exhaust duration, improving top end power. Changing exhaust port timing allows for the engine to produce maximum torque at low rpm and maximum horsepower at high rpm.



**Benefits:**
A KIPS-equipped 2-stroke engine has a broader power band making the vehicle easier to ride for a variety of track conditions.

**KIPS-D**

**Features:**
- The KIPS-D feature is a slot cut in the top of each exhaust sub-port and a third position for the KIPS valves. When the engine is stopped, the KIPS valves turn to open the slotted sub-ports to the main exhaust port. When the engine is being started, the open valves relieve a portion of the compression pressure, making kick lever forces much lower. Once running, the valves turn to the low speed position and close the slot.



**Benefits:**
- The KX500 with this feature can be kick started with less effort.

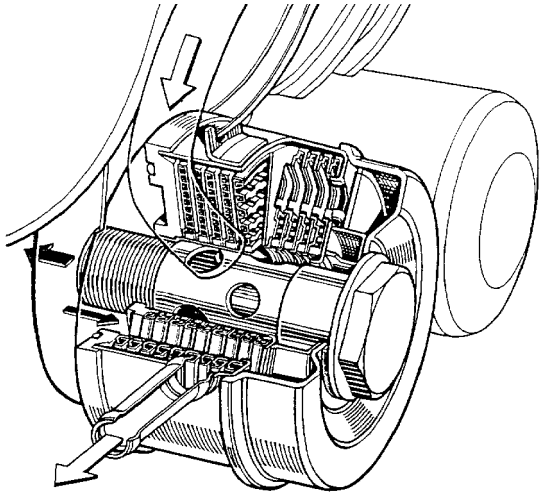
**DUAL-OIL PUMPS**

**Features:**
- The primary pump supplies oil to the engine and transmission bearings. The secondary pump circulates oil through the oil cooler and back to the oil sump. The small passages in the oil cooler slow the oil flow for better cooling while oil going to the bearings is supplied at full flow and pressure.

**Benefits:**
- Two oil pumps ensure that the oil has time to be cooled in the oil cooler and still supply full oil pressure to critical crankshaft, camshaft and transmission bearings. Cool, high pressure oil is an important factor in producing lasting engine performance and is superior to a single pump system.

**LIQUID-COOLED OIL COOLER**

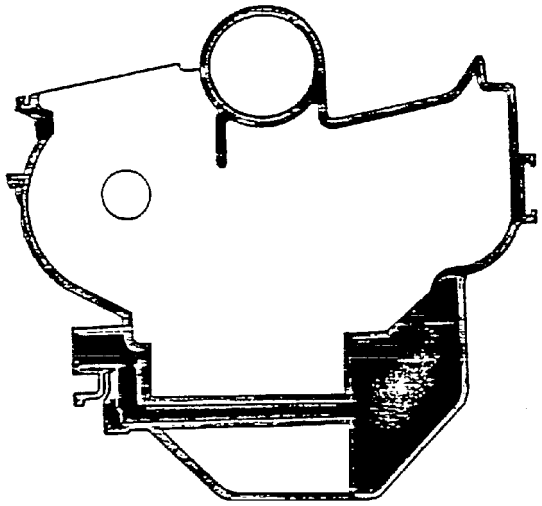
**Features:**
- The liquid in the cooling system cools the oil in a heat exchanger. The coolant temperature is more stable than air temperature so the temperature of the oil and the entire engine is more constant. Mounted low on the front of the engine, the heat exchanger is compact and has no external oil lines that can leak.



**Benefits:**
- The liquid-cooled oil cooler improves the stability of the oil temperature resulting in an increase to engine durability.

**SEMI-DRY SUMP**

**Features:**
- When the crankshaft rotates, oil can be drawn around with the flywheels. At high rpm friction between the oil and the crankshaft consumes several horsepower. The power lost to this phenomena is called stirring loss. To prevent stirring losses, oil draining from the engine is stored in the transmission.



**Benefits:**

- Reducing engine stirring losses leaves more power to propel the vehicle. A semi-dry sump design can also help to keep engine size smaller.

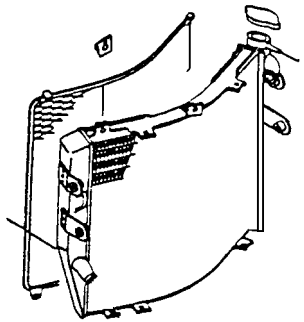
**CURVED RADIATOR**

**Features:**

- Curving the radiator concentrates more cooling surface area in a narrower package.

**Benefits:**

- Keeping the radiator and cowling narrow reduces wind drag and ups the efficiency of the motorcycle. The increased cooling capacity handles the extreme heat generated by today's high performance engines.



**PRIMARY KICK-START**

**Features:**

- The primary kick-start system allows the motorcycle to be started in any gear when the clutch is disengaged.
- Pressure on the kick-start lever causes a ratchet mechanism to engage on the kick-start gear. When the kick-start lever is pushed down the locked kick-start gear turns an idler gear which in turn rotates the engine via a gear on the clutch housing.
- When the kick-start lever is released the ratchet mechanism disenges from the kick-start gear and spring pressure on the kick-start shaft returns the lever to it's original position.

## FUEL SYSTEM

### CARBURETTOR

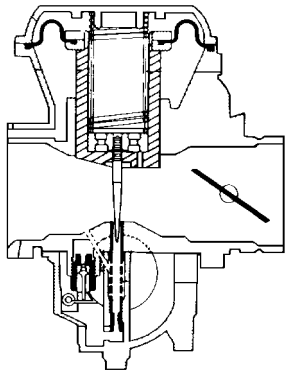
**Features:**

- Carburettors create an air/fuel mixture for the engine to burn. The carburettor controls (or throttles) the amount of air/fuel mixture that reaches the engine and changes the air/fuel ratio for different operating conditions such as starting or abrupt slowing of the vehicle. Carburettors have an air valve called a slide connected to a fuel valve called a jet needle and needle jet. As the slide is raised, letting more air flow into the engine, the needle also rises letting fuel flow out the needle jet to mix with the air. The shape of the slide and size of the jet needle and needle jet control the air/fuel ratio at mid-throttle rpm. At low throttle openings when little air flows past the jet needle and needle jet, fuel does not mix efficiently. A smaller jet and several passages, together called the pilot circuit, control the fuel at low throttle openings. During full throttle, the main jet controls fuel delivery.

### CONSTANT VELOCITY CARBURETTOR

**Features:**

- In conventional slide-type carburettors the slide controls air flow to the engine. In CV carburettors a butterfly valve controls air flow to the engine. This slide in a CV carburettor is controlled by a diaphragm in a chamber on top of the carburettor. As speed increases the slide raises to enlarge the venturi opening to maintain an almost constant air speed across the needle jet.



**Benefits:**

- Constant velocity through the carburettor permits accurate control of air and fuel during sudden throttle movement for smooth and immediate low speed engine response.

### POWER JET CARBURETTOR

**Features:**

- The Keihin power jet carburettor uses an electronic solenoid to open and close a fuel passage in the carburettor to provide a wider range of power. The solenoid is controlled by the digital igniter. The igniter uses rpm and throttle position data to open and close the solenoid at pre-set points.
- Typically, the fuel passage is closed under a specified throttle position. Once the specified throttle position point is reached, the solenoid opens the fuel passage allowing fuel into the engine intake. Once the rpm reach a second specified point, the solenoid closes off the fuel passage leaning out the engine at high rpm.

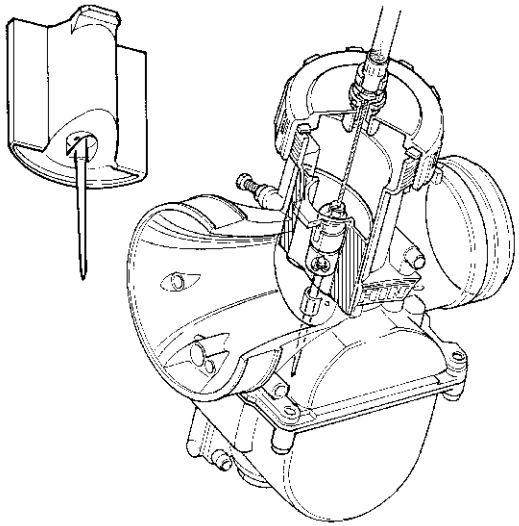
**Benefits:**

- This carburettor provides more accurate fuel delivery to better meet the demands of the 2-stroke engine. The result is a wider powerband, cleaner running at lower rpm, and increased top end power.

### CRESCENT SLIDE CARBURETTOR

**Features:**

- The shape of the Keihin crescent slide improves air velocity through the carburettor creating more vacuum draw around the atomising tower, improving fuel atomisation. The crescent shape of the slide also allows the main and pilot circuit passages to be closely spaced for smoother transitions as different fuel circuits come into effect.



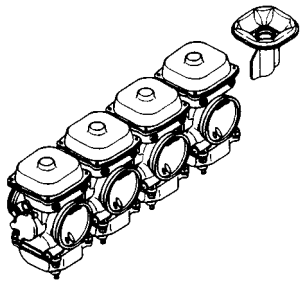
**Benefits:**

- The crescent slide carburettor provides accurate air/ fuel mixtures at all throttle openings allowing the engine to pull smoothly.

### FLAT SLIDE CARBURETTOR

**Features:**

- The carburettor slide is flat rather than round. The resulting carburettor is more compact and air flow is excellent at all engine speeds for better fuel mixing (*See* CARBURETTOR).



**Benefits:**

- Flat slide carburettors take less room to mount, which allows more room for the air cleaner and other undertheseat systems. Better fuel mixing gives more top-end power with a broader power band.

### DIGITAL FUEL INJECTION

**Features:**

- An on-board, digital microprocessor reads various inputs from the engine, like ignition timing, rpm, and throttle position, and from the environment, like air temperature and pressure. It uses the information to decide the precise amount of fuel that the engine needs at that moment, and injects it into the intake air headed for the intake valve.

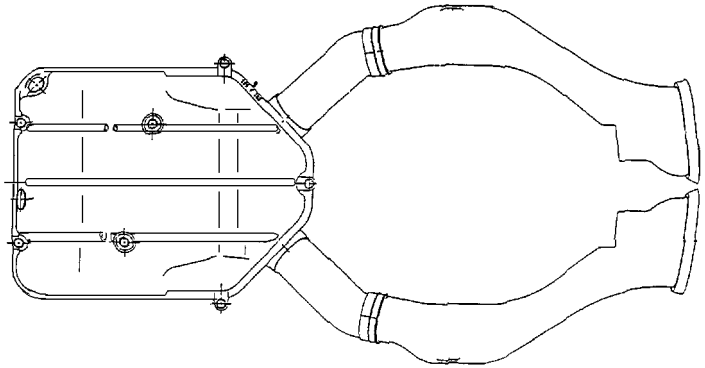
**Benefits:**

- The fuel injection system feeds the engine just the amount of fuel it needs, when it needs it. Fuel is not wasted, nor is the engine forced to run too lean. The result is excellent fuel economy, driveability and lower emissions. The engine runs smoothly and powerfully from idle to top speed.

### RAM AIR INDUCTION

**Features:**

- A scoop in the front of the cowling supplies cool air directly to the airbox. The cool, dense air packs more energy into the combustion chamber to increase torque and power. At high speeds the incoming air pressurises the airbox improving intake efficiency. On models with carburettors, to maintain proper air/fuel mixture as airbox pressure increases, balance tubes in the cowling scoops vent the float bowls.



**Benefits:**
- The ram-air induction packs more air and fuel into the cylinders for strong power at high speeds.

**SUPERCHARGER**

**Features:**
- Increasing the fuel supply for engine combustion creates more horsepower. But more fuel requires more air to achieve the correct air-fuel mixture. One way to create more air is by using a supercharger, which increases intake by compressing air above atmospheric pressure. Air forced into the engine creates “boost” and since the boost contains additional air more fuel can be added and engine power is increased.

