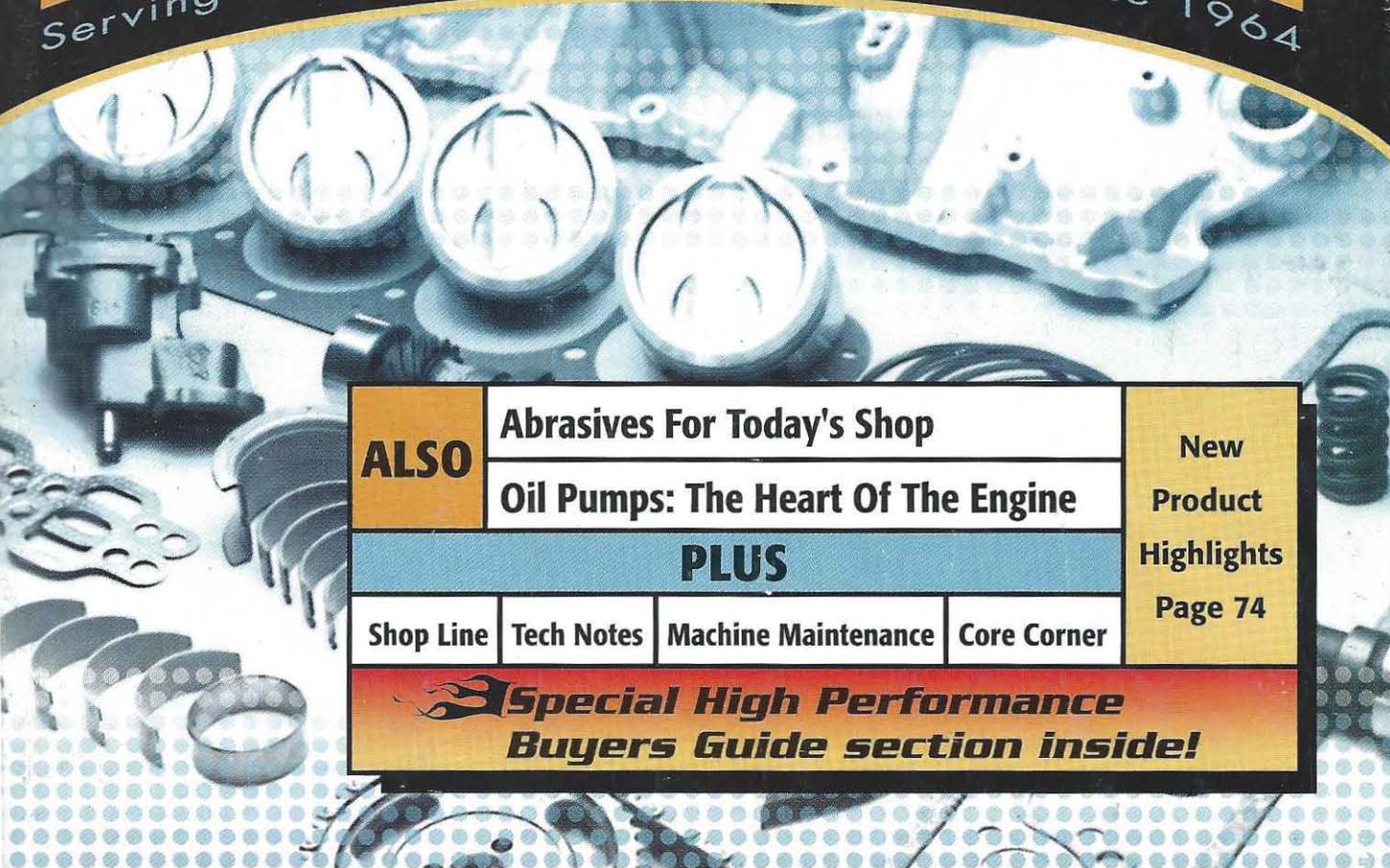


January 2004



ENGINE BUILDER

Serving Engine Builders and Rebuilders Since 1964



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2004

ENGINE BUILDERS BUYERS GUIDE

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pumps, debris usually won't lock up the pump because it is driven directly off the crankshaft, but it can damage or destroy the rotors.

Even if a pump doesn't fail, it loses efficiency as it wears. Over time, the effects of pumping unfiltered oil takes a toll. Scratches and wear in the gears and pump housing increase clearances and reduce pumping efficiency. The result is a gradual loss of oil flow and oil pressure.

