

This document is a review of the various options for people experimenting with the sub 250cc Honda 2 valve single overhead cam, single cylinder upright engines with built in gearbox, such as TL125, XL125, XR125 and CB125. This information may also be useful to the various Chinese clone engine builders.

The original motivation was to build an XR200 engine in the UK, as this engine is hard to find here. However, anyone building these engines for competitions, such as Trials, Road Race or just off roading in general, may find it useful.

The document began in 2002, but I have long since stopped developing these engines so can only offer general advice - all the information I have is in this document, and I have already forgotten most of it.

You are encouraged to make a small donation if you find this useful, especially if you are making money from this information, like the guy who asked me about the Yamaha pistons.

There is also a memorial on this site for Hoyt, since it was Hoyt's website that got me interested in the prospect of modifying Honda single engines.

I never met Hoyt and only communicated by emails, but the internet and world will be a less rich place now he is gone.

If you see any obvious mistakes or can add useful information, let me know and I will credit you.

Whatever you glean from this article, make sure you are working within the spirit of your local club. If the rules say pre 1985 equipment and parts, they mean it. Although you may *get away with* using later parts inside the engine, it's hardly cricket.

Thanks must go to David Chinn, Al Johnston, Trevor Hughes, Clint Wilson, Rusty P., Mike Claybrook, 'Two Stroke Eddie', 'The Phantom', Alan Barnes, Jeff in France, Tony Brooks and Doug Simpson (in no particular order) for helping provide content for this article.

Finally, I have to say that any errors are accidental and I cannot be held responsible for anything as a result of reading this internet web page.

Synopsis

In the the 2-valve XR200 engine was never officially imported (AFAIK). This is unfortunate, since the forgiving characteristics of XR200 engine (Compared to two strokes), and relative power, made it very popular in the both for novices and, with several tuning options, for the more advanced riders.

This document details several options available to an engine builder wishing to achieve similar performance

This text is also of (lesser) use to people such as ATV and Trail/Trial riders, wishing to extract the maximum performance (both torque or power) from their Honda, such as ATC200, TL125 etc, for all kinds of racing - one of my favourites is [Australian Bucket racing](#).

Introduction

The Honda XR200 engine has been in production for many years, basically in two forms:- the 2-valve engine, which follows the standard vertical cylinder engine format, and the RFVC four valve engine. The 4-valve engine was only produced for two years and can have reliability issues, and is not discussed further.

The 2 valve XR can trace its history back to before the 1980s, which is when the split head vertical Honda singles began to appear, themselves based on the one piece head designs which appeared in the early 1970's. The XR200 appears to be a development of the 125 and 185 series engines, simply (if you are a manufacturer) by boring, stroking and changing head and cam specs.

XR200 Specs

The 200cc capacity is on the upper bound of the Honda small engine vertical cylinder format. The basic specs are shown below along with some other members of the same family.

| | CB100N | XL125S | XL185S | XR185A ^s | XR200 | TLR200R | CRF230F# |
|-----------------------|--------|-------------|--------------|---------------------|------------|--------------|--------------|
| Bore | 50.5 | 56.5 | 63 | 63 | 65.5 | 65.5 | 65.5 |
| Stroke | 49.6 | 49.5 | 57.8 | 57.8 | 57.8 | 57.8 | 66.2 |
| Capacity,cc | 99.35 | 124.11 | 180.18 | 180.18 | 194.76 | 194.76 | 223.06 |
| Wrist Pin, mm | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| CR | 9 | 9.4 | 9.2 | 10 | 10 | 9 | 9 |
| Power, bhp/rpm | | 9.7 9500 | 14.3 8000 | 18 9000 | 19 9000 | 11.8 6500 | 18.4 8000 |

| | | | | | | | |
|--------------------------|-------|----------------|----------------|---------------|----------------|----------------|----------------|
| Torque, lb-ft | | 7.09 8000 | 10.34 6500 | 11.49 7500 | 11.51 7500 | 11.6 4000 | 13.87 6000 |
| Carb bore, mm | 22 | 22 | 22 | 24 | 26 | 22 | 28 |
| Primary reduction | 4.055 | 21/70 3.333 | 21/70 3.333 | 3.333 | 21/70 3.333 | 21/70 3.333 | 22/68 3.091 |
| 1st Gear | 2.769 | 3.083 | 2.769 | 3.083 | 2.769 | 2.769 | 2.769 |
| 2nd Gear | 1.882 | 1.941 | 1.722 | 1.941 | 1.941 | 2.062 | 1.941 |
| 3rd Gear | 1.450 | 1.400 | 1.272 | 1.450 | 1.450 | 1.5 | 1.45 |
| 4th Gear | 1.173 | 1.130 | 1.000 | 1.130 | 1.130 | 1.13 | 1.148 |
| 5th Gear | 1.00 | 0.923 | 0.777 | 0.923 | 0.923 | 0.923 | 0.960 |
| 6th Gear | - | 0.785 | - | 0.785 | 0.785 | 0.785 | 0.812 |

§ Thanks to Trevor Hughes - XR185/200A Twin Shock. Note XR200A has XR200 Top End, XR185A Gearbox.

Thanks to Darrin Mark & [Honda EU](http://HondaEU.com)

Notice that the 185 and the 200 engines use the same stroke. There is more commonality between these engines, as we shall see further.

All these engines use a 15mm wrist pin - earlier models of the CB100, one-piece head (possibly K) may have used a 14mm pin, and care must be taken when mixing pistons.

Cosmetically/practically, the 100 does not have the castings for an exhaust decompressor, as the crankcase does not have a bulge at the rear of the RHS crankcase, and the head does not have the decompressor linkage and internals. The 125 engines I worked on have a casting bulge and blanked off cover.

The 122cc engines (which *may* have one piece heads), also lack the decompressor

The TLR200R engine I owned had a short [camshaft](#) than the other engines, since it used an electric ignition, not points, and therefore did not need bob-weight points and points carrier.