Benefits:
- Higher power and torque can be produced from an engine of the same displacement.

**INTERCOOLER**

**Features:**
- As air is compressed by a supercharger it gets hot and loses density. This means that it can not expand as much during combustion and power drops. In order to obtain peak power from the supercharger, compressed air must be cooled before it enters the intake manifold. An intercooler does just that as it acts as a radiator to cool the intake air for a denser charge.

Benefits:
- Cooler air entering the combustion chamber results in higher power and torque.

**ACCELERATOR PUMP**

**Features:**
- When a rider rapidly opens the throttle, air and fuel in the carburettor begin the trip to the combustion chamber together. Air, being lighter, accelerates ahead of the fuel and arrives in the combustion chamber without much fuel. On some engines this will cause a lean stumble or miss. A carburettor accelerator pump squirts the heavy fuel toward the combustion chamber so the fuel and air mixture arrive at the combustion chamber at the same time.

**Benefits:**
- An accelerator pump equipped carburettor helps produce smooth power delivery and strong throttle response.

**ELECTRIC FUEL PUMP**

**Features:**
- To ensure an uninterrupted fuel flow, an electric fuel pump is placed between the EFI system and the fuel tank. The fuel pump primes itself when the ignition is switched on and operates when the ECU receives a signal from the pick up coils.

**Benefits:**
- Fuel flow is maintained for all phases of engine performance. Fuel flow stops when the engine stops.

**THROTTLE LIMITER**

**Features:**
- A handlebar mounted adjuster can be used to limit throttle lever travel.

**Benefits:**
- This feature gives new users a chance to ride at reduced speed and power levels.

**ELECTRONIC THROTTLE VALVE SYSTEM**

**Features:**
- Kawasaki’s fully electronic throttle actuation system enables the ECU to control the volume of both fuel (via the injectors) and air (via the throttle valves) delivered to the engine. As the rider opens or closes the throttle an electronic sensor signals the ECU which calculates the ideal throttle

angle. The ECU then sends a signal to a motor on the throttle body which opens the butterfly to the required angle.

**Benefits:**

- Ideal fuel injection and throttle position results in smooth, natural response. This system also makes it very easy to incorporate other systems, like cruise control.

### CAB FRAME AIR INTAKE

**Features:**

- The air intake is placed high on the vehicle. Air going to the engine and converter is drawn from the cleanest, driest and coolest place on the vehicle.

**Benefits:**

- Performance in hot, wet or dusty conditions remains strong. The air filter requires less frequent service for reduced maintenance costs and less down time.

### CYCLONE AIR FILTER WITH RESTRICTION GAUGE

**Features:**

- Before intake air reaches the air filter, it is swirled in a cylindrical airbox where dirt particles are forced out of the air by centrifugal force. Dirt settles to the bottom of the airbox and is expelled through a one-way valve. A gauge is located in the airway behind the air filter and measures the vacuum force created in the intake tract. Increased vacuum created due to a dirty air cleaner is shown on the gauge, indicating that the air filter needs to be cleaned.

**Benefits:**

- The cyclone air filter system causes large dirt particles to fall out of the airflow, effectively pre-filtering the air so that the air filter stays cleaner longer for reduced maintenance. The restriction gauge gives the operator a quick and easy indication of when the air filter should be cleaned or replaced without having to open the air intake system to visually inspect it.

### SNORKEL AIR INTAKE

**Features:**

- Used on off-road vehicles, the snorkel opening is placed high and forward. Air going to the engine is drawn from the cleanest, driest and coolest place on the vehicle.

**Benefits:**

- Performance in hot, wet or dusty conditions remains strong. The air filter requires less frequent service for reduced maintenance costs and less down time.

### REED VALVES

**Features:**

- Reed valves, used on 2-stroke engines, act as one-way valves in the intake port. As the piston moves up creating low pressure in the crankcase, the reeds open and allow the fuel/air mixture to fill the crankcase. As the piston starts to pass top dead centre (TDC) and pressurises the crankcase, the reeds close preventing the air/fuel mixture from being pushed out through the carburettor.

**Benefits:**

- The reeds provide variable intake timing depending on intake pressures to give the engine strong low rpm power while maintaining high rpm power.

### CARBON FIBRE REED VALVES

**Features:**

- The reed valve petals are made of carbon fibre reinforced plastic. The lightweight carbon fibre reeds seal better against the reed cage and the reeds maintain their form better at high RPMs. (see REED VALVE)

**Benefits:**

- The light, flexible reeds respond better at low flow rates for excellent throttle response and low RPM torque. At high engine speeds, the reeds maintain their form better to improve high RPM power. The result is a broader power band, better throttle response and increased high RPM power.

### CRANKCASE REED VALVE INDUCTION

**Features:**

- The intake and reed assembly is mounted into the crankcase instead of the cylinder. Intake flow directly into the crankcase reduces the number of bends and shortens the path the intake mixture must travel to get to the combustion chamber. More fuel stays suspended in the air and more mixture flows when the piston clears the transfer ports. (see REED VALVES)

**Benefits:**

- The shortened intake path produces better throttle response, and improved cylinder filling for increased torque for the entire rpm range.

**HOT START SYSTEM**

**Features:**

- Without a hot start system, restarting a 4-stroke motocross machine after a fall often takes many kicks losing valuable time. When the motorcycle tips over, fuel flows from the carburettor and floods the intake tract, creating an overly rich mixture that makes starting a hot engine difficult. With this system a rider pulls the hot start lever mounted on the left handlebar, a plunger at the front of the carburettor opens an additional air passage which allows air to enter the intake and lean the mixture.

**Benefits:**

- Combined with the KX250/450F's special "neutral" ignition map, the hot start system allows riders to quickly restart their machine.

**STRAIGHT SHOT INTAKE**

**Features:**

- Straight-shot design intake ports places the intake tract centre line nearly in line with the valve stem. The fuel charge reaches the cylinder without having to go around corners which can slow it down. To take advantage of the straight-shot intake ports, the carburettors are mounted nearly vertically. The surface of the fuel in the float bowl is still horizontal and is maintained at the correct height for proper mixture.

**Benefits:**

- The high velocity mixture entering the cylinder from the straight-shot intake produces strong throttle response, efficient fuel usage and improved torque.

## DRIVE TRAIN

### PAPER-BASED FRICTION PLATES

**Features:**

- The friction qualities of paper-based clutch friction material are more uniform under hard use. It better resists deformation in extreme heat from hard use as compared to cork compounds.

**Benefits:**

- The paper-based clutch friction plates retain smooth operating qualities under hard use and last longer.

### BACK TORQUE LIMITING CLUTCH

**Features:**

- A two-piece clutch hub with a cam and ramp allows the clutch to slip a little during sudden and severe engine braking or abrupt down shifts.

**Benefits:**

- Wheel hop can occur during severe engine braking on a motorcycle. The back torque limiting clutch helps prevent this cause of wheel hop and improves the rider’s smoothness.

### KNURLED CLUTCH PLATES

**Features:**

- The plates in the clutch have a pattern of dimples pressed into their surface called knurling. The depressions created in the plates retain oil and allow for cooling of the plates with each disengagement. The pockets of oil also allow the plates to separate more easily when the engine is cold. This eliminates the ‘clunk’ and lurch that sometimes accompanies the first shift of the day.

**Benefits:**

- The clutch operation is smoother and more predictable, making the motorcycle easier for riders of all skill levels to operate.

### DUAL AUTOMATIC CLUTCHES

**Features:**

- Some Kawasaki ATVs have two automatic clutches. The primary clutch, mounted on the crankshaft, engages as rpm increase above idle moving the machine forward when in gear. The primary clutch disengages as the engine rpm slows back to idle. If the ATV is going down hill and the throttle is closed a one-way bearing maintains the primary clutch's connection to the crankshaft producing engine braking. The secondary clutch completes the flow of power to the transmission and is connected to the shift mechanism. As the shift pedal is moved, the clutch disengages just before the transmission shifts. As pressure on the shift pedal is released the clutch re-engages.

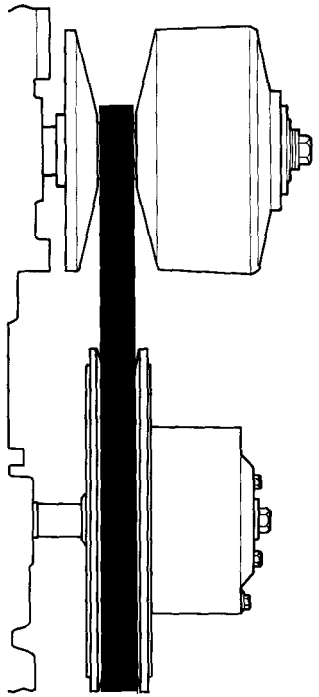
**Benefits:**

- The automatic clutch means the rider doesn't have to coordinate a hand lever, making shifting easier.

### KAWASAKI AUTOMATIC POWER DRIVE SYSTEM (KAPS)

**Features:**

- This continuously variable transmission system (CVT), known as the Kawasaki Automatic Power-drive system (KAPS), features a torque converter which has two variable-diameter pulleys. A large V-belt transmits power from the crankshaft mounted pulley to the pulley on the transmission input shaft. The crankshaft pulley increases in diameter as engine rpm increases applying more load to the engine. The input shaft pulley decreases in diameter as the torque required to turn the drive wheels decreases.



**Benefits:**

- The KAPS automatically adjusts the reduction ratio of the transmission as operator demand and terrain conditions change, making the vehicle easy to operate.

## EXTERNALLY ADJUSTABLE CVT

**Features:**
- To adjust the belt tension on conventional CVT systems means dismantling and stripping the driven pulley to replace the shims. On the new CVT system all that is necessary is removing the two easily accessible deflection bolts from the driven pulley and replacing the shims.

**Benefits:**
- Reduced manintenance time and cost.

## BELT SERVICE / WARNING SYSTEM

**Features:**
- Excessive drive belt wear or belt damage will activate a Belt Warning System switch in the CVT cover. When the switch is activated, the multifunction meter and reverse indicator light flash a warning to the rider, the engine slows to 3,600 rpm and the vehicle will not shift into 4WD. Once the machine has reached 100 hours of operation the belt check light will illuminate to prompt periodic maintenance.

**Benefits:**
- The Belt Failure Detection System informs the operator that the KAPS belt drive needs immediate servicing. Because vehicle performance is automatically limited, it helps prevent the operator from performing tasks that might cause a hazardous riding condition.

## KAWASAKI ENGINE BRAKE CONTROL (KEBC)

**Features:**
- Constantly Variable Transmissions (CVTs) don't normally allow engine braking when the throttle is released. However, using information from speed and directional sensors, the KEBC system automatically engages the CVT when the throttle is released to generate braking force from the engine's compression. To maintain consistent engagement, the KEBC system is equipped with a "learning" mode that automatically compensates for CVT drive belt wear. KEBC only works when the vehicle is moving forward.

**Benefits:**
- KEBC provides supplemental braking force to help slow the vehicle in certain situations, such as when descending a hill. Operators should understand that, when descending hills, the KEBC system alone may not provide enough braking force to adequately slow the vehicle. Operators should apply the brakes to keep speed safe for the terrain, visibility, operating conditions and their experience.

## DUAL-RANGE SUB-TRANSMISSION

**Features:**
- A two-speed transmission is added to the output of the belt-type torque converter, greatly extending its operating speed range.

**Benefits:**
- The extended speed range allowed by the sub-transmission gives tremendous pulling and hauling flexibility without sacrificing sporty performance.

## ELECTRICALLY SELECTABLE 2WD/4WD

**Features:**
- A switch on the right side of the handlebar allows the operator to choose between 2 and 4WD when the vehicle is stopped.

