ISX/QSX CUMMINS – CONTINUOUS DESIGN CHANGES

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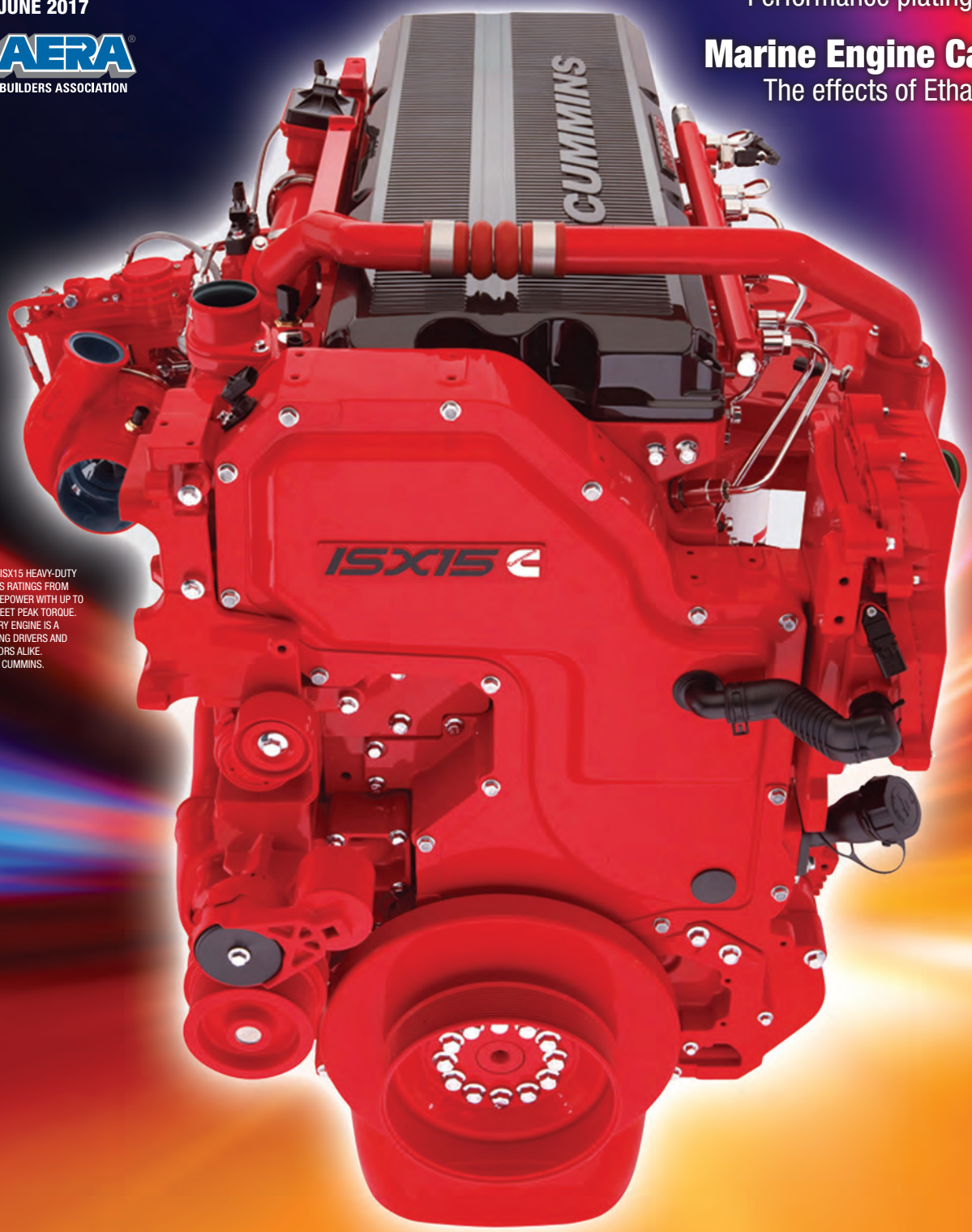

THE CUMMINS ISX15 HEAVY-DUTY ENGINE BOASTS RATINGS FROM 400-600 HORSEPOWER WITH UP TO 2050 POUND-FEET PEAK TORQUE. THIS LEGENDARY ENGINE IS A FAVORITE AMONG DRIVERS AND FLEET OPERATORS ALIKE. PHOTO CREDIT CUMMINS.

