**HOW TO MODIFY A DATSUN/NISSAN STEEL CRANK TO FIT A CROSSFLOW**

**By Martin Lucas (NZ)**

I'd like to stress that I do not claim to be an expert - having said that I have modified seventeen cranks to date. Fitting of Datsun cranks into Ford Kent pushrod type engines has been very popular here in New Zealand for a number of years. It has also been done in Australia and South Africa. Bob Homewood told me about this alternative when the crank in my Escort Twin Cam was cracked and all subequent Ford/Lotus cranks I found were cracked too !!. Since then I have modified a number of Datsun crank shafts to suit Lotus Twin Cams, Ford/Cosworth BDAs, and 1600 Ford Crossflows. All L16 and L18 Datsun engines are made from a factory steel forging. I haven't been able to find out what grade of steel it is but it is certainly tough as it gives the cutting tools a very hard time when being machined. These cranks are an inexpensive alternative to the steel cranks sourced from the UK, not as strong ultimately but certainly far stronger than the OE Ford cast iron cranks.

First step is to find a crank. For Ford 1500cc precrossflow blocked engines using standard 72.75mm stroke then a crank from a Datsun 1600 (L16) is required (73.3mm stroke). For Ford 1600 crossflow engines using a standard stroke of 77.62mm then a crank from a Datsun 180B (L18) is required (78.00mm stroke). A Datsun 200B 2lt (L20B) can be made to fit into a Ford 1600 crossflow blocked DOHC engine such as the Twin Cam or BDA. The longer stroke crank (86mm) requires a lot more machining. Also the block requires a lot of machining to allow clearance for the crank and rods. I am lead to believe that to get the L20 crank to fit Isuzu Gemini rods are used. I am unsure of what pistons are used. Rod to stroke ratio is important so the longer the rod with the L20 the better..

Why do it? - Is it economical for you?, or worth the bother?. For me the Dasun crank provides an affordable steel crank compared to the more expensive purpose made UK cranks. Access to the necessary machinery to modify the crank keeps costs down. I only pay for grinding and balancing Datsun cranks do have different counterbalancing compared to the Ford and Lotus items. Miles Wilkin's quotes BRM as having modified standard cranks by adding more counter balance weight. This is a topic in itself. Personally I think the OE Ford and Lotus cast iron cranks are built to light with a flywheel that is far too heavy (standard Ford 1600 Xflow flywheel weighs 10kg). I believe the heavy flywheel on the light crank causes them to crack. Having said this it could be argued that the Datsun crank is overweighted. For this reason I feel happy to machine down the counter weights to reduce the Datsun cranks' mass.

What has to be done to make it fit? If you lay the Datsun crank next to the Ford it will be self evident. The front snout has to be machined down, and cut back. The overall web diameter has to be reduced to aid clearance in the block. The rear flywheel mounting flange is shortened and the spigot bearing hole bored out to suit the Ford bearing. The webs and counter-balances will need to be slimmed down, and some chamfered. As the Main and Big Ends are larger these can be ground back to suit standard Ford bearing sizes and strokes. Don't forget to have the all important fillet radii preserved when the crank is ground. The keyway for the front pulley can be milled in. The Datsun crank is a 5 bolt not 6 like a Ford. You can make a flywheel to adapt the Ford clutch plate and starter ring gear to fit the Datsun crank. This isn't hard. A medium tensile steel (EN8) or a high tensile steel (EN25) can be used. Or try modifying the Datsun flywheel. I have always made a flywheel as I prefer this solution. Also I can safely make a light weight flywheel with a steel blank. Samples shown .

The photo above shows five different types of crank shaft.
**Far Left:** Standard OE Lotus Twin Cam cast iron crank (72.7mm stroke)
**Second from Left:** Datsun L18 fully counterbalanced crank modified to suit 1600 Crossflow.
**Centre:** Datsun L18 fully counterballanced crank modified to Suit Ford/Cosworth BDA.
**Second from Right:** Datsun L18 fully counterbalanced crank prior to machining.
**Far Left:** Datsun L18 partly counterballanced crank prior to machining.

The photo above shows a more detailed view of the differences between the partly and the fully counter balanced Datsun L18 crankshafts.

The photo above shows roughly where the crank will need to be machined. The pens are pointing to areas that will need to be machined.

The photo above shows the modifying of a Datsun crankshaft - in this case a L16.

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The photo above shows the modifying of a Datsun crankshaft - in this case a L16. The rear of the crank is machined as per the Ford crankshaft.

The photo above shows the modifying of a Datsun crankshaft - in this case a L16. The webs are machined to clear the webs in the Ford cylinder block.


