Lotus Twincam Engines

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Topic: Block Specs (1 of 34), Read 207 times
Conf: Lotus Twincam Engines
From: George Katselis (george.katselis@dsto.defence.gov.au)
Date: Monday, August 27, 2001 12:07 PM

Hi Frank,
Is the manual you refer the original Ford Factory manual, because if not I have it and I can check things in there if you like. Also there was a excellent book a few years ago (and I think it has since been reprinted as a 2nd ed.) on Lotus TC motors. As usual I lent it out to someone and they never returned it. Also, does anyone know whats the expected output of a 1600 x-flow with Datsun internals /Twin cam headed engine running 45's ? Could one get a streetable and reliable 155-160hp?
George

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Topic: Block Specs (2 of 34), Read 201 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Monday, August 27, 2001 09:38 PM

I'm in the process of building up a twin cam of similar spec, except I'm using the 'L' block . Datsun L18 crank, Datsun L18 130mm rods with 9mm ARP bolts, 85mm pistons, L1 cams, 45 carbs. From memory the inlet valves are 40.4, and the exhaust are 35mm approx. I'm not brave enough to estimate a power figure, maybe in the region you are talking. I'm fitting a competition clutch (car is for competition) so unsure of what the engine would be like on the street.

The only books I have found on the Twin Cam are David Vizards old paperback, and Miles Wilkins hard back book. Miles Wilkins doesn't go into engine mods.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (3 of 34), Read 200 times
Conf: Lotus Twincam Engines
From: George Katselis (george.katselis@dsto.defence.gov.au)
Date: Tuesday, August 28, 2001 09:34 AM

Hi Martin,
Is the book you are referring to (not the vizard one) a large hard cover one
that was around $70 a few years ago? I think I can find the details of the
one I am referring to tonight.
George

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Topic: Block Specs (4 of 34), Read 185 times
Conf: Lotus Twincam Engines
From: Frank Harris (frankh@brivis.com.au)
Date: Tuesday, August 28, 2001 10:49 PM

Martin,
Your engine spec sounds about what I'm looking for.
If you're using the 130 mm rods c.f. 121.9 rods as standard, wont the gudgeon
pin be high in the piston. (You'd end up with a compression height of 39 -
9.1 = 29.9mm? to the center of the gudgeon pin)
Due to this wouldn't the 711 block be better, although you may not get your
85mm pistons in, but you could then go to 133 mm rods and a compression
height of approx 39.6
cheers
Frank

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Topic: Block Specs (5 of 34), Read 182 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Wednesday, August 29, 2001 10:57 PM

Hi Frank,

Your comments about the gudgeon pin are correct. It gets a bit worse, I
intend to use the L18 crank with 78mm stroke. The L block I have has been
running an 85mm bore. Unfortunately a previous owner has modified the rod
widths to the point where I don't feel comfortable. My solutions are, find
another set of 121.9mm Lotus Rods, get a set of steel rods, fit x-flow 125.25
rods and get new pistons made. I decided to fit x-flow rods and get new

pistons made, then I decided if I was to do this then why not go the whole
hog - go Datsun L18. I'll need a set of pistons with a compression height in
the region of 28mm. I feel comfortable with this as the guy who supplies
them reckons it isn't a problem, he also felt my choice was safe. Engine
guru man Lynn Rogers agreed so that was good enough for me.

It appears that a 711M block is not safe to bore to 85mm. Also I'd need to
make up a front spacer. The use of an 'L' block allows me to put my hand on
my heart and say 'of course its a 1558cc' ;-) . I'm building a replica Lotus
23B so I did want to try and retain the 'L' block for emotional reasons.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (6 of 34), Read 177 times
Conf: Lotus Twincam Engines
From: Scott Waldron (scott77_nz@yahoo.com)
Date: Thursday, August 30, 2001 09:26 AM

Hi Martin
Have you had bad experiences with the standard crank??
Guys who build competitive twinks down here, go the other way, standard crank, custom rods forged pistons etc.
I know of at least 3 guys who go as far as 85mm on the bore, with there x-flow blocked twink.
Its a matter of spending the insurance money on sonic testing, to see if
85mm is possible.
Scott

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Topic: Block Specs (7 of 34), Read 171 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Thursday, August 30, 2001 09:55 PM

Hi Scott,

Just to clarify any confusion, the bottom end I have is a 'L' block. This is
a Ford 1500 pre-crossflow block cast for Lotus with thicker cylinder walls. A
crossflow block will be either a 691, or 711M. These are 1/2" taller than

the 1500/'L' block. Also from what I have read, and been told, x-flow blocks
can generally only be bored to 84mm max safely. That is unless you have a
ready supply of x-flow blocks and have the luxury of getting them all tested
to see which should stand up to a 85mm bore.

