Engine Pre-Oiling

A critical procedure for any fresh engine

BY **MIKE MAVRIGIAN**

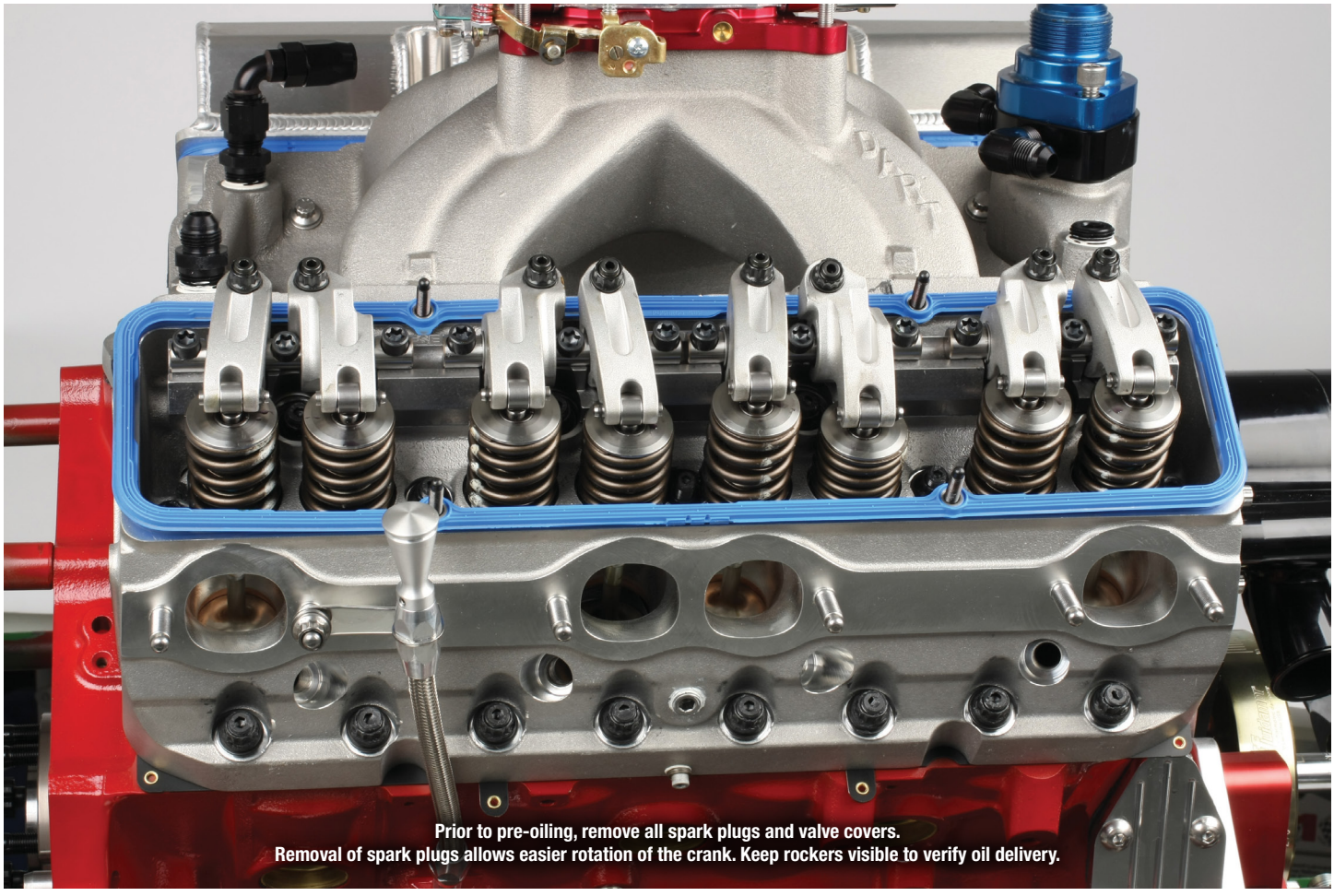
A customer's engine represents a major investment. Regardless of whether the engine is brand new (a factory replacement engine), a freshly rebuilt engine, or an engine that has been stored for an extended period, it can be quickly damaged if the bearings and friction related components are not properly lubricated prior to firing the engine for the first time.

