



Interchangeability of Motor-Cycle Parts for Maintenance Purposes

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Abstract: Manufacturers of motor cycle parts, usually supply the motor cycle assemblers with motor cycle parts of same specification. Thus these parts can be interchanged between different makes, series, and brands of motor cycle during maintenance. This study is being prompted by the wide spread counterfeit, high cost and scarcity of motor cycle parts. The study covers motor cycle families such as: HONDA; SUZUKI; KAWASAKI; and YAMAHA which are commonly used in the North-Eastern Nigeria. Honda CG and CGL (125) shows high degree of parts interchangeability, while Yamaha YB50, 80, 100 and 125 (single and double exhaust) has limited parts interchangeability. Suzuki has parts interchangeability with exception of A100; and Kawasaki also shows high degree of parts interchangeability with exception of GTO-125.

Significance: The study is intended to reveal and address some of the major problems faced by motor cycle mechanics and motor cycle users; were spare parts demands amidst acute scarcity or obsolescence is glaring. Parts interchangeability is therefore the necessary solution if such a motor cycle must be road worthy all the time.

Key words: interchangeability, motor cycle, Spare parts scarcity, & maintenance.

I. INTRODUCTION

Most motor cycle companies are by virtue of practice, source their parts or components from general manufacturer. The manufacturer may design the components and market them, or manufacture based on design provided by the motor cycle assemblers. For instance, Tiger motor cycle parts Ltd supplies Piston and Connecting rod to China motor cycle manufacturers (Tiger Ltd, 2000).

Hence, there is possibility of using a component, or some on different makes of motor cycle. A typical single cylinder or double cylinder four-stroke cycle motor cycle is assembled from about 15,000 different parts (including bolts and nuts). Some of these components are universal parts, which readily fit into different makes and brands of motor cycle. Some components will fit other makes with some little modification (Michael, 2010). This work is therefore targeted at identifying parts of same Makes and Brand of motor cycle that are common to Series, brands, or models. These arise from the need to keep some models serviceable when acute shortage, high cost or counterfeiting of parts occur.

II. THE SCOPE OF THE STUDY

The scope covers most popularly used motor cycle brands in North eastern states of Nigeria. These include:-

-Honda Family: (a). CB50, C50, C70, C75, JH50, CD100, CD110, CD125.

(b). CG/CGL125, CGL150

-Suzuki Family: A50, A100, K50, K90, AX100, K125, B120, B200 (super double cylinder).

-Kawasaki Family: KH100, ELX100, KC100, GTO 125

-Yamaha Family: YB50, YB80, YB100, YB125 (single and double exhaust), M50, M80, M90.

Some major components in the engine, power train, suspension and break system were covered; but since it could not be possible to report all these findings in a single paper, the cylinder block, cylinder head, valve springs, piston and piston rings, connecting rod, crank shaft, disc clutches, and gear trains have been selected, and covered as an example. Some motor cycle parts despite their differences in materials used for manufacturing their parts (e.g., carbon content, plastics in place of metal, etc.) may be similar in terms of dimension. Though might affect the durability, performance and fuel economy of the engine, interchangeability may be vital advantage during acute parts scarcity.

III. MATERIALS AND METHOD

A. Data collection method

Being a new study area, relevant information is scarce. A search through some existing data from motor cycle manufacturer's manual, maintenance manual, automotive council of Nigeria, and assemble components yielded little result. Thus, decision to search through service manuals, parts manuals, and trade literatures were made.

Questionnaires were also administered to spare parts dealers, motor cycle assembly companies, and motor cycle mechanics. Some standard measuring instruments such as micrometer screw gauge and vernier caliper were also used to validate the information obtained from the questionnaire. 200 questionnaires were randomly administered as shown in table (1) below.