However, these engines have a cam cover that supports or covers the left hand end of the cam, which is interchangeable. But, bob-weight points do not fit the short TL cam.

The Table below shows Honda Part numbers for the heads, valves and cams.

| | CB100N | XL125S | XL125R& | XL185 | XR200 | TLR200R | CRF230F |
|------------------------------|---------------|---------------|--------------------|---------------|---------------|----------------|----------------|
| Inlet Valve | 14711-107-020 | 14711-437-000 | | 14711-437-000 | 14711-437-000 | 14711-KY2-000 | |
| Diameter,mm | 27* | 30 | | 30 | 30 | 27* | |
| Exhaust Valve | 14721-107-010 | 14721-437-000 | | 14721-437-000 | 14721-437-000 | 14721-KY2-000 | |
| Diameter,mm | 21* | 25 | | 25 | 25 | 20.5* | |
| Cam | 14101-383-000 | 14101-437-000 | 14101-KB9-000 | 14101-437-000 | 14101-446-000 | 14101-KJ2-000 | 14100-kps-900@ |
| Inlet Valve Open | 5 BTDC | 10 BTDC | 5 BTDC | 10 BTDC | 15 BTDC | 0 BTDC% | 10 BTDC# |
| Inlet Valve Closes | 35 ATDC | 40 ABDC | 30 ABDC | 40 ABDC | 45 ABDC | 30 ABDC% | 40 ABDC# |
| Exhaust Valve Opens | 30 BBDC | 40 BBDC | 35 BBDC | 40 BBDC | 45 BBDC | 35 BBDC% | 35 BBDC# |
| Exhaust Valve Closes | 5 ATDC | 10 ATDC | 5 ATDC | 10 ATDC | 15 ATDC | 0 ATDC% | 10 ATDC# |
| Inlet Lobe Height | 31.75§ | 31.7 | | 31.7 | 31.91* | 31.07* | |
| Exhaust Lobe height | 30.99§ | 31.3 | | 31.3 | 31.57* | 30.67* | |
| Inlet Lobe base dia | | | | | 25.1* | 25.04* | |
| Exhaust lobe base dia | | | | | 25.0* | 25.17* | |
| RH journal | | 19.97 | | 19.97 | 19.97 | 19.9* | |

| | | | | | | | |
|-------------------|--|-------|--|-------|-------|--------|--|
| LH journal | | 33.96 | | 33.96 | 33.96 | 33.95* | |
|-------------------|--|-------|--|-------|-------|--------|--|

* - Measured by Me \$ - Thanks Al Johnston & - Thanks Trevor Hughes @ - Thanks Bill Todd

% - Thanks David Chinn @ 1mm Lift (shop manual) # - Darrin Mark, CRF Shop Manual @ 1mm Lift

It can be seen the XL125S, XL185 and XR200 use the same [valves](#), which means they may also use the same [head](#) with the 125 using the non-decompressor cam cover (not available separately).

The TLR200 engine has substantially more finning than the other, with smaller ports, and the valves are marked specifically for the TLR200, whereas the CB100 engine uses valves also installed into the TL125 (78-79), CB125S (75-79), SL125 (76-78) i.e. 122cc engines.

Additionally, the 437 series of valves were also used on the CB125RS, ATC185-200 engines, and the TL200 76-78. The CB100 head is the only engine mentioned in the table that does not use a bush in the head.

The XL125S and 185 both use the same cam, whereas the CB100, XR200 and TLR200 use cams designed for that relevant engine. However, the cam journals are the same size and the lobe heights are similar, permitting cams to be swapped between heads to select the desired tune. For example, the TL cam fitted an old CB100 head I have in my garage.

The TL200 and XR200 engine uses a flat-topped piston with a large squish area. The XL185 uses a slightly dished piston, whereas the CB100 uses a slightly domed piston. A useful list of Honda part numbers for these and other engines is available [here](#), which can be analysed to further understand these engines for the careful reader.

Any errors are accidental, and I would appreciate feedback if you spot them.

Implimentation

To develop a high power engine, the following sections must be considered.

Following the sound advice from the [TL125 Big bore Page](#) by Mark Worsfold, a builder can use the XL185 engine as a basis. The XL125S gearbox (6 speed) is most easily available in the UK (though getting scarce) and fits into the 185 cases. The 125 cases require the crankcase mouth to be bored out for the 200cc cylinder spigot, but this intrudes into the cylinder head oilway.

One option is to weld up the oilway and use an external oilway to the head - ideal for a cylinder head oil cooler.

More details and further excellent advice on reboring and relining 125 cylinders is available from given by Al Johnston available from the TL125 link above.

An XR200 cam and piston can then be fitted to the 185 engine with 6 speed box, using an XL125 or XL185 head depending if a decompressor is required.

Many builders people do not bother with the decompressor on such a small engine. My experience found that the cheap pattern kickstart lever kept bending when the decompressor was not used.

That is it, 6 speed XR200 Look-a-like in the UK.

If you want to get a ready made bottom end, a British Breaker who advertises in the back of [Trials and Motocross News](#) imports Honda TLR200s from Japan and breaks them. You could buy a complete bottom end from them, fit an XR200 or GL145 head (see below) and carb, and off you go. However, I was charged GBP£90 for a TLR200 alternator, so a complete bottom end will not be cheap.

Elleston-Breakers are/were on 0188-959-0186, UK.

Cases/Gearbox

There are several real options. Theoretically, the 57.8mm stroke crank of the XL185 and XR200 should fit the CB100N cases the crankwheel diameter is the same at about 111mm and the bearings are the same, but have not checked yet. However, a 185 Barrel spigot does not fit. The cylinder stud spacing is identical on all these engines, but the studs are different lengths, so 185/200 studs would be required.