The 'L' block I have was purchased already bored to 85mm from Bob Homewood.
As you say they can be ultrasonically tested, as was this block. There are a
number of twin cams running on x-flow blocks up here too. But I have decided
to stay with the 'L' block as it is already bored to what I want. The 78mm
crank will give me a 1770cc capacity. Furthermore I prefer a 'L' block for
the car I'm building (Lotus 23B), which gave the Lotus Twin cam its very
first competition outing - many years before the xflow.

I'm not really a fan of the standard Lotus Twin cam cast iron crank (72.7mm
stroke). The standard Lotus crank has different counterbalances to the 1500
precrossflow crank, and a shorter stroke compared to the 1600 crossflow. The
original crank in my Escort was found to be cracked, five others that I
later found were cracked too. Now I'm a fan of the Datsun conversion.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (8 of 34), Read 167 times
Conf: Lotus Twincam Engines
From: Daniel Wright (dan_005@hotmail.com)
Date: Friday, August 31, 2001 11:25 AM

Isn't it possible to get 1900cc out of a 1500 block??
Dan

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Topic: Block Specs (9 of 34), Read 162 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Friday, August 31, 2001 05:12 PM

There is the odd 'L" block that will accept an 87mm bore. Using a 1600 xflow
stroke crank you will get around 1846cc. It depends on the block. Ford
tested and graded every 'L' block for Lotus. From memory they are marked up
LA , LAA, Or LAB. This is an indication of cylinder wall thickness.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (10 of 34), Read 162 times
Conf: Lotus Twincam Engines
From: Scott Waldron (scott77_nz@yahoo.com)
Date: Saturday, September 01, 2001 08:20 AM

I don't know the exact cc but I know a guy..... that got approx.
2000cc out
of there pre-xflow.
It was done by major overbore by the use of cylinder sleeves and a
unknown
standard crank which he wont tell me.
Scott

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Topic: Block Specs (11 of 34), Read 153 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Saturday, September 01, 2001 07:45 PM

There are that many permutations that anything is possible. There are
precrossflow built on 711M blocks up here, Twin Cams built on AX
blocks.
crossflow running stroked Farndon cranks. There are a couple of Twin
Cams
running 86mm Datsun 2lt cranks.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (12 of 34), Read 147 times
Conf: Lotus Twincam Engines
From: Ashley McDermott (mcdermid@ihug.com.au)
Date: Sunday, September 02, 2001 06:14 PM

Martin,
are you familiar with what sort of power/torque these engines are
making?
Just wondering if engines with stroked cranks and shorter rods(more
capacity) are going faster or making more power than engines using
standard
spec cranks and longer rods? (able to rev a lot harder I would expect)
I like the idea of getting more capacity however the longer stroke and
shorter rods are starting to look a bit ugly.
what are the Farndon cranks like? cheaper than a Datsun conversion?
I guess engines with the longer rods are more reliable in the long run?

Ash.

Topic: Block Specs (13 of 34), Read 141 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Monday, September 03, 2001 01:20 PM

Hello Ashley,

I'm no expert but I've certainly being forming some theories and opinions lately. Some of which I'm sure will differ to many on this web board.

Farndon cranks are purpose made steel cranks made in the UK. No they aren't cheap. Especially with the exchange rate. Don't quote me but I think some of the Farndon cranks are available with 82 or 84mm strokes. I haven't really spent the time to make it all work (costs too much money) but I'm pretty sure a 2lt Datsun crank will fit and work in a 1600 crossflow block. The problem is the stroke is that great that the rod start to strike the camshaft. This can be remedied in a T/C or BDA but not a pushrod. In all honesty I think unless the person using a 2lt crank is prepared to buy some special 138 to 140mm rods and pistons to suit then the engine maybe a bit of a dog. Better to get a shorter stroke big bore engine to work properly.