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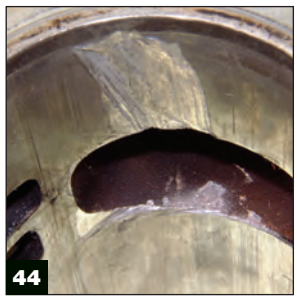
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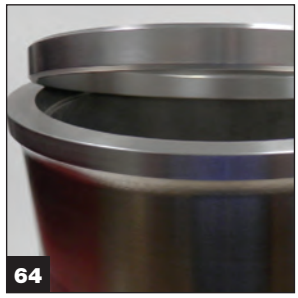
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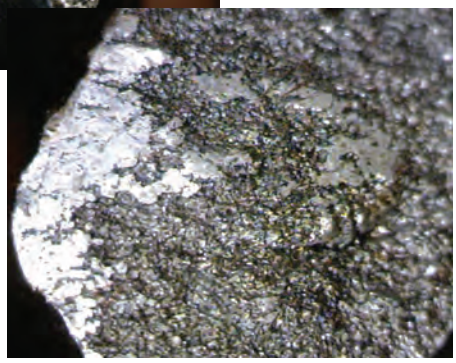
Continuous Design Changes on Cummins® ISX/QSX Series Cylinder Components

BY **STEVE SCOTT**

The Cummins ISX was originally called the "signature" series, and was developed to replace older N14 engines. These Cummins ISX/QSX engines have been subject to numerous updates and design modifications, which is no surprise given their wide power range of 430-650hp. The ISX has become a very popular power source, and is used in on-highway and vocation trucks, while the QSX is used in a variety of industrial, agriculture, marine, and off-highway applications. The earlier version of this engine was a dual overhead camshaft design, while the latter ISX15/QSX15 version has a single camshaft and includes an XPI (eXtreme high Pressure Injection) common rail fuel system.

In previous publications, we've addressed some of the changes, updates, and precautions regarding the Cummins ISX/QSX 14.9 and 15 liter engines. Some of the updates are of no concern if you are doing an overhaul, however, for those repairing an engine by replacing only select components, it can be a challenge since the replacement parts may not be compatible with the remaining components in the engine. This is especially relevant if cylinder components are involved. The intent of this article is to explain the design changes in the ISX/QSX cylinder components, and the recent introduction of an APR (anti-polishing ring pistons and liners).

Reusable



Damaged; not reusable

There are three types of connecting rods to be aware of, and each has an associated rod bearing. The early engines had non-drilled rods, later engines had drilled rods that are "saw cut" or machined on the surfaces between the rod and cap. The latest version is a drilled rod that has a fractured surface between the rod and cap. Drilled, saw cut and fractured rods can be mixed within an engine, but using a non-drilled rod in a drilled application will result in a failure. Special care must be taken to protect the surfaces of the fractured rods. If these surfaces are damaged in any way, the rod must be replaced. (See images below.)

An article in the July-September 2015 issue of *Engine Professional* magazine (pages 58-62) provided "simple precautions" regarding the use of plugs to stop debris, pre-lube precautions, and the potential for a catastrophic failure with the drilled, saw cut rod bearings.

As mentioned above, the cylinder components have undergone another major design change. Understanding these changes, and which components are compatible is key to a successful repair or overhaul.

History of the liner updates

- 1998-2000: Engines used a grooved top liner and multiple piece head gasket.
- 2000-2010: The flat top liner (150mm OD) with no shim was released and a one-piece head gasket.
- 2010-2013: A 152mm flat top liner with no shim was introduced.**
- 2012-2015: A 150mm flat top liner with a replaceable shim was released.*
- 2015: A 150mm flat top liner with an Anti-Polishing Ring (APR) and replaceable shim was released.*
  (Note: there is also a 152mm liner with an APR.)

* Shimmed liners are backwards compatible to with all flat top liners and can be mixed within an engine.

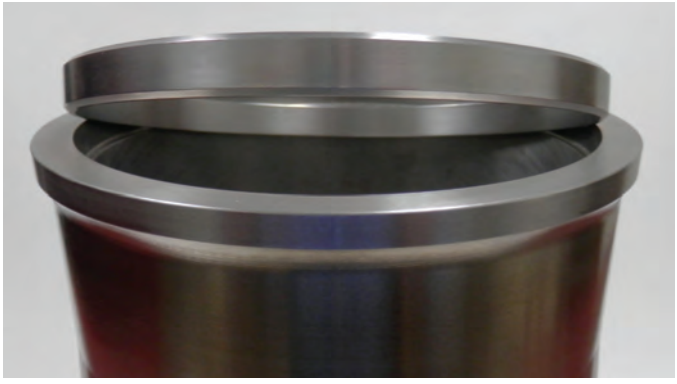
** The introduction of a limited number of cylinder blocks released by Cummins in 2010 with a 152mm OD liner dimeter was somewhat confusing, and caught a few rebuilders off guard who installed a standard 150mm OD liner into the oversized block unknowingly (see *Engine Professional* Jan-Mar 2015 for more information). The same piston kits could be used in the both the 150mm flat top liners (no shim and shimmed) and the 152mm liner, but the liners are not interchangeable.

(continued)

CONTINUOUS DESIGN CHANGES...