An oil pump, by the way, does not create oil pressure. It pushes oil from one place to another. It is a positive displacement pump that moves oil every time it turns. Oil is incompressible so once it leaves the pump it continues to flow until it encounters resistance in the filter, oil gal-

leries and bearings. It's the resistance to flow that builds pressure in the oil system. Trying to force oil through a small opening is going to create more resistance and pressure than allowing it to pass freely through a large opening.

A worn pump can't deliver the same volume of oil as a new pump, so with less flow there's a drop in oil pressure.

As pressure starts to back up in the oil system, it has to go somewhere. A spring-loaded "pressure relief valve" built in the oil pump (or next to the pump) opens when pressure exceeds a certain limit (typically 50 to 60 psi) and either reroutes oil back into the pump's inlet or the oil pan. This prevents a dangerous

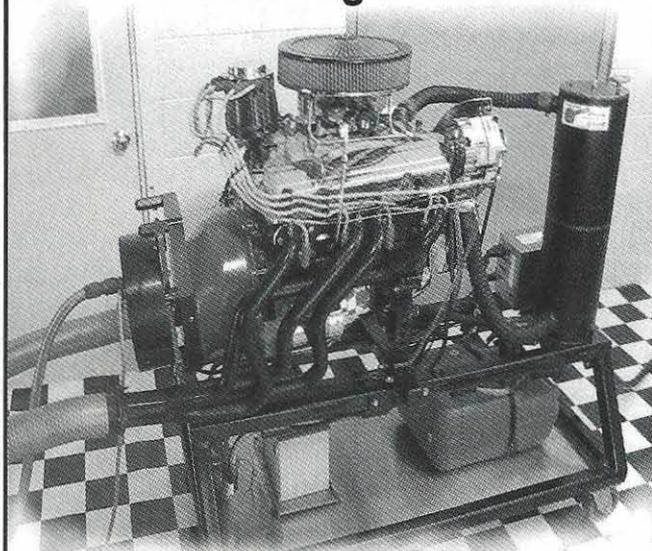
buildup of pressure that could rupture the oil filter or blow out press-fit oil plugs.

At idle, most oil pumps do not produce enough flow to force open the relief valve. Oil pumps that are camshaft driven only turn at half engine speed so output isn't great at



Bottom side of oil pump with an adjustable pressure relief valve.

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and low rpm. Even pumps that crankshaft driven and turn at the same speed (or double engine speed in a few instances) don't pump enough oil to overcome the relief valve spring. The relief valve generally only comes into play at higher rpm when the pump's output pushes more oil into the system than it can handle. Then the relief valve opens and vents oil and limit maximum oil pressure until engine returns to idle or lower rpm.

Vehicle manufacturers have traditionally recommended a minimum of 10 psi of oil pressure for every 1,000 rpm of engine speed. Using these numbers, most stock engines don't need any more than 50 to 60 psi of oil pressure. With tighter bearing clearances, pressure goes up requiring less flow from the pump and less parasitic horsepower loss to drive the pump.

In racing applications, the old school of thought was more oil pressure was needed to keep the engine lubricated. That's true if bearing clearances are loosened up. But most engine builders today tighten clearances so less oil flow is needed to maintain adequate oil pressure. This approach increases the horsepower output because less power is needed to drive the pump at high rpm.

According to various sources, a stock oil pump is usually more than adequate for modified stock block performance engines. NASCAR engines typically get by just fine with more than 50 psi of oil pressure at 6,000 rpm! Some top fuel dragster and funny car engines are set up so the oil pump will dump excessive oil pressure at high rpm so more power can be routed to the rear wheels.