The problem I believe is that whilst 1600 711m blocks initially have bigger capacities than a 'L' block the 711M is a bit dodgey on anything bigger than a 84mm bore. A 77.62 crank will fit into a 'L' block, but rods are a problem. Reusing standard twin cam rods gives a horifically low rod to stroke ratio. Now I know there are those who are trying longer rods. I have been informed that for the Twin Cams and the BDA that 1.71 rod to stroke ratio is ideal. As one guy said 'Cosworth spent a lot of time developing the 133mm rod - there's a damn good reason why'. The standard 1600 xflow with standard rods has a rod/stroke ratio of 1.61 , Cosworth rod 1600 crank has a rod ratio of 1.71. Lotus rod and lotus crank has a rod/stroke ratio of 1.68 . The lotus twin cam has a better rod to stroke ratio than the xflow 1600.
Running a Datsun L18 crank with 130mm rods (9mm bolts) gives a rod ratio of 1.66 . Marginally less than the standard t/c, yet a lot superior to the standard 1600 xflow. This combination will fit into a 'L' block if you fit

special pistons. Special custom made forged pistons are of similar price to
of the shelf 'standard' forged pistons.

My latest theories on Rod to stroke ratio start getting a bit long. I'm thinking that you have to look at the whole picture. Port size, valve size,
bore to stroke ratio, cam timing. A short rod will snap the piston over TDC
and BDC. This will help with keeping the velocity of the inlet charge up,
given that at 7000rpm the inlet valve is only open for around 0.007 of a
second with a 290 degree cam. With this in mind I believe that smaller ports
maybe the way to go as Bernoulli's theorem of flow through a venturi states
that velocity increases/pressure drops through a venturi. Which is in effect
what an inlet tract is. So if you can get the velocity up the momentum of
the inlet charge must be greater.

Longer rods will have less side loads, but a slower TDC acceleration. Yes
there is lower piston wear with longer rods, but wear has never been a factor in race engines as such.

As I said earlier, I'm no expert but I'm slowly starting to form ideas, especially when I hear that Brian Hart, Keith Duckworth and Eric Broad were
all fans of small ports and other similar strange theories.

Martin Lucas.
http://www.geocities.com/marty7_nz/index.html

Topic: Block Specs (14 of 34), Read 135 times
Conf: Lotus Twincam Engines
From: Ashley McDermid (mcdermid@ihug.com.au)
Date: Tuesday, September 04, 2001 03:13 PM

Hi Martin
Thanks for the detailed reply, it was an interesting read.
Are there any dyno figures available for some of the engines you mentioned?
it would be interesting to see what comes out on top for power and for torque.

I'm particularly interested in alternative rebuilds for a 1600 x/flow. My
engine runs fine at the moment, but in a few years I'm going to want to build a pretty good bottom end that will work a bit better than using just
standard parts. An increase in cc's sounds good but it may end up being just

that little bit too expensive. A shorter stroke and bigger bore sounds better with longer rods but getting some pistons to suit might be the hard
bit, especially with a highlight cam.

So what is your current thinking on your theories? larger stroke, more cc's
OR shorter stroke but better rod to stroke ratio? or somewhere in between?

when you say Brian Hart, Keith Duckworth and Eric Broad are fans of small
ports etc, was that with the use of a long duration cam to squeeze out more
power higher in the rev range? and still try to keep a bit of torque? are there any other sources of information on this or similar subjects?

thanks again
Ashley.

Topic: Block Specs (15 of 34), Read 130 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Tuesday, September 04, 2001 06:06 PM

Just wish to stress again - I'm no expert. With your xflow I'd be thinking
fitness for purpose. Is it going to be a road engine, club car, of competition. This will indicate a possible direction. Of course budget is
very important.

Power is a factor of torque and engine speed. If you want more power spin
the engine faster. Torque is what makes you move. I think there is more to
it than making a flippant comment like "big bore, short stroke is best".
Again I think you need to look at the engine as a whole package. A short
stroke engine will be easier to rev to a higher limit. But Torque is a function of stroke so you will sacrifice some torque. A big bore will help
un-shroud the valves and as a result let you run bigger valves. A longer
stroke will help develop more torque, but max revs will be less. However
inlet charge velocities will be higher. Win on one hand, lose on the other.

