

## **HALT! WHO GOES THERE?**

Identifying your engine and frame the correct and easy way.

Since it goes without saying that the proper and **correct** identification of your bike is important for a number of purposes----first and foremost, so that you can order the correct parts for it! But equally important is making sure that your title is correctly identifying your bike for registration, title, and licensing purposes, as well as for insurance registration purposes, etc.

Our **STRONGEST** advice is to not rely on the information on your title, bill of sale, insurance documents, state registration certificates, what the former owner claimed, or any other **PIECE OF PAPER**-----always go "right to the horse's mouth"----or in this case, your bike's frame and engine case, and absolutely verify **100%** what bike you actually have! You would be quite surprised how many people we come across who are ordering parts, for example, for a 1981 model XJ-whatever because that's what it was sold to them as (or titled as), when in reality they have a 1982 model! **YOUR FRAME AND ENGINE ID NUMBERS ALWAYS SPEAKS THE REAL TRUTH!** Some typed-up piece of paper from a government or insurance company clerk does not always fall into that same category of certainty!

**ALSO:** verify that the engine in your bike is the original engine! Since many of the XJ-series engines are physically interchangeable with each other, you never know what's been done over the years as far as engine-swapping is concerned! Rings and pistons from a 650 model engine are **NOT** going to fit a 750 engine, even if the 750 engine is installed in an XJ650 frame!!! So please---spend the 90 seconds or so necessary to determine whether the engine is original to the bike, and if not, what year/make/model bike the engine came from. The procedure for doing this is described completely (and in agonizing detail) at:

<http://www.xjbikes.com/forums/threads/tech-topic-model-id-and-vins.14577>

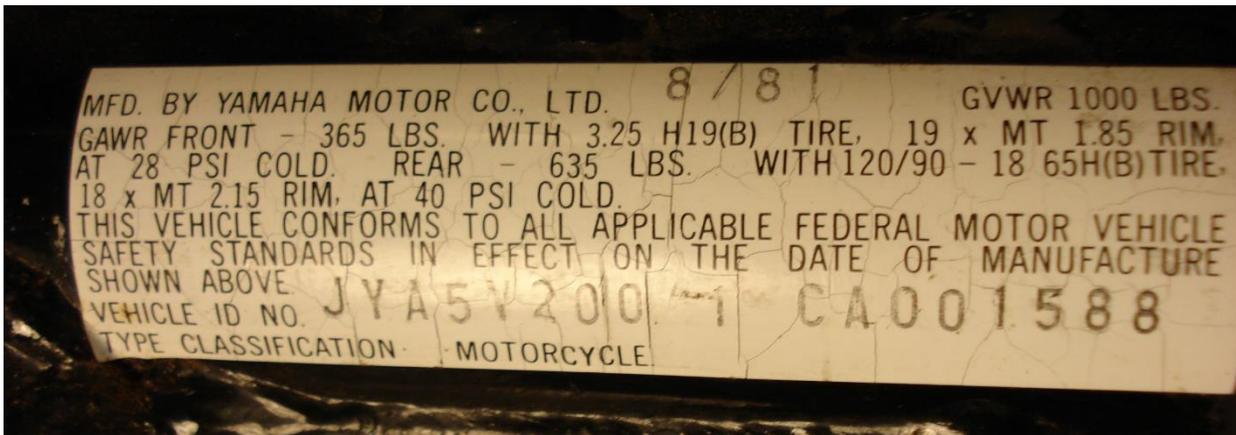
By the way, the information contained within this document and at the link above to the "model ID and vins" can sometimes be **VERY USEFUL** when you go to apply for a title in your state, since some states or inspection agencies are in **NO WAY FAMILIAR** with the concept of the "**shorty VIN**" which is stamped on the frame tube on most 1980-81 models.....and neither have they ever seen a vehicle without any VIN decal, nor without a full 17-position VIN number.

In fact, if you have recently purchased a 1980-81 bike and are going to have it "inspected" (basically, to try and determine whether it's a stolen vehicle) before having it titled in your name, we suggest that you print out both this document **AND** the article at the above link and take them with you when you go to the inspection and/or the title agency, as it may save you hours of grief and wasted time.

After all, if your local governmental agency isn't fully aware of the peculiarities and realities of these early bikes, well then, you'll certainly need to be!