NEVER start a fresh engine without first circulating oil through the oil galleys to provide oil to the bearings and valvetrain. Even though the engine may have been recently assembled with a quality engine assembly lube on the bearings, pre-oiling is absolutely mandatory. Rather cranking the engine and waiting for oil pressure to build via the engine's oil pump, pressurizing the oil circuits before ever cranking the engine will insure lubrication that will protect the bearings and valvetrain from damage during the first rotation of the crank. This also holds true for even a previously-run engine that may have sat dormant for a long period of time. Main bearing, rod bearing, cam bearing, rocker tip and other potential valvetrain damage can be easily avoided by first pressure pre-lubricating the engine before it's started.

As we all know, distributor-equipped engines that feature an oil pump driven by the camshaft can be pre-oiled by removing the distributor and running the oil pump with the use of an adapter and a power drill. That traditional practice works fine, assuming that you're able to drive the oil pump without rotating the crankshaft.

However, late model engines that feature a front-mounted oil pump that's driven by the crankshaft cannot be pre-oiled in this manner. The use of a pressurized pre-oiling tank allows you to easily push pressurized oil throughout the engine's oil circuit without the need to "spin" the engine's oil pump (the LS engine is but one example). These pressure tanks are applicable to any engine, regardless of the year of manufacture or the location and design of the oil pump.

It's all too common for some folks to assume that there's no need to pre-oil, since they believe that the engine's oil pump will distribute oil through the engine's oil circuit quickly enough to protect the bearings. A common practice involves disconnecting the coil wire and cranking the engine, in order for the oil pump



Prior to pre-oiling, remove all spark plugs and valve covers. Removal of spark plugs allows easier rotation of the crank. Keep rockers visible to verify oil delivery.



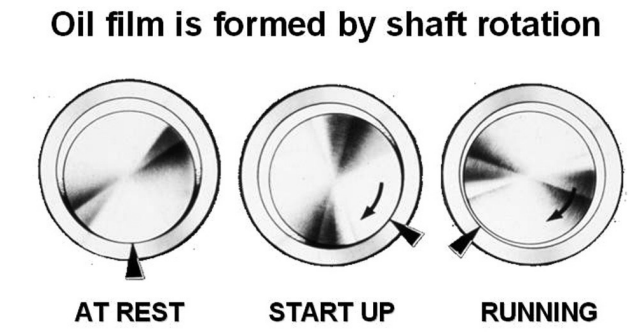
Pre-oiling any freshly built engine is critical, regardless of the style of pumping system.

to build pressure. While this will eventually pull oil from the sump and deliver to the main feeds, in the process of cranking the engine (even without firing), there is no guarantee that you'll have adequate lubrication delivered quickly enough to protect the bearings during this initial cranking period. Beyond a concern for sending oil to the main bearings, by cranking the engine, it will take even longer to send oil all the way up to the rockers.

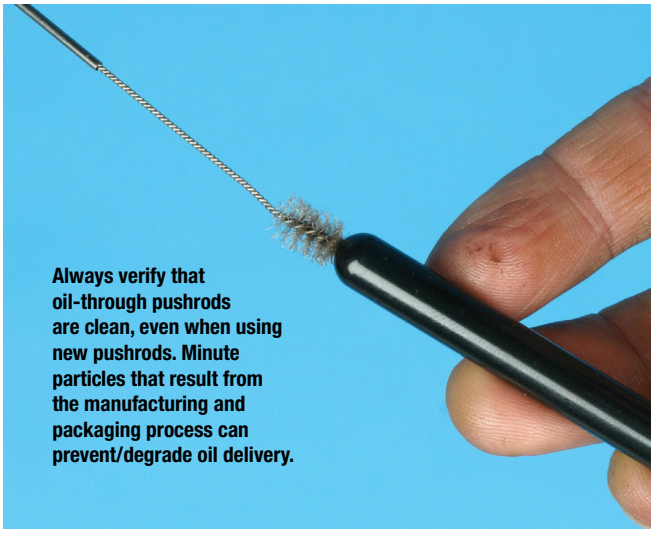
It's important to understand that you never want to allow the crankshaft main journals, rod journals or cam journals to ride directly on the bearing surfaces. An oil film is needed to support the journals. With oil already present (by pressurizing the system), as soon as the crank begins to rotate, this oil film will create a lubrication ramp that will support the journals.

Granted, the lubricant that was applied to bearing surfaces during assembly will somewhat help to protect the bearings, this lube may quickly be wiped away as the crank rotates, without oil being pushed through the galleys to provide the critical oil film that is needed to support the crankshaft and rod bearings....the risk of running bearings dry is simply too great.

