

STROKE

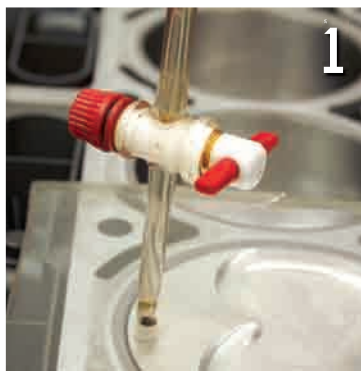
ME BABY - PART II

Last issue we brought you part one of the build-up of the 383ci stroker LS1 for our cover car, LUNATI, out of the Sam's Performance workshop.

When we finished up last issue, we had a fully assembled short motor (in other words, from the top of the block down).

We had prepared the block, checked bearing clearances and installed the rings, pistons, rods, crank, mains caps, cam, lifters, timing chain, oil pump, valley cover and sump, and a few bits and pieces in between.

Part two will see us take the engine from this point right through to the running in and testing process on the engine dyno. *SC*



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1) The piston bowls are CC'd, with the results used to help determine the exact static compression ratio of the engine. Vaseline is smeared around the edge of the piston to ensure that there is no leakage, and a mixture of transmission fluid and fuel is then added to the bowl of the piston with a burette to determine its volume in CCs

2) The head gaskets are then laid on to the decks of the block. It is possible to put them on back-to-front, so it's important to install them correctly. They're labelled clearly as you can see here. Sam only uses genuine Holden head gaskets

3) Larger-diameter Comp valve springs and chromoly retainers are installed in the heads. Sam has found these components to be reliable under heavy loads. Valve springs are an inherent weakness in LS1s and any internal upgrades should be



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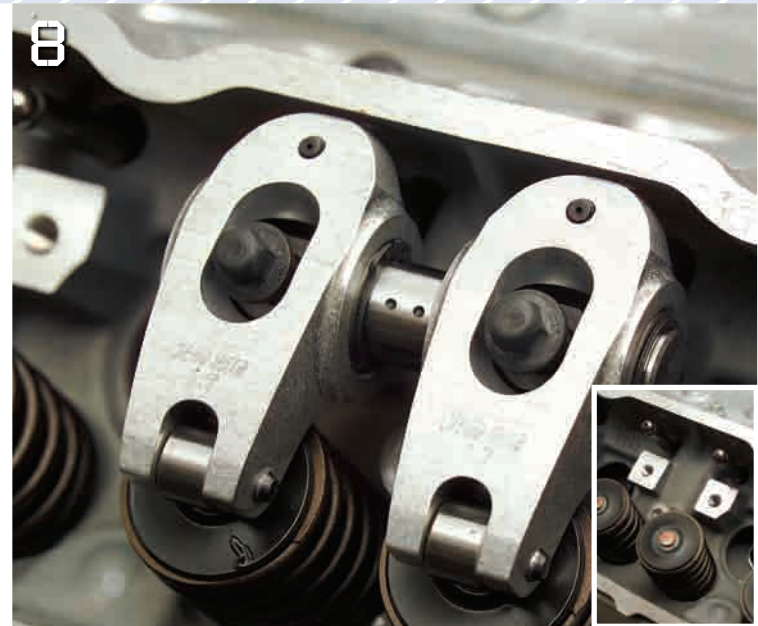
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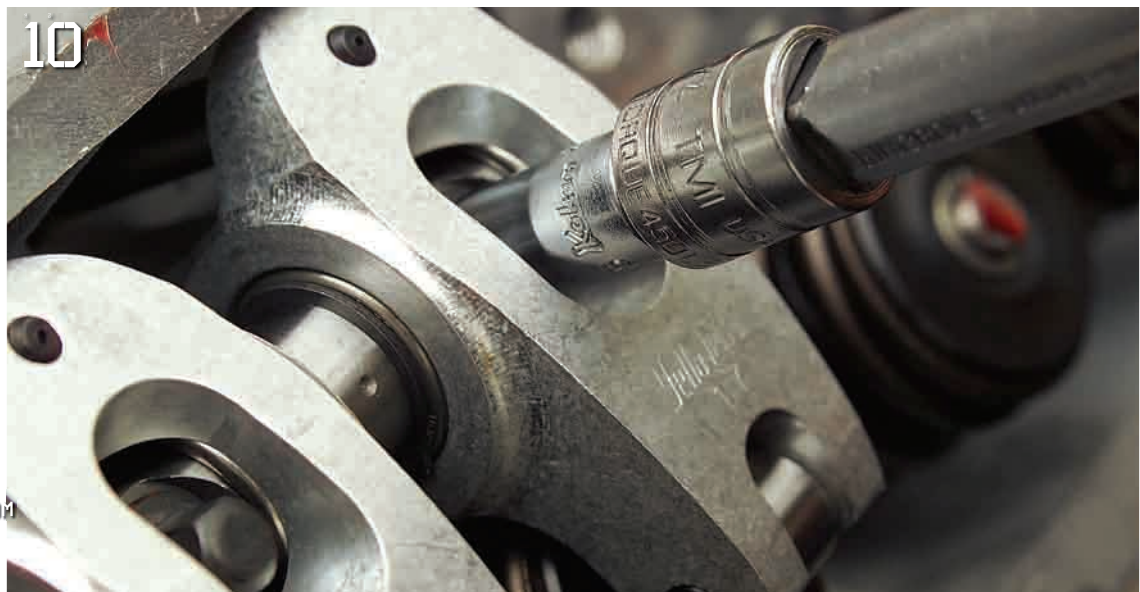
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matched with performance valve springs. When running springs and retainers of this size, it is important to ensure adequate clearance underneath the rocker arms