For visual reference, here is what you are specifically looking for:

## VIN decal:



This vinyl sticker will be found on the left side (or, on some models, directly in the center, facing almost straight forward) of the steering bearing “headpipe” or “frame vertical tube” behind your headlight housing. This decal measures about 1-1/2” x 4” and is located vertically on the headpipe (in other words, you have to rotate your head 90-degrees to read it). So in the above image the left side of the image would be “up” or at the top of the headpipe.

Besides the typically boiler-plate wording, you will find two important pieces of information on this decal:

1) the **BUILD DATE** of your bike, in the format of MM/YY, such as 10/81 for an October, 1981 assembled bike. Note that since the “1982” model year bikes start showing up in Yamaha showrooms around September of 1981, that a build date of 10/81 means that it is a 1982 model-year bike (in fact, a build date on around 05/XX or 06/XX almost always translates to an XX+1 model-year bike (e.g. 05/81 or 06/81 = a 1982 model year bike, and 1982 model year bikes were also made all the way thru 04/82 or even the early part of 05/82).

2) the full 17-position **VIN** (“Vehicle Identification Number”) for your bike. This code *always* starts with the letters “JYA”, and then the next 3 positions are the **Model ID Code** for your bike.....i.e. what model your bike really is.

In the image above, we see the decal from a 1982 XJ650RJ Seca (USA) with VIN JYA5V2001CA001588 and a build date of 08/81. Note that the **August 1981** build date corresponds to a **1982** model year bike, as outlined previously.

Again, for a more complete and excruciatingly detailed breakdown of the full VIN, go visit the link above.

**NOTE:** if your VIN decal is missing or worn/torn, there are other ways to identify your bike:



## Engine ID:



On the upper engine case, just behind or just beside the clutch cover on the right side of the engine, you will find a small, flat “ribbed” (to prevent re-stamping) machined pad that faces up (towards the sky).

This pad has stamped into it the **MODEL ID CODE** and the **SERIAL NUMBER** of the bike into which this engine was originally installed into. In the example photographed here, the Model ID Code is (5N8) and the Serial Number is (004386). This engine came out of a 1982 XJ650 Maxim (USA), and it's full VIN was JYA5N8000CA004386.

The water-cooled XJ700-X and XJ750-X have this same pad, but it is located a little further “inward” on the engine case (it is **behind**, rather than “outside” of the clutch cable holder bracket as on XJ650, XJ700 air-cooled, XJ750 air-cooled, XJ900, and XJ1100 models).