Two Stroke Eddie reports that the XL125R and S (six speed remember), takes the XL185/200 barrel spigot directly, confirmed by David Chinn. Eddie preferred the shorter 125's 49.5mm stroke for a quick revving engine. The XL125S and R already have a 6-speed gearbox, but I don't think it is possible to fit a 6-speed gearbox to the CB100N.

If using the XL185 bottom end, then the 6 speed XL125S fits the cases described elsewhere.

David Chinn, investigated fitting the first gear of the XL125S into his TLR200, since it is lower. However, it seems the width across the gears of the two assembled gear clusters is different, as the table shows (provided by David).

| Width, mm (inches) | 125 | 200 |
|------------------------------|--------------------|---------------------|
| Mainshaft (Input) | 96.6978mm / 3.807" | 101.8794mm / 4.011" |
| Countershaft (Output) | 96.266mm / 3.790" | 100.33mm / 3.950" |

This ties in with other reports from Mark Worsfold and Trevor Hughes it seems the 5 speed XL185 cases will accept the narrower 6 speed XL125 gears, but the gears from the 200 engines (the TLR uses the XR200 gear shafts – confirmed since the TLR200 has 446 on the shift forks) will not fit the 185 or 125 cases. If you have a 200 Engine such as a TL/R or XR, then you already have 6 speeds, and do not have to worry.

Several people have whined to me that a TLR engine is not suitable for road use since it has a close ratio trail gearbox, but this is untrue - they may be confused with the TL125 which really has. The TLR200 has more of a trail gearbox and would be fine for green-laning and road use, but not short powerband road-racer (Australian Bucket) use.

Mike Claybrook reports that in his experience, the bottom end is the same between the 185 and the 200, whereas David found the opposite. I think this could be because of differences due to locale - Mike Claybrook is in the UK, whereas David Chinn is in the US. It is therefore essential to thoroughly inspect both halves of the crankcase you are planning to use. On both (XR and TLR) my 200cc engines, the right hand crankcase had 437 cast into the right hand case at the front next to the mounting bolt holes, and 446 cast into the left hand case at the rear.

I believe (but haven't checked) that the 185 used 437 cases for both the left and right halves, which is why they accept the 6 speed xl125 gearbox. If your cases have 446 cast, then you don't have a lot to worry about anyway since you have a 57.8mm stroke crank with a 6 speed gearbox. If your cases say 437, then you should be able to fit the XL185 crank.

The CB100 uses 8mm mountings, whereas the 185 and 200 use 10mm mountings. Reaming the frame out is an option, but care must be taken, and the decompressor bulge must also be accommodated. Al Johnson recommend making a cardboard template which can then be used to modify the frame - saves grinding away too much then regretting it (as I did).

Crank

Options are limited for stock 57.8mm stroke cranks, and more so for oversize/long stroke cranks.

Stock Honda 200cc 57.8mm Stroke Cranks

The 57.8mm stroke crank of the 200 engine is relatively difficult to obtain in the UK. The only Honda engine which uses this crank is the scarce XL185 crank.

However, the Cranks seem to be made from the same blank for the CB100, XL185, XL125 etc so it should theoretically be possible to use the same stroking principle discussed on the [TL125 Big bore](#) to stroke a 49.5mm throw crank.

In the UK, the second option is to use the TL/R200 crank, which is even more difficult to find. However, the TLR200 has a heavier flywheel than the XL185/125/200, and the flywheel Taper is also larger on the TLR. This makes generator options more limited as discussed below. Additionally, the heavier TLR200 crank is therefore less suited to a fast revving engine. It would of course be ideal for a trials engine.

Also, check the TLR200 and XR200 LHS crank (main) bearings, as there seems to be some confusions as to whether the XR and TLR use the same left hand crank bearing.

I know from experience that the TLR200R and XR200 crank and cases are interchangeable, and may be mixed and matched - the TLR200 cases are stamped with 446 which is the XR200 ID number.

Honda 62.2mm Stroke Crank

The [Honda CTX200 Bushlander](#) has a long stroke [62.2mm crank](#) default, and is also electric start. This is an 'agricultural' machine, so is not high performance, with 5 gears. However, it looks very interesting, and should be followed up further...

Stroked Standard Cranks

A stroker crank is a crank where the centre point of the big end pin has been moved further out from the centre of the crank. [Powrol](#) have a good overview [Booklet](#). [Powroll](#) still/used to offer stroked cranks on an exchange basis, but are expensive, and you obviously need a crank to exchange in the first place.

One problem with the stroked cranks is to ensure that the top hat bush, as seen on the [TL125 Stroke pager](#) does not break out from the crank web. Also, any throw increase must be checked for clearance against the gears in the 446 engines I have looked at, there isn't much room between the crank outer edge and the gear clusters.

If you don't like the top hat bush option, then consider the Offset crankpin approach. [MB Developments](#) near Doncaster did [this](#) work to a Gilera 2 stroke scooter engine, which uses the same principle on pressed together cranks, including the TL/XR.

Things to consider when using offset pins are that the stroke increase is relatively small, since the offset must be small enough to allow the bearing and one piece conrod to be fitted - split conrod big ends would permit a larger offset, but these require shell bearings, which in turn require high oil pump pressure, not to mention custom rods. [Falcon](#) can manufacture custom rods \$100 (in 2003).

Spinning of the offset pin can also be a problem - oversizing the pin by 0.0001" is one possible solution, but this makes assembling and truing a pressed up crank more difficult, and can crack the crank web during assembly.

I prefer TIG welding the crank pin in place, but this makes rebuilding the crank more difficult as the weld must be ground out.

I think this is generally why top hat bushes, described above, are preferred.

Apparently, [Powroll](#) can 'Shrink' the con rod when using stroker cranks. They do this by pinning the top and bottom of the rod into a press and heating it until cherry red, then apply downward force with the press. It actually causes a bulge in the rod! I don't like this for two reasons - the rod is forged during manufacture, which increases rigidity and tensile strength by developing a layer of compacted metal crystals near the surface, which is better for hardening, and it sounds like this process will destroy this surface hardening.