If I could get my hands on the necessary bits for a xflow I'd fit a Datsun
L18 crank, the 133mm Datsun rods with 9mm bolts, a light weight steel flywheel, and flat top pistons. If I could get my hands on a good South

African AX block I use this as a base and bore the hell out of it. I think
86mm is possible from the right block. I'd cheat with the head and take it
to Lynn Rogers and have him make up one of his spacer plates that provides a
chamber, instead of chambering the head and losing the inner radii on the
ports. I'd also be a Pratt and try and get it to work on a single downdraught
- a 32/36dcd Weber - just to be different. I've seen a similar set up in a
non legal classic Formula Ford that was pulling away from other Single
seaters with twin 45 webs. I'm not really all that hot on Cam technology.
It would be best talking to those in the know. Having had a very enjoyable
discussion with Danny Mishock I think there is still a lot I've got to
learn. A bit of experimentation with some of the more modern grinds maybe
very fruitful.

If I had the cash available I'd love to set one up one fuel injection. But
at this stage dreams are free. I'll stick with what I have got and can
afford.

I don't have any Dyno data on different engine specs. Bob Homewood in
Pukekohe would be able to ball park power figures. But as with most
professionals he is always busy and very hard to tie down to quietly discuss
different ideas and theories - Time is money.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

Topic: Block Specs (16 of 34), Read 131 times
Conf: Lotus Twincam Engines
From: Scott Waldron (scott77_nz@yahoo.com)
Date: Tuesday, September 04, 2001 06:30 PM

Hi Martin,
How does your twink compare to the green Cossack mk1 twink. The one with
bubble arched flares, I’m pretty sure its home to up north. Anyway it came
down for the PDL, just interested.
As for a south African Ax block, I have one just don’t look on the rHS and
you'll be fine.
Cheers
Scott

Topic: Block Specs (17 of 34), Read 133 times
 Conf: Lotus Twincam Engines
 From: Martin Lucas (marty7@ihug.co.nz)
 Date: Wednesday, September 05, 2001 07:15 AM

Hi Scott,

The engine in my Escort Twin Cam isn't anything special. I built it as a
Road/club car. The problem is now I want it to go quicker I need to do a
lot of mods. Having owned a Lotus Seven I have always said that it is
certainly more of a challenge stopping an Escort and getting it go around a
corner compared to a car that really does handle. For this reason I am now
concentrating on a purpose built circuit car. It's weight is about half that
of an Escort. The car was originally a widened single seater. Having driven
a friends single seater briefly I felt far more comfortable at speed and
the braking/cornering performance is in a different league to an Escort. The
much modified Twin Cam is destinted for this car.

Did you knock a hole in the side of the AX block ? How badly damaged is it ?
Do you still have it?

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (18 of 34), Read 135 times
 Conf: Lotus Twincam Engines
 From: Scott Waldron (scott77_nz@yahoo.com)
 Date: Wednesday, September 05, 2001 10:50 AM

Its not my twink that keeps on failing just a close friends. But yes there
is a rather large hole in the side complements of a 180b rod(sorry if I
have lowered your confidence in these rods). Its shagged as believe me if
it was anywhere near repairable it would have been fix.
It was offered to me, due of the amount of help I gave the guy trying to get
his lotus Cortina ready for PDL, but it was all to no avail.
At the time I just thought the block was just some fancy named south African
piece of s**t, so I told him I did not want it.
You seem to be keen on your single seaters, I’m led to believe that there is
a green Lola chassied (4age powered) competing at manfield.
Who knows you may have even raced him with your 7???.

Cheers
Scott

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Topic: Block Specs (19 of 34), Read 136 times
Conf: Lotus Twincam Engines
From: Danny Mischok (dmischok@bigpond.com.)
Date: Wednesday, September 05, 2001 05:52 PM

No, but I'll see if the owner has.
Scott

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Topic: Block Specs (21 of 34), Read 117 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Friday, September 07, 2001 07:09 PM

Hi Scott,

Sorry no, don't know the guy. I never raced my Seven, only club days. I have
had a shift in focus as a friend very kindly offered a drive in his single
seater when it was finished. It took a number of months for a day to allow
it, but what fun. There is something about driving a car that really does
wind up, and then can be stopped easily. I still enjoy the Escort - great
fun. I just can not bring myself to start hacking it about.

Aren't you located in Christchurch ? If so I hope to be down that way in a
couple of weeks.
Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Block Specs (22 of 34), Read 102 times
Conf: Lotus Twincam Engines
From: Scott Waldron (scott77_nz@yahoo.com)
Date: Tuesday, September 18, 2001 07:11 PM

Ashley,

Basically for power, you want the shortest stroke for a given displacement.
The equation for power can be reduced to:

Power = A Constant / Stroke,

So shorter you make the stroke, more scope for power. Because as you can see

from the equation, smaller the stroke, greater the power ends up.