Engine main, rod and cam bearings can be damaged in the blink of an eye if oil isn't delivered quickly. Just because you topped off the oil pan sump and perhaps added some oil into the oil pump during assembly, this is no guarantee that oil will be delivered to the bearings quickly enough to avoid damage.



At rest, journals make direct contact with bearings. A support film of oil is critical, especially when the engine is first started. Without pre-oiling, chances of immediate bearing wear/damage are high.



Always verify that oil-through pushrods are clean, even when using new pushrods. Minute particles that result from the manufacturing and packaging process can prevent/degrade oil delivery.



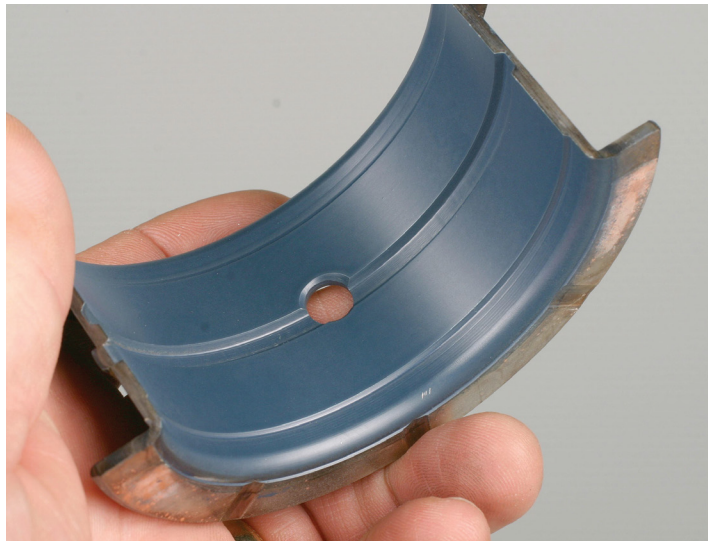
ENGINE PRE-OILING

BY **MIKE MAVRIGIAN**

If you want to protect your engine investment, PRE-OIL THE ENGINE FIRST BY PRESSURIZING THE SYSTEM! If you crank and start the engine without lubrication already delivered, and you end up with damaged bearings and/or valvetrain pieces, you'll have no one to blame but yourself.

COATED BEARINGS

The use of coated bearings (main, rod, cam), while not necessarily mandatory, is always a good idea. Granted, the dry film lubricant applied to bearing surfaces offers a level of lubricity in the event of a momentary loss of oil, but to rely on the coatings alone is a bad idea. If the initial start up is dry (void of sufficient oil), yes, the anti-friction coating does serve a purpose, but you may end up ruining/sacrificing the coating that you relied on. Even if the coating managed to "save" the bearings, you may end up simply wasting the benefit of the coating in the process. So, even when using coated bearings, pre-oiling is still necessary. Yes, using coated bearings is always a good move, but why tempt fate?



Taking advantage of coated bearings is always a good idea, but don't depend on the coating alone during initial startup. Even if all bearings (mains, rods, cam) are coated, pre-oiling is a must.