Secondly, the piston skirt must be cut away excessively, which reduces the life of the piston by both wear and also encourages piston rock.

Another option for 66.2mm cranks exists, to be discussed below.

Clint Wilson has experimented with a 6mm stroker crank on an XR200. In addition, he has experimented with a 3mm longer con rod from a TRX 4 wheeler on Stock Stroke for Trials engines - he says it makes a smoother power delivery. I feel it is also a good idea to use a longer rod on stroker cranks for two reasons, makes the engine less choppy for trials work (by restoring to some extent the stroke/rod length ratio) and reduces the amount of piston skirt needed to be removed (flycut) so the piston clears the crankwheels at BDC. If you are really interested in this stuff, you can look at the piston acceleration program in my programs page, which looks at the effect of acceleration on piston velocity when changing stroke and rod length. An interesting article on this theory is available at http://e30m3performance.com/tech_articles/engine-tech/rod-ratio . Clint says he would offer this kind of service to whoever is interested - email him on bianese@aol.com if interested.

It is conceivable that if you were to fit a longer rod, it may be possible to find one with a larger small end eye, which can then be bushed back to size, assuming you are using a Honda dimensioned piston, to fit the 15mm wrist pin. The phosphor bronze bush would then reduce the likelihood of the small end seizing at high revs, which is a weakness on these engines. In addition, a rod could be found which possesses a smaller big end eye, which when used with a smaller pin could allow a stroke increase without breaking out of the flywheel. [Here](#) is a drawing that tries to explain these points, but I'm no AutoCad expert, so it looks crude. Again, [Falicon](#) or Hoyt or [Belfab](#) could make a conrod for you if you really wanted one. If the conrod small end eye was slightly larger, then pistons with 16mm wrist pins could be used along with a small end needle roller. This will be discussed in the piston section.

[The Phantom](#) of the Australian bucket racers made his own high spec alloy con rods with a pressed in hard steel bush for the roller, which is one way but quite specialised. In addition a different piston could be used, but you run into dome and valve cutout problems, so would take a lot of investigation and possible machining.

One thing I haven't found any information on is balancing cranks. Static and balancing is easy, dynamic balancing is not. John Wood gives a description on Dynamic Balancing cranks in his [Two StrokeTuning](#) book that is excellent. I feel this is a big issue when stroking cranks increased vibes fatigue both the rider and the engine!

Other Crank Sources

Since this article was originally Written, Jeff in Frane contacted me about the Shineray/Lifan 200cc engine. This is available in both OHV and OHC form, both electric start, and is 62.3 stroke. Jef fitted the Shineray crank to his XL125S, pictures below:-



The only problem is the alternator taper is a little bit long, due to the electric start I guess. Jeff says this can be trimmed down, and will send more pictures.

And Finally...

Lastly, though obvious, I just thought I'd point this out - when stroking or increasing rod lengths, spacer plates are usually required to restore the piston deck height. As described, above, I feel these are best fitted underneath the cylinder barrel, for reasons discussed below. In addition, cam chains must be lengthened, which is not too difficult for the dedicated. An excellent article in general, but specifically discussing cam chains and barrel spacers, is on the [Army of Darkness FZR400 Campaign](#) website from 1995.

Honda themselves have used different part specs on differing applications. For example, one CB100N engine I had had a conrod marked 383, with a 36mm big end ID. 383 is the designation for CB125J whereas another engine had a conrod marked 437, 38mm big end ID. This is the designation for the XL125S. See [TL125 Website](#) for Part designation info.

Generator

The power system you require depends on your application if you want maximum power, fast revving and are only running for 15 minutes, you could consider using a total loss gel battery system, without a flywheel or stator race CBR600 engines I have seen have the crank shortened so it just pokes out from the bearing crank bearing, but this is extreme. Most people will require at least self-starting capabilities, and probably a brake light. If you only need marker front/rear lights for day or at most dusk work, then 6 volts systems are ample, but do not expect them to run turn signals without the headlamp *blinking* too. However, if you need to run comfortably at night without constant fear of running off a cliff, then 12V, preferably 3 phase systems are essential. This is especially true if you run an electric starter, discussed below.

The smallest system I can imagine would use a CB100N rotor (tiny and lightweight) on an XR200 the rotor fits straight on the crank taper, and the CB100 stator cover fits the cases no problem. The problem is that the XR cases don't have the mountings for the outer

stator ring like the CB100N cases do but they could be easily added more on this when I get time to investigate fully. The CB100 uses a small central rotor and outer stator which looks like it could easily be rewound to 3 phase, or a 3 phase stator from a CB175 used, but I have not checked. Incidentally, 3 phase is the most efficient power generation method.

I suspect the TLR and XL/XR series use separate twin/triple coil systems, with one as the *power* coil and the other as the *lighting* coil, with a battery charging coil possibly. Trevor Hughes modified his XL185 based system for 12V lights. He gives full and comprehensive details [Here](#) and includes [spreadsheet](#) and contact details of a place in the UK who sell the appropriate connectors and wire bits all credit to him for providing this fully working solution.

However, this method is not recommended if you wish to run a halogen bulb, as Halogens require a steady 13.8V for best performance and longevity. I also feel that *burning* power from the alternator with a zener diode is a waste of the energy the engine is creating, which is better used to directing the bike forward. One option could be to look into using a CBR600 regulator (which I believe is a switching regulator) with 3 phase coils, but most people are afraid of electrics.

The XR and TLR engines use an outer flywheel system, with the rotor overlapping the coils, and the central stator mounted on the inside of the alternator cover. Trevor Hughes originally informed me the TLR engine uses larger tapers than the XR series, which I found out for myself later. The TLR also uses a crank mounted ignition pickup, but you can ignore this if you wish to use the conventional cam mounted points or CDI. Additionally, the TLR200 uses a flywheel mounted ignition pickup, and has extra winding on the stator for HV and ignition advance since the centrifugal advance on the cam is not used on this engine.