**Benefits:**
- Electrically selectable 2WD/4WD systems allow easy changing between drive systems to suit changing terrain and applications.

## FULL-TIME 4WD

**Features:**
- Kawasaki full-time 4WD ATVs use front and rear driveshafts to deliver power to the wheels from the transmission. A bevel gear drive turns the solid rear axle. A limited slip differential turns the front axles. Full-time 4WD has few maintenance items and is easy to operate.

**Benefits:**
- Kawasaki 4X4s deliver all wheel drive when you need it.

## HI / LO RATIO SUB-TRANSMISSION

**Features:**
- A two-speed transmission is added to the output of the belt-type torque converter, greatly extending its operating speed range.
- With the vehicle at a standstill shift the sub-transmission into lo ratio for towing and hill work or hi ratio for general use.

**Benefits:**
- The extended speed range allowed by the sub-transmission gives tremendous pulling and hauling flexibility without sacrificing sporty performance.

## DUAL MODE DIFFERENTIAL

**Features:**
Dual-mode differentials in the unlocked mode allow the drive wheels to revolve at different speeds. This allows the vehicle to round corners without wheel slippage just like a car. Locking dogs are machined into the outside of the differential case cover. Shifting a coupling into engagement with the locking dogs causes the differential to lock and work like a solid axle. In the locked mode the left and right drive wheels now turn at the same speed to increase traction.

**Benefits:**
The locking differential lets the operator choose the mode of operation: unlocked so the soil or grass is not disturbed to preserve the environment, or locked for increased traction for rough terrain or pulling a trailer.

## LIMITED-SLIP DIFFERENTIAL

**Features:**

- In slippery terrain, an ordinary differential gives all the drive torque to the wheel without traction while the wheel with grip gets none. The limited-slip differential prevents this with a clutch on each axle that slips at a preset torque. The clutch connects the side gears to the differential case, causing the case and axles to act like a solid axle. This provides a fixed amount of torque to each wheel before the clutches slip. The wheel with traction will always receive some torque.

**Benefits:**

- The limited-slip differential works automatically to pull through when extra traction is needed. This type of front drive also produces light steering for easy operation.

## VARIABLE FRONT DIFFERENTIAL CONTROL

**Features:**

- In slippery conditions such as mud or snow an ordinary differential gives all of the drive torque to the wheel without traction while the wheel with grip gets none. The limited slip differential prevents this with a clutch pack at the front axle that slips at a preset torque. Using a small lever on the left side of the handlebar, riders can vary the amount of differential slip to help control power delivered to each front wheel so that the wheel with traction will always receive some torque.

**Benefits:**

- The variable front differential control helps to pull the rider through when extra traction is needed and allows the rider to adjust the amount of torque to each front wheel to suit specific conditions.

## POSITIVE NEUTRAL FINDER

**Features:**

- To use the neutral finder, the rider stops the motorcycle, shifts to first gear, and then lifts up on the shift pedal. The transmission stops in neutral, and will not go into second gear. As soon as the motorcycle starts moving, the transmission shifts normally.

**Benefits:**

- The rider can very quickly find neutral in demanding traffic situations.

## INVOLUTE SPLINES

**Features:**

- Some transmissions use involute splines on the drive or driven shafts and gears to positively locate them. The cross section of the spline is curved and angled (20º pressure angle) so that the base of each spline is much wider than the top. This type of spline is self-centering and distributes the load evenly to all the splines around the transmission shaft. The base of the spline is very strong.

**Benefits:**

- Because overall strength is much greater than ordinary splines, the transmission is more durable, and can absorb more torque for its weight. The self-centering action of the splines helps the transmission shift more smoothly. Even load distribution increases strength and contributes to a lower noise level.

## O-RING CHAIN

**Features:**

- O-rings between the side plates and link plates seal grease inside the bushings to keep the internal bearing surfaces lubricated. Wear on the pins and bushings slows dramatically because they are running in a film of grease, and are sealed from any outside debris that could cause additional wear. The chain length stays more constant due to the slow wear; therefore, front and rear sprockets last longer.

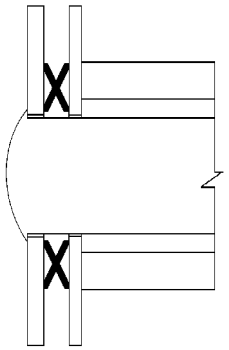
**Benefits:**

- The O-ring chain requires less maintenance. Less wear means more miles can be ridden between chain adjustments and the chain life is extended.

## X-RING CHAIN

**Features:**

- The O-ring chain uses a single contact point at the edge of the O-ring to seal in grease and keep out dirt. The X-ring chain, which uses an 'X' cross section between the side plates and link plates, has double sealing surfaces and small pockets to trap grease and keep out dirt.



**Benefits:**

- The X-ring chain has superior sealing qualities for longer chain life.

## ECCENTRIC CHAIN ADJUSTER

**Features:**

- Eccentric chain adjusters are eccentric plugs in the rear ends of the swingarm which capture the rear axle. When the swingarm clamps are loosened the plugs and axle rotate as a unit keeping the rear wheel aligned. The axle remains tight in the plugs when the chain is adjusted.

**Benefits:**

- Chain adjustments are fast and easy because the axle need not be loosened and wheel alignment is maintained.

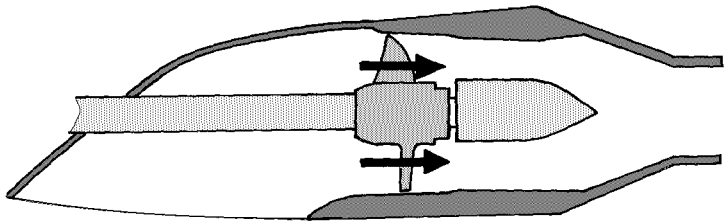
## JET PUMP – AXIAL FLOW

**Feaures:**

- The Jet Ski watercraft pump, directly driven from the engine, pushes the watercraft with a stream of pressurised water. The fully enclosed pump takes in water through the grate in the bottom of the craft, pressurises it with an impeller then pushes the water out the back at high speed, driving the watercraft forward.
- An axial-flow pump (one that pushes the water out in line with the pump centre line) has guide vanes straightening the flow from the impeller. The guide vanes straighten the water flow and eliminate torque reaction which can cause the craft to roll during acceleration.

**Benefits:**

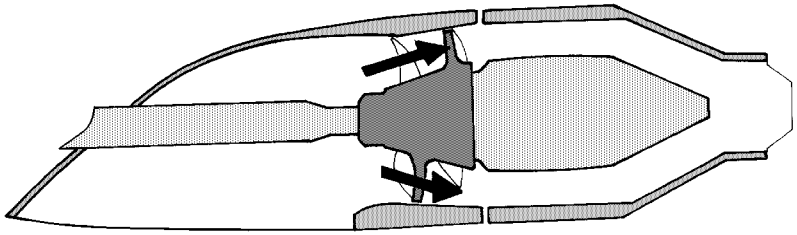
- The axial-flow pump has excellent high rpm performance and good handling during acceleration. The completely enclosed pump has no exposed propeller.



## JET PUMP – MIXED FLOW

**Features:**

- Unlike an axial-flow jet pump, the mixed flow pump has a tapered impeller housing. Instead of the water just travelling straight through the pump along the axis of the impeller (axial flow), it expands radially outward through the impeller (radial flow) as well. The result is a mixed flow that turns more horsepower into thrust for the overall size and weight of the pump. It is more expensive technology, but it is more efficient.



**Benefits:**

- The mixed-flow pump is smaller and lighter for the amount of horsepower it can turn into thrust than an axial-flow pump. Performance without penalties is the bottom line.

## ELECTRIC NOZZLE TRIM

**Features:**

- When the rider pushes the electric nozzle trim switch on the left handlebar, an electric motor lifts or lowers the jet pump nozzle. Pushing the trim switch down moves the jet pump nozzle down lowering the nose of the watercraft as it moves through the water. Pushing the nozzle trim switch up raises the nozzle letting the nose of the watercraft rise. The indicator on the panel makes it easy to find level on the trim adjustment. The trim stops automatically at level when trimming up or down. To continue trim movement, just push the direction switch again.

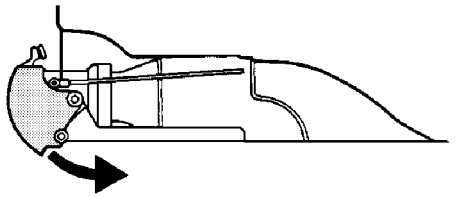
**Benefits:**

- The rider can push the electric nozzle trim switch, adjusting the pitch of the watercraft to suit the load and water conditions, while the watercraft is moving. The electric trim motor permits subtle changes for a more precise ride and increased comfort.

## REVERSE

**Features**

- Some Kawasaki Jet Ski watercraft have a reverse mechanism on the jet pump. A cable-operated reverse thrust bucket can be lowered over the mouth of the steering nozzle, redirecting the pump's thrust forward underneath the craft and pushing it backward. The reverse bucket is curved so no matter what direction the steering nozzle is pointed, the water is redirected toward the bow.



**Benefits:**

- The reverse feature allows the watercraft to be ridden backward to increase manoeuvrability in tight situations.

## CHASSIS

### PERIMETER FRAME

**Features:**

- From the steering head two upper frame tubes sweep around the sides of the cylinder head to the Uni-Trak® shock mount then down to the swingarm pivot. The direct path between the two load points makes the frame very rigid and light at the same time.

**Benefits:**

- The perimeter frame is very rigid and low in weight while allowing space for the easy breathing engine intake and exhaust systems. The result is phenomenal handling and the feel of solid control.

### BACKBONE FRAME

**Features:**

- The twin spars from the steering head travel over the top of the engine to the Uni-Trak® shock mount and then to the swingarm. The direct path makes the frame very rigid, narrow and light.



**Benefits:**

- The backbone frame is very rigid and low in weight while being very narrow. This results in a very light, responsive frame with a small frontal area reducing wind resistance.

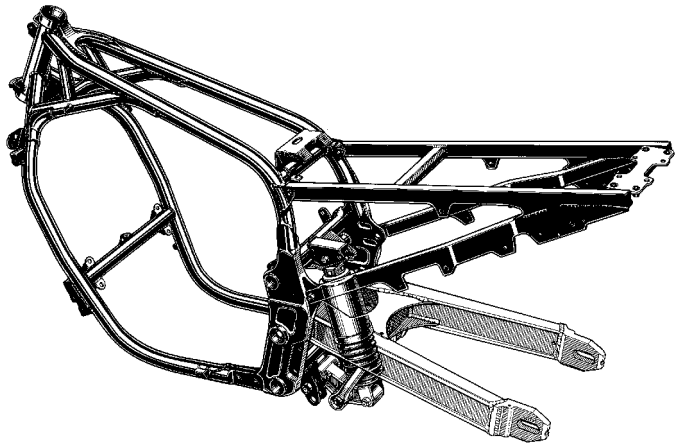
### CRADLE FRAME

**Features:**

- The cradle frame has one or two frame members called down tubes that begin at the steering head, extend under the engine and re-attach to the frame near the swingarm pivot.

**Benefits**

- Extra protection of vital engine parts and added strength are the advantages of a cradle frame.



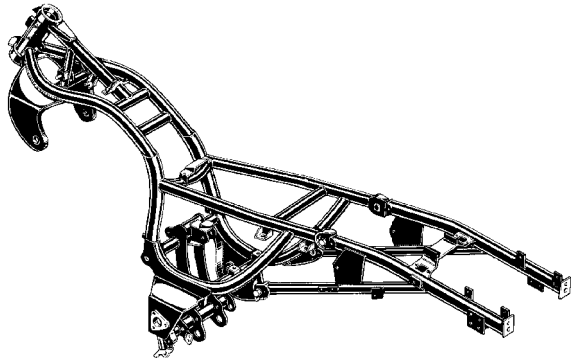
## DIAMOND FRAME

**Features:**

- A motorcycle with a diamond frame uses the engine as a stressed part of the frame instead of down tubes that usually run under the engine.