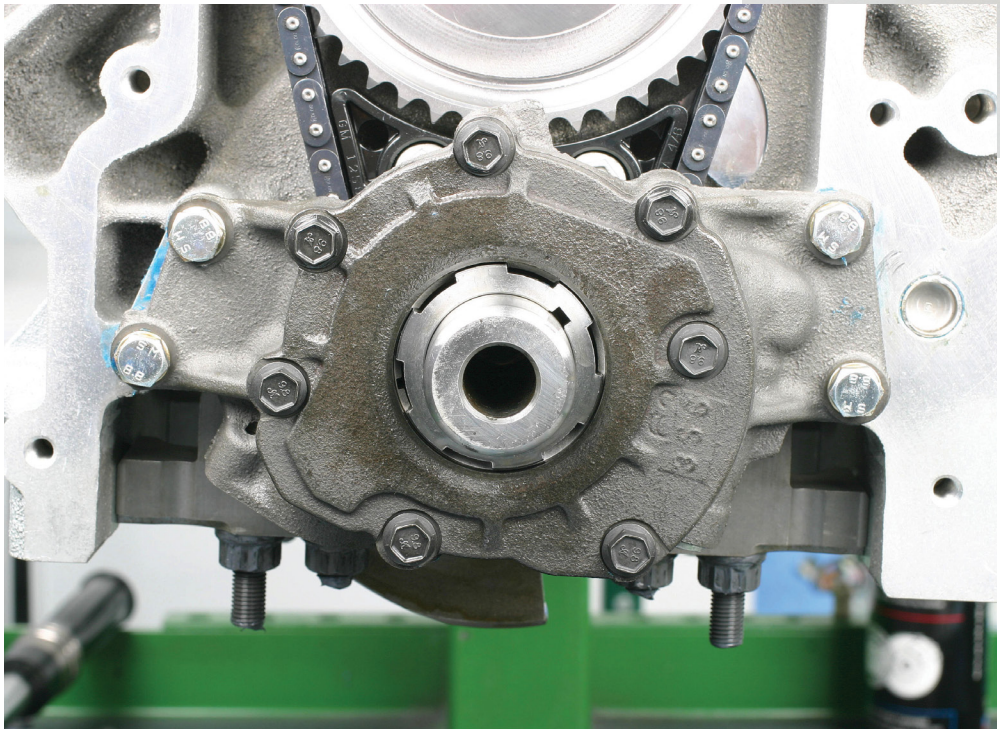
PRE-OILER TANKS

An engine pre-oiler/pre-lube tank works on a very simple principle. The tank is designed as a simple pressure tank. Oil is added to the tank reservoir. When the tank is charged with compressed air and the tank's valve is open, pressurized oil is forced into the engine via a connection hose between the tank and engine block. This is the easiest and by far the most efficient method of pressurizing the engine's oil circuits, without the need to use an oil pump drive adapter and a hefty power drill (and as mentioned earlier, with late model crank-driven oil pump designs, you can't turn the oil pump with a drill anyway).

RIGHT: Today's late model engines (GM LS, Chrysler Hemi, Ford Coyote as examples) feature a crank-driven oil pump and distributorless ignition. Priming an engine by turning the pump is no longer an option.



BELOW: Oil pumps that are directly driven by the crank eliminate the need for cam gear-to-distributor interface and intermediate shaft.



An engine pre-oiler can be used whether the engine is on a stand, on an engine dyno or with the engine already installed in the vehicle.

Note that today's high quality pre-oiler tanks are available in stainless steel and aluminum construction. Older style steel tanks are essentially the same type as used for propane. While serviceable if maintained correctly, if not stored properly with clean oil, it is possible for rust to form inside the tank which can lead to potential oil contamination. Quality alloy-constructed pre-oil tanks are readily available from sources such as Melling,

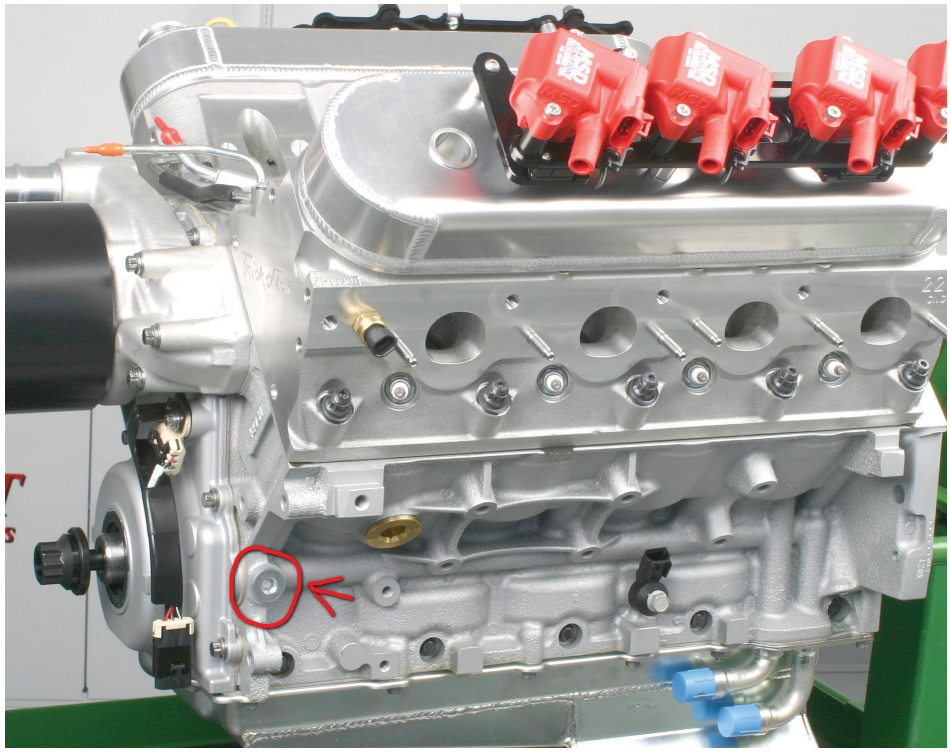
(continued)

Silver Seal and Goodson. Purchasing (and using) a pressurized oil delivery system is one of the best investments you'll ever make.