The photo above shows a flywheel made to suit both the 5 bolt Datsun crank, and the Ford Lotus Twin Cam 8.5" clutch. In order to reduce weight five 20mm holes were drilled near the centre, and segments were milled at the periphery of the flywheel. Total weight is around 5.75Kg. EN8 medium tensile steel was used.


The photo above shows a L18 fully counter weighted crank set up for a Lotus Twin Cam. The flywheel has been made from EN25, and mates to a Tilton single plate competition clutch. The front of the crank has been machined to suit the Twin Cam sprocket and pulley.

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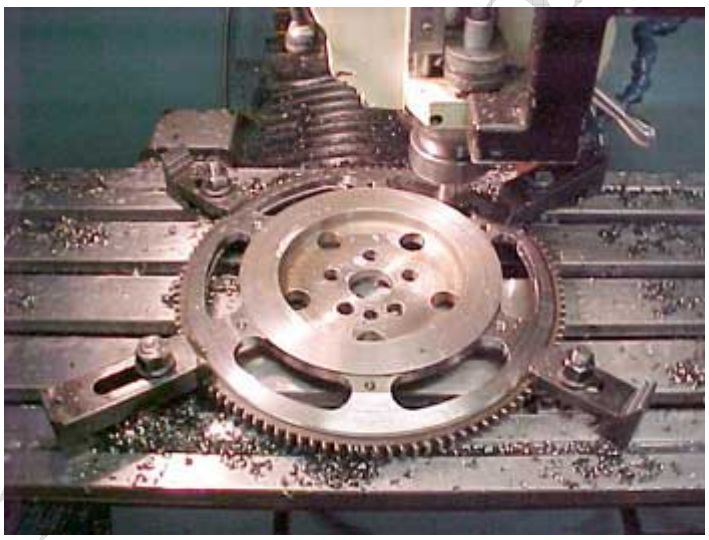
The photo above shows two types of flywheel I have made to suit the Datsun crank. The flywheels with the six radial slots are for a 7.25" sintered racing clutch. The flywheel weighed in at 4.1Kg including ring gear and was machined from EN25 - a high tensile alloy steel. The other flywheel has been made for a 7.5" OE type Ford clutch (Formula Ford competition will be used). It was made from 4140 high tensile steel and weighed in at 4.3kg including ring gear.



The photo above shows the milling of the six radial slots for the 7.25" sintered racing clutch style flywheel. The flywheel weighed in at 4.1Kg including ring gear and was machined from EN25 - a high tensile alloy steel. I machined in the slots in order to reduce its weight as the slots saved 0.8Kg. Also the removal of mass on the outer diameter is to reduce the flywheels Rotational Moment of Inertia.

The photo below shows the CNC milling of the six radial slots

*A big "Thanks" goes out to Martin Lucas in New Zealand for this feature!*

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**The issue from a Lotus point of view!**

Rebuild Using a Modified Datsun Crankshaft.

The engine rebuild from hell! The most likely reasons why a Datsun crankshaft would be used instead of the original Lotus cast iron crank are:

The original cast iron crankshaft is cracked, and a suitable replacement can not be found. The Datsun crank is steel, utilising this crank results in the obvious advantage of the increased strength of a steel crank versus cast iron. This conversion is a lot cheaper than a 'genuine' steel Twin Cam crank from Lotus. Whatever the reason for using a Datsun crank the procedure is the same. For this scenario it is assumed that the conversion is necessary because the original crank shaft was cracked and a suitable replacement could not be found. It is also assumed that the engine is fully stripped down.

Once it has been determined that a Datsun Crank is to be used, one of the first steps is to locate a suitable one. For a Lotus Twin Cam 1558cc, 'L' block, a Datsun 1600 crank shaft is required. Although not confirmed, the Datsun 1800 crank maybe suitable for the longer stroke of the Ford Kent 1600 engines. Your budget and access to resources/machinery will influence the final cost for the Datsun crankshaft modification. A point to remember here is

of course the more you can do your self, the less the final bill will be. The simplest way to get the crank shaft is to ring wreckers, use the yellow pages and start at the first ad. There will be two prices for the crank, depending on who removes it. You can save money by removing the crank yourself. As a rough guide $60 - $100 if you remove the crank, $120 - $150 if the wreckers do it.

