

Heavy-Duty Engine Pistons



Which way did they go?

BY STEVE SCOTT

“Which way did they go?” That phrase has been used in cartoons, countless Western movies and TV shows as far back as most of us can remember. But how does it relate to pistons for a heavy-duty engine? Pistons may or may not be directional, and you may not be able to tell by appearance alone. Here are a few examples of why some pistons are directional. The easiest ones to recognize are pistons with distinct crown designs. The photo (Figure 1) shows the offset bowl in the crown of the piston. However, there is no indication on the crown that the piston is directional. In this case following the OE assembly guide, or possibly an information sheet in the packaging, will have the instruction as to the positioning of the bowl. Installing this type of piston incorrectly will alter how the fuel is injected into the cylinder. The engine may not start, and if it somehow does manage to start, fuel erosion will soon damage the aluminum crown.

Another indicator of a directional piston are valve reliefs (Figures 2 and 3). Pistons can have single or multiple valve reliefs (pockets).

The valve reliefs often differ in diameter, but do not be too hasty when you look at them. The photo (Figure 4) is a common piston for a Cummins ISX engine. At first glance you may not catch that one valve relief is deeper than the others.

The upper valve pocket shown in this photo (Figures 4 and 5) is approximately 0.075” deeper than the other three pockets.

Installing any piston with valve reliefs incorrectly may keep the engine from turning over once the head is installed. In other applications the engine may turn over and start, but will likely bend or break the valves shortly after. A broken valve in an aluminum piston application (Figure 6) will cause a considerable amount of damage, but the engine will likely be repairable.

(continued)