HOW TO USE A PRE-OILER TANK

Locate an accessible oil port on the engine block (the port to be used for the oil pressure sender is but one option). Remove the oil pressure sender or threaded plug that opens a passage to the crank-driven oil pump.

First, install a new pre-filled oil filter. Locate the proper fitting to adapt the pressure oiling tank's hose fitting to the port in order to connect the oil tank's hose using adapters (usually included with the tank kit). For example, the LS block can feature a 16mm x 1.5 hole, the Chrysler Hemi 1/8" NPT, Ford Coyote 12mm x 1.5). Hoses provided with these tanks are generally about 8 ft long, allowing you to place the tank securely on the shop floor or on a nearby workbench or cart. Remove the oil reservoir cap from the tank and add fresh, clean engine oil to the tank's oil reservoir. Depending on the make/model of the pressure oiler, capacity can range



On the LS engine, for example, the threaded plug located on the forward left side of the block allows oil to be directly injected into the oil pump during priming. See plug circled in red.





The use of a pressurized pre-oil tank is applicable to any engine, regardless of the style or location of the oil pump system. Add the appropriate oil to the cannister, using the same oil you plan to use for engine break-in.

The pre-oil tank features a thread cap with a sealing O-ring (shown below). After adding oil, install the cap.





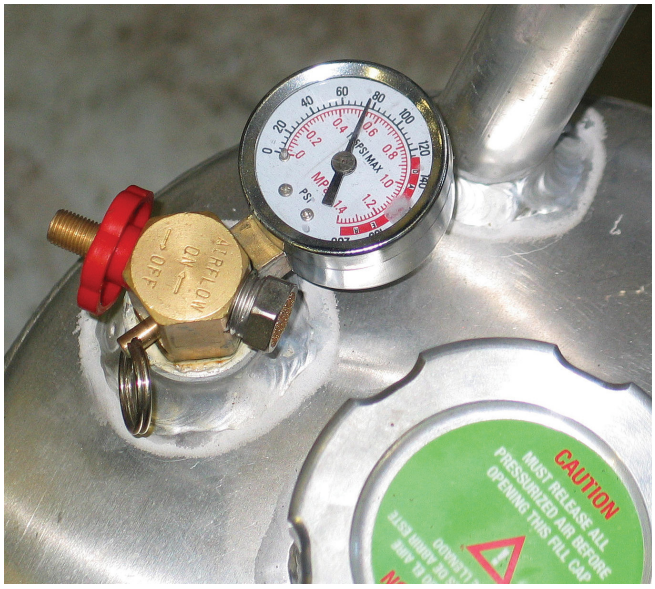
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from 4 to 12 quarts. Install the oil reservoir's cap. Make sure that the pressure oil tank's flow control valve is in the closed position.

Charge the tank using compressed air. Connect the tank's hose to an oil port on the engine block. On a GM LS engine for example, you may utilize the 16mm x 1.5-thread oil plug located at the left front of the block...this will allow oil to be delivered directly to the crank-operated oil pump. Make sure that the connection is secure. While not mandatory, a bit of Teflon sealant paste on the adapter threads may be a good idea to prevent potential minor leakage. Do not use Teflon tape, as loose "threads" of Teflon tape can potentially break loose and enter the system.

If using the left front oil port on an LS engine, you may then connect an oil pressure gauge to the top rear oil pressure sender port to monitor pressure. You can also prime using the top rear oil pressure sender port (sort of "backfeeding" the oil). You may wish to pour oil into the oil pump's pickup tube port prior to installing the pickup tube and then proceed with oil pressurization. Regardless, the goal is to send oil throughout the entire oil delivery system to prevent a dry start.



Using compressed shop air, pressurize the tank.

Open the pressure oiler's flow control valve to introduce oil into the engine. You'll soon hear oil gurgling/burping inside the engine as it travels through the block's oil passages. It will take a while to thoroughly deliver oil throughout the engine, so be patient.