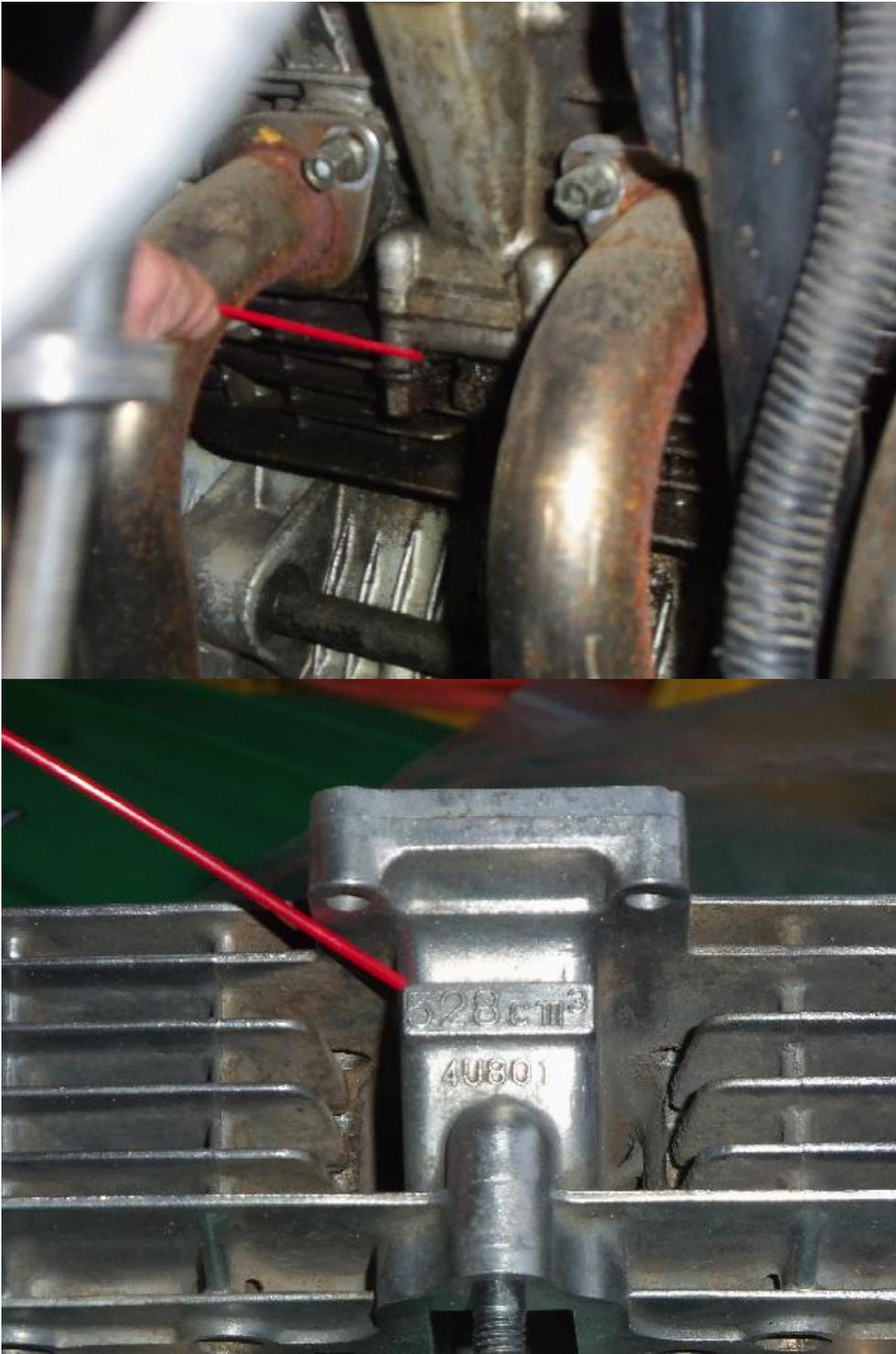


XJ550 engines have the same machined pad, but it runs side-to-side on the engine case:

This engine came in a 1982 XJ550 Maxim USE (5k5) and the Serial Number is (029359).

One final issue: all factory replacement engine cases (or complete engines), supplied and/or purchased over-the-counter at a Yamaha dealership, will not have **ANY** id number stamped into this engine ID area, so unless you can somehow prove that a new replacement engine or upper crankcase section was purchased or used (sales receipt, title notation, etc.), then expect lots of fun-and-games when you try to title such a bike!

Engine (cylinders) Size Casting:



On the cylinder **JUGS**, forward side, at the top of the jugs (just below the cylinder head/cylinder jugs mating surface) you will find the **ENGINE SIZE** casting. Note that these cast engine “sizes” are the actual true engine displacement, rather than the “model name” (i.e. “XJ550”) displacements:

XJ550 engines = 528cc

FJ600 engines = 598cc  
XJ650 engines = 653cc  
XJ700 engines - 696cc (air-cooled) or 697cc (water-cooled)  
XJ750 engines = 748cc (air-cooled) or 749cc (water cooled)  
XJ900 engines = 853cc (1983-84)  
XJ900 engines = 891cc (1985-up)  
XJ1100 engines = 1101cc

Also note that on the cylinder, it will actually show, in example, 528cm<sup>3</sup>, which stands for 528 “centimeters cubed”, which is the same as the notation 528cc, since “cc” is an abbreviation for “cubic centimeters”, and “centimeters cubed” and “cubic centimeters” are thus equivalent measurements.