In the past, I used self advancing points with no real problems on the XR engine. A Table is presented below which summarises this information, including the weight of a few rotors.

| Machine | Rotor Weight | Rotor OD | Rotor ID | Voltage/Power | Notes |
|----------------------|--------------|----------|----------|---------------|----------------------------------|
| XL125R | 1.3kg | | | 12 volt | |
| XL185s | 1.9kg | | | 6 volt | can be modified to 12volt |
| TLR200 Reflex | 2.4kg | 126.8mm | 86mm | 12 volt | must be fitted with TLR200 crank |
| TLR200 | 2.85kg | | | 12 volt | must be fitted with TLR200 crank |
| CB100N | ~0.75kg | 79.5mm | | 6 volt | Fits XR200 crank |

With help from Trevor Hughes.

A trials engine builder looking for extra plonk might also consider a system similar to the [Steady Bolt on Flywheel Weights](#), which look interesting. The XR200 is not listed but you get the idea.

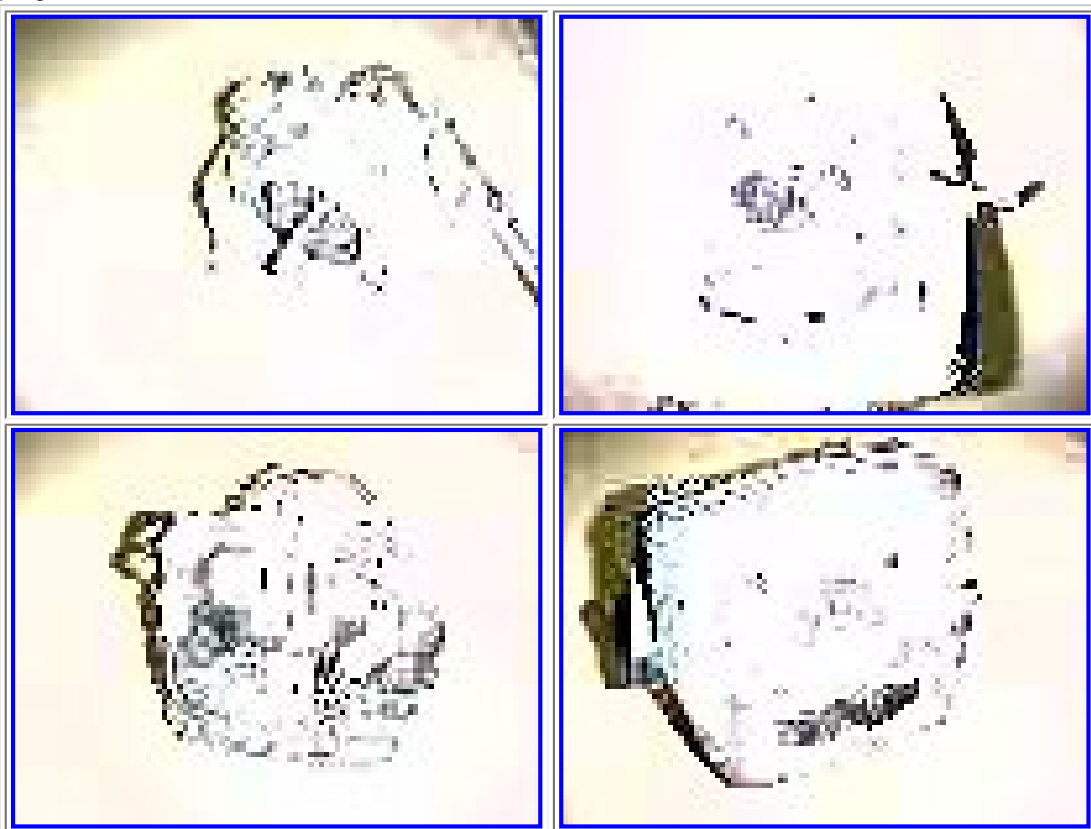
Two Stroke Eddie contacted me and says to use a CB125RS generator system since it has the greatest 12V output power, (but I have no information on flywheel sizes), with a CB250N regulator, which could be a useful solution.

Cylinder Head

XR200 [Heads](#) are not such a great problem - looking at the part numbers provided, the builder can use almost any XL/ XR125/185/200 head throughout the year ranges. It is the cams that are different, discussed below.

For comparison, an XR200 head is shown along with a TL200 Reflex head. Externally, they look identical, apart from the more rounded finning, and the XR200 is usually bare or silver or black, depending on year, the TLR200 is usually black.

Careful inspection shows the TL head uses smaller valves and a radiussed squish area. Also look at the valve separation and spark plug clearance.



As stated, someone wishing to build a trial engine may consider any of the head with small valves in it - I believe the earlier TL125 one piece head had even smaller valves in it, but can't be certain. The only disadvantage in this respect is the TL engines generally have more finning than the road engines. Al Johnson says the ports and Valve sizes for the CB100 are the same for the TL125, but a slight radius must be matched to the piston dome when used on the 56mm bore piston. Apparently, the valves on the One piece heads are even smaller, but I cannot confirm if the head will fit.

One last point - when looking for large capacity increases, the head becomes a restriction, since it isn't designed to work with the new engine capacity. To rectify this, the valves and porting or the cam lift and porting must be changed if you wish to keep peak power in the same place - see the excellent [AOD](#) article mentioned above, read the white paper on Valve lift by me and play with the programs I wrote to investigate this further.

On the subject of Big Valves, Alan Barnes uses a Honda GL145 head, Machine type KC02, model code KG2. He says it fits straight onto the usual studs and has 1 mm bigger valves than the XR200 standard. The GL145 uses points as standard, and Alan said simply machining the cam journal allows you to fit the XR200 CDI system. The GL145 also has a Roller bearing on the chain side of the cam and on the other, so looks good, but doesn't have the decompressor. The GL145 is available in NZ and I'm trying to confirm more details on it.