Table (1): population and sample size

Population	Sample size
-Spare parts dealers	50
-Motor cycle dealers	40
-Motor cycle assembly companies	30
-Motor cycle mechanics	80
Total	200

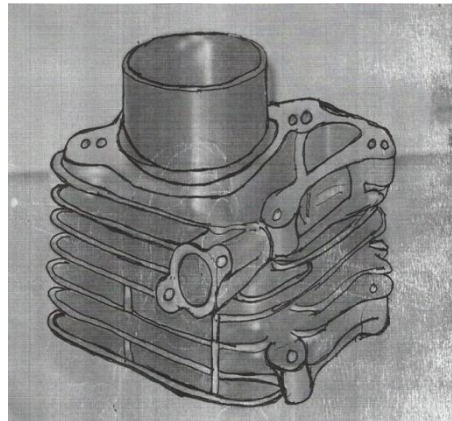
The recipients all responded, and questions asked include:

- Respondent background, whether technical or not technical.
- Types and models of motor cycle spare parts sold.
- Types and model of motor cycle repaired.
- List of spare parts which can fits different makes, and models of motor cycle sold or repaired.
- Is there need for modification, or requires any adjustment for parts to be interchanged.
- What are the effects of parts interchangeability on the performance, durability, and fuel economy of motor cycle(s)?

IV. RESULTS AND DISCUSSION

For the purpose of this paper, the following components which frequently fail have been selected to illustrate the result. These are: The Engine block, cylinder heads, valves springs, piston and piston rings, connecting rods, crank shaft, gear trains and disc clutches.

A. ENGINE BLOCK



This is the most complex castings in motor cycle parts which consist of the cylinder barrel, oil galleries, the air-cooled fins (Wikipedia, 1959; Michael, 2010). This category of Engine block is made from Aluminium which for easy dissipation of heat. Failure in the engine block occurs due to excessive wear of the cylinder bore which mostly, is reground to lager diameter (bore). Differences are noticed in cylinder bores, attachment point of gear systems, and engine mounting for different models, makes and series.

A.1. Honda Family

Irrespective of their makes or model, perfect interchangeability exist between CG125, CGL125 and CG150; as well as CB50 and C50; and C70, C75 & JH70 respectively. While the block engines of CD100, CD110, & CD125 cannot be interchanged.

A.2. Suzuki Family

The engine block for A100, & AX100; K50 & K90 are un-interchangeable. But AX100 & MAX100; K50, & K90 are perfectly interchangeable irrespective of make or model. K125, B120, & B200 super (double cylinder) has great differences in their engine blocks.

A.3. Kawasaki Family

KH100, ELX100, & KC100 block engines are perfectly interchangeable; But GTO125 engine block can't fit any of its family members.

A.4. Yamaha Family

YB50, YB80, YB100 & YB125 (single or double exhaust) engine blocks are un-interchangeable.

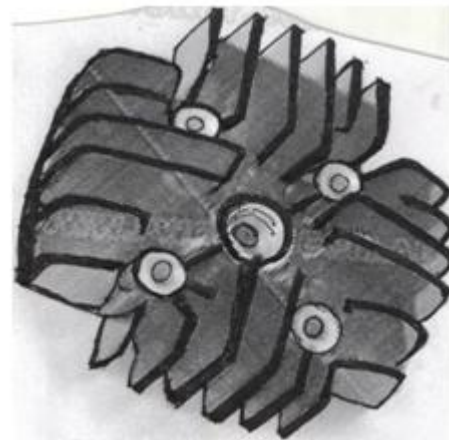
Yamaha mate: M80 & M90 engine blocks are interchangeable with little modification; while M50 cannot be interchanged with any of its family members.

B. CYLINDER HEAD

Depending on the model/make, this bears the valves, valve mechanisms, spark plugs, cooling fins, and oil lubrication galleries. It is normally bolted to engine block with gasket between. The bolt positions differ from one model or make to others (Pag, 2005).



(a) Honda motor cycle cylinder head



(b) Suzuki motor cycle cylinder head

B.1. Honda Family

Perfect interchangeability of the cylinder head exists between CG125, CGL125 and CG150; as well as CB50 and C50; and C70, C75 & JH70 respectively. While the cylinder heads of CD100, CD110, & CD125 cannot be interchanged.