**Benefits:**

- The diamond frame is elegantly simple in design while reducing the weight of the entire motorcycle. The absence of down tubes makes engine maintenance and service easier.



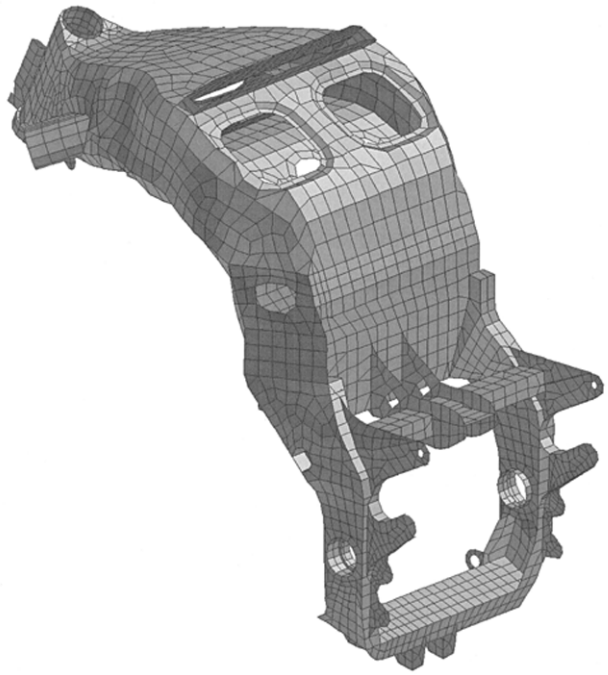
## MONOCOQUE FRAME

**Features:**

- Instead of a frame made up of individual tubes or even aluminium beams, the monocoque frame is one large, welded aluminium sheet, ‘box’ structure. The ‘box’ has the steering head welded to the front. It arches over the engine and down to the swing arm pivot casting which is also welded to it. The air box, air cleaner, and battery box can be incorporated into the main frame ‘box.’ The design principles behind the monocoque frame were born in the military aircraft industry.

**Benefits:**

- The monocoque frame is lighter and more rigid than other designs, though it is more difficult to engineer and construct. This design saves space aboard the motorcycle by enclosing the air box, air filter and battery box. Lighter and more rigid means better performance and handling. The smaller the frame, the less frontal area the motorcycle has, cutting wind resistance at high speeds.



### DETACHABLE SUB-FRAME

**Features:**
- The portion of the frame holding the seat, airbox, and rear fender removes for easy access to the Uni-Trak® shock and spring.

**Benefits:**
- The removable portion of the frame allows easy access to the suspension components. If the frame is damaged, only the bent portion of the frame need be replaced for lower repair costs.

### LADDER FRAME

**Features:**
- Similar to the frames used on full-sized pickup trucks the ladder frame keeps the frame rails rigidly parallel for good load carrying capacity.

**Benefits:**
- The ladder frame is stronger and able to carry more.

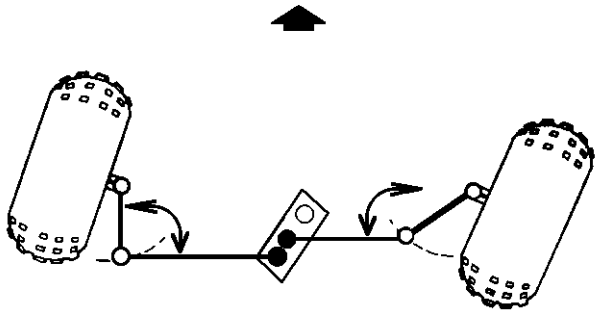
### RACK AND PINION STEERING

**Features:**
- The rack and pinion steering system utilises a small gear at the bottom of the steering shaft that acts on a toothed bar, or rack. The rack is connected to the front wheels through a pair of tie rods.

**Benefits:**
- Because of its simple design and fewer linkage components, the rack and pinion system provides more responsive steering and handling.

### ACKERMAN STEERING

**Features:**
- Ackerman steering design places the steering arm on each front hub along a line drawn from the centre of the rear axle to the pivot point of each front wheel. When the steering is turned the wheel on the inside of the turn is pulled to a tighter steering angle than the outside wheel. This allows the wheels to follow the inside and outside arc of the turn without scrubbing the tyres.



**Benefits:**
- Steering forces are lighter and tyre wear is reduced, making the vehicle easier to use and reducing operating costs.

### BUNGEE ATTACHMENTS

**Features:**
- The bungee cord attachments are pegs with mushroomed heads attached to the frame or luggage rack as on the KLRs. Kawasaki sport motorcycles have hooks that fold out of the way for a cleaner appearance.

**Benefits:**
- Bungee cord attachments look good when not in use and keep your gear where it belongs, on the bike.

## HULL

### AUTOMATIC BILGE SYSTEM

**Features:**

- All Kawasaki watercraft have an automatic bilge system that removes water from the engine compartment (bilge) when the craft is ridden. A hose connects the pick-up screen in the bottom of the engine compartment to a nozzle on the jet pump. The nozzle creates a low pressure and pulls water from the bilge. A siphon breaker is installed in the hose to prevent the hull from filling with water when the engine is not running.

**Benefits**

- Water that enters the engine compartment during use is automatically expelled by the bilge system.

### HULL CONSTRUCTION – CHOPPER OVER FOAM (COF)

**Features:**

- COF construction is a more efficient process for manufacturing fibreglass hulls. A robot “chopper” gun is used to manufacture the hull.
- The chopper gun starts construction of the outer part of the hull, a jig is then used to place foam blocks into the outer part of the hull to form the engine bed. The chopper gun then continues to cover over the outer part of the hull and the foam blocks to form the inner part of the hull. This results in a one piece, foam filled, double wall hull construction.

**Benefits:**

- COF construction is lighter than other methods due to the one piece hull not requiring any bonding. Because there is no bonding, weight of the hull is reduced by 4.5 kg compared to a hand laid hull of similar size.

### HAND LAID FIBREGLASS

**Features:**

- Hand-laid fibreglass is the most expensive process for manufacturing fibreglass-reinforced plastic hulls. First, a layer of plastic gel coat is ‘painted’ into the mould. Next, alternating layers of fibreglass mat or cloth are laid into the mould by hand and saturated with catalysed resin. Thickness is carefully controlled to keep weight down and strengthen critical areas.

**Benefits:**

- While hand-laid fibreglass is expensive, it is the strongest construction for its weight of any fibreglass manufacturing process. It is admirably suited to smaller production runs.

### SHEET MOULDING COMPOUND (SMC)

**Features:**

- SMC is used in some Jet Ski watercraft. Fibreglass mat saturated with polyester resin is supplied by a vendor. Many layers of mat are used in high stress areas. Areas of the hull or deck with little stress have fewer layers to save weight. The mat ‘charge’ is placed in the bottom half of the mould contained in a very large hydraulic press. The top mould half is brought down on the mat charge and the mould is heated and squeezed. The press opens and out pops a shiny new hull or deck ready for curing.

**Benefits:**

- Using SMC makes Kawasaki Jet Ski watercraft light and strong. Kawasaki presses the hulls and decks at its manufacturing plant in Lincoln, Nebraska where SMC parts are made to the highest standards.

### KAWASAKI SPLASH DEFLECTOR (KSD)

**Features:**

- The Kawasaki Splash Deflector (KSD) is one or two ridges across the bottom of the bow of the watercraft hull. These ridges are carefully designed to catch water splashing forward from under the hull, and keep it from flying up in front of the watercraft and into the rider’s face.

**Benefits:**

- Less splash means a drier, more comfortable ride. This is especially important if the water is cold and in cold weather.

**FLUSH KIT**

**Features:**

- To prevent the build up of salt and sand deposits, the cooling system has to be flushed after use. The flush kit has been added to ease this process. Simply attach a garden hose to the flush point, switch on the engine then switch on the tap. Allow the engine to run for several minutes to ensure the cleaning of the system is thorough; switch off the tap and then rev the engine a few times before switching it off to expel all water from the cooling system.

**Benefits:**



- Keeping the cooling system free of deposits ensures the engine temperature will remain in the desired range resulting in maximum engine reliability.

## SUSPENSION

### COMPRESSION DAMPING

**Features:**

- Shock absorbers and front forks control spring compression with compression damping. Compression damping slows the speed of the spring as it compresses when the wheel strikes a bump. Compression damping also helps limit the compression/extension cycles (bounce) after the spring has extended. Compression damping is achieved with oil being pushed through a small opening of a fixed size. (see REBOUND DAMPING)

**Benefits:**

- Compression damping keeps the chassis level and less affected by bumps and holes in the riding surface, improving tyre contact.

### ADJUSTABLE COMPRESSION DAMPING

**Features:**

- Some models allow the rider to adjust the speed of spring compression and or rebound.

**Benefits:**

- Allows the rider to tune the suspension to suit their riding style and different tracks.

### ADJUSTABLE LOW & HIGH SPEED COMPRESSION DAMPING

**Features:**

- Low and high-speed compression refers to how fast the shock is compressed while hitting an obstacle in the track. Models featuring adjustable low and high-speed compression damping have two compression adjustments on the shock. The two adjusters can be used to fine tune the compression damping to provide a supple ride on small bumps yet ample bottoming resistance for big jumps.

**Benefits:**

- Compression damping absorbs the force transmitted to the motorcycle from bumps in the riding surface to provide a controllable ride.

### PROGRESSIVE COMPRESSION DAMPING

**Features:**

- Progressive damping increases the amount of damping as the compressive load increases. Kawasaki has two types of progressive compression damping. The first uses flexible washers which vary the damping according to the rate of spring movement. This type of compression damping is used in some rear shocks, some conventional forks and in cartridge-type forks. The second type of progressive damping is called a travel control valve (TCV). TCV varies the compression damping according to the amount of spring compression and the rate of wheel travel.

**Benefits:**

- Compression damping keeps the chassis level and less affected by bumps and holes in the road, tyres stay in contact with the road. Both of these things are important parts of good handling.

### REBOUND DAMPING

**Features:**

- Shock absorbers and front forks control spring extension with rebound damping. Rebound damping slows the speed of the suspension as it tries to extend after striking a bump in the riding surface. Rebound damping also helps limit the compression / extension cycles (bounce) after the spring has extended. Oil pushed through a small opening of a fixed size is the most common method of damping. If more damping is required for a vehicle, the factory makes the opening smaller which slows the spring more and increases the damping rate.

**Benefits:**

- Rebound damping helps keep the bike stable and wheels in contact with the ground when riding over irregularities in the riding surface.

### ADJUSTABLE REBOUND DAMPING

**Features:**

- Some models allow the rider to adjust the speed of spring extension or rebound. Externally adjustable rebound is typically controlled by a needle and orifice within the shock or fork. Turning the adjuster in, restricts the amount of oil flowing through the orifice, increasing rebound damping and slowing down spring extension. Turning the adjuster out decreases damping and lets the spring return more rapidly. Adjustable rebound damping allows the rider to fine tune the damping to suit the riding

conditions and is an important feature for high performance models. All three damping openings: fixed, progressive and adjustable are used in Kawasaki products in various combinations depending on the vehicle's intended use. (*see* CARTRIDGE FORKS, COMPRESSION DAMPING, SPRING PRELOAD)

**Benefits:**

- Rebound damping helps keep the bike stable and wheels in contact with the ground when riding over irregularities in the riding surface.