I am no expert here, but see if this helps.

On most engines, limiting factor on flow is the valve opening area. Port
becomes the limiting factor only at very high lifts, where the cam spends
minimal time. Hence a larger port only helps you for a short period.

Larger the port, slower the velocity of the intake charge, hence reduced
pressure charging in the port (its the pressure charging that allows engines
to exceed 100% volumetric efficiency). However, faster the intake charge,
more choking takes place in the port. Once the intake charge velocity
reaches speed of sound (340 meters/second or 1 Mach or 1224 kph), the flow
will be totally choked, and you won't be able to get anymore flow in the
port (this is the theory behind the restrictors used in WRC and similar
cars).

To sum it up, what you need is the smallest port that flows the most, i.e. one
that has the best SHAPE and SIZE for the power level you're chasing.

Hope this helps.

YG.

Topic: Block Specs (24 of 34), Read 78 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Monday, October 01, 2001 11:25 PM

Your formula for power doesn't look right.

Power = P = 2 (pi) N T

Where N = revs per second, T = Torque.

Torque = Fr

Where F = Force, and r = Radius,

So P= 2 (pi) N F r

Power is directly proportional to engine speed and radius (stroke).

Well yes and no. A shorter stroke engine mathematically develops less power
given the remainder stay the same. However a shorter stroke engine is easier

to make rev to a higher limit than a longer stroke unit. Then it all becomes
academic.

Martin Lucas

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Topic: Block Specs (25 of 34), Read 80 times
Conf: Lotus Twincam Engines
From: Yavuz Guven (yavuzguven@hotmail.com)
Date: Wednesday, October 03, 2001 12:26 PM

Martin,

The below equation is valid for a given displacement. You're not taking into
account that shorter the stoke larger the bore (Bore indirectly effect the
engine volumetric efficiency due to larger valve area).

Force on the crank as you've stated below in torque equation (T=Fs), is also
a function of bore, because Force=Mean effective pressure inside the
cylinder X bore. Larger the bore, larger the possible valve area, hence
better volumetric efficiency (VE). Better VE, higher mean effective pressure
inside the cylinder, so higher force.

Re-do the math's and you'll see that you agree with me.

Hence formula one engines or any engine that makes very high hp/litre will
all have very short stroke compared to bore. This is because shorter the
stroke for a given displacement, higher the potential for power as the
original equation suggests.

Cheers,

YG.

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Topic: Block Specs (26 of 34), Read 72 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Wednesday, October 03, 2001 04:26 PM

Hi Yavuz

It's been a while since I've had to do any engineering math's so I'm a bit
rusty.

Pressure = F/A

Where F= force and A = Area of piston. A units check will prove this - Pressure = Pounds/inch, or N/mm square.

So Force = Pressure A = Pressure (pi) D (squared) /4 (D is diameter of piston)

So Power=2(pi)NT
Power = 2 (pi) N F r where F= piston force, r= crank radius.

so Power=2 (pi) N r (Pressure (pi)/4 D(squared))

So
Power=2(pi)squared Nr Pressure D(squared) / 4

So power is a factor of
P= Constant x Revs x Crank radius x Bore(squared)

What I'm getting at is that Power is not a function of dividing by the stroke.

It is easier to get power by spinning the engine faster. A shorter stroke
engine will have a higher rev capability than a longer stroke engine. Power
is a measure of the rate of work done in time. So if the engine revs faster
there is more work done - therefore more power. When you decrease the stroke
and then increase the revs one variable offsets the other.

As you mentioned there is a number of good reasons to increasing bore and
decreasing stroke. The mathematics of it bear this out. An increase in bore
size is very advantageous. It is the square rule. Double the bore, four times the potential power. Life is never quite so simple though.

Martin Lucas.

http://www.geocities.com/marty7_nz/index.html

Topic: Block Specs (27 of 34), Read 71 times
Conf: Lotus Twincam Engines
From: Yavuz Guven (yavuzguven@hotmail.com)
Date: Thursday, October 04, 2001 03:31 PM

Same with me. The relationship that I was talking about (P = constant/stroke)
was a side issue in the thesis that I wrote over a year ago at uni. That
section was on evaluating ways of improving power on my pinto, such as

boring, stroking, etc and the potential power increase from each. I can send
you the relevant section via email if you like. Its all trivial stuff but
some find it interesting.