Clint Wilson says the Honda ATC200X 83-85 head bolts straight on uses the standard stud pattern, and has the best port design of the XR and XL series he has seen. I can confirm that it bolts up, but not sure if it has the best ports.

On the subject of Cams, the Jialing Chinese copy of the XL125, known as the JH125, has a roller bearing on the chain side of the cam.

The CRF230F appears to have a roller bearing cam too, but I have no further information about compatibility with XR200.

Cams

XR200 cams may be obtained from David Silver spares for less than £50. Alternatively, due to the fact that the XR200 is so popular in the US, a used cam may be purchased on E-Bay USA. I purchased one for \$20 plus \$10 postage, but you must keep your eyes open.

David Silver Spares also lists XR200 cams for less than 50 GB pounds.

The *ultimate engine* builder has the option of using performance parts, such as available from [Powroll](#), [MegaCycle](#) or [Hot Cams](#), but getting the cam re-profiled is my preferred options - burnt cams may be obtained from breakers at low cost, hence the cost effectiveness of this method.

Phil Joy of Joy Engineering, who has lots of experience with Honda Singles, can regrind them very reasonably to a profile you suggest or to a profile known to work well. Look [Here](#) for an example of Phil Joy's work.

Phil Joy
 Joy Engineering
 Ryes Lane
 Hatfield Heath
 Nr. Bishop Stortford
 Hertfordshire
 CM22 7BS, UK
 Telephone: 01279 730682
joy@essexcottage.freemove.co.uk
 Website: <http://www.joyengineering.co.uk> - Not working?

From outside UK call +44-1279 730 682. Tony Brooks had a scrap burnt cam reground for 75 British Pounds, which is less than US \$120 and Euro 120, and kindly provided the Contact details.

[Ivan Tighe Engineering](#) sells cams for the Australian Bucket racers, but I dont know anything about them. Also, an Australian firm Waggots also regrind cams, but I have no details.

Finally, the valve lift and flow scenario, mentioned above, must be considered on large capacity engines.

Pistons/Cylinders

You will need a barrel/cylinder. These can be standard 65.5mm bore, to take a stock XR200 piston, or oversize.

Stock Bore

The Table below shows details of a few barrels I measured.

| mm | CB100N | XL185S | TLR200R | XR200 - 82 | XR200 - 96 |
|-------------------------|--------|--------|---------|------------|------------|
| Bore (Spigot ID) | 50.5 | 63 | 65.5 | 65.5 | 65.5 |
| Spigot OD | 58.8 | 69.2 | 69.1 | 69.2 | 69.2 |
| Gasket to Gasket | 67.7 | 74.1 | 74.0 | 74.0 | 74.1 |
| Spigot Length | 25.5 | 32.4 | 32.3 | 32.1 | 32.2 |

Note: All measurements by Me with cheap Vernier Calipers.

Basically, the 185 and 200cc barrel are more or less identical, with only initial bore size differing. Someone in the UK could either use an XL185 and bore it out, or again buy an XR200 cylinder from E-Bay, not forgetting the TL which is more rare than the XL185. Even a heavily worn XL185 barrel will require serious boring for an XR200 Piston, so make sure whoever does the boring knows how to keep everything true and on the centre line of the barrel (some places who bore commuter bikes such as 50cc scooters and the like can be less than rigorous when setting the boring bar up).

[XR200 pistons](#) may be obtained from David Silver (I checked at £33 plus VAT (sales Tax) plus rings and wrist pin). The stock XR200 piston 65.5mm size is relatively rare in the UK - the ATC200 65.0mm piston may be used instead, but I believe the compression ratio is lower (dished crown), as used with the CG125 engine mentioned on the TL125 Big bore page. This would be the best approach for TL engine builders (using either the 125 or 200 crank), since a *low* compression ratio of 8:1 is preferred for trials engines to reduce the risk of stalling at low engine speed. However, we would be more interested in a high compression engine, such as 10.5:1 to get more power up top, so remedial work such as skimming or head reprofiling (or both) would be required for a high performance engine.

The ATC200X 1983 to 1985 barrel can also be used and is highly recommended. This barrel has the largest finning of all the engines I have seen, and would be excellent for a trials bike. This barrel is also best for oversizing with a liner as discussed below.

Oversize

Oversize barrels are designed to take pistons wider than the stock XR200. This is obviously to get a big bore engine. The liner on the stock XR200 is very thin at the bottom, so most people go to relining.

[Mark Worsfold](#) used a novel approach when oversizing a CG125 engine for a TL125. Placing a spacer underneath the top lip of the liner on the top edge of the barrel extended the barrel of the CG125 donor engine, which is only around 50mm stroke standard. Mark used this approach because of the pushrod arrangement used by the CG125 engine, but since the XR200 engine uses a camchain, we can place the spacer underneath the barrel, which I believe is better for heat dissipation, since the cylinder fins are closer to the hot part of the engine.

If you wish to investigate pistons further, Rytech, a Malaysian Piston manufacturer, have allowed me to produce [This](#) page giving piston dimensions in order of bore size and wrist pin size, four strokes first.

Performance pistons, available from [Wiseco](#) or [Powroll](#) may also be used. [Powroll](#) produce a bore in piston of 66mm offering 12:1 compression, with [Wiseco](#) offering 10.25 CR and 4 rebore sizes.

However, these pistons are rather expensive, so a cost conscious builder may opt for the ditch pump engine piston of 67mm, mentioned on the [TL125 page](#), giving a capacity of 203cc when used with the stock crank. The TL125 page says this piston should bore straight into the XL185 barrel, but the compression ratio should be checked and adjusted by skimming where required in the same manner as for the ATC engine. I also feel that there isn't a lot of meat left in the barrels I have seen, since the spigot diameter is only around 69mm. Al Johnston has some cautionary tales at the bottom of the [TL125 page](#) which illustrate my point.