Remove the spark plugs to make crank rotation easier and to relieve mechanical pressure at the rod bearings. While the system is being pressurized, slowly rotate the crankshaft using a wrench at the crank snout bolt. This will aid in delivery, as you allow bearings to pass by and intersect with the block's oil passages. Eventually you will see oil being delivered to the rockers. Continue pressurization until you verify that oil is being delivered to all rockers, on both banks (if V-type engine). Again, sometimes this takes a while. Sit back and wait for the oil to migrate thoroughly.

Note: When dealing with a dry sump system, consider adding oil to the pan and scavenging oil from the pan, and removing the external oil pump belt and turning the pump



with a drill (using the appropriate adapter). Turning the dry sump pump by hand will be too slow and will not obtain sufficient oil volume to feed oil throughout the engine.

USING A DRILL ON ENGINE WITH DISTRIBUTOR

Of course, if the engine is outfitted with an oil pump that is mechanically driven by a shaft that is connected to a distributor (granted, uncommon on late model engines), remove the distributor and the intermediate oil pump drive shaft. Insert an extended priming shaft of the style that will engage the oil pump's shaft (these are available in hex or slotted styles to accommodate various designs of GM, Ford, Chrysler, etc.). Install an oil pressure gauge to the engine block. Remove the valve cover(s). Connect a power drill to the priming shaft and drive the pump until the gauge shows that oil pressure is established. Continue to turn the pump while monitoring the rocker arms. Keep turning the pump until you see oil exiting at the rockers (on both banks if dealing with a V type engine). Once oil is being delivered



Once the tank's discharge hose has been connected to the block, open the air valve to allow pressurized oil to be forced into the engine.

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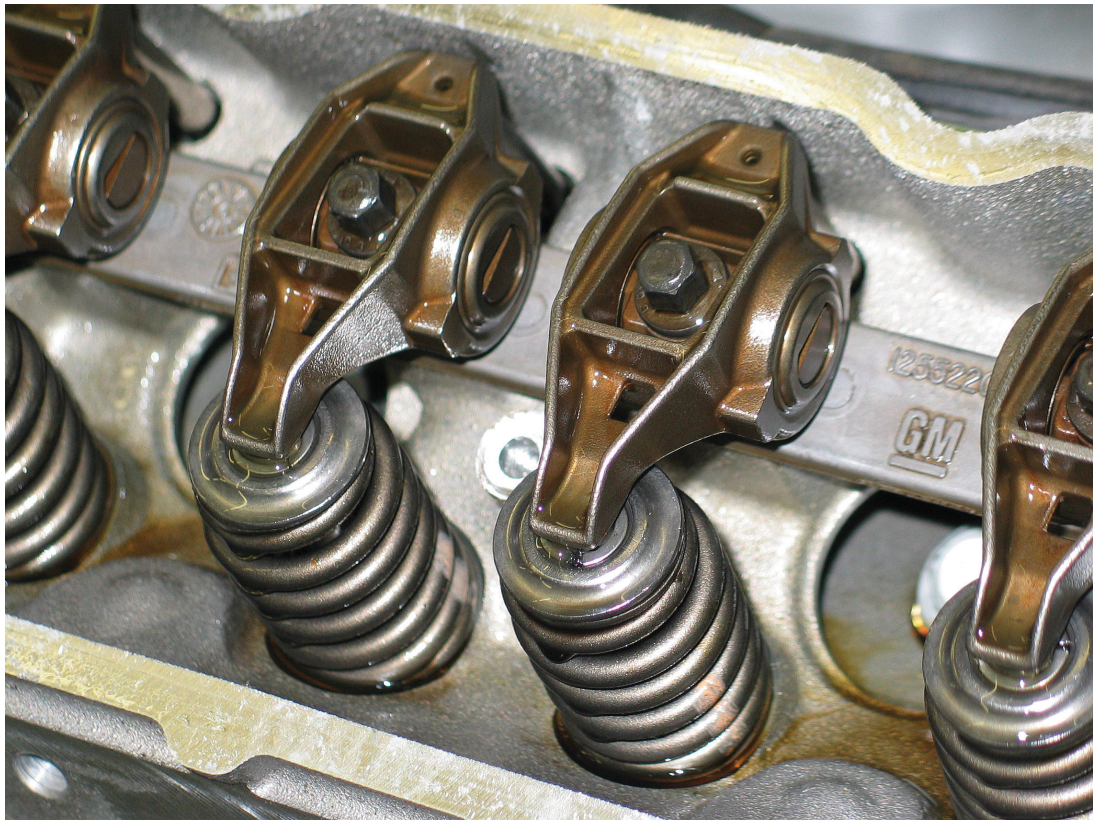
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As oil is forced into the engine, you'll hear gurgling noises as oil begins to displace air in the oil passages. Slowly turn the crank to allow bearing oil holes/channels to intersect with oil gallery holes for more efficient oil delivery to the bearings. Closely observe to verify that all rockers are receiving oil. Be patient, as this may take a while.