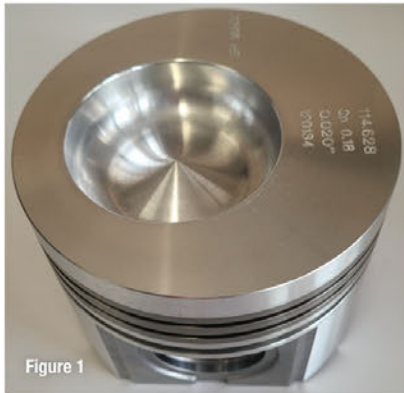


Figure 1

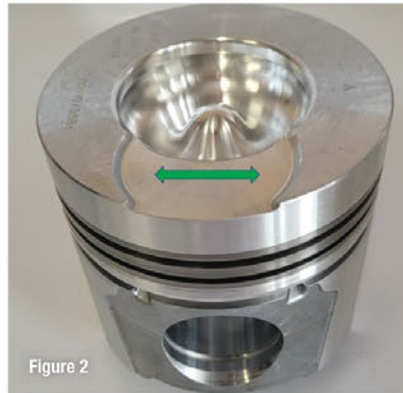


Figure 2

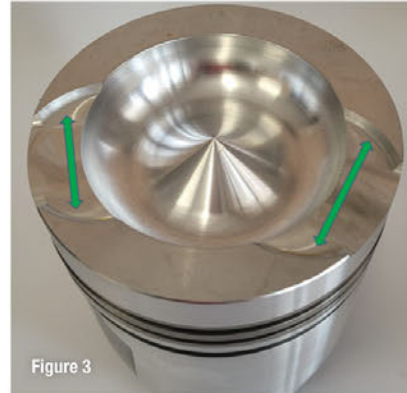


Figure 3

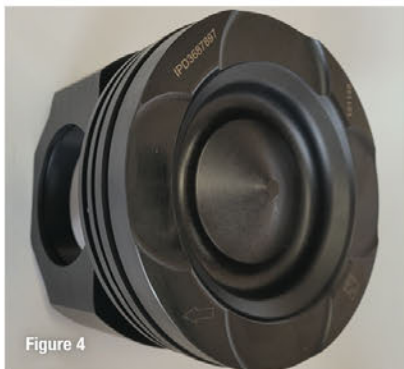


Figure 4

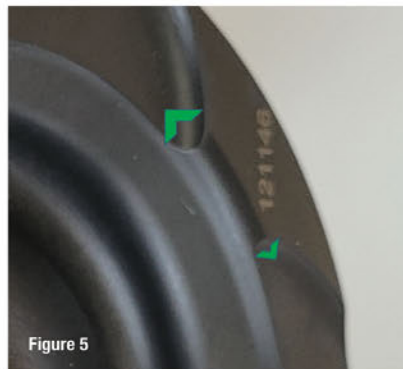


Figure 5

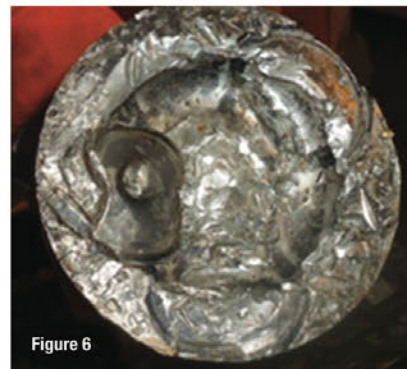


Figure 6

HEAVY-DUTY ENGINE PISTONS

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Figure 7

A broken valve in a steel piston application (Figure 7) can result in a catastrophic failure that destroys the cylinder head, block and connecting rod.

Woodworkers are constantly chattering “measure twice, cut once”. Maybe the motto for a technician should be “check twice, assemble once”.

A more difficult directional piston to recognize are those with an offset piston pin bore (Figures 8 and 9). This is more commonly thought of in the automotive and racing industries, but is used in several of the heavy-duty diesel engines. An offset piston has the pin bore slightly off the center line of the piston. This is an engineering design to reduce friction, piston slap, and noise. Excluding the various crown designs discussed above, installing an offset piston incorrectly would likely increase those properties.

Another subtle, but very important feature is the notch (cutout) in the bottom of the piston skirt (Figure 10) to allow clearance for the piston cooling tube (jet). Commonly these notches are on opposite sides of the skirt and are the same size. On non-symmetrical skirts the notch is only on one side. Installing the piston incorrectly will result in inadequate clearance for the piston cooling tube (jet) with subsequent contact with the skirt breaking the tube. Without the cooling oil from the tube, the piston will overheat and seize.

Generally, a directional piston will have an arrow, marked front, or some marking indicating the correct direction to be installed.

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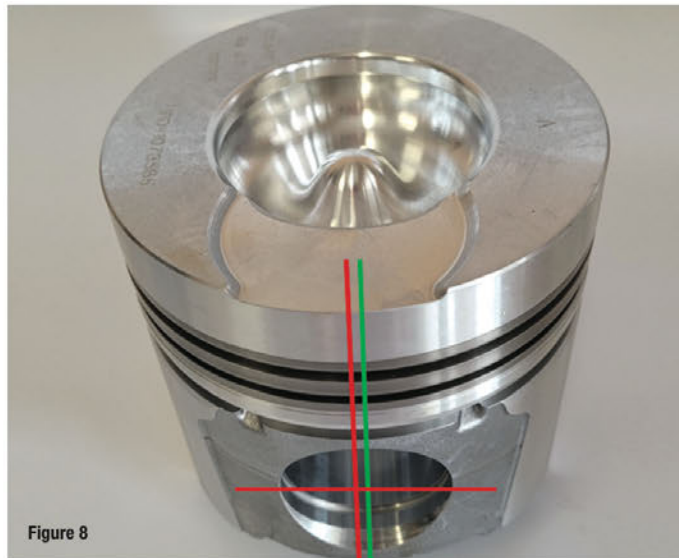