The point that I was trying to make was:
As you make stroke smaller (i.e. crank radius), both the 'constant' and the
'bore squared' in the above equation is getting larger. Remembering large
bore gives larger valve area and in turn higher vol. eff. and higher
pressure.

>It is easier to get power by spinning
>the engine faster.

Yes, but only if the torque doesn't drop off to offset the gains.

>A shorter stroke
>engine will have a higher rev capability
>than a longer stroke engine.

Reason for that is because it keeps breathing at high revs due to larger
valves i.e. better cylinder filling.

>Power is a
>measure of the rate of work done in
>time. So if the engine revs faster there
>is more work done - therefore more power.

Yes but only if the torque stays up there.

>When you decrease the stroke and then
>increase the revs one variable offsets
>the other.

Yes, but for a given displacement, shorter the stroke, larger the valves
(better cylinder filling). That’s the reason why it has more potential for
higher power.

>As you mentioned there is a number of
>good reasons to increasing bore and
>decreasing stroke. The mathematics of it
>bear this out. An increase in bore size
>is very advantageous. It is the square
>rule. Double the bore, four times the
>potential power.

Correct but that’s only half the story. You're forgetting the increased
breathing potential due to larger valves.

>Life is never quite so

>simple though.

Ain't that true!

Cheers,

YG.

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Topic: Block Specs (28 of 34), Read 71 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Thursday, October 04, 2001 08:23 PM

On 10/4/01 3:31:22 PM, Yavuz Guven wrote:
Hi Yavuz

I would be very interested in your paper.

There must be a point where for argument sake stroke is reduced to a point where power drops off (i.e. zero power at zero stroke ;-)), despite any additional increase in bore. I imagine an exceptionally short stroke engine would have difficulty pulling a decent vacuum, also the combustion chamber would be reduced in size to preserve compression ratio. This may lead to ignition/combustion problems.

I'm sure if someone had the time that there must be a relationship where for ideal power/torque the bore and stroke must be calculatable given the intended operating rev range. This must then work into the valve/ports as the engine now becomes an air pump, so you would be dealing with an engines ability to flow the volume of air required. I agree with you that a bigger bore allows bigger valves, and hence bigger valve curtain. I'd love to find out what the ideal valve/port size is when related back to bore/stroke and rev range . It is of course possible to loose power by having valve/port combinations to big.

I do have an equation in a Fiat book for inlet charge velocity, which is very dependent on stroke. Now don't get me wrong I'm not into long stroke cranks, I just think that for plods like myself whose engines are on the 7500 rpm range that the crankshafts stroke isn't the limiting factor.

For example, if I fitted a 1300 crank to a 1600, and then increased the bore
to restore capacity I bet the bottom end performance would suffer greatly
for a normally aspirated engine. Top end would be fine though - but at a far
higher rev range.

I have a feeling that many modern road cars are built with long strokes to
give it low down torque. Modern performance/race engines are short stroke,
and generally turboed. I'm starting to think that the addition of a turbo in
modern engines solves a number of problems for the designer. Filling isn't
so critical as in a NA engine as the filling is pressurised. Thus bore to
stroke, and rod to stroke ratios are more of a concern for mechanical
reliability, not cylinder filling. I imagine you can get away with a far
longer rod on a turboed engine. Also cylinder filling at high revs in a
turbo isn't such a problem with a short stroke as the incoming charge is
being pressure force feed, not drawn in under atmospheric pressure alone.

Shame you aren't local, Smoko time discussions would be very interesting :-)

Short stroke engine will not have problems with vacuum, as vacuum is a
result of change in cylinder volume. With the larger bore and shorter
stroke, motion of the piston downwards will still cause a similar change in
cylinder volume which generates the vacuum inside the cylinder (pressure
differential between the cylinder and the port) and causes the inlet charge
to flow.

The biggest cause of low idle vacuum is late inlet valve closing, which
upsets the volumetric efficiency at low rpm, and valve overlap.

It is true that as the bore gets larger, the combustion chamber becomes too
wide, which makes it less efficient. One of the reasons you'll find that f1
engines have many cylinders to keep the bores down to a reasonable size.