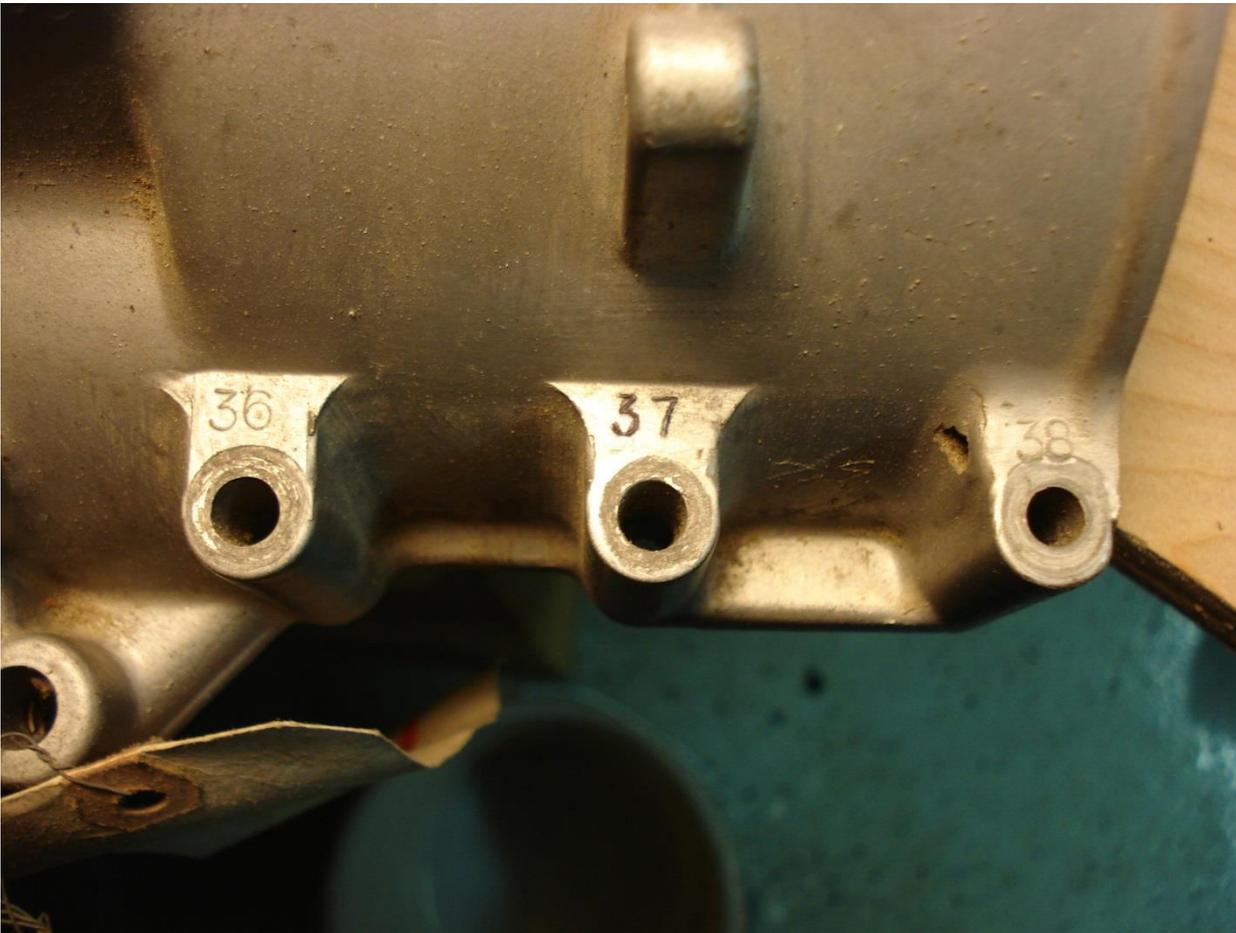
### Engine Oil Capacity Casting:



This measurement is cast into the engine **CLUTCH COVER**, just next to the oil filler thumbscrew. This is actually the **oil change volume**, and does **not** include the additional 0.5 - 1.0 liter (or so) amount included in the oil filter housing, oil cooler system (on bikes so equipped), or in the middle gear “sump”. Yes, that’s confusing! But this amount (2500cm<sup>3</sup> for the 650cc - 900cc engines) is the amount of oil you drain / add back in when doing an oil change but **without** changing the oil filter nor draining the middle gear “sump”.

**NOTE:** Each 1000cm<sup>3</sup> = 1 Liter = a little more than 1 quart. So in this example, 2500cc = 2.5 liters = about 2.75 quarts.

## Crankcase Bolt Tightening Sequence:



All over the upper and lower crankcase sections, you will find small cast numbers that range from 1-39 (actually, different number ranges on different engine styles; we're using the 650 - 900cc engines for this example). These numbers are always just beside a drilled passage hole in the case, and these bolt holes are all for the fasteners (bolts) that secure the upper crankcase section to the lower section.