B.2. Suzuki Family

A100 & AX100; K50 & K90 cylinder heads are un-interchangeable. But AX100 & MAX100; K50, & K90 are interchangeable. K125, B120, & B200 super (double cylinder) cylinder heads are not interchangeable.

B.3. Kawasaki Family

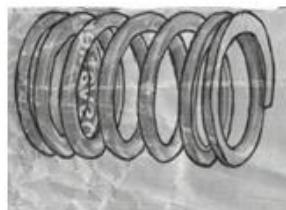
The cylinder head of KH100 & ELX100 are perfectly interchangeable; While KC100 and GTO125 are un-interchangeable with any of its family members.

B.4. Yamaha Family

YB50, YB80, YB100 & YB125 (single or double exhaust) cylinder heads are un-interchangeable. Yamaha mate: The cylinder heads of M80 & M90 are interchangeable; while M50 cylinder head is not interchanged with any of Yamaha mate brands.

C. VALVE SPRINGS

The valve springs are compression springs meant for controlling the opening, and closing of the inlet and outlet valves. Made from spring steel wire of 4mm diameter, 20mm spring diameter, with up to 6 coils per spring and stiffness of up to 6KN/m. Depending on the type, model, and make of motor cycle, the springs are used as single or double spring. If two springs are used, springs of opposite helix direction are used per valve to avoid bouncing and jamming of the spring during operation (RCAR, 2009).



C.1. Honda Family

CG125, CGL125 and CG150 have two springs per valve and are interchangeable; CB50 and C50; and C70, C75 & JH70 valve springs are interchangeable. The valve spring of CD100, CD110, & CD125 are also interchangeable.

C.2. Suzuki, Kawasaki, and Yamaha Families

These motor cycle families does not have valves and valve springs; instead, utilizes ports (inlet and outlet) for administering charged fuel into the combustion chamber and expelling exhaust gas out of the chamber.

D. CAMSHAFT

This is a mechanism which is used in controlling the opening and closing of the valve at a specific time. It is mostly situated in the top cylinder having two lobes per cylinder; and driven by timing chain at half the speed of the crankshaft. Irrespective of its profile, all motor cycle camshaft are situated in the top cylinder; mostly acting on the rocker arm without push rod (Michael, 2010).

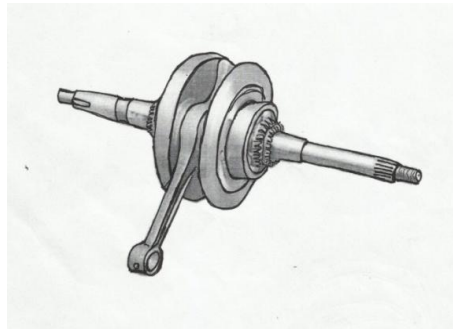
D.1. Honda Family

CG125, and CGL125; C70, C75 and JH70 have mostly interchangeable cam shaft; While CGL150; CD100, CD110, and CD125 have un-interchangeable camshaft with two above.

D.2. Suzuki, Kawasaki, and Yamaha Families

These families of motor cycles does not have camshaft since there is no valve to operate.

E. CRANKSHAFT



The crankshaft through the connecting rod converts the reciprocating motion of the piston into rotary motion. The motor cycle crankshaft is forged from grey cast Iron or forged steel. Mounted on the engine block at its main journals and to the connecting rod at the crankpin. Mostly, the motor cycle crankshaft has one crankpin. The rotary motion is transmitted to gear system through the clutch system. If fitted accurately, does not fail easily; but if it does, there is no provision for re-grounding as in the case of automobile. Its crankshaft weight balancing can be separated from the crankpin. Differences occur in the crankpin, basic configuration and diameter of journals (Vadervel Ltd., 1988).

D.1. Honda Family

The crankshafts of: CG125, CGL125 and CGL150 (30mm diameter) are perfectly interchangeable as well as CB50, and C50; C70, C75, and JH70. CD100, CD110, and CD125 have un-interchangeable crankshafts.

