CAT 3406E AND C-15

Blocks, Heads and Head Gaskets

BY **STEVE SCOTT**

The Cat 3406E and C-15 engine lines have a long history of updates and improvements, some of which resulted in components that are not compatible for use in earlier or later model years. Understanding the differences in 3406E and C-15 cylinder blocks, heads, and head gaskets can be confusing. Knowing some of the differences can be important given the multitude of exchange programs, updates and interchangeability.

HEAD GASKETS

Visually, there is only a subtle difference between the two original style head gaskets, at the oil return port (at the rear of the engine). The earlier engines used the Part #1539653 head gasket, which has an integral seal embedded into the head gasket at the oil drain back passage (shown on top). The gasket for the later series engines does not have the integral seal embedded at the oil return, and is designed to be used with a free floating seal on the later style cylinder blocks as shown in Figure 1 insert. Care must be taken when cleaning the block or spacer plate in this area since abrasive pads or wheels can quickly taper or distort the surfaces, resulting in leaks.

Structurally these two gaskets are considerably different. The earlier style head gasket is constructed of a single layer of perforated metal core, and two layers of graphite material as shown in Figure 2. This design works well as long as the original style block, cylinder head and spacer plate are in very good condition.

Later production engines used the #2245122 head gasket, which is constructed of two layers of perforated metal core, and three layers of graphite material as shown in Figure 3. This gasket is approximately 1/3 heavier than the

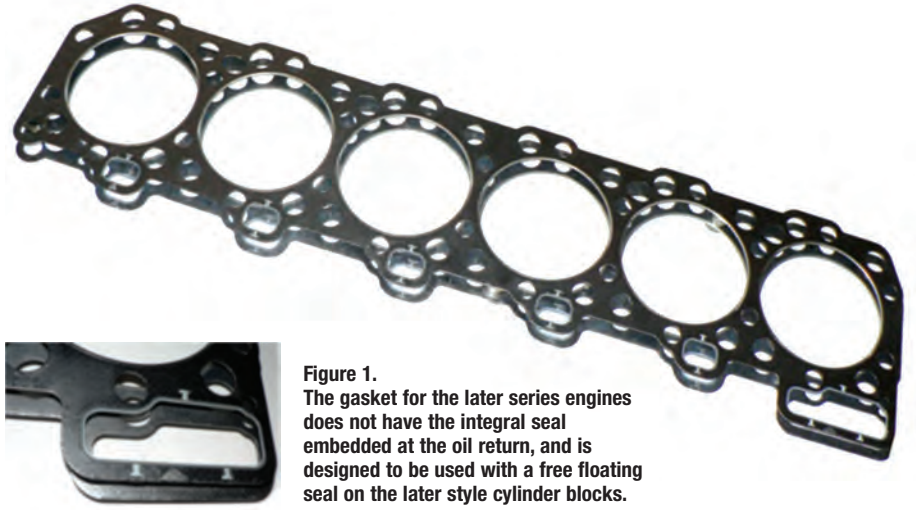


Figure 1.
The gasket for the later series engines does not have the integral seal embedded at the oil return, and is designed to be used with a free floating seal on the later style cylinder blocks.

Figure 2.
Early Style Head Gasket

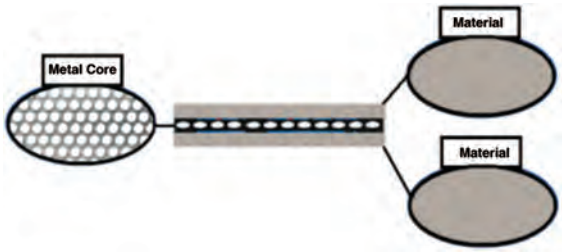
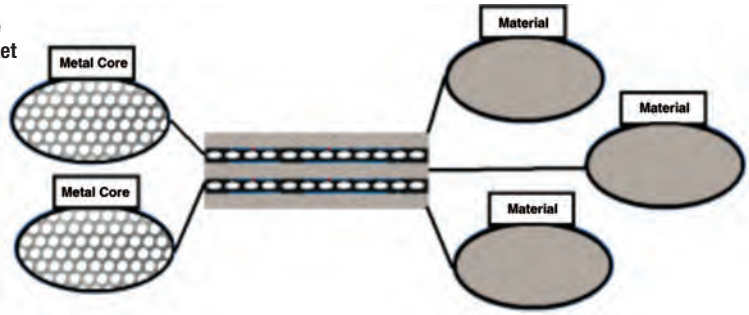