### PROGRESSIVE REBOUND DAMPING

**Features:**

- Ideal damping would slow the spring extension, or rebound, very slightly for small amounts of compression and when the suspension was greatly compressed the rebound damping would also be great. This is called 'progressive damping'. This is accomplished using a series of deflecting washers and a piston with fixed orifices. Flexible washers are held against the piston. As the shock starts to move through its travel, oil pushes the ends of the washers off the piston, allowing oil to flow through the piston. Oil flows easily at slow rebound speeds because the washer is flexed away from the opening a small amount for a given amount of spring movement. When the spring is greatly compressed, the high rebound speed forces the oil to flex the washers more for a given amount of spring movement. The restriction at high speed as compared to oil flow is much higher and therefore the damping rate is higher. Progressive damping is on KX model shocks and on models with cartridge forks.

**Benefits:**

- Rebound damping helps keep the bike stable and wheels in contact with the ground when riding over irregularities in the riding surface.

### TEMPERATURE COMPENSATING REBOUND DAMPING SHOCKS

**Features:**

- When the shock absorber fluid heats with use, it thins and damping lessens. Shocks with temperature compensating rebound damping have a temperature sensitive tapered rod that expands at higher temperatures. The rod acts on the rebound damping adjustment needle and orifice, decreasing the amount of oil flow to compensate for the thinning of the fluid.

**Benefits:**

- Ride quality remains unchanged as the shock heats up from use for better all around handling.

### SPRING PRELOAD

**Features:**

- Motorcycle suspension is set up to not only provide a comfortable ride for the rider, but also to maintain proper geometry and ride height of the motorcycle. Spring preload refers to the amount the spring is initially compressed to maintain proper ride height. To compensate for different rider weights or changing loads, the amount of spring preload can be adjusted.

**Benefits:**

- Adjustable spring preload offers more flexibility in fine tuning the suspension to the rider's needs.

### SPRING PRELOAD ADJUSTMENT

**Features:**

- Spring preload adjustment compensates for changing loads. Spring preload compresses the spring initially so when a load is applied it takes more weight to compress the spring further. The spring preload adjuster is a threaded collar or cam on one end of the shock(s) which rotates to compress the spring.

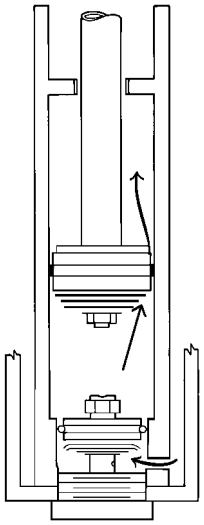
**Benefits:**

- Adjustable springs offer more flexibility in fine tuning the suspension to the rider's needs.

### CARTRIDGE FORKS

**Features:**

- The fork inner cylinder and piston rod form a damping chamber inside the fork to prevent the mixture of oil and air. Air mixed into the oil results in inconsistent damping. The design of the cartridge allows for minimal oil and air mixture, and allows for adjusters to control damping. Depending on the model application, cartridge forks may have compression damping adjustment or both compression and rebound damping adjustment. (*see* REBOUND DAMPING, COMPRESSION DAMPING).



**Benefits:**

- The cartridge design provides damping control necessary for high performance motorcycles and allows for the addition of damping adjustment.

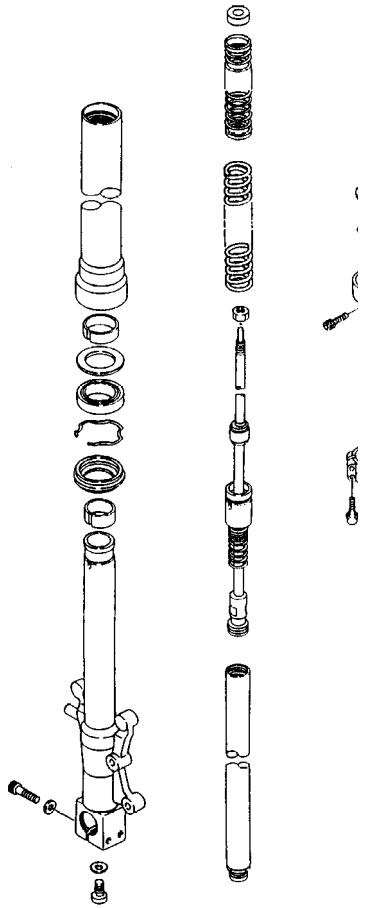
## INVERTED FORKS

**Features:**

- The large diameter fork outer-tube is held in the tripleclamps and the inner tube holds the front axle. The forces put on the fork during turning, braking and suspension travel are more evenly applied to the length of the fork assembly so the fork flexes less.

**Benefits:**

- The more rigid inverted fork produces very precise handling with less suspension weight.



## AIR OIL SEPARATE / TWIN CHAMBER FORKS

**Features:**

- This design of front fork is used on the KX250F and KX450F. Separate chambers within the fork prevent the fork oil and air from mixing.

**Benefits:**

- Preventing the oil and air mixing in the front fork gives consistent suspension performance over long races.

## BIG PISTON FORK (BPF)

**Features:**

- Compared to a cartridge fork of the same size, the BPF features a piston that is almost twice as big. Oil inside the fork acts on a surface area almost four times the size. This allows the damping pressure to be reduced while ensuring the damping remains the same. Reducing damping pressure allows the slide pipe to move more smoothly, which is especially noticeable at the initial part of the stroke.

**Benefits:**

- Greater control as the fork begins to compress and very calm attitude change as the vehicle weight shifts forward during braking resulting in greater chassis stability on corner entry. The BPF also eliminates many of the internal components used in a cartridge fork resulting in simpler contsruction and lighter weight.

## SINGLE A-ARM INDEPENDENT FRONT SUSPENSION

**Features:**

- The single A-Arm locates the front wheel side-to-side and front-to-rear. A coil spring shock absorber carries the weight of the vehicle. The resulting suspension system looks something like the MacPherson strut, but is simpler, lighter, and less expensive.

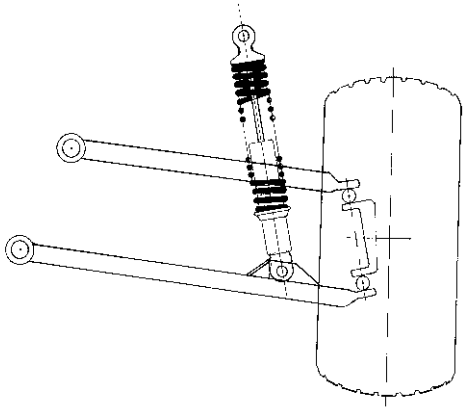
**Benefits:**

- The single A-Arm front suspension is compact and light weight for good performance. Fewer moving parts mean less friction in the steering system for low-effort handlebar movement and quick, precise turns.

## DOUBLE WISHBONE SUSPENSION

**Features:**

- Double wishbone front suspensions have longer wheel travel with less camber change. As the wheel is pushed up when it rolls over a bump, the lower wishbone pivots up and at the same time the upper wishbone moves up and pushes the hub carrier out. This keeps the front axle parallel to the ground, letting the tyre maintain traction for steering and controlling chassis roll.



**Benefits:**

- Similar to suspensions on sports cars, the double wishbone suspension keeps the tyres and chassis in the right place at the right time for good cornering and steering control.

## MACPHERSON STRUT

**Features:**

- A MacPherson strut used with a single wishbone is a compact independent front suspension. The strut carries the brake backing plate and wheel spindle in addition to containing the spring and damper. The end of the strut pivots in a ball joint at the point of the wishbone. The wishbone keeps the spindle end of the strut from moving front to back and the strut permits steering movement.

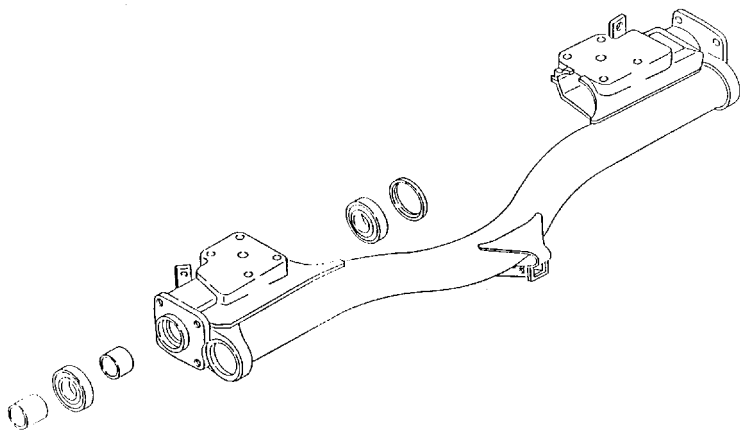
**Benefits:**

- MacPherson struts: a durable, compact suspension that can absorb pounding potholes and still deliver a comfortable ride and easy steering.

## DE DION REAR SUSPENSION

**Features:**

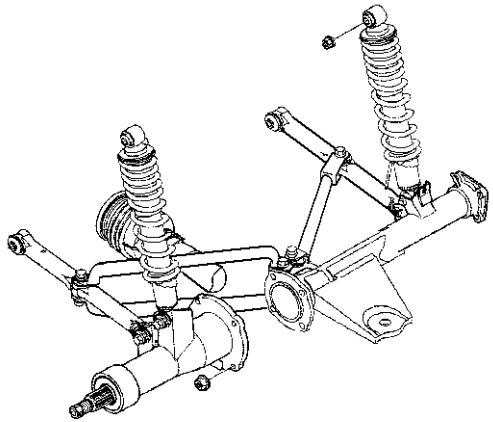
De Dion suspensions have a large tube connecting the right and left hubs. The tube carries more weight than most other suspensions and keeps both wheels perpendicular to the ground as the vehicle corners.



**Benefits:**
The DeDion suspension carries more weight with improved ride and handling qualities.

**QUAD-LINK REAR SUSPENSION**

**Features:**
- The quad-link suspension has two trailing arms attached to the axle and two link arms that keep the trailing arms perpendicular to the axle. All four links are connected with rubber bushings to allow the right and left wheels to move over bumps nearly independently of each other. Coil springs with shock absorbers support the vehicle.



**Benefits:**
- ATV suspensions of other manufacturers have traditionally been adaptations of motorcycle designs. The quad-link rear suspension on Kawasaki KLF models is borrowed from automotive technology and that's why it works so well on our four-wheelers. The semi-independent suspension system complies with the terrain providing comfort and good handling while still being sturdy and light.

**INDEPENDENT REAR SUSPENSION (IRS)**

**Features:**
- As the name suggests, IRS wheels are sprung and can be moved independently of each other.
- On a conventional swingarm or axle layout the differential/final gear case forms part of the unpsrung mass of the suspension system. On IRS suspension systems the differential/final gear case is attached to the chassis. A solid torsion bar is also attached to the chassis and to both sides of the suspension to reduce body roll.

**Benefits:**
- IRS allows each wheel to maintain contact with the ground to maximise traction.

## RIDE HEIGHT ADJUSTMENT

**Features:**

- Found primarily on sport models, the ride height adjustment allows the back of the motorcycle to be adjusted up or down. Adjustments can be made on a threaded section at the top of the shock or with shims depending on the model. Changing rear ride height changes rake angle and front tyre trail which changes steering feel. For a closed circuit race course with many slow speed corners, steering can be quickened by raising the ride height. On a track with few corners the steering can be slowed by lowering the height.

**Benefits:**

- Riders can tune the motorcycle to their riding style and to the riding conditions for improved handling performance.

## UNI-TRAK®

**Features:**

- Uni-Trak® transfers the movement of the rear wheel and swingarm to a link arm which acts upon one large shock absorber and spring. The shock absorber is centrally located low in the frame, improving mass centralisation and lowering the machine's centre of gravity. The shock linkage decreases leverage on the shock as the suspension is compressed. Bumps are damped progressively with small bumps receiving light damping and large bumps receiving heavy damping.

**Benefits:**

- Uni-Trak® with its single shock and spring offers a smoother ride with more comfort, better steering and high speed handling control. It also puts more power to the ground. For high performance machines, this is what it’s all about.