Topic: Lotus crank and rods? (1 of 6), Read 106 times
Conf: Lotus Twincam Engines
From: George Katselis (george.katselis@dsto.defence.gov.au)
Date: Wednesday, October 03, 2001 04:59 PM

According to the old Vizard booklet on twinks, nitrided standard rods and
crank are good for a continuos 7500 rpm. This sounds too high to be true.
What are the rpm limits for nitrided 125E rods and twin cam crank? How about
1600XF rods and crank? Why do people use the Datsun crank + rods then, is it
to get to over 8K rpm?
George

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Topic: Lotus crank and rods? (2 of 6), Read 69 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Thursday, October 04, 2001 07:49 PM

Hi George,

Crank and rod combinations depend on what block/piston combination you want
to go with. For example a L16 crank can be made to fit a standard Lotus 'L'
block bottom end. If you swap the Lotus 125E rods for xflow 2737 rods then
new pistons with shorter compression height will be required. This
combination gives a better rod to stroke ratio. If you are going to fit new
pistons then you can get custom pistons made. This will allow you to fit
just about any crank and rod combination into any block. Xflow crank and
rods into a 'L' block, Datsun L18 crank and rods into a 'L' block.

If you go for a xflow block then again standard ford xflow crank and rods
are ok, you'll need to deck about 6mm though. Or you can fit a Datsun L18
crank and L18 (130mm) rods. This combination with standard TC pistons will
mean that only 1mm will need to be decked from the block. All xflow blocked
Twin Cams require a longer timing chain.

I personally prefer the Datsun crank over the ford/Lotus crank as the Datsun
crank is steel. Rods are made from a better alloy steel. I'd say it is safe
to rev the Datsun combination to 7500 safely. I wouldn't be too happy to do
that with the Ford/Lotus.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

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Topic: Lotus crank and rods? (3 of 6), Read 53 times
Conf: Lotus Twincam Engines
From: George Katselis (george.katselis@dsto.defence.gov.au)
Date: Wednesday, October 10, 2001 01:16 PM

Hi guys,
According to the bulk reading that I have down over the last few days, I
have come with the following plan for a bottom end that I would appreciate
some opinions on.

- X/F block bored to 83-84mm and modified for height for use of lotus head
- Standard crank, crack tested and balanced, tuftrided and use of steel mains caps (obviously these would have to be in line bored)
- Standard X/F rods crack tested and lightened (as per Vizards recommendations)and shotpeened and fitted with ARP/Cossie rod bolts
- Use of Lotus Cortina flat top pistons

>From what I have read this should be good for a regular 7500 rpm

Also does anyone have opinions on the efficiency of the Lotus head because
if people claim that a X/F can be tuned up to 135hp or even 160hp then why
is 140-150hp from a Twin Cam hard to achieve? Or is it just a case of
divability/reliability being a limiting factor? Surely the TC head is much
better than the X/F head.
George

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Topic: Lotus crank and rods? (4 of 6), Read 49 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Wednesday, October 10, 2001 07:56 PM

Hello again George,

Your proposed 1600 based bottom end is pretty standard. You shouldn't have
any problems. If you use a 711M block with square main caps then I'd suggest
that replacing them with steel mains could be a waste. 7500 isn't overly
high revs.

I haven't had the opportunity to test my theories but I believe that whilst
the standard Ford 1600 cast iron crank and 2737 rods are good for 7500 rpm
there are better solutions. Retaining the 1600 crank and rods will result in
at least 5mm needing to be decked from the block if standard 39mm
compression height TC pistons are used. If you use the 130mm L18 rods with
9mm bolts (go ARP) then barely 1mm will need to decked from the block. Also
the rod ratio will be better. 1.68 compared to the standard 1600 ford which
is 1.61 . I have a gut feeling that by using the L18 rods and retaining more
of the deck height the block will be more rigid versus the 5mm decked
version. This must be good for head gasket integrity.

Crossflows can be made to give good power. But it is very much a case of
grandpas axe. Steel crank, forged pistons, steel rods, roller rockers,
different valves, springs, cams. Head chambered, new carbs.

Do the same to a Twin cam and it will be every bit as powerful. Problem is
the capacity will never be the same if you retain the 'L' block and shorter
stroke. A twin cam built on a 1600 block and 77.6 crank will out perform a
1600 xflow.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

Topic: Lotus crank and rods? (5 of 6), Read 45 times
Conf: Lotus Twincam Engines
From: George Katselis (george.katselis@dsto.defence.gov.au)
Date: Thursday, October 11, 2001 02:06 PM

Hi Martin,
In the above explanation, when you refer to using L18 rods and X/F block in
order to only shave around 1mm versus 5mm, what crank are you referring to?
Are you talking about L18 rods and crank or L18 rods on a X/F crank coupled
with TC pistons.

