

# PERFORMANCE

## Oiling System 101: To Restrict or Not to Restrict?

Factory stock engine blocks were designed to be mass-produced economically and to operate in a passenger car environment. Original equipment oiling systems are typically restrictive and feed oil to the top of the engine first. The common practice has been to use a high-volume oil pump to offset these shortcomings and help the main bearings get more oil to survive.

Dart aftermarket blocks have been designed with a less restrictive oil system which feeds oil to the main bearings first; a "priority main" oiling system. Many of us in this industry are inclined to use a high-volume oil pump due to history. However, this causes excessive oil to the top of the engine. Restrictors are then used in the lifter galleys to reduce the amount of oil to the top.

Modern lifter designs typically have small oiling orifices which restrict the oil reaching the top of the engine. Using a standard-volume oil pump with current lifter designs and the Dart priority-main oiling system eliminates the need for restrictors, simplifying engine assembly and taking the guesswork out of oiling system design.

— From *Dart Cylinder Heads*

## BMW Oil Filter Control Valve Leak Found on Some M20 and S14 Engines

A repair kit is available that eliminates oil leaks coming from the control valve cover area of the oil filter housing on all M20 (B25 with engine oil cooler) and S14 (M-Power) engines.

An O-ring with improved material quality (Viton) has been developed by BMW. The new repair kit (consisting of 1

Viton O-ring, 1 cover and 1 snap ring) must be installed whenever an oil leak is detected coming from the control valve cover of the oil filter housing (see illustration). This repair kit will eliminate the need to replace the complete oil filter housing and can be installed without removing the oil filter housing from the engine.

### Repair Procedure:

- Clean oil filter head cover area;
- Clamp the control valve cover using a 4-inch "C" clamp and lift snap ring out of its seat using a small bladed screwdriver or similar tool;
- Carefully remove the control valve with the O-ring. Catch escaping engine oil. Caution: The cover spring is loaded;
- Replace the O-ring, cover and snap ring included in the repair kit. Note: On S14 engines (M3 vehicles), only the O-ring and snap ring should be replaced since the control valve cover differs in design from the M20 engines.
- Run the engine to operating temperature (80° C oil temperature) and check control valve cover area for leaks; and
- Check engine oil level and top off if necessary.

The repair kit can be ordered under BMW part number 11 42 9 059 338.

## Revised Camshaft Seals for 1990-'91 Acura B18A

There have been complaints of an oil leak on some 1990-'91 Acura B18 engines. The leak appears to be coming from behind the power steering pump bracket, between the engine block and timing belt cover.

To repair or prevent oil leaks around camshaft, use revised camshaft oil seals (p/n 91203-PR4-004).

1) Remove the timing belt and the camshaft pulleys. Note: There is a small possibility that the timing belt may have been contaminated with oil if this is a warranty repair. Inspect the belt and replace it if it has been contaminated.

2) Remove the No. 1 intake and exhaust camshaft holders and remove camshaft oil seals. See **Figure 1**, page 18.

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- Rinse residues from surfaces and passageways
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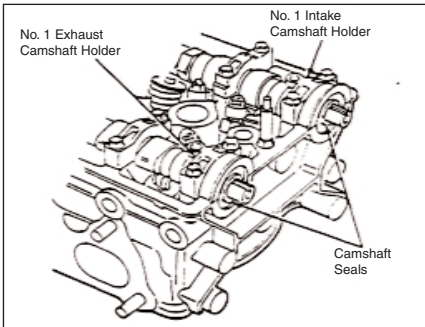


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3) Clean the camshaft holders and camshaft oil seal seats on the cylinder head.

4) Apply a light film of white grease to the lips of the new oil seals. Carefully slide the seals onto the camshafts. Make sure the seal lips are not distorted and the seals are bottomed out in their seats.



**Figure 1** Clean the camshaft holders and camshaft oil seals on Acura B18A engine.

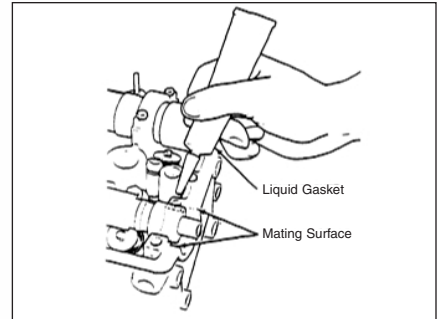
5) Apply liquid gasket (p/n 08718-0001) to the cylinder head mating surfaces of the camshaft holders (**Figure 2**, right), then install the holders onto the head. Tighten the camshaft holder bolts to 7 ft.lbs. (10 Nm).

6) Install camshaft pulleys and timing belt.