## BRAKES

### ANTI-LOCK BRAKE SYSTEM (ABS)

**Features:**

- Anti-lock brake systems control tyre slip. Wheel speed sensors monitor the speeds of the front and rear wheels. If one wheel starts to slow down at a faster rate than the other, or at a speed faster than that programmed into the ECU, it indicates the wheel is starting to lose traction. ABS responds by momentarily reducing hydraulic pressure to the brake on the affected wheel or wheels. Electronically controlled solenoid valves in the ABS unit are signalled by the ECU to hold, release and reapply hydraulic pressure to the brakes. This produces a pulsating effect, which can usually be felt in the brake lever / pedal during hard braking.

**Benefits:**

- This safety feature allows the user to remain in control of the vehicle during hard straight-up braking.

### KAWASAKI ADVANCED COACTIVE-BRAKING TECHNOLOGY (K-ACT) ABS

**Features:**

- When the rider applies the front and / or rear brake, brake fluid operates the caliper pistons as in a normal brake system. Pressure sensors (one for the front and one for the rear brake) detect the amount of force the rider is applying. The brake ECU then calculates the best force to achieve maximum braking efficiency. A motor then increases hydraulic pressure to the front and / or rear as necessary. K-ACT also incorporates ABS.

**Benefits:**

- K-ACT ABS assists riders to execute controlled, balanced braking. Designed to complement the rider's applied brake force, K-ACT ABS ensures ideal brake force distribution to maximise braking efficiency.

### BALANCED ACTUATION CALIPER SYSTEM (BAC)

**Features:**

- The disc brake caliper has one small piston and one large one. The small piston is on the leading edge of the brake pad, where less pressure is needed because the leading edge tries to 'dig in' when the brake is applied.

**Benefits:**

- Balanced actuation means even pad wear, and better brake feel.

### OPPOSED MULTI-PISTON CALIPERS

**Features:**

- When the brakes are applied on a disc brake system brake fluid pushes the pistons in both sides of the caliper out against the brake pads which clamp the disc. Friction between the pads and the rotating disc causes the vehicle to slow. Increasing the number of pistons in the caliper increases the amount of braking force and pad surface area applied to the disc.

**Benefits:**

- Multi-piston caliper performance is very responsive with light finger pressure and good brake feel.

### RADIAL MOUNTED CALIPERS

**Features:**

- Radial mounted brake calipers have mounting points at both the top and bottom of the caliper, with the mounting bolts inserted through the rear instead of the side/front of the caliper. This makes the caliper more rigid.

**Benefits:**

- Making the caliper more rigid improves the feel and performance of the braking system.

### MULTI-PAD CALIPERS

**Features:**

- Usually found on high performance racing machines, multi-pad calipers have individual brake pads for each piston in the caliper. A single large brake pad can distort if too much heat is generated due to extreme braking forces, resulting in reduction of the braking performance.

**Benefits:**

- Smaller brake pads can absorb more heat without distorting. The smaller surface area allows heat to dissipate from the brake pad faster than a conventional sized brake pad resulting in consistent performance at higher temperatures.

### BRAKE INSULATORS

**Features:**

- Brake fade occurs when, under the repeated hard braking of competition, heat from the brake pads heats the brake fluid to its boiling point. Phenolic

brake insulators are installed between the brake pads and the caliper pistons. Brake insulators help prevent transfer of heat from the brake pads to the brake fluid.

**Benefits:**

- Brake insulators keep the brake system at peak efficiency and allow the rider to be more competitive.

### FLOATING DISC

**Features:**

- Disc brake calipers must be aligned with the disc to provide effective braking and have a small amount of clearance from the disc to prevent the brakes from dragging. Some disc brakes have pins on which the calipers float back and forth to maintain alignment and clearance. Letting the disc float on the hub is a simpler and lighter way to maintain the caliper to disc alignment and clearance. Small spring washers between the hub and the disc dampen disc noise when the brakes are not applied.

**Benefits:**

- Floating discs ensure correct brake pad to disc alignment for good brake feel while reducing weight and complexity.

### SEMI FLOATING DISC

**Features:**

- Disc brake calipers must be aligned with the disc to provide effective braking and have a small amount of clearance from the disc to prevent the brakes from dragging. Some disc brakes have pins on which the calipers float back and forth to maintain alignment and clearance. Letting the disc float on the hub is a simpler and lighter way to maintain the caliper to disc alignment and clearance. Small spring washers between the hub and the disc dampen disc noise when the brakes are not applied.

**Benefits:**

- Semi floating discs ensure correct brake pad to disc alignment for good brake performance and feel while reducing weight and complexity.

### SEALED MULTI-PLATE BRAKE

**Features:**

- The sealed multi-plate brake is a feature commonly found in heavy equipment design. The sealed, multi-disc system has long-life Kevlar discs and is sealed in the swingarm where it operates in an oil bath.

**Benefits:**

- Not only does the sealed multi-plate brake provide exceptional stopping power, but because it is a sealed system it is protected from water, mud, dust and debris. Brake life is extraordinary and there is minimal maintenance. The compact design also provides added ground clearance at the rear axle.

### AUTOMATIC BRAKE ADJUSTER

**Features:**

- Automatic brake adjusters maintain the brake shoe to drum clearance as the brake shoes wear. The automatic brake adjusters are mounted outside the wheel cylinder on the brake panel.

**Benefits:**

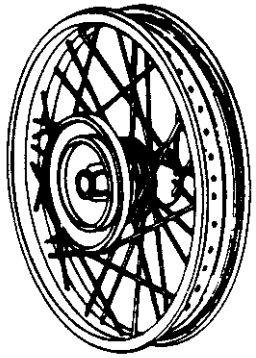
- The MULE owner has less maintenance down time and expense with automatic brake adjusters.

## WHEELS/TYRES

### STRAIGHT-PULL SPOKES

**Features:**

- The spokes have little or no bend at the head where the spoke exits the wheel hub, thus eliminating a critical weak spot.



**Benefits:**

- The wheels are stronger for their weight than ever before.

### BUTTED SPOKES

**Features:**

- Spokes generally require their strength where the spoke attaches to the wheel. To reduce weight the middle of the spoke can be made thinner.

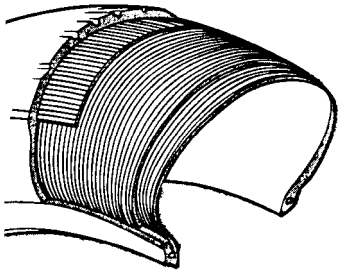
**Benefits:**

- Butted spokes reduce unsprung weight and offer better ride quality due to the more flexible centre section.

### RADIAL TYRES

**Features:**

- Radial tyres have the belts or plies that reinforce the rubber wrapped radially around the tyre carcass. This allows the side walls to flex without generating a lot of heat. Short, stiff tyre side walls maintain the good handling character of the tyre for motorcycle use.



**Benefits:**

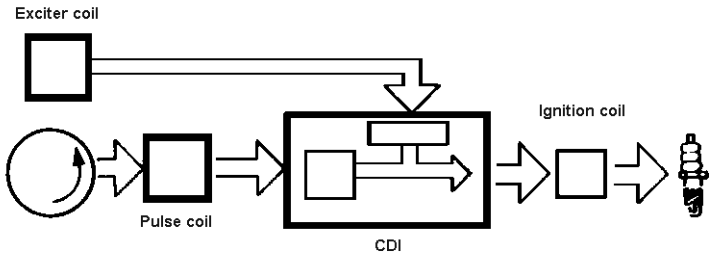
- Cooler running tyres wear longer and handle better.

## ELECTRICAL

### CAPACITOR DISCHARGE IGNITION (CDI)

**Features:**

- CDI is a self-powered ignition which relies on the quick discharge of a capacitor to fire the spark plug. An exciter coil and the magnets in the engine's rotating flywheel generate a voltage charging the capacitor in the CDI unit. A pulse coil senses the position of the flywheel and times the discharge of the capacitor. At the correct moment the capacitor voltage is discharged through the ignition coil firing the spark plug.




**Benefits:**

- CDI helps the engine start easily and ensures firing under adverse conditions. CDI requires no battery so the ignition weighs less and requires no maintenance. Spark plugs last longer too.

### DIRECT CURRENT CDI (DC-CDI)

**Features:**

- DC-CDI is a capacitor discharge ignition system that is powered by the battery. Direct current from the battery, after being stepped-up to several hundred volts, charges a capacitor. The pulser coil sends a signal at just the right time to discharge the capacitor through the primary winding of the ignition coil, firing the spark plug. A large alternator charges the battery.

**Benefits:**

- DC-CDI helps the engine start easily and ensures firing even at very low rpm.

### DIGITAL CAPACITOR DISCHARGE IGNITION (DIGITAL CDI)

**Features:**

- Digital CDI features a computer chip that dictates spark advance. Kawasaki engineers program the chip to change spark advance to match the exact demands of each model. The engineer considers port timing, powervalve operation, expansion chamber design, and more before plotting the timing map. Extensive testing under actual operating conditions finalises the timing map. Kawasaki's digital CDI system uses a pickup coil instead of a pulser coil because it is more accurate.

**Benefits:**

- Digital CDI helps the engine make maximum power at all engine speeds. It responds more quickly to rpm changes for better response and power.

### ACCELERATION COMPENSATING CAPACITOR DISCHARGE IGNITION (AC-CDI)

**Features:**

- AC-CDI features seperate ignition maps for in-gear operation and neutral. When the gears are engaged the ignition timing raises the idle speed to minimise the 4-stroke engine braking effect. A neutral sensor engages another ignition map that reduces idle speed to a normal level.

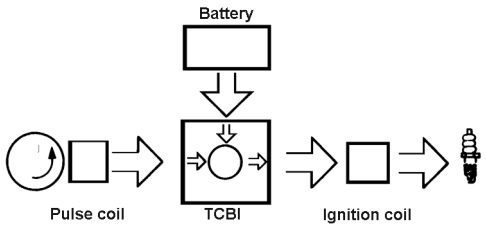
**Benefits:**

- AC-CDI reduces the 4-stroke engine braking effect making the bike more stable when shifting down and when entering corners and making the bike easier to start when hot (in conjunction with the hot start system).

### TRANSISTOR CONTROLLED BREAKERLESS IGNITION (TCBI)

**Features:**

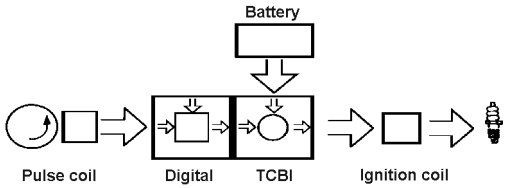
- TCBI replaces the contact breaker points in a battery/ coil ignition with a pick-up coil. This coil produces a reliable and precisely timed signal which, when amplified by transistors, functions just like the opening of the breaker points, firing the spark plug.



**Benefits:**
- TCBI requires next to no maintenance, increases spark plug life, fuel economy and performance with reduced exhaust emissions.

## DIGITAL TRANSISTOR CONTROLLED BREAKERLESS IGNITION (DIGITAL TCBI)

**Features:**
- Digital TCBI uses a small computer to time when the spark plug fires. The computer has a record of the right time to fire the spark plug. The computer reads rpm from the pulse coil signal, waits the right amount of time, and then fires the plug. The spark timing can advance and retard as many times as is needed to achieve the best power and lowest emissions without risk of detonation.




**Benefits:**
- Digital TCBI delivers the best performance and emissions control while avoiding engine damaging detonation.

## EXCITED FIELD ALTERNATOR

**Features:**
- Excited field alternators have a rotating electromagnet that pushes charging system voltage from the stator coil and sends it on the battery. A small amount of battery current powers the electromagnet. An electromagnetic field has greater low RPM battery charging ability and weighs less than a permanent magnet. The excited field alternator is positioned behind the crankshaft narrowing the engine. The self-contained alternator has the rectifier and regulator enclosed in the alternator case.