Figure 8

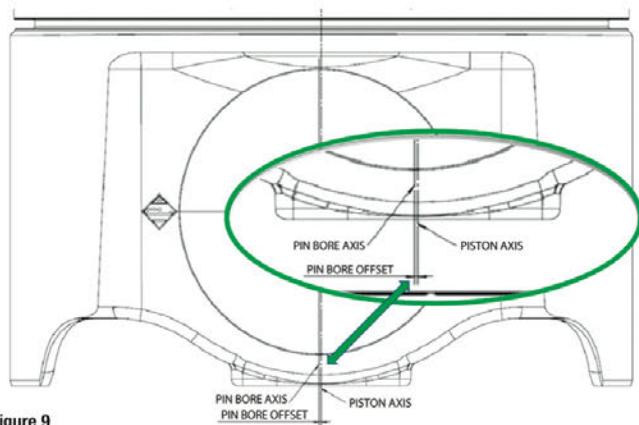


Figure 9



Figure 10

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Shown below in Figure 11, there is only a “V” stamped in the crown. In this example, the piston is not actually directional. This “V” simply helps the technician during the engine assembly.

The OE assembly guide instructs that this “V” needs to go on the same side as the numbers and tabs of the connecting rod (Figure 12).

(continued)

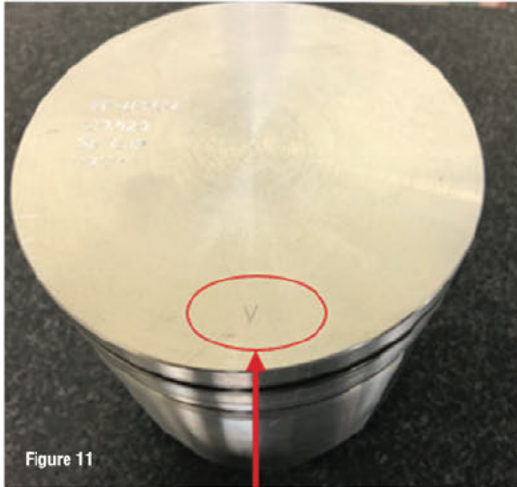


Figure 11



Figure 12

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The markings on the piston and the piston designs are often enough to determine the correct direction. If unsure, referring to the OE service guides and the information sheets included with the piston are the best resources.

Cartoons, movies and TV shows have endless answers as to “which way did they go”, but in a diesel engine, there is a 50/50 chance of guessing “which way did they go”, the right way or the wrong way. In engine repairs, the piston doesn’t magically spring back to life when you get it wrong either...■



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, email sscott@ipdparts.com.

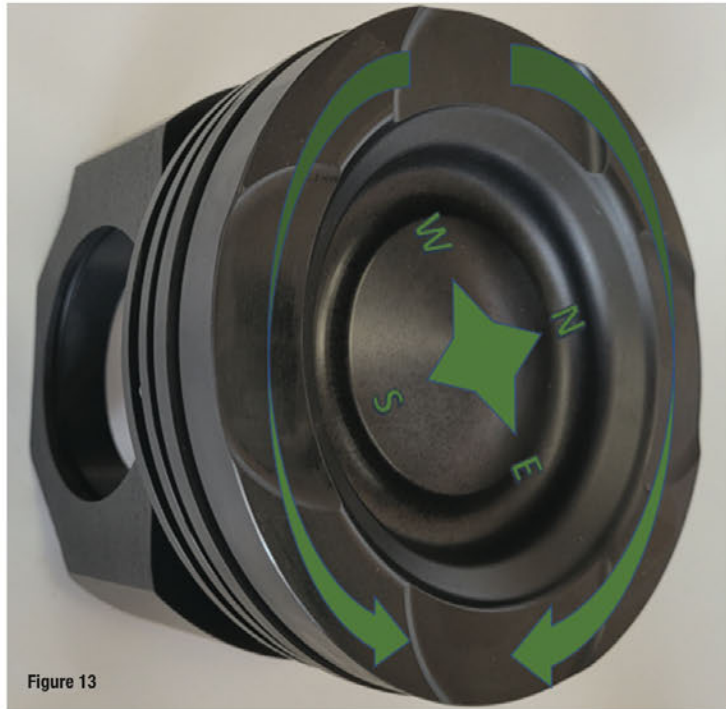


Figure 13



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