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to the rockers, and if you've achieved at least minimum oil pressure on the gauge, oil has been delivered throughout the engine. By the way, don't try this with a cordless drill or a low-powered electric drill. Use a strong electric or pneumatic drill.

As already mentioned, while pressurized oil is being forced through the engine, it's a good idea to slowly manually rotate the crankshaft a full 360 degrees using a wrench at the crankshaft snout (with spark plugs removed for easier crank rotation). This provides added insurance that the oil feed holes on the crank get a healthy shot of oil from the bearing saddle oil holes as the oil transfer holes between bearings and journals align.

If using a pre-oiler tank, once you're satisfied with oil delivery, close the flow control valve on the pressure oiler



On the LS engine, an option to feed pressurized oil, you may use the top rear-located oil pressure sender port, though using the front-left port to feed the oil pump directly is usually preferred. Either method will work.



and disconnect the compressed air line. Carefully remove the pressure oiler's hose from the engine block (place a rag under the end of the hose to prevent dripping oil onto surfaces as the hose is removed). Reinstall the vehicle's oil port plug and spark plugs. Reinstall the oil pressure sender and distributor (if these were removed).

Check engine oil level in the engine's oil pan sump (check the dipstick). If you've introduced the type and grade of oil you plan to run, check the dipstick and add to the fill mark if necessary. Naturally, if overfull, drain oil from the sump and adjust oil level as needed.

Note: Consider the type of oil to use during pre-oiling. This should be the same type and viscosity that you plan to initially run in the engine. If the engine is newly-built, you may want to avoid using a full-synthetic oil for break-in, as this may prevent the piston rings from properly bedding against the cylinder walls. Ideally, it's always best to use a dedicated break-in oil for initial firing (an oil designed with the appropriate level of zinc phosphate). If you're running a flat tappet camshaft (solid or hydraulic), you MUST run an oil with adequate high-pressure lubricant (commonly referred to as featuring zinc phosphate). Specialty engine oils are readily available today that are specifically designed to provide the needed protection for flat tappet lifters/camshafts.



While pre-oiling perhaps a few days prior to startup, it's best to pre-oil the engine immediately prior to engine startup.



