

Multiple Layer Steel and Composite Head Gasket Options for Larger Bore Caterpillar Applications

BY STEVE SCOTT

Multiple Layer Steel (MLS) head gaskets have been used in combustion engines for years, and are common in some of the smaller Caterpillar diesel engines. The C13 is one of the larger bore engines that was originally released with MLS head gaskets, but optional composite head gaskets are available. There is also an optional MLS gasket that can be used to replace the composite head gaskets for the much larger 3500 series Caterpillar engines. Use of the MLS gasket in these larger bore engines has raised some questions, and there is some amount of confusion regarding specifications & installation of the two different gasket designs for the 3500 series engines. Whereas, the standard installation procedure and specifications are correct for either design head gasket for the C13 Cat applications.

MLS gaskets typically have 3 to 7 layers of steel. The layers may vary in thickness, and the outer layers are usually embossed spring steel, which creates a spring affect that retains a positive seal against head lift and movement. Other features may include beadings and coatings to improve seal ability.

For an MLS gasket to seal, the sealing surfaces (cylinder block, spacer plate-if equipped, & cylinder head) must be within specifications, and they require smoother surface finishes. They do not do well with rough surface finishes or questionable surface profiles. This makes MLS gaskets far less forgiving than traditional composite type gaskets. The larger machine specialists we've talked with recommend 40Ra or smoother for these engines with cast iron



blocks and heads. 40Ra is smoother than some of the OE published specs, but works well for either design gasket. On engines that use a spacer plate between the cylinder block and head, the condition of the spacer plate is just as important. Smaller bore engines tend to have “parent” bore cylinder blocks that do not have replaceable liners. They require boring of the cylinders or installing machine sleeves to correct cylinder wall wear or damage,

and are more often completely disassembled and machined. Larger bore engines have replaceable liners, and many times may be repaired or rebuilt on site without the block being resurfaced. This brings up the question of whether or not the MLS gasket will seal completely as the engine ages and if the composite gasket is better suited for the larger bore applications. The MLS gaskets may also have difficulty sealing blocks that have been repaired with

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liner inserts. Thus, depending on the circumstances, the composite designed gasket may be a better option.

The release of the MLS head gasket for the 3500 series Cat engines also included a new spacer plate, a change to the liner protrusion specification, as well as a new torque procedure and sequence (the spacer plate gasket is the same). Originally, the service information noted that the new head gasket (3628264) had to be used with the new spacer plate (3629677). That has been revised, and any combination of new (3629677) or old (1106994 aluminum or 2603904 steel) spacer plates can be used with new MLS (3628264) or old Composite (1106991) head gaskets, but the different liner protrusion and torque procedures are still required.

The liner protrusion for the MLS gasket is .003"-.006", no matter which spacer plate is used.

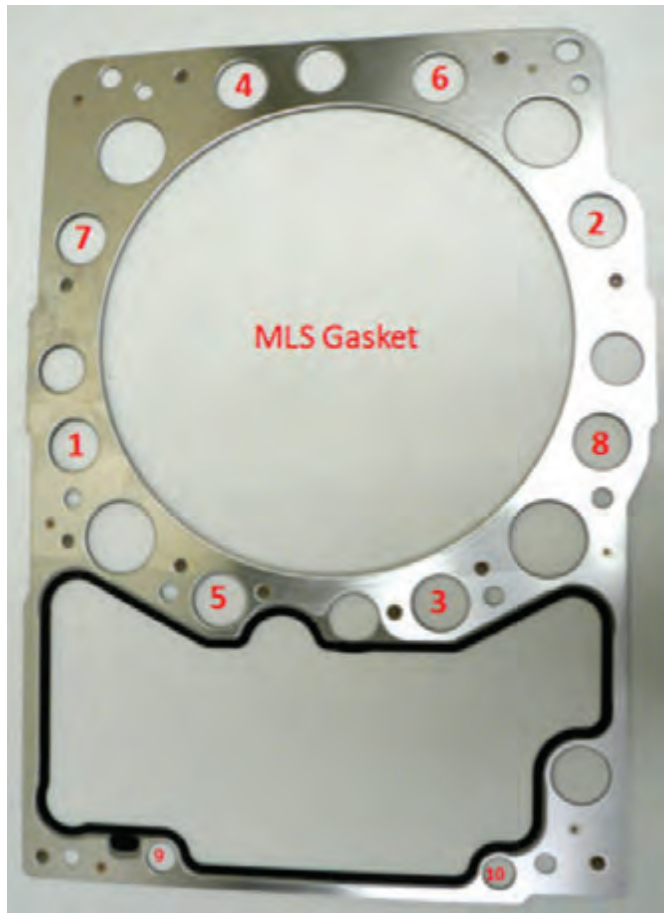
The liner protrusion for the composite gasket is .002"-.008", no matter which spacer plate is used.



A Multiple Layer Steel (MLS) Head Gasket is pictured top and a Composite Head Gasket is shown beneath it.

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MLS Head Gasket Sequence

- Tighten bolts 1 through 8 to 22 ± 4 lb ft
- Tighten bolts 1 through 8 to 75 ± 11 lb ft
- Tighten bolts 1 through 8 to 330 ± 11 lb ft
- Loosen bolts 1 through 8 an angle of 90 ± 5 degrees
- Tighten bolts 1 through 8 to 360 ± 11 lb ft
- Tighten bolts 9 and 10 to 40 ± 7 lb ft

Composite Head Gasket Sequence

- Tighten bolts 1 through 8 to 22 ± 4 lb ft
- Tighten bolts 1 through 8 to 148 ± 11 lb ft
- Tighten bolts 1 through 8 a 2nd time to 148 ± 11 lb ft
- Tighten bolts 1 through 8 an additional 180 degrees
- Tighten bolts 9 and 10 to 40 ± 7 lb ft

The torque sequence and procedure for the two gaskets is shown below. Each step in the tightening process must be followed. Attempting to skip, shorten, or increase any of these steps will place excessive load on the liner flange, as well as the first bolt tightened. As the cylinder head is tightened, there is constant creep or movement taking place. The torque sequence and procedure must be followed correctly to assure the crush is properly controlled.

Beyond the two gasket designs discussed above, you might also want to consider the aluminum vs. steel spacer plates that may be available.

Most industrial engines have cast iron cylinder blocks and heads, our experience has proven that the steel spacer-plate has more consistent thermal expansion with

those castings than the aluminum plates, and are superior over the aluminum plates in durability and reusability.

Another area of importance is the installation hardware, such as the cylinder head bolts. While you may find reusability guides for critical hardware like cylinder head bolts, we are seeing more OE publications that require head bolts to be replaced more often than in the past. Some recommend one use only for the cylinder head bolts, and the 3500 series Cat applications have a maximum of 5 uses as long as the reuse criteria is met.

The information, parts numbers, and specifications in this article are the latest available to us at the time of the publication. Refer to the latest OE service bulletins and guides for additional updates. ■



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