D.2. Suzuki Family

The crank shafts of: A100, AX100, and MAX100; as well as A50, K50 and K90 perfectly interchangeable. The crank shafts of: K125, B120 and B200 (super) are un-interchangeable.

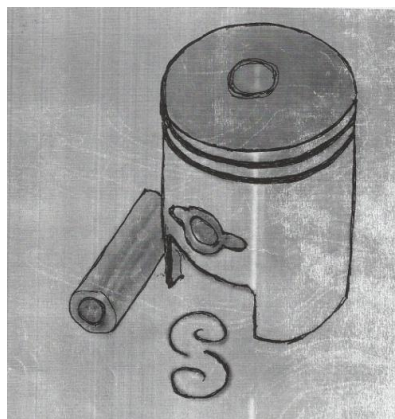
D.3. Kawasaki Family

KH100, ELX100 and KC100 have perfectly interchangeable crankshafts. But crank shaft of GTO125 is an integrated type, which is un-interchangeable.

D.4. Yamaha Family

The crank shafts of Yamaha motor cycles are un-interchangeable, except for Yamaha mate: M80, and M90 brands.

E. PISTON



This is the device which by its reciprocating motion (up and down), compresses the air fuel mixture thereby converting the chemical energy of the expanding gases to mechanical energy (Power). It is made from

aluminium for easy heat dissipation in the cylinder walls. Cylindrical in shape and prevent the lubricating oils from entering the combustion chamber and minimizes blow-by of the combustion gases. The differences usually occur in the bore diameter and the height; Standard and re-bored sizes are available (A.E. Engine parts Ltd, 1989).

E.1. Honda Family

CG125, CGL125, and CGL150 have a standard size of 56.5mm, and the re-bored size of 58mm diameter respectively; the pistons are perfectly interchangeable. C70, C75, and JH70 have an average piston size of 47mm diameter and are interchangeable. The pistons bore of CD100 (50mm); CD110 (52mm); and CD125 (54mm) and are not interchangeable.

E.2. Suzuki Family

The Piston bore for A100, AX100, and MAX100 is averagely 50mm (Standard) and 51mm (0.50 re-bored) are interchangeable; K50, K90, and A50 have piston bore of 52mm and are interchangeable as well. Great variation of piston sizes exist in K125 (62mm), B120 (60mm), and B200 super (65mm); and are un-interchangeable.

E.3. Kawasaki Family

KH100 and ELX100 piston are perfectly interchangeable, but varies greatly with KC100.

E.4. Yamaha Family

Interchangeability of piston is perfectly available only between Yamaha mates: M50, M80, and M90 respectively.

F. PISTON RINGS

The piston rings are mounted on the piston grooves just as an internal circlip arrangement. The ring arrangement comprises of two compression rings on top and oil rings at the bottom. It allows sliding of the piston up and down with little friction; preventing the lubricating oil from getting to the piston crown. The compression rings are made from cast iron, and chrome plated for wear resistance. This one of motor cycle parts with high degree of interchangeability with little modification by packing with shims.

F.1. Honda Family

CG125, CGL125, and CGL150 are the same; CD100, CD110, and CD125 are perfectly interchangeable; CB50, and C50 are also interchangeable. C70, and C75 has same piston rings, but has variation with JH70.

F.2. Suzuki Family

The piston rings of A100, AX100, and MAX100 are the same; K90, K50 and A50 piston rings are interchangeable. K125 and B120 has interchangeable piston rings; but the piston ring of B200 varies from its Brands, and interchangeable with Kawasaki family.

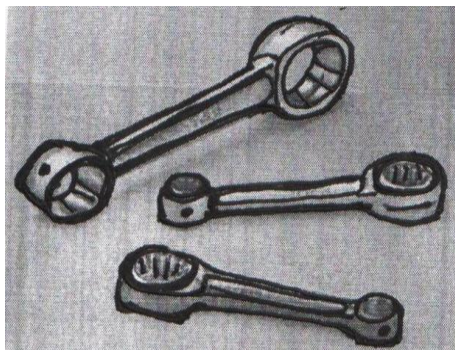
F.3. Kawasaki Family

The piston rings of KH100, ELX100, KC100 and GTO125 are interchangeable with little modification.