## Spin Testing Caution to Prevent Premature Camshaft Failure

Some engine builders use a test stand to drive the engine with an external power source. Duration of this testing must be held to an absolute minimum and a test oil, such as one with a high “EP” additive content, should be used to prevent damage to critical cam lobe and follower surfaces.

Typically the engine is fed a light oil by a pump within the test stand to simulate



**Figure 2** Apply liquid gasket to the cylinder head mating surfaces of the camshaft holders then install the holders onto the head.

hot operating conditions. The engine is powered by the external power source at a speed of less than 500 rpms for 2 or 3 minutes while oil pressure, oil flow and torque required to spin the engine, are monitored. Occasionally a camshaft failure develops following the test and subsequent installation into a vehicle or power unit.

The speeds generated during this test are too low compared to those required for proper camshaft and lifter break-in. Since the camshaft in a 4-cylinder engine rotates at only one half crankshaft speed, the low rpms do not create sufficient inertia force to “toss” the lifter off the lobe apex which is necessary to reduce the loading on the nose or apex of the cam lobe. This reduction in loading at higher engine speeds prevents scuffing and wear of the lifter and lobe contact surfaces.

The thin test oil being circulated also tends to flush the camshaft break-in lubricant from the lobe and lifter surfaces. Then with the engine delivered to the installer the camshaft is protected only by the residual test oil. If the installer experiences problems firing the engine, or delays the break-in procedure for any reason, metal to metal contact is likely to occur; resulting in a lobe failure.

– From MAHLE Clevite

## Carburetor CFM Rules For Maximum Performance

Carburetors are rated by CFM (cubic feet per minute) capacity. Four-barrel (4V) carburetors are rated at 1.5” (Hg) of pressure



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drop (manifold vacuum) and two-barrel (2V) carburetors at 3" (Hg).

For maximum performance, select a carburetor that is rated higher than the engine CFM requirement. Use 110 to 130 percent higher on single-plane manifolds. For example, if the engine needs 590 CFM, select a carburetor rated in the range of 650 to 770 CFM for a single-plane manifold. A 750 would be right. An 850 probably would cause driveability problems at lower rpm. A 1050 probably would cause actual loss of hp below 4,500 rpm. For dual-plane manifolds use 120 to 150 percent higher.

#### *CFM and Manifolds:*

Manifolds must be sized to match the application. Because manifolds are made for specific engines, select manifolds based on the RPM range.

#### *CFM and Camshafts:*

With the proper carburetor and manifold it is possible to select a cam that loses 5 to 15 percent of the potential hp. These losses come from the wrong lift and duration which try to create air flow that does not match the air flow characteristics of the carburetor, manifold, head and exhaust so volumetric efficiency is reduced. An increase in camshaft lobe duration of 10 degrees will move the hp peak up 500 rpm but watch out; it may lose too much hp at lower rpm.

#### *CFM and Cylinder Heads:*

Cylinder heads are usually the limiting component in the whole air flow chain. That is why installing only a large carburetor or a long cam in a stock engine does not work. When it is not possible to replace the cylinder heads because of cost, a better matching carburetor, manifold, cam and exhaust can increase hp of most stock engines by 10 to 15 points. To break 100 percent Volumetric Efficiency, however, better cylinder heads or OEM "HO" level engines are usually needed.

#### *CFM and Exhaust:*

An engine must exhaust burned gases before it can intake the next fresh charge. Cast iron, log style manifolds hamper the exhaust process. Tube style exhaust systems

are preferred. But headers are often too big; especially for Performer and Performer RPM levels. Improving an engine's Volumetric Efficiency depends on high exhaust gas velocity to scavenge the cylinder. This will not happen if the exhaust valve dumps into a big header pipe. On the newer computer controlled vehicles it is also important to ensure that all emissions control devices, and especially the O2 sensor, still work as intended.

#### *CFM and Engine Control:*

Spark timing must be matched to Volumetric Efficiency because VE indicates the quantity of charge in each cylinder on each stroke of the engine. Different engine families require distinctly different spark advance profiles. And even engines of equal CID but different CR require their own unique spark advance profiles. Rule:

Expect 0.1 to 0.5 percent loss in Torque for each 1 degree error in spark timing advanced or retarded from best timing. Also, detonation will occur with spark advanced only 3 degrees to 5 degrees over best timing and detonation will cause 1 to 10 percent torque loss, immediately, and engine damage if allowed to persist.

— From Edelbrock

#### **Wet Sump vs. Dry Sump Oiling Systems**

A wet sump system is based on the original equipment oiling system, and can be enhanced with certain components to improve oil control and increase power.