**Benefits:**
- Excited field alternators produce more power at lower RPMs and weigh less while allowing the width of the engine to be reduced for improved cornering clearance.

## CONTROLLER AREA NETWORK (CAN)

**Features:**
- CAN uses a different method to encode electrical signals than conventional electrical networks. This coding allows multiple signals to be sent using a single wire. The CAN system is also designed to operate reliably in extremely harsh conditions making it ideal for motorcycle use.

**Benefits:**
- Using CAN allows a greater volume of information to be transfered while reducing the complexity of the wiring harness.

## ENGINE TEMPERATURE PROTECTION

**Features:**
- If sand or weeds temporarily clog the cooling water inlet on a watercraft and the cooling water flow indicator goes unnoticed, elevated engine temperatures can cause piston and cylinder damage. On the newest Jet Ski watercraft, water on its way to the cooling flow indicator passes through a temperature sensor before it goes overboard. When the sensor temperature goes above 95º C, a dash-mounted warning light comes on and the digital CDI selects a second spark advance curve which limits engine rpm to 3500 allowing the craft to be ridden at low power to shore.

**Benefits:**
- Just one of the many Kawasaki built-in protection features which help preserve the good times for owners of Kawasaki products.

## MAGNETO AND TRANSISTOR IGNITION

**Features:**
- A magneto and transistor ignition is a self powered ignition which relies on the quick discharge of a capacitor to fire the spark plug(s). An exciter coil and the magnets in the engine's rotating flywheel generate a voltage charging the capacitor. At the correct moment the capacitor voltage is discharged through the ignition coil firing the spark plug.

**Benefits:**
- Magneto and transistor ignition helps the engine start easily and ensures firing under adverse conditions. It does not require a battery so the system is simple and requires no maintenance.

## IGNITION LOCKOUT

**Features:**

- When the side stand is down, the ignition lockout will only allow the engine to run when the rider places the transmission in neutral or squeezes the clutch. If the rider places the transmission in gear and releases the clutch the engine will stop if the side stand is down. The engine runs normally if the side stand is up. All models in this sales guide have this feature.

**Benefits:**

- The ignition lockout circuit prevents the rider from riding away with the side stand down.

## IGNITION TIMING MAP

**Features:**

- Most motorcycle ignitions use an electronic advance that varies the ignition timing depending on rpm. Using two sources of data, rpm and throttle position, allows for multiple ignition advance points to maximise ignition timing in all conditions without detonation. These pre-set advance points form a three-dimensional "map" with peaks and plateaus to correspond with the amount of load on the engine.

**Benefits:**

- The ignition timing map allows for maximum ignition advance in all conditions for efficient combustion. This results in better engine performance from idle to wide open throttle.

## KAWASAKI IGNITION MANAGEMENT SYSTEM (KIMS)

**Features:**

- In addition to the standard FI system where input data includes (engine speed, throttle position, vehicle speed, gear position and feedback from intake air temperature, intake air pressure, engine temperature and O2 sensors), KIMS also monitors the change in engine speed. Should a significant sudden change in engine speed be detected, the above factors are taken into account and, when deemed necessary, ignition timing is slowed to protect the engine and catalysers from damage and reduce rear wheel slippage.

**Benefits:**

- As part of a rider-active package, KIMS was designed not to interfere with the rider's intentions. The ECU's complex programme assumes that all rider input is intentional, so unless the change in engine speed exceeds the predicted response for the given parameters (throttle position, gear, etc), the system is designed NOT to act.
- For example:
- - When the throttle is being opened and the rear tyre starts to slip, the system looks at how much (and how quickly) the throttle was opened.
- - If it was being opened slowly, KIMS determines it was not the rider's intention to initiate a rear wheel slide and slows ignition timing to avoid the sudden abnormal load on the engine and catalysers. Slowing the ignition may reduce the rear wheel slippage.
- - If the throttle was opened widely and quickly, KIMS assumes the rider intended to initiate a rear wheel slide and does NOT act to slow the ignition timing.

## IMMOBILISER SYSTEM

**Features:**

- To improve security Kawasaki has introduced an immobiliser to some models. The Kawasaki immobiliser is an insurance approved electronic key recognition system. As soon as the ignition key is inserted into the barrel the ECU ‘reads’ the code from the key. If the key code does not match the code stored in the ECU the vehicle will not start.

**Benefits:**

- Because the immobiliser works automatically the operator does not have to remember to set the system. Costs are also reduced for the customer who may no longer need to purchase a separate insurance approved security system.

## KAWASAKI SMART STEERING (KSS)

**Features:**

- A steering system feature where an electric sensor in the steering column is tied to the Engine Management Module (EMM) to produce thrust for cornering in certain conditions. A microprocessor in the EMM monitors the steering sensor input and the engine rpm and can raise engine rpm and therefore thrust, to help cornering.
- If the handle bar is fully turned in either direction, and the engine rpm quickly drops from a designated high rpm (like when the throttle is released at speed), the EMM will raise engine rpm to produce enough thrust to initiate the desired turn.

- On carburetted models with KSS, the engine rpm is raised by an actuator and cable system receiving signals from steering and throttle position sensors and the ignition system.

**Benefits:**

- This system improves handling by helping initiate corners more smoothly at higher speeds. Average riders may not even know the system is there, since they normally apply the throttle when initiating a corner.

### KAWASAKI THROTTLE RESPONSIVE IGNITION CONTROL (K-TRIC)

**Features:**

- Kawasaki Throttle Responsive Ignition Control (K-TRIC) identifies throttle position and relays this input to the igniter. The igniter adjusts the ignition timing according to a pre-set ignition timing map for efficient combustion, without detonation, based on how much load is on the engine.

**Benefits:**

- K-TRIC allows the engine to use optimum ignition advance in all conditions resulting in better response and power throughout the rpm range.

### LAMP CHECK CIRCUIT

**Features:**

- All warning lamps are grounded through the oil pressure switch. When the ignition key is turned on all lamps light so the operator can see that the bulbs work. When the engine is started the oil pressure switch opens. If everything is working properly all warning lamps go out. If low fuel level or high coolant temperature warning switches close, the associated lamps turn on. If oil pressure is lost all warning lamps come on telling the rider to find a place to pull over and shut off the engine.

**Benefits:**

- This feature informs the operator that the warning systems are operating properly.

### LCD INSTRUMENTATION

**Features:**

- Advancements in technology have allowed the use of Liquid Crystal Display (LCD) systems. The LCD unit includes the speedometer, tachometer, odometer, trip meter, temperature and clock functions in one compact unit. On some models the LCD unit also allows the use of shift lights and stopwatch functions.

**Benefits:**

- The LCD instrumentation panel is a compact, self-controlled unit. This allows easy switching of the measurement functions such as MPH to KPH for use when travelling in other countries.

### LED REAR LAMP

**Features:**

- Multiple Light Emitting Diodes (LEDs) are used in the rear lamp of some models. LEDs use less power, have a quicker response time and are more reliable than conventional light bulbs.

**Benefits:**

- LEDs use approximately 80% less power, last approximately 6 times longer and due to their small size are able to fit into a more compact lamp unit.

### PERMANENT MAGNET ALTERNATOR

**Features:**

- The permanent magnet alternator has several permanent magnets installed in the flywheel. The magnetic field cuts across the stator coil producing AC voltage. The AC voltage is rectified to DC and regulated to 14 volts at the solid state regulator/ rectifier before charging the battery. Neither the alternator nor the regulator/rectifier requires maintenance.

**Benefits:**

- This design of alternator is simple with no brushes or bearings to replace, keeping maintenance costs to a minimum.

### SELF-EXCITING ALTERNATOR

**Features:**

- Similar to the field-excited alternator the self-excited alternator gets power for the electromagnetic field directly from the stator rather than from the battery. This design produces electric power more efficiently at low engine RPMs.

**Benefits:**

- The self-excited alternator produces more battery charging power at low rpms giving better reliability and owner peace of mind.

### QUARTZ HALOGEN HEADLIGHT

**Features:**
- The quartz glass envelope transmits more light than standard glass bulbs. The halogen gas inside does not react with the metal filament so it lasts longer.

**Benefits:**
- The bulb is brighter for relaxed night time riding and the bulb stays bright longer for reduced maintenance costs.

### REV LIMITER

**Features:**
- Some ignition units have a preset rpm limit above which they retard spark advance, reduce the number of sparks, or simply shut off. This helps prevent over-revving. Exceeding the engine's rev limit could cause valve float which allows the pistons to collide with the valves causing severe engine damage.

**Benefits:**
- The rev limiter is just one of the many Kawasaki built-in protection features which help preserve the good times for owners of Kawasaki products.

### SELF-CANCELLING TURN SIGNAL

**Features:**
- Self-cancelling turn signals rely on a small computer to count the pulses from the speedometer distance sensor. After the turn signals have been on for 8 seconds the computer begins to count the speedometer pulses. After a pre-set period the computer completes the ground path for a solenoid in the turn signal switch housing returning the turn signal switch to the OFF position.

**Benefits:**
- Self-cancelling turn signals are more convenient.

### SEMI-KEYLESS IGNITION

**Features:**
- Usually found on cruiser models, semi-keyless ignition allows the ignition key to be removed with the ignition switch in the on position.

**Benefits:**
- Removing the ignition key after the ignition switch has been set to the on position prevents damage that can occur to the instrument panel and surrounding area by other keys on a key ring when the motorcycle is ridden.

### SMART LEARNING OPERATION (SLO)

**Features:**
- Activated by pressing the MODE button on the multi-function meter, the Smart Learning Operation feature limits the engine rpm to approximately 5800, this reduces the watercraft speed by approximately 30%. When Smart Learning Operation is selected SLO appears on the multi-function meter screen. When Full Power Mode is selected by pressing the MODE button FPO appears in the multi-function meter screen.

**Benefits:**
- Unskilled operators can practise manoeuvring the watercraft at reduced power and speed until they become familiar with the handling of the craft.

### SPARK LOSS CONTROL

**Features:**
Some Kawasaki MX machines use rev limiters that completely cut power to the spark plug at a set rpm. Spark loss control limits the engine rpm by progressively cutting individual sparks as the engine nears the red line.

**Benefits:**
Power gradually tapers off near the red line instead of coming to an abrupt stop.

### STARTER LOCKOUT

**Features:**
- The starter lockout originally was a switch on the clutch in series with the starter button. The starter solenoid could close when the rider pushed the starter button and squeezed the clutch lever.
- On newer models a relay controlling the solenoid increases usability. When the rider pushes the starter button the relay will close, turning on the starter solenoid if the rider also squeezes the clutch or places the transmission in neutral.

**Benefits:**
- The starter lockout circuit prevents the motorcycle jumping forward when the engine is started with the transmission in gear.