F.4. Yamaha Family

The piston rings of: YB50 and M50; YB80, M80, and M90; as well as YB100, YB125 are interchangeable respectively.

G. CONNECTING ROD



Motor cycle connecting rods are mostly made of aluminium alloys, with two ends for attachments. During assembly, the big end is connected to Crankshaft using plain bearings; while the small end with help of gudgeon pin is connected to the piston. This permits easy reciprocation of the piston which is converted to rotary motion. The length and size of the big and small ends of connecting rods accounts for its differences.

G.1. Honda Family

The connecting rods of CG125, CGL125 and CGL150 are highly interchangeable. CD100, CD110, and CD125 connecting rods also exhibit interchangeability; as well as CB50, and C50. The connecting rods of C70, C75, and JH70 are un-interchangeable.

G.2. Suzuki Family

The connecting rods for: A100, AX100, and MAX100 are the same; Likewise K50, and A50.

G.3. Kawasaki Family

KH100, ELX100, and KC100 have same connecting rod; but GTO125 has an integrated piston and connecting rod assembly, hence un-interchangeable with any brand of motor cycle.

G.4. Yamaha Family

The connecting rods of YB50, and M70; YB80, M80 and M90 have interchangeability connecting rods; but YB100, and YB125 connecting rods are not interchangeable with any model or brand.

H. CLUTCH PLATE and DISC



H.1. Honda Family

The clutch plates and clutch disc of CG125, and CGL125 are perfectly interchangeable; but varies with those above. CD100, and CD110 has perfectly interchangeable clutch plates/disc; as well as CB50, and C50. The clutch plates and clutch discs of C70, C75 and JH70 are also perfectly interchangeable.

H.2. Suzuki Family

The clutch plates, and discs of A100, AX100, and MAX100 are perfectly interchangeable. A50 and K90 have interchangeable clutch plates and disc; as well as K125, B200.

H.3. Kawasaki Family

The clutch plates and disc of KH100, ELX100, KC100 and GTO125 are perfectly interchangeable.

H.4. Yamaha Family

The clutch plates and clutch disc of YB80, and YB100 are interchangeable. Mate: M50, M80 and M90 have perfectly interchangeable clutch plates and clutch disc.

I. GEAR TRAIN

I.1. Honda Family

CG125 and CGL125 have perfectly interchangeable gear system, but vary to great extent with CGL150. The gear trains of CD100, and CD110; CB50, and C50; and C70, C75, and JH70 are perfectly interchangeable.

I.2. Suzuki Family

The gear trains of A100 despite its selection methods are interchangeable with AX100, and MAX100. A50, and K90 gear trains are interchangeable; as well as K125, and B200.

I.3. Kawasaki Family

KH100, ELX100, and KC100 have perfectly interchangeable gear trains.

I.4. Yamaha Family

There is perfect interchangeability of the gear trains of YB80, and YB100; Mate: M50, M80, and M90 are also interchangeable.

V. CONCLUSION

Models and wide range of spare parts to be stocked is experienced from different product of Yamaha motor cycle because of the un-interchangeability of parts/ components of different models. Suzuki and Honda motor cycle families are regarded as the mechanic's favorite because of their wide range of parts interchangeability and parts simplicity. The possibility of interchangeability between models of motor cycles is a strong factor that has helped the success of Suzuki and Honda in Nigeria. Thus any motor cycle manufacturer wishing to make strong hold of market in Nigeria must first consider wide range of parts interchangeability to compete with the existing brands, the cost of spare parts of new model in terms of maintenance and part procurement. It also aid high commercial use of these motor cycles with high interchangeabilities for fleet operations (within local areas). Hence decision on which model, brand or type of motor cycle to purchase is also made simple. Therefore this result tends to suggest for universal motor cycles with un-restricted part interchangeability.

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