I agree that block strength/rigidity would be greater in a block that had
less shaved off the top. This combo would also require a thicker timing
cover spacer.

I found an old photocopy of a CCC article that was given to me with the car

(around 95ish) that deals with modifying twin cams. Unfortunately this was
the first in the series but I've got no idea what year it was. In this article they used 85mm + 30thou pistons and an L block. Got about 20 hp more
than standard but not suprising, the motor split a liner and they were going
to start again next month. Interesting read, if only I new what year it was.
George

Topic: Lotus crank and rods? (6 of 6), Read 49 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Thursday, October 11, 2001 05:09 PM

George,

L18 crank has a 78mm stroke compared to Ford's 77.6mm . Either combination
will work with the longer Datsun rod. The reason you don't need to shave so
much from the deck is because the Datsun L18 Rod is 130mm between centers,
the Ford is 125.25mm between center's.
130 - 125.25 = 4.75mm . Ford 125.25mm rods and crank (Datsun crank will be
similar) require around 6mm to be machined from the deck using T/C pistons
in a 711M block. Why 6mm, Compression height of xflow piston = 44.75mm, Twin
Cam piston compression height = 39mm. 44.75 - 39 = 5.75mm . Why only 1mm
when ford crank and Datsun L18 rod (same with Datsun crank)- difference between compression height and rod length,
5.75 - 4.75mm = 1mm.

Correct, if you have to make a spacer then really the thickness of it is a
side issue. The thicker one will require a bit more elbow grease with the
file though ;-)

The key here is that if you don't machine so much from the block deck then
an even longer timing chain is required. Added to that I bet the timing marks on the standard cam sprockets won't be aligned on assembly. No problem
fit vernier sprockets and dial them in :-)

Bob informed me that big bore 'L' blocks are something you have to be careful with. He only likes them if they are a known quantity. That is,

they have been known to have done trouble free mileage. The block I have has
been ultrasonically tested and run previously at the 85mm bore. This he terms a 'safe bet'.

I could be wrong but a number of articles I read on Twin Cams tend to be
very general and contain the odd error. Some even start by saying the engine
is rare and technically beyond the owner's skill level. Solution take it to
a 'professional' - end of article. Even I could write that if paid ;-)

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

http://bne001w.webcentral.com.au/read?224503,1196

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Topic: Tuning twincam (1 of 3), Read 94 times
Conf: Lotus Twincam Engines
From: Edward Sansil (sansil@tpg.com.au)
Date: Tuesday, October 09, 2001 10:10 PM

Help required as a starting point to tune a twink motor. Motor came with a
set of 45mm webers, L1 cams (420" lift) and a big valve head. Capacity is
unaltered. What combination of main jets, emulsion tubes etc would be a good
start?. Carbs are fitted with 34mm chokes. Car is being set up for sprints.
Thanks in advance for any help.

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Topic: Tuning twincam (2 of 3), Read 66 times
Conf: Lotus Twincam Engines
From: Martin Lucas (marty7@ihug.co.nz)
Date: Friday, October 12, 2001 04:46 PM

Hello Edward,

The following is only a general rule to get you started. After that take the
car to someone who knows what they are doing to jet the carbs on a dyno.
There really is no other way. Trial and error will not work.

The info I have for a 400cc cylinder with inlet port per cylinder (not siamesed) recommends a venturi size of 36mm for twin 45's at 7500rpm. However, the general rule is multiply the venturi size by four to get the

main jet size, so in your case you're around 135. Then add forty for the air
correctors, so 175. Safe starting point for emulsion tubes is F16. Again
dyno the car to verify. I bet they will need to be changed.

Martin Lucas
http://www.geocities.com/marty7_nz/index.html

Topic: Tuning twincam (3 of 3), Read 65 times
Conf: Lotus Twincam Engines
From: Dave Tristram (sikscort@hotmail.com)
Date: Friday, October 12, 2001 05:42 PM

If you chose to stick with the 34mm chokes that will limit your max Rpm. As
martin said with 36mm chokes you could take it to 7500 engine permitting of
course, but with the 34's you'll be pushing it to get 6500.
Dave T