4) The ARP head bolts are then installed. This is not due to any physical weakness of the factory head bolts (they are actually quite strong), but more due to the fact that the OEM items are a stretch bolt and can only be used once, and hence every time the heads are pulled of an engine the bolts must be replaced.

The sort of customers that have these engines built often like to play around with them and make further enhancements down the track, so it is cheaper and easier in the long run to switch to the ARP bolts

5) The hardened washers and ARP moly lube supplied with the bolts must also be used. The head bolts are torqued in three stages, first 45lb.ft, then 60lb.ft and a final setting of 75lb.ft, starting in the middle and progressively travelling outwards on alternating sides

6) These dowels are what locate the head in precisely the right spot on the block. Without them the head could be

bolted down crooked, which would have all sorts of nasty ramifications

7) Here the burette is used to CC the chambers in the head. It is this figure, the figure from the piston bowl and also the volume of the head gasket, which is used to determine the engine's compression ratio

8) The pushrods are then inserted. Both ends of the pushrods are lubricated with the Royal Purple assembly lube. This engine runs Yella Terra roller rockers, which were soaked in oil prior to installation to ensure that they are properly lubricated on initial start-up

9) The whole engine is then CC'd as a complete unit. This is generally the most accurate way to do it, but it is possible to get an air pocket in the combustion chambers that can alter the results

10) The rocker bolts are then torqued up to 30-35lb.ft. Rocker bolts should be replaced as it's impossible to tell how many times they have been on and off an engine and as a result they could be past their use-by date



11) The water pump and other accessories are then installed, followed by the rocker covers, making sure that the O-rings are correctly seated. The rocker cover bolts are only hand-tightened (approx 15-17lb.ft)

12) This is the cam angle sensor. Without this the car will backfire and misbehave on start-up as the ECU isn't receiving a signal as to the position of the cam in its rotation

13) These oil block-offs are positioned at the rear of the engine. They must be fitted to avoid leaks

14) The crank angle sensor must then be installed. This tells the ECU where the pistons are in their cycle and without it the engine won't run

15) Another specialist tool is used to install the timing case seal to ensure that it doesn't go in crooked. Sam tells us you shouldn't use any oil on this seal - as a matter of fact, the minute you do it's "f*ckin' rooted"

16) This plastic plug is located in the back of the block in an oil gallery, and it is of paramount importance to your engine's survival. Failure to correctly install the plug will see an oil pressure gauge registering in the acceptable range, but the oil will not circulate to the front of the engine. The result is almost invariably a

IN-HOUSE ENGINE DYNO and 4WD CHASSIS DYNO

Stage 1 280KW

LS1 EDIT Tune
Cold Air Induction

Stage 2 300KW

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Stage 3 320KW

LS1 EDIT Tune
Cold Air Induction
Exhaust System
Cam & Valve Springs

Stage 4 340KW

LS1 EDIT Tune
Cold Air Induction
Exhaust System
Cam & Valve Springs
Gear Set
Polished Heads - Stage 1

Stage 5 360KW

LS1 EDIT Tune
Cold Air Induction
Exhaust System
Cam & Valve Springs
Gear Set
Roller Rockers
Ported Heads - Stage 2