The use of a wet or dry sump oiling system is often determined by the level of competition and the racer's budget. A wet sump system is based on the original

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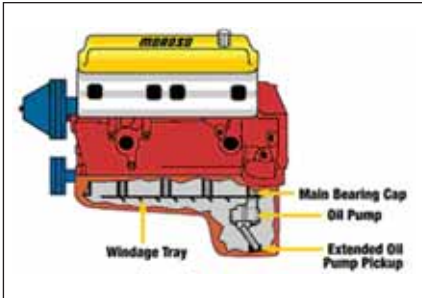
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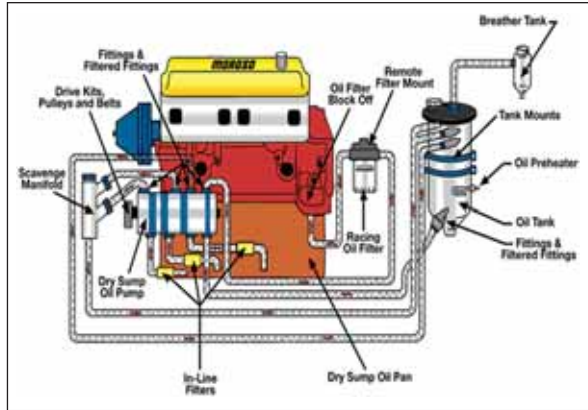


**Figure 2** Typical wet sump oiling system. A wet sump system is based on the original equipment oiling system.

equipment oiling system, and can be enhanced with certain components to improve oil control and increase power. A dry sump system is designed for the top levels of racing where maximum power and oil control are absolutely essential.

**Oil Pan Capacities:**

Capacities listed for Moroso Wet Sump



**Figure 3** Typical wet sump oiling system. A dry sump system is designed for the top levels of racing where maximum power and oil control are absolutely essential.

Oil Pans include the capacity of the pan only, measured at or below the normal fill mark on a stock dipstick. Additional oil must be added to compensate for filters, coolers, tanks, etc.

Unlike a wet sump system where oil is stored in the pan, a Dry Sump Oiling system stores oil in a separate tank – leaving

the pan essentially “dry.” An externally-mounted pump, generally with three or four stages, is used to “scavenge” or remove oil from the pan, deliver it to the storage tank, and send it back through the engine. In a typical setup, all but one of the stages is used to scavenge oil from the pan. A single pressure stage is normally used to return oil from the tank to the engine.

The primary advantage of a dry sump system is its ability to make more power. With very little oil in the pan, the rotating assembly is not burdened with the weight of excess oil (a phenomenon commonly referred to as “windage”). And because there is no internal pump, the windage tray or screen which serves to isolate sump oil from the rotating assembly, is allowed to run the full length of the pan. Keeping the rotating assembly free of windage allows it to spin freely and make more power. In addition, the extra crankcase vacuum created by the dry sump pump helps to improve ring seal for additional power gain.

Other advantages of a dry sump system include increased oil capacity, more consistent oil pressure, the ability to easily add remote coolers, and adjustable oil pressure. And because the pan doesn’t store oil, it can be relatively shallow in depth to allow lower engine placement for improved weight distribution and handling.

Note: Oil pan rules vary from track to track. Check with your race track and/or sanctioning body before selecting your Moroso Oil Pan.

– Courtesy of Moroso TSG

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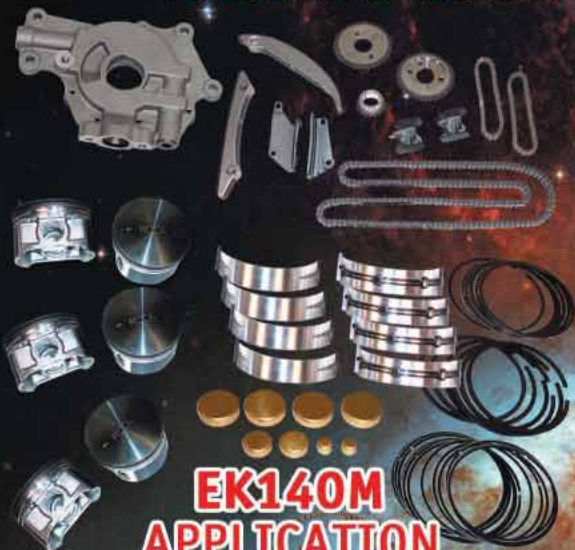
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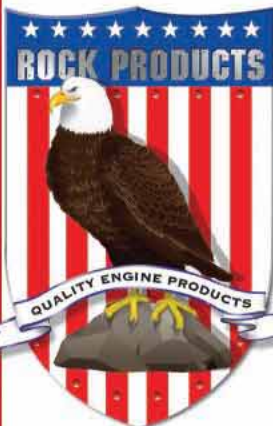
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