These numbers indicate the **tightening sequence** (and loosening sequence, too) of the bolts as you cinch the two crankcase halves together. As always, make sure run through this sequence twice when tightening; once until each fastener is snug, and then to their final torque. Refer to your service or workshop manual for torque values and any other information regarding proper procedures about this subject.

Crankcase Main Bearing Sizes:



We've often noted that one of the secrets to the success of these Yamaha engines is that they were assembled with a sophisticated level of quality and tolerance control, and in essence are just short of being a truly "blueprinted" assembly.

An example of this are the **main bearing size** guides that are scratched (by hand) into each crankcase, on the upper surface, on the rounded “arch” section of the case just behind the starter motor opening (facing the rear). These bearing size markings, individual for each engine, allow for the proper selection of engine main bearings (and more).

First of all, these numbers may be hard to read. These seem to have been “scratched” into the engine case with a pick or an awl, and the “penmanship” of these scratchings can be modest (at best).

Next, be aware that these numbers are meant to be read from the front of the engine, as if you were leaning over the cylinder head and facing towards the rear of the engine. If you try to read the numbers from the rear of the engine, they are upside down (or simply look like unintelligible scribbles).

Read from the proper point of view, the line of 5 numbers represent the main bearing saddle sizes for that particular engine case.

These numbers, when used with the crankshaft journal size numbers (below), allow you to determine the correct main crankshaft bearings sizes used in that particular engine.

By the way, the “bottom” 2 sets of 2 numbers --- “40” and “46” in the above example --- are the codes used for calculating the thickness of the shims used with the middle gear drive shaft of each particular engine.

### **Crankshaft Main Bearing Sizes:**



On the left side of the crankshaft, on the large flat counterweight, you'll find two sets of stamped numbers:

a) 5 position **main journal size** guide numbers.

b) 4 position **rod journal size** guide numbers. These rod journal size numbers are used in conjunction with the **ink stamping** on the rod side-beam to determine each rod's correct bearing size.



Keep in mind that Yamaha uses a somewhat convoluted bearing "color" designation for bearing size selection.

To calculate the crankshaft bearing sizes to use in a particular engine, you will go through the following process:

- the correct main journal bearing selection is made by subtracting the crankshaft journal number from the engine case main bearing saddle size number, for each main bearing journal position.
- the correct rod journal bearing selection is made by subtracting the crankshaft journal size number from the rod size number, for each rod/crank journal position.

For both the crank main journal bearings and the rod bearings, you will then use the numbers calculated above to realize a "bearing color" as outlined in the chart below. You would then order the correct "color" bearing for each crankshaft main journal or connecting rod big-end position:

**Bearing "Color Codes":**

- #1 = Blue
- #2 = Black
- #3 = Brown
- #4 = Green
- #5 = Yellow

A good visual of the color marking on each bearing shell can be seen here:



### Example:

- Crankshaft is marked 21222 1111
- Engine case is marked 56545 40 46 (note that these last 2 sets of 2 numbers --- '40' and '46' in this example --- are codes used for calculating the thickness of the shims used with the middle gear drive shaft)
- Rods (1 thru 4) are marked 4, 4, 3, and 4

The first set of 5 numbers on the crankshaft (21222) are the main bearing journal sizes for that crankshaft, and are sequentially #1 to #5 as read. The corresponding 5 numbers scratched onto the engine case (56545) are the main journal saddle sizes for that engine **and are sequentially #5 to #1 as read**. For the #1 main journal position (the far left position), we would have 5 (on the engine case) - 2 (on the crankshaft) = 3. The #1 main journal bearing is a "size" 3, which is a "brown" bearing.

**NOTE THAT THE HAND-SCRAWLED NUMBERS ON THE CRANKCASE READS JOURNALS #5 TO #1** as you read them left-to-right, and thus in a 5/4/3/2/1 sequence for the main journal bearing sizes! They are actually "backwards" from an intuitive approach (and "backwards" from the sequence they are coded onto the crank itself), but are "correct" in spatial orientation and sequence for the top crankcase half (since they are scrawled "reverse" in relation to the crankshaft position within the crankcase).

For the #1 con-rod, using the example above, you would use the 2nd set of numbers on the crankshaft (1111), and the ink-stamped number on the rod itself. So the #1 rod is stamped as 4, and the #1 crank rod journal is 1, and  $4 - 1 = 3$ . Thus the #1 rod will use a "size" 3 connecting rod bearing, which is a "brown" bearing.