Stage 6 380KW

LS1 EDIT Tune
Cold Air Induction
Exhaust System
Cam & Valve Springs
Gear Set
Roller Rockers
Ported Heads - Stage 3



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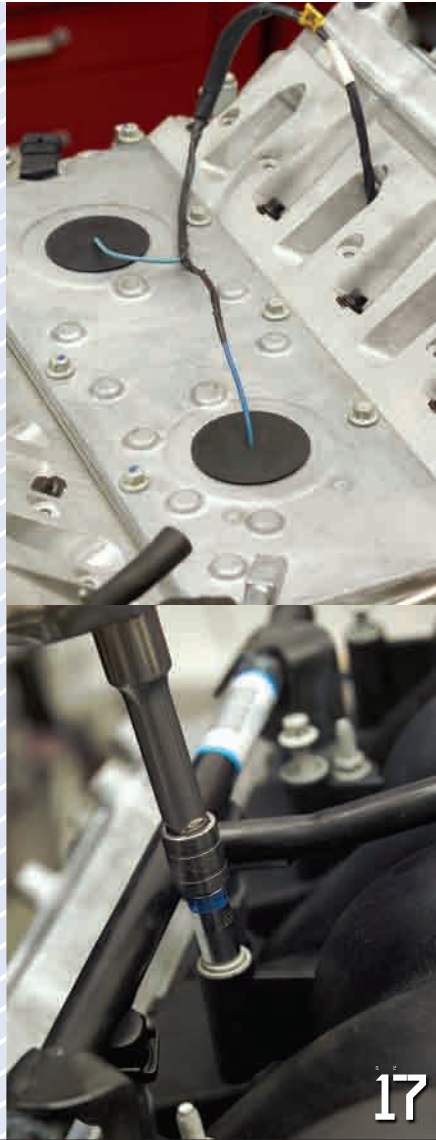
seized engine for the sake of a \$10 part, so it's essential to make sure it's right

17) The knock sensors and relevant wiring must be in place in the valley before the intake manifold can go on. The intake manifold is installed with all bolts tightened and all O-rings in place. The manifold used is an LS6 type fitted to VX and onwards Commodores. It is superior to the VT (LS1) manifold by about 20hp on an engine dyno. The intake manifold bolts are nipped up hand tight (approx 20lb.ft)

18) Injectors are then tested before fitment. It is important to identify any faulty injectors before the engine is run. The fuel rails and throttle body are also installed at this stage. The throttle body used on this engine is a Starr Performance product that Sam has found to be one of the better ones on the market, not so much for outright horsepower as for a meatier midrange torque band



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LUNATI STROKER LS1 BUILD

19

19) Yet another specialty tool is used to pull the balancer in during installation. Performance balancers are used in most applications, but Sam is yet to see a standard one fail. Here he makes the point that the LS1 is a very well engineered engine straight out of the box, and that most of the standard components can be reused, even in a 500hp engine build



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20) The engine is then placed on the dyno for a thorough testing procedure before the power output is checked. Sam runs eight individual lambdas so that each individual cylinder can be monitored. While cylinders cannot be individually tuned, this does allow any specific problems to be correctly identified and isolated, and the problem can be fixed before the engine goes in the car.

Another benefit of using an engine dyno for this process is that the results are 100 percent repeatable. A chassis dyno adds many variables between the engine and the dyno itself, and there's no guarantee that transmission/clutch slip, and fluctuating intake, water and tyre temperatures won't affect the data from one run to the next. These variables can either be accurately controlled or are non-existent on an engine dyno

FINALLY!

All that is left to do is the running-in process. As a roller engine there is no need for the traditional bedding in of the cam on initial start-up. A moderate-quality engine oil is used in the engine under light loads for the first 20 minutes while oil pressure is carefully monitored and the engine is checked for oil leaks.

After this, Sam places the engine under moderate loads, constantly varying revs between 2500 and 3500rpm. When he is satisfied that everything is performing as it should and the engine is up to temperature, the engine is loaded up to allow the rings to correctly bed in. Sam says that after half an hour of torture on the dyno, the rings should be bedded in and ready to go. After this process, the running-in oil is dumped out of the engine, the regular oil is put in and the engine is ready to fly.

If the engine is assembled correctly and all of the clearances are right (Sam has built more of these strokers than most people have had hot dinners), the only thing that requires bedding in during the run-in process is the rings. Once the piston is sealing correctly in the bore, then your brand-new 383ci stroker LS1 is ready to rock!



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