High Volume/Pressure

In applications where more oil flow is desired either to increase oil

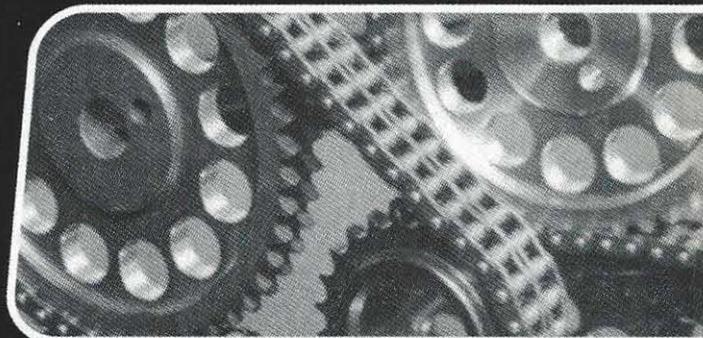
flow and pressure for better bearing lubrication and cooling, an oil pump with longer or larger gears may be installed. The physically larger surface area of the gears pushes more oil through the pump at the same rpm as a stock pump. A high volume oil pump typically flows 20 to 25 percent more oil than a stock pump. The increase in oil flow produces an increase in oil pressure at idle, which helps compensate for increased bearing clearances. Consequently, some people may install a high volume pump in a high mileage engine in an attempt to restore normal oil pressure. But oil isn't metal, and the only real cure for low oil pressure is to replace worn bearings and restore normal clearances.

High pressure oil pumps are



The spring loaded relief valve opens when the oil pressure reaches its limit.

another option. A high pressure pump contains a stiffer relief valve spring that does not open until a higher pressure is reached (75 psi or higher). The actual flow rate of a high pressure pump may be no different than a



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-Ronnie Weedon
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Q&A

Q: I've heard that ASE is introducing some of its tests on computer. What's this all about?

A: Computer-based testing will create more opportunities each year for you to take ASE tests with greater flexibility in scheduling.

During the 2004 pilot, a limited number of tests will be offered: Automobile Series tests (A1 through A8), the Advanced Automobile Engine Performance Specialist (L1), and the Automobile Parts Specialist (P2) tests. Additional tests may be added in the future.

Like the regular, paper-and-pencil testing, you must first register for the tests you want. For this pilot phase, the only registration method available is via telephone.

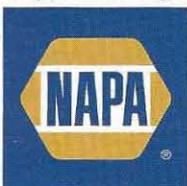
- Registration period
Jan. 5 – Feb. 9, 2004
- Testing period
Jan. 20 – Feb. 15, 2004
- Registration

Call toll-free 800-525-6929

Unlike the paper and pencil testing, however, you can schedule your testing date and time, subject to availability. You must allow at least two business days between the time you register and the test appointment. You will receive an appointment confirmation via e-mail. Then, show up at the test center at your appointed time and present your photo ID. You will be seated, given a brief tutorial to acquaint you with the computer-delivered test, and then be able to take the certification tests. After you complete your tests, you will be asked to respond to a short survey about the CBT experience.

You will receive your test results, including a detailed score report, before you leave the test center. Certification credentials, such as certificates and insignia, will be mailed to you following the close of the testing period. For more information on the computer-based ASE tests, go to www.ase.com/cbt.

Sponsored by



stock pump, or it may be higher if longer gears are used. Either way, the pump will increase the system oil pressure reading at high rpm when the pump is working hard, but it won't have any effect on idle pressure when the pump is turning slowly.

A high volume or high pressure oil pump may be recommended in engines where bearing clearances



High-Volume Oil Pump: The larger gears push more oil at the same engine rpm as a stock pump. A high volume pump flows 20-25 percent more oil than stock. (photos courtesy of Schumann's Sales & Service)

are looser than normal, in engines where an auxiliary external oil cooler has been added to improve oil cooling, and in racing engines where a oil accumulator has been installed.

Rebuild or Replace?

When a high mileage engine is being remanufactured, you have the option of rebuilding or replacing the oil pump. No engine builder in their right mind is going to risk a warranty return by reusing a worn pump in a rebuilt engine, so most simply replace the pump. According to Melling Engine Parts, a major supplier of oil pumps and repair kits, most engine builders today replace pumps rather than rebuild them because installing a new pump is quicker, easier and less risky.

Replacing the gears in a twin-gear pump can restore gear-to-gear clearances but not gear-to-housing clearances. The end plate that covers the pump often develops a heavy wear

pattern that is most noticeable on the outlet gear side. Regrinding the face of the plate smooth can restore end play tolerances between the plate and gears but it can't compensate for wear in the housing. Deep scratches or grooves worn into the sides of the housing will leak oil and reduce the pump's ability to move oil.

In the case of front cover oil



pumps on overhead cam engines, the pump turns at engine rpm and generates more flow at idle than crankcase mounted pumps. Consequently, when the pump becomes worn it isn't always necessary to replace the entire cover assembly – provided the pump housing inside the cover isn't worn or damaged. A new drive gear can be mounted on the crankshaft and a new rotor installed in the cover to restore normal oil pressure. This approach can usually save you 50 percent or more over replacing the entire cover assembly.