Notice that it is **NOT** unusual for a single crankshaft to use a variety of different "size" or "color" bearings in each journal position.

**NOTE:** the yellow "size" bearings are used only for crankshaft main journal bearings. Rod bearings were never made nor available in the yellow "size".

Finally, as long as we are discussing bearings, there are two other issues that you should be aware of in regards to crank and rod bearings:

1) there are two different styles of rod BEAM bearing shells, because there are two different styles of rods: those **with** and those **without** an oil spray passage hole:



The oil spray passage hole allows pressurized oil to be sprayed onto the cylinder walls, aiding lubrication of that area.



Obviously, rods which have the oil spray hole **MUST** use the bearing shell that has the spray hole passage hole in it:



2) there are two different types of crankshaft main journal bearings: those **with** and **without** oil passage holes:

The **lower** crankcase bearing shell must **always** use the bearing shell type **with** the oil passage holes, as the crank journals are lubricated via oil passages in the lower crankcase bearing saddles.

The **upper** crankcase bearing shell may be of either type (holed or hole-less) as there are no oil passages in the upper crankcase bearing saddles.

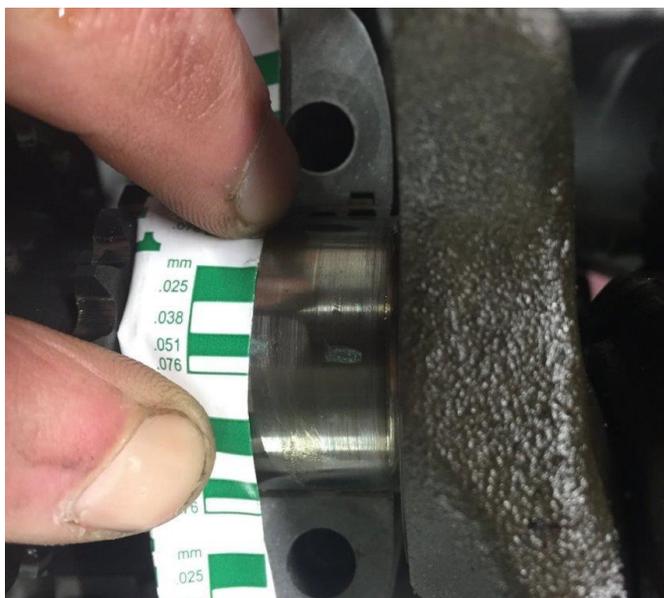
Originally, it appears that Yamaha serviced the bearings as a matched set of a single “holed” and a single “hole-less” version, so that when you ordered a set of main journal bearings from the parts department, you received a set (2) of bearing shells, which had to be fitted in their proper upper or lower position. Sometime later on, you could only get the “holed” version, which could be fitted into either position. Note, however, that the holed version serves real no purpose in the upper position, and the (approximately) 1/5 (20%) less bearing surface area in the “holed” version results in a reduction in bearing performance.

I'd guess that customers (or service departments) were possibly reversing the positions of the bearings when servicing or rebuilding engines --- putting the hole-less versions in the lower crankcase saddles, thus cutting off oil supply to the crankshaft! --- and thus the way to prevent this situation from occurring was, of course, to offer **ONLY** the holed type of bearings.

Don't you make this same mistake!

Rod and crank bearing clearances should be checked with a “plastigauge” type material, and actual clearance measured should be compared against allowable clearances as shown in the factory service manual for your engine:

<http://www.xjbikes.com/forums/threads/complete-xj650-rebuild.81981/page-2#post-498539>



IN ALL CASES YOU SHOULD REFER TO A FACTORY SERVICE MANUAL OR A SKILLED, EXPERIENCED MACHINIST AS TO HOW AND WHAT SIZE ENGINE BEARINGS THAT NEED TO BE PURCHASED AND USED DURING AN ENGINE REBUILD! **DO NOT PURCHASE ENGINE MAIN OR ROD BEARINGS BASED ON THE "NUMBERS" ALONE----**ALWAYS PLAN YOUR ENGINE REBUILD PARTS NEEDED ONLY AFTER ENGINE DIS-ASSEMBLY, PARTS MEASUREMENT, AND CONSULTATION WITH A MACHINIST.