# Business Unit and Year for Technical Features

| Technical feature | Business Unit | Year |
|---|---|---|
| Acceleration Compensating Capacitor Discharge Ignition (AC-CDI) | MX | 09, 08, 07, 06, 05, 04 |
| Accelerator Pump | ST MC | 07, 03 |
| Ackerman Steering | ATV, UV | 09, 08, 07, 06, 05, 04, 03 |
| Adjustable Compression Damping | MX, ST MC | 07, 03 |
| Adjustable Damping | MX | 09, 08 |
| Adjustable Low and High Speed Compression Damping | MX | 03 |
| Adjustable Rebound Damping | ST MC, MX | 03 |
| Air Oil Separate / Twin Chamber Forks | MX | 09, 08, 07, 06 |
| Automatic Bilge System | PWC | 09, 08, 07, 06, 05, 04 |
| Automatic Brake Adjuster | UV | 09, 08, 07, 06, 05, 04, 03 |
| Automatic Camchain Tensioner | ST MC, MX, ATV | 09, 08, 07, 06, 05, 04, 03 |
| Automatic Compression Release (ACR) | MX | 09, 08, 07, 06, 05, 04 |
| Back Torque Limiter Clutch | ST MC | 09, 08, 07, 06, 05, 04 |
| Backbone Frame | ST MC | 09, 08, 07, 06, 05, 04 |
| Balanced Actuation Caliper System (BAC) | ST MC | 03 |
| Balancer System | ST MC, UV, MX, ATV | 09, 08, 07, 06, 05, 04, 03 |
| Belt Failure Detection System | ATV | 05, 04, 03 |
| Belt Service / Warning System | ATV | 09, 08, 07, 06 |
| Brake Insulators | ST MC | 03 |
| Bungee Attachments | ST MC | 03 |

| Technical feature | Business Unit | Year |
|---|---|---|
| Butted Spokes | MX | 09, 08, 07, 06 |
| Cab Frame Air Intake | UV | 09, 08, 07, 06, 05, 04, 03 |
| Cam Chains (Roller & Silent) | ATV, ST MC | 05, 03 |
| Capacitor Discharge Ignition (CDI) | MX, PWC, ATV | 07, 06, 05, 04, 03 |
| Carbon Fibre Reed Valves | MX | 07, 06, 03 |
| Carburettor | MX, ATV, PWC, ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Cartridge Forks | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Catalyser | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Chopper Over Foam (COF) | PWC | 09, 08, 07, 06, 05, 04 |
| Compression Damping | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Compression Ratio - Variable | MX | 09, 08, 07, 06, 05, 04, 03 |
| Constant Velocity Carburettor | ATV, MX, PWC | 09, 08, 07, 06, 05, 04, 03 |
| Continuously Variable Transmission (CVT) | ATV, UV | 09 |
| Contoured Crankcase Covers | ST MC | 03 |
| Controller Area Network (CAN) | ST MC | 09, 08, 07, 06 |
| Cradle Frame | ST MC, ATV | 09, 08, 07, 06, 05, 04, 03 |
| Crankcase Reed Valve Induction | PWC | 03 |
| Crankcase Reed Valves | MX, PWC | 09, 08, 07, 06, 05, 04, 03 |
| Crescent Slide Carburettor | MX | 09, 08, 07, 06, 05, 04, 03 |
| Curved Radiator | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Cyclone Air Filter With Restriction Gauge | UV | 09, 08, 07, 06, 05, 04, 03 |
| De Dion Rear Suspension | UV | 09, 08, 07, 06, 05, 04, 03 |

| Technical feature | Business Unit | Year |
|---|---|---|
| Detachable Sub-Frame | MX, ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Diamond Frame | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Diesel Engine | UV | 09, 08, 07, 06, 05, 04, 03 |
| Digital CDI | MX | 06, 05, 04, 03 |
| Digital Fuel Injection | ST MC, MX, ATV, PWC | 09, 08, 07, 06, 05, 04, 03 |
| Digital Transistor Controlled Breakeless Ignition (Digital TCBI) | PWC, ST MC | 07, 06, 05, 04, 03 |
| Direct Actuation Valves | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Direct Current CDI (DC-CDI) | PWC, ST MC, ATV | 07, 06, 05, 04, 03 |
| Double Overhead Camshaft (DOHC) | ST MC, PWC, MX, ATV | 09, 08, 07, 06, 05, 04, 03 |
| Double Wishbone Suspension | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Dual Automatic Clutches | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Dual Plug Head | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Dual Stage Cam Chain | ST MC | 03 |
| Dual-Mode Differential | ATV, UV | 09, 08, 07, 06, 05, 04, 03 |
| Dual-Oil Pumps | ST MC, ATV | 09, 08, 07, 06, 05, 04, 03 |
| Dual-Range Sub-Transmission | ATV | 05, 03 |
| Eccentric Chain Adjuster | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Electric Fuel Pump | MC, UV | 05, 04, 03 |
| Electric Nozzle Trim | PWC | 04 |
| Electrically Selectable 2WD / 4WD | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Electrofusion | MX | 05, 04, 03 |
| Electronic Fuel Pump | ST MC | 09, 08, 07, 06, 05, 04 |

| Technical feature | Business Unit | Year |
|---|---|---|
| Engine Temperature Protection | PWC | 09, 08, 07, 06, 05, 04 |
| Excited Field Alternator | ST MC | |
| Exhaust System - Dry | PWC | 04 |
| Exhaust System - Semi-Dry | PWC | 09, 08, 07, 06, 05, 04 |
| Externally Adjustable CVT | UV | 09, 08, 07, 06, 05 |
| Flat Slide Carburettor | ST MC | 03 |
| Floating Disc | ST MC, MX | 03 |
| Flush Kit | PWC | 09, 08, 07, 06, 05, 04 |
| Four Valve Heads | ST MC, MX, ATV, PWC | 09, 08, 07, 06, 05, 04, 03 |
| Full-Time 4WD | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Hand Laid Fibreglass | PWC | 04 |
| HI / LO Ratio Sub-Transmission | ATV | 09, 08, 07, 06 |
| Hollow Cams | ST MC | 03 |
| Hot Start System | MX | 09, 08, 07, 06, 05, 04 |
| Hydraulic Valve Lash Adjusters (HLA) | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Ignition Lockout | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Ignition Timing Map | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Immobiliser System | ST MC | 09, 08, 07, 06, 05, 04 |
| Inconel Valves | PWC | 09, 08, 07 |
| Independent Rear Suspension (IRS) | ATV | 08 |
| Individual Rocker Arm System (IRS) | ST MC | 03 |
| Inverted Forks | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |

| Technical feature | Business Unit | Year |
|---|---|---|
| Involute Splines | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Jet Pump - Axial Flow | PWC | 09, 08, 07, 06, 05, 04 |
| Jet Pump - Mixed Flow | PWC | 04, 03 |
| K-Recipro Balancer | UV | 04, 03 |
| Kawasaki Automatic Compression Release System (KACR) | ST MC, MX, ATV | 09, 08, 07, 06, 05, 04, 03 |
| Kawasaki Automatic Power Drive System (KAPS) | ATV, UV | 09, 08, 07, 06, 05, 04, 03 |
| Kawasaki Clean Air System (KCA) | ST MC | 03 |
| Kawasaki Engine Brake Control (KEBC) | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Kawasaki Integrated Powervalve System (KIPS) | MX | 09, 08, 07, 06, 05, 04 |
| Kawasaki Low Exhaust Emission Catalyic Converter System (KLEEN) | ST MC | 03 |
| Kawasaki Smart Steering (KSS) | PWC | 09, 08, 07, 06, 05, 04, 03 |
| Kawasaki Splash Deflector (KSD) | PWC | 09, 08, 07, 06, 05, 04, 03 |
| Kawasaki Throttle Responsive Ignition Control (K-TRIC) | ST MC, MX, PWC | 09, 08, 07, 06, 05, 04, 03 |
| KIPS-D | MX | 03 |
| Knurled Clutch Plates | ST MC | 03 |
| Ladder Frame | UV | 04, 03 |
| Lamp Check Circuit | ST MC | 03 |
| LCD Instrumentation | ST MC | 09, 08, 07, 06, 05, 04 |
| LED Rear Lamp | ST MC | 09, 08, 07, 06, 05, 04 |
| Limited-Slip Differential | ATV, UV | 09, 08, 07, 06, 05, 04, 03 |
| Liquid Cooling | ST MC, MX, ATV, UV | 09, 08, 07, 06, 05, 04, 03 |
| Liquid-Cooled Oil Cooler | ST MC | 09, 08, 07, 06, 05, 04, 03 |

| Technical feature | Business Unit | Year |
|---|---|---|
| MacPherson Strut | ATV, UV | 09, 08, 07, 06, 05, 04, 03 |
| Magneto and Transistor Ignition | UV | 06, 05, 04, 03 |
| Monocoque Frame | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Multi-Pad Calipers | ST MC | 09, 08, 07, 06, 05, 04 |
| NCC Coating | ST MC | 03 |
| O-Ring Chain | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Open Deck Cylinder | ATV | 03 |
| Opposed Multi-Piston Calipers | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Overhead Valves (OHV) | UV | 09, 08, 07, 06, 05, 04, 03 |
| Paper Based Friction Plates | MX, ST MC | 06, 05, 04, 03 |
| Perimeter Frame | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Permanent Magnet Alternator | UV, ATV, MX | 06, 05, 04, 03 |
| Positive Neutral Finder | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Power Jet Carburettor | MX | 09, 08, 07, 06, 05, 04, 03 |
| Primary Kick-Start | MX | 09, 08, 07, 06, 05 |
| Progressive Compression Damping | ST MC, MX | 03 |
| Progressive Rebound Damping | ST MC, MX | 03 |
| Pulsed Secondary Air System | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Quad-Link Rear Suspension | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Quartz Halogen Headlight | ST MC | 03 |
| Rack and Pinion Steering | UV | 06, 05, 04, 03 |
| Radial Mounted Calipers | ST MC | 09, 08, 07, 06, 05, 04 |

| Technical feature | Business Unit | Year |
|---|---|---|
| Radial Tyres | ST MC | 03 |
| Ram Air Induction | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Rebound Damping | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Reed Valves | MX, PWC | 09, 08, 07, 06, 05, 04, 03 |
| Rev Limiter | ST MC, PWC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Reverse | PWC | 09, 08, 07, 06, 05, 04, 03 |
| Ride Height Adjustment | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Rubber Engine Mounts | ST MC | 03, 09 |
| Sealed Multi-Plate Brake | ATV | 09, 08, 07, 06, 05, 04 |
| Self Excited Alternator | ST MC | 03 |
| Self-Cancelling Turn Signals | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Semi Floating Disc | ST MC, MX | 09, 08, 07, 06, 05, 04 |
| Semi-Dry Sump | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Semi-Keyless Ignition | ST MC | 09, 08, 07, 06, 05 |
| Sheet Moulding Compound (SMC) | PWC | 04 |
| Side Cam Chain Drive | ST MC | 03 |
| Single A-Arm Independent Front Suspension | UV, ATV | 04, 03 |
| Single Wishbone Independent Front Suspension | UV | 06, 05 |
| Smart Learning Operation (SLO) | PWC | 09, 08, 07, 06, 05 |
| Snorkel Air Intake | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Spark Loss Control | MX | 09, 08, 07, 06, 05 |
| Spring Preload | ST MC, MX, ATV | 09, 08, 07, 06, 05, 04, 03 |

| Technical feature | Business Unit | Year |
|---|---|---|
| Spring Preload Adjustment | ATV | 03 |
| Starter Lockout | ST MC | 09, 08, 07, 06, 05, 04, 03 |
| Straight Pull Spokes | MX | 09, 08, 07, 06, 05, 04, 03 |
| Straight Shot Intake | ST MC | 03 |
| Superlube Oil Injection | PWC | 09, 08, 07, 06, 05, 04, 03 |
| Temperature Compensating Rebound Damping Shocks | MX | 03 |
| Throttle Limiter | ATV | 09, 08, 07, 06, 05, 04 |
| Transistor Controlled Breakerless Ignition | ATV, PWC, MX | 06, 05, 04, 03 |
| Uni-Trak | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Valve Included Angle | ST MC, MX | 09, 08, 07, 06, 05, 04, 03 |
| Variable Front Differential Control | ATV | 09, 08, 07, 06, 05, 04, 03 |
| Wet Brake | ATV | 03 |
| X-Ring Chain | ST MC | 09, 08, 07, 06, 05, 04, 03 |

Kawasaki

Let the good times roll.

**Kawasaki Motors Europe NV**
**Jacobus Spijkerdreef 1-3, 2132 PZ HOOFDDORP**
**The Netherlands**