In cases where an engine has experienced a bearing failure or any other kind of internal failure that puts debris into the crankcase, the oil pump should always be replaced.

Another item that should always be replaced (but often isn't) is the pickup tube and screen. Pickups are difficult to clean and can hide debris that may damage a new pump or the engine.



You should also attach a yellow or red tag on the engine warning the installer to prime the oil system with a pressurized oiler before cranking or attempting to start the engine. Oil tends to drain off bearing surfaces when an engine sits for more than a week or so without running. So if an

CAUSES OF LOW OIL PRESSURE

The last thing anyone wants to see is a low oil pressure reading on a newly rebuilt engine. Besides being noisy, low oil pressure increases the risk of bearing, camshaft and valvetrain failure. Possible causes include:

- Excessive main and rod bearing clearances (someone may have installed the wrong sized bearings or standard sized bearings on a reground crankshaft). Only .001" of extra clearance in the main bearings can reduce oil pressure up to 20 percent!

- Excessive camshaft bearing clearances (a bearing may have slipped out of place when the cam was installed).

- Excessive clearances inside the oil pump.

- Leaks between the oil pump and engine.

- Oil pump relief valve stuck open or installed backwards.

- A loose or mispositioned oil pickup tube (too high in oil pan).

- A defective oil pressure sending unit or oil pressure gauge.

- Low oil level in the oil pan.

- Cracks or leaks in oil galleries or gallery plugs.

- Cracked oil pump housing (improper installation).

- Oil viscosity too thin for hot weather.

- Oil viscosity too thick for cold weather.

engine has been sitting in a warehouse for a month or more before it is installed in a vehicle, you can bet the bearings are going to be dry unless they were precoated with a long-lived assembly lube.

On older engines with distributor driven oil pumps, the engine can be primed by using a drill to spin the oil pump shaft through the distributor hole. But on engines with no distributor or those with oil pumps inside the front cover, this isn't possible. Feeding pressurized oil into the main oil gallery through the oil pressure sending unit fitting will route oil to all the critical areas inside the engine and eliminate the risk of scuffing the bearings when it is first started.

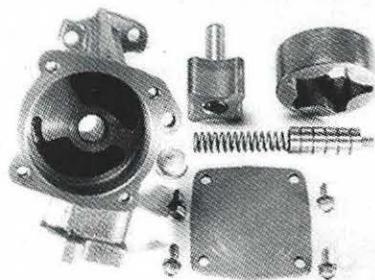
New Oil Pump Program

Vern Schumann of Schumann's Sales & Service in Blue Grass, IA, said his company is launching a brand new oil pump program that will be sold under the Manley brand name. The new line will eventually include twelve of the most popular oil pumps, starting with four pumps in February. "Our goal is to create a quality program that will grow at its own rate, probably one pump a month," said Schumann.

"Our first applications will be for small block Chevy V8s and short deck 289/302 Windsor Ford V8s. The numbers are 55, 55HV (high volume), 55HV Racing, and 68."

Schumann said one of the advantages of launching an entirely new pump program from scratch is that he is not locked into any existing designs. Consequently, gear tolerances and relief pressures can be optimized for the aftermarket.

"Our 55 pump, for example, will have a kick out pressure of 60 psi, which is on the high end of the specifications. When engines are rebuilt, customers never complain



about too much oil pressure. They typically complain about too little oil pressure. On small block Chevys with hot thin oil in the crankcase and a 200 degree thermostat, it's common to see only about 10 to 15 psi of oil pressure at idle on the oil pressure gauge - which is not very reassuring. So we're minimizing clearances to reduce pumping losses and to maximize oil flow at idle.

"Another problem with most relief valves is that the side of the valve as well as the end is exposed to oil pressure. This produces a sideways thrust that can cause the valve to hang up halfway in the bore. Our relief valves are redesigned so pressure is only applied to the end of the valve."

Schumann said improving machining accuracy and reducing tooth-to-tooth tolerances and gear-to-housing tolerances maximizes oil pressure at idle. "Something else you have to watch is the finish on the pedestal pads because this affects the end play of the pump gears. You don't want any chatter marks on the pads because it will increase end play and cause a loss of pressure. Our pumps have .002" of end play and will stay that way because there are no chatter marks to wear away."

As for pricing, Schumann said his pumps will be competitively priced somewhere between the old DynaGear prices and those of the other major aftermarket suppliers. **EB**