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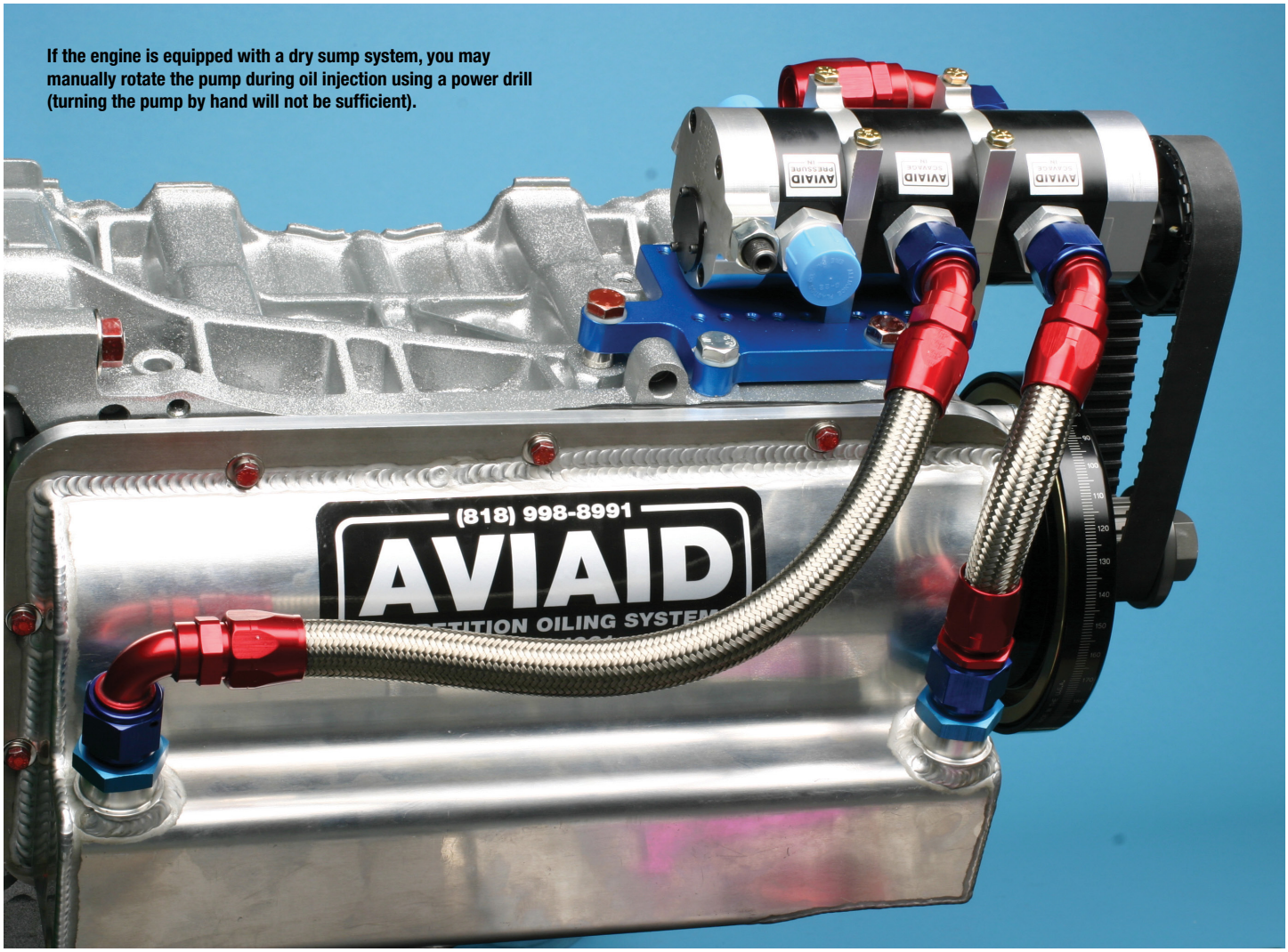
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If the engine is equipped with a dry sump system, you may manually rotate the pump during oil injection using a power drill (turning the pump by hand will not be sufficient).

Even if you're running a performance roller cam coupled with high valve spring pressure, be aware that higher valve spring pressures can promote wear on rocker and valve tips, so a specially formulated oil (or concentrated zinc additive added to your oil of choice) is highly recommended as well. Most of today's off-the-shelf engine oils feature greatly reduced levels of high pressure zinc additives, so it's important to select an oil that retains a high level of zinc. These specialty oils are now readily available from firms such as Brad Penn, Joe Gibbs, Lucas, Royal Purple, Comp Cams and others.

In order to "break in" the engine, follow the recommended procedure when dealing with a flat tappet camshaft (fire the engine, do not allow it to idle, run at approximately 2400 rpm, for about 15 minutes, varying engine speed during the break-in period). Even if you're running a roller cam, run the engine at varying speeds for a few minutes to allow the rings to seat.

Naturally, monitor engine oil pressure and temperature during the break-in period. When breaking-in a flat tappet cam, it's important that the engine is not stopped at any point during the procedure. That's why it's important to perform a solid pre-flight check to verify that you have no leaks, timing is correct (or as close as possible), etc. before you start the engine. And make sure that the fuel tank has an adequate supply to avoid stopping the engine prematurely.

Once the initial break-in has been accomplished, change the engine oil and filter. DO NOT immediately pitch the used oil filter. On a workbench, cut the filter apart (dedicated oil filter cutters are available), remove the filter element, and inspect all filter surfaces/pleats to check for any large pieces of metal debris.

The need for pre-oiling is not limited to only performance engines. Any fresh engine (or one that has been dormant for an extended period) should be pre-oiled prior to its initial starting.■



Mike Mavrigian has written thousands of technical articles for a variety of automotive publications and many books for CarTech and HP Books. Contact him at Birchwood Automotive Group, Creston, OH. Call (330) 435-6347, email: birchwdag@frontier.com or go to birchwoodautomotive.com.