Clint Wilson informed that a 70mm Yamaha piston fits the XR200 (but not which one!). I was worried about oilways and dowels, but he reckons it goes straight in with a new liner

He did not elaborate whether dome or valve cut-outs needed modifying for the XR combustion chamber, but I would assume they would.

However, I found that a 68.5mm Piston from a Yamaha Riva XC200T, 1987 fits nicely. This piston uses a short skirt, low compression height and a 15mm wrist pin. Part numbers are shown below:



| | |
|-----------------|---------------------|
| 1XX-11631-00-A0 | Piston (STD) |
| 1XX-11636-00-00 | Piston (0.50MM O/S) |
| 1XX-11638-00-00 | Piston (1.00MM O/S) |
| 1AA-11610-00-00 | Ring Set (STD) |
| 1AA-11610-20-00 | Ring Set (2ND O/S) |
| 1AA-11610-40-00 | Ring Set (4TH O/S) |
| 25G-11633-00-00 | Piston Pin |
| 93450-16068-00 | Circlip (Get two) |

The pictures above show the Riva piston between an XL185 piston on the left and a TLR200 on the right, with the wrist pin slid

through. The top picture shows the shorter skirt and the lower compression height. This piston would be ideal in a stroker crank of a few mm since that would restore the piston deck height, and flycutting the piston skirt would be reduced or unnecessary. Bill Todd has a Stroked and Bored TLR200 to 250cc using 70mm RTL250 piston and head gasket was used, and he has been kind enough to provide some of the part numbers - currently lost. (Dammit)

Exhausts

The [Oz Bucket Racing Forum](#) gave details for a Megaphone Exhaust - thanks to *The Phantom* for disclosing this info. The important bits are below.

I would advise you to get a header made 36mm inside diameter. The length will determine the shape of the torque curve. Shorter shifts the torque peak up in the rev range. 450mm will give a tuned length for peak torque at 10000 rpm, 500mm is tuned to 9000 rpm. On the end of the header put a megaphone starting at 36mm and expanding to 90mm over a 700mm length. Put a reverse cone on the end 12mm long at 60 degree included angle. It will be LOUD but fast.

The Phantom, Sat Apr 12, 2003 1:56 am, Newcastle, Australia

This gives an exit hole of 78mm. I drew [this](#) Autocad drawing if it is any use.

As for sourcing and locating supplied for custom exhaust development, an interesting website <http://www.headersbyed.com> is useful, informative and sells the required parts if you are in Minneapolis - USA.

Another source for performance exhausts exists from Japan, discussed in the next section.

Further developments

Honda (and other manufacturers) have been slowly dropping their two-stroke range of competition machines for some time, turning in favour to the more eco friendly four stroke engines. The upshot is the release of the [CRF230F enduro/motocross](#) in 2003.

Upon close inspection, the engine looks very similar to the XR200 available more than 22 years ago! Looking at the specs, it seems Honda have been surfing the web, and they too have agreed the way to increase capacity is by stroking, since the engine bore and stroke is now 65.5 by 66.2mm, very similar to the big bore TL engine mentioned earlier.

Clint Wilson has one for his BBR and informed me it is possible to refit the kicker and have both. This prompted me to look further, where I came across the following models; all related to the two-decade XR200 engine: [SL230](#) (released in 1997) [XL230](#) (released in 2002) and [FTR230](#), also released in 2002. The CRF230F does not appear to be a Japanese market model as I cannot find it on the [Honda Japan](#) website.

I think all these engines are electric start, and the FTR and SL230 engines look to have a CV carb fitted as standard, but they can be easily changed if desired, see above.

| Model Name | XR200 | SL230 | FTR223 | XL230 | CRF230F |
|------------------------------|-------------|---|--------------|--------------|--------------|
| ID | | BA-MD33 | BA-MC34 | BA-MC36 | |
| Engine ID & Type | ME09E | MD33E air cooled 4 cycle OHC 2 valve single | | | |
| Displacement, cc | 195 | 223 | | | |
| Bore X Stroke, mm | 65.5x57.8 | 65.5x66.2 | | | |
| Compression ratio | 10 | 9 | | | |
| Max Power Bhp/rpm | 19 / 9000 | 19.73 / 7500 | 18.75 / 7000 | 17.75 / 7000 | 18.4 / 8000 |
| Max torque lbft / rpm | 11.5 / 7500 | 15.5 / 6000 | 15.5 / 6000 | 14 / 6000 | 13.87 / 6000 |
| Carburettor | 26mm Khein | VE3A | VE3DA | PDC7A | 26mm Khein |
| Starting system | Kick | Electric | | | |
| Gearbox | 6 Speed | 6 Speed | 5 Speed | 5 Speed | 6 Speed |
| 1st gear | 2.769 | 3.083 | 2.769 | 2.769 | 2.769 |
| 2nd gear | 1.941 | 2.062 | 1.722 | 1.772 | 1.941 |
| 3rd gear | 1.45 | 1.45 | 1.263 | 1.263 | 1.45 |
| 4th gear | 1.13 | 1.13 | 0.96 | 0.96 | 1.148 |
| 5th Gear | 0.923 | 0.96 | 0.814 | 0.814 | 0.96 |
| 6th Gear | 0.785 | 0.814 | | | 0.812 |
| Primary Reduction | 3.33 | 3.09 | 3.09 | 3.09 | 3.09 |

Clint Wilson told me that the mountings on the CRF230F are the same as the XR200 - he is fitting/fitted one to his BBR XR200. Clint does not think that much of the XR200 is interchangeable with the CRF, but he did let slip that it is possible to fit the SL/XL crank into a TL – removal of 5th gear to clear

the flywheels, and much work/hassle with alternator tapers/flywheels was required however.

As for using the electric start, a quick glance at the left hand side cover shows its probably a bigger job than just swapping covers. I cant tell if it uses a one way clutch on the flywheel, like a CBR6, or a throw-out starter dog like early Aprillia 125s, but I suspect the SL has starter motor mounts on the right hand crankcase half.