Datsun Crank Modifications.
Now you have your Datsun crank lay it along side the Lotus crank, here you will see what needs to be done. Access to a suitable Lathe will help save costs. If not find a friend who does, otherwise be prepared to pay up to $40/hour for a machinist to do the necessary work. The front nose for the spigot and sprocket is longer and of a larger diameter, this needs to be turned down as per the Lotus. Don't forget to drill and tap the nose for the Imperial bolt that holds the pulley on, or mill the keyway to locate the chain sprocket. Next step is to machine down all the counter-balances. The crank to block clearances are different for the Lotus block, so not only will the diameter need to be changed but also some counter-balances need to have their respective corners chamfered to avoid block casting protrusions. Do not be concerned about where the big end journals are relative to the Lotus crank. There is sufficient side ways clearance for the Lotus conrod to move along the Piston gudgeon pin. The mains are another story, these need to be widened, use the middle main (number three) as your datum. The rear flange (where the flywheel is bolted to may also require machining. Choices are make a phosphor bronze spigot bush, or machine the crank to accept a Ford needle roller spigot bearing. Also the Datsun rear flywheel mounting flange is slightly longer than the Lotus. Again options are to machine it back as per the Lotus, or since a new flywheel is required machine the required offset into the new flywheel. Having only machined one crankshaft, after work, learning as I went, the above took about twenty hours. Should I do another I am confident it could be done in eight hours. An experienced machinist should be able to do it in a similar time.

Now the crank is turned down it can be ground to size. Be aware that this will not be cheap as a lot of material must be ground away. Take the original crank along as well so bearing sizes and fillet radii can be checked and reproduced. It is recommended to get the crank ground to standard size and use new standard size mains and big end bearings. Thus as the crank wears undersized bearings can be used, extending the life of the Datsun Crank Shaft. When the Datsun crank is finished check its fit and rotational clearance in the block. If all is okay it can now be balanced.

Flywheel
A new flywheel is needed as the Datsun crank has a five bolt flywheel mounting pattern, whereas the Lotus has a six bolt pattern.

For the slight increase in material cost it is well worth while specifying a medium tensile steel (1040), or if you want extreme strength, a high tensile such as 4340 would be more than adequate. Mild steel may have the strength but a tensile steel gives a safety factor as well as the bonus of producing better surface finish when machined. This is what you want of course for the clutch face.

The dimensions for the flywheel are the same as the original, changes are required if the crank rear flange has not been machined down, don't forget the five bolt pattern. The starter ring gear is open to choice, since tensile steels can be hardened the new flywheel can be made with teeth machined in to it, or a groove as per the original can be reproduced, and a Lotus Ring Gear heat shrunk on. It would make sense to change the clutch cover mounting bolts from 5/16" UNC to 5/16" UNF. Since tensile steel has a greater strength than cast iron it can be drilled and tapped to suit a fine thread. A UNF bolt will be slightly stronger than a UNC as its thread is not as coarse (deep). This allows a greater hold down force to be obtained from the same tightening torque setting.

A final point to note is that steel has a slightly greater density than cast iron. Put simply for the same shape/size a steel part will weigh more than a cast iron one. If you make the steel flywheel identical to the cast iron version then it will be heavier. A heavier flywheel will reduce an engines ability to accelerate (rev). All is not lost though. Because you specified a tensile steel it is safe to have it 'lightened'. The main point to remember here is that when lightening flywheels the most important weight to get rid of is the mass furthest away from the centre, as it is this material that affects the Rotational Moment of Inertia. In other words take two flywheels, each weighing 5Kgs. One has 4Kgs on the outer circumference, this will be harder for an engine to spin compared to the other 5Kg flywheel with 4Kgs on the centre. And don't get too carried away with lightening the centre, this has to keep everything together.

You should expect to pay around $60 - $80 for the steel, if you can not machine the flywheel yourself then a machinist may charge in the region of $250 - $300.

When you have all the parts finished and in your garage, don't forget a trial assembly. Assemble with pistons and rods, again check every thing turns over, and piston to deck height is satisfactory. The pistons should be .005 to .010" under the block face (or more considering Unleaded 96). The pistons tops may need to be machined if there is insufficient deck height. don't forget piston cutouts for the valves, and a trial assembly (with gasket) should give a minimum valve-piston clearance of 2.5mm (0.10 inch). Use plasticine to check.

Approximate Costs. (NZ $)

| | Description DIY | Outside Vendor |
|---|---|---|
| Datsun Crank | 60.00 | 120.00 |
| Machine modifications to crank | 0.00 | 400.00 |
| Crank Grinding | 250.00 | 250.00 |
| Steel for Flywheel | 80.00 | 80.00 |
| Flywheel Complete Machined | 0.00 | 250.00 |
| Totals | 390.00 | 1,100.00 |

Either way the above still works out cheaper than a 'genuine' steel crank supplied from overseas (can cost as much as $3,000.00).