Figure 3.
Later Style Head Gasket



earlier series gasket. Note that this later series gasket does not have the integral seal embedded at the oil return and is designed to be used with a free floating seal on the later style cylinder blocks. The free floating seal offers a more positive seal between the head and block as compared to the earlier design which relied on the coated spacer plate gasket to seal between the block and spacer plate.

CYLINDER HEADS

Differences in the cylinder blocks and cylinder heads can also have an effect on the head gaskets. Earlier cylinder heads had a flat surface between the cylinders, and typically used the early and lighter three layer head gasket. Later cylinder head castings have a relief cut (or groove) between the cylinders as shown in the comparison photo in Figure 4. This head design was typically used in later engines, and with the heavier five layer style head gasket. The photos in Figure 5 show a comparison of the two head designs, with the early head on the left and the later head on the right.

The various exchange programs and cylinder heads replacements have increased the usage of these relief style cylinder heads. They have become far more common in the marketplace and are being used more frequently in the early style engines. Field issues arose when the earlier three layer head gaskets were used with these current design relief cut cylinder heads. The combined conditions of the cylinder block, spacer plate and cylinder head could allow for thermal push of the gasket material into the voids of the relief cuts, pulling the gasket material back away from the fire rings. Depending on the condition of the other components, this could cause the head gasket to fail prematurely. This failure mode is not the fault of the head gasket, it was simply caused by the head gasket being used with components (and in conditions) it was not designed for.

CYLINDER BLOCKS

At this point, one might ask if the later head gasket with its heavier construction could be used in all applications. Although both gasket designs have the same hole patterns and are within the same thickness range (i.e, no compression ratio change), using a 5 layer gasket with earlier cylinder blocks may result in leaks or seepage around the oil return port. The early style blocks have a large oil return port at the rear that is approximately 1-3/8" (3.5cm)

Figure 4. Original design, left; current design, right.

Figure 5. Block deck differences, prior on left; current on right.

Figure 6. (above) Early block, free floating seal — will not work.

Figure 7. (right) Later block, omitted seal.

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wide. The coated spacer plate gasket seals between the block and spacer plate while the integral embedded seal in the head gasket seals between the spacer plate and head. Later style blocks have a smaller oil return port that is approximately 13/16" (2cm) wide. This narrow port supports the free floating seal and seals the block directly to the cylinder head.

When comparing the two block designs side by side, the difference is more apparent (see Figure 5 on page 38).

The early cylinder blocks cannot support the free floating seal. The photo in Figure 6 (on page 38) shows the early block and late style gasket and seal. If the free floating seal were used with this style cylinder block there is no support and the floating seal falls into the return port.

To help eliminate some of the confusion these different combinations may present IPD has developed a one head gasket solution that overcomes the confusion. Using it will alleviate any issues with the various combinations of heads, blocks and head gaskets. IPD's #2245122SP head gasket offers an improved 5-layer construction, and an integral seal embedded in the gasket at the oil return port. It can be used with either style cylinder block. This head gasket can also be used with the free floating seal in the later blocks, as shown in the photo shown if Figure 7 (on page 38).

Of course, when used with the earlier blocks, the free floating seal cannot be used; it is simply omitted from assembly. Thus, the condition of the block and spacer plate must still be within specifications since they still rely solely on the spacer plate gasket to seal between the block and spacer plate.

Hopefully this information has resolved some of the confusion and has explained the IPD's innovative solution. If you've any questions, do not hesitate to contact me.■

Steve Scott joined the service department at IPD in 1982, working with parts, service and sales for a variety of equipment, diesel, and natural gas engines. Since 2004, he has been the director of product development and technical support for IPD. For more information, please call 713-574-6145 or email sscott@ipdparts.com.