Additionally, the cam chain tensioner has a different design bolted to the barrel, like the CBR6, so it would be difficult to retrofit the electric start. Wiseco Already sell a High comp piston for these engines - Part No. [4816M06550](#), 11:1 compression, 65.5mm bore. The *Japanese Tuning* industry is working well. Takegawa have both a CRF [camshaft](#) offer a [67mm bore up kit](#) for the above engines, giving 233cc with the stock 66.2mm stroke, with the compression ratio of 11.4:1 (!).

Interestingly, Takegawa also offered a 170cc big bore kit for the TL125S using a supplied barrel, but is not listed anymore - email them if interested.

[Babyface](#) offer a 4mm over stock to 69.5mm big bore kit, which requires relining, giving 10.5:1 compression and 251cc. It looks good, at 22,500 Yen, (GBP115 plus VAT plus excise duty plus postage), is a little expensive.

I particularly like the Left hand side cover mods, which are common on the FTR223. It would be trivial to do the same thing on the XR200. If the head supply was then blocked off (since the oil passage also feeds the gearbox) and a restrictor was used, an external oil feed to the head could be implemented, which is always one of the worries with the Single Series Honda Engines.



Used spares for these engines are available from Yahoo Auctions Japan via the [OK!Shon Website](#) - they act as intermediaries, re-posting items from Japan to you in your own country, even though the auction seller does not post outside Japan.

See ([SL230 XL230](#)) and ([ftr223 crf230f](#)) Yahoo Auctions Searches.

Hopefully the CRF230F will be available on [Ebay US](#) now.

The range of performance exhausts offered in Japan for the XL, TL and FTR - a simple [Google search](#) reveals many, as does [OK!Shon](#), which may be suitable for XR200 type specials here.

The Japanese websites can be translated using [Babelfish](#).

Further Investigation

PowerSports Pro have recently put the CRF into their database, and Bill Todd also graciously sent over some CRF230F part numbers, below:

| Part No | Description |
|---------------|--------------------|
| 12191-kcn-000 | base gasket |
| 11393-kgg-900 | gasket right cover |
| 14711-kbb-900 | inlet valve |
| 14721-kbb-900 | exhaust valve |
| 14100-kps-900 | camshaft |
| 13101-kfb-750 | piston |

| | |
|---------------|--------------------|
| 91001-kbw-941 | bearing (6207) |
| 91001-kcn-003 | bearing (28x72x18) |
| 23211-kps-900 | mainshaft |
| 23221-kps-900 | countershaft |
| 15100-kps-900 | oil pump |
| 22100-kps-900 | clutch outer |
| 11191-kha-940 | Crankcase gasket |

Looking at the CRF engine pictures, it appears there is little commonality between the young and the old. The parts numbers do not have any recognisable [Honda Model Code](#) part numbers, such as 446 or 383. The cases are different to accept an electric start that sits on top of the cases, underneath the carb next to the barrel, and the camchain tensioner is different.

The Honda RTL250S, pictures [Here](#), [Here](#) and [Here](#). The RTL250S appears to be the same engine, but with a 70 by 64.9 mm bore and stroke. The external oil feed is visible and as the engine is only stroked to 64.9mm shows how close it must come to the gear wheels.

David Chinn and Bill Todd first pointed these machines and the HRC TLR250 out to me. Mike Claybrook also thinks these are worthy of further investigation.

Some of the Honda scooters brought to my attention by [Doug Simpson](#) might also provide donor parts. Finally, the [Honda NX125](#) (introduced in 1998?) engine needs looking at, since it looks to be based on the classic vertical engine style, but revamped with six speed and electric start. The most recent [XL125L](#) looks familiar, but has 5 speeds. These could be good replacements for the XL125s which is hard to come by.

The old part numbers for this article were obtained from <http://www.cmsnl.com>, thanks to them.

CBR125R

The [CBR150RR](#) was introduced to me (by Col from Timebomb) in about 2003, then Honda released the [CBR125R](#) version in the UK. This engine looks very interesting, but purely from a technical point since I doubt it will be backward compatible - electric start, water cooled etc.

The 125 seems to be SOHC but the [150 seems to be DOHC](#). Both have stroke of 47.2mm, 58 bore for the 125cc, 63.5 for the 150cc, water cooled and 6 speed.

Malossi produce a [166cc kit for the 125](#), and there is also a [150cc DOHC for the 125](#). I wonder if this is simply the 150 engine top end...

I am considering buying one of these 125's to play with...

As an aside, [an excellent project](#) was developed by Powroll before Honda started producing the CRF series. Basically, it's a CR80 bottom end with a CBR600 head cleaved into a single cylinder format, then welded up giving a 150cc 4 valve 4 stroke, with a 6 speed transmission, i.e CBR600 divided by four. If you consider the technical problems, such as oil pump, big and little end lubrication, oil filtering, top end and piston lubrication etc, it is very impressive what you can do in a machine shop with a TIG welder and a skilled person at the wheel.

I have briefly discussed with Alan Barnes the Possibility of fitting a 4 valve head on to a 2-valve bottom end. Apart from the hundreds of man hours required for TIG welding and milling, the main problem was thinking of a suitable donor. All we could come up with is a head from VT400 from a horrible custom

thing and a head from an NTV400 Bros, but I think this is water-cooled. Any suggestions gratefully received.

Honda experimented with a 4-Valve XR200 in the mid-eighties, but it was dropped too expensive to produce probably. However, you can probably bet there will be Hondas, Yams and even Suzukis painted lime green with four valve single engines in the near future, as manufacturers shift from horrible smelly noisy two strokes to oil burners. *(Written in late 2002, apparently coming true with CRF250's etc, just wait for the 85cc four valve four strokes, just like the late 1960's Multi valve road racers!*

Written 1stNov 2002

Updated 22ndJuly 2007