BY **STEVE SCOTT**

This latest change involving the introduction of an APR also requires a smaller diameter and lower top ring design pistons. This affects both the 150mm and 152mm cylinder block engines. The APR liner has a counter bore machined in the inside top of the liner to accept the APR. The APR ring is slightly smaller in diameter than the liner bore. The propose of the APR ring is to scrape carbon off of the side of the piston crown, thus limiting the amount of carbon that can build up on the piston and reduces liner wear and polishing. The APR ring is symmetrical, and can be installed in either direction. The APR ring can be replaced without replacing the liner. A different ring compressor (or adapter) is required to install the piston assembly into these new design liners.



While in the engine, these liners can be identified by the two bands machined around the bottom of the liner. Mixing an APR liner with non-APR liners within an engine is not recommended.

Liner	Liner Kit	APR?	O.D.	Shimmed?	Top Design
3690557	4376168	Yes	150mm	Yes	Flat
4311633	4309389	No	150mm	Yes	Flat
n/a	4376391	Yes	152mm	Yes	Flat
3685235	2881719	No	152mm	No	Flat
3682025	3800453	No	150mm	No	Grooved

Open, closed and articulated (2 piece) pistons cannot be mixed within an engine.

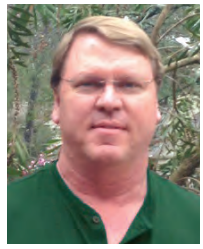
One piece pistons must be used with drilled connecting rods and rod bearings. Failure to align the deep valve pocket and the piston skirt cooling notch correctly will result in extensive engine damage. Refer to the latest OE service bulletin or contact IPD for further information.

Along with the changes in the liners, pistons have had a variety of updates. Pistons can have open or closed skirts (as shown in the photos below). They can have high or low top ring positions, and the crown diameters can vary. In general, the order of these updates has been from open to closed skirts, from high top ring position to low, and from non-reduced crown diameters to reduced crown diameters. To determine the ring height, measure from the top of the piston to the top of the top ring land (groove). High top ring piston measure approx. 8mm (.315”), and low ring pistons are approx. 11mm (.433”). Reduced crown diameter piston, above the top ring measure approx. 134.86 +/- 0.05mm (5.309 +/- 0.002”) and non-reduced crowns measure approx. 135.30 +/- 0.05mm (5.327 +/- 0.002”).

The chart below outlines the succession and compatibility of the piston and liners. Installing pistons that are not designed to be used with the APR liners will result in damage and/or failure of the engine.

This information is for reference only, and is not intended to be used as a guideline. Please refer to the latest OE service and parts publications for the latest updates and information.■

Original (bare) Piston	Original Piston Kit	Piston Design Open/ Closed	Top Ring Location	Ring Top Land Diameter	APR Compatible	Update Replacement APR Piston	Update Replacement Piston Kit For APR	Update Replacement Piston Kit For APR	Piston Design Open/ Closed	Top Ring Location	Ring Top Land Diameter	APR Compatible	Camshaft Design
3687605		Closed	Low	Non	No	3687897	2882080	2882080 CM2250	Closed	Low	Reduced	Yes	Single Camshaft
								4309337 CM2350	Closed	Low	Reduced	Yes	Single Camshaft
3687177	2882023	Open	Low	Non	No	3688100	2882023	2882023 CM2250	Closed	Low	Reduced	Yes	Single Camshaft
								4309338 CM2350	Closed	Low	Reduced	Yes	Single Camshaft
3688405								2882080	Closed	Low	Reduced	Yes	Dual Camshaft
3686366	2881758	Closed	Low	Non	No	3688099	2881758	2881758	Closed	Low	Reduced	Yes	Dual Camshaft
4298991	2882118	Closed	High	Reduced	No	4357149		4376245	Closed	Low	Reduced	Yes	Dual Camshaft
3104186		Open	High	Non	No								
2882635	2881873	Closed	High	Reduced	No	4357150		4376241	Closed	Low	Reduced	Yes	Dual Camshaft
4923745	4089896	Open	High	Non	No								
2863938	4955966	Closed	High	Non	No								
2882636	2881876	Closed	High	Reduced	No	4367126		4676242	Closed	Low	Reduced	Yes	Dual Camshaft
4923746	4089897	Open	High	Non	No								
2863939	4955697	Closed	High	Non	No								
4298992	2882120	Closed	High	Reduced	No	4367132		4376246	Closed	Low	Reduced	Yes	Dual Camshaft
4923744	4089895	Open	High	Non	No								
2882630	2881879	Closed	High	Reduced	No	4367161		4376243	Closed	Low	Reduced	Yes	Dual Camshaft
4923747	4089898	Open	High	Non	No								
3684472	4955968	Closed	High	Non	No								
2882631	2881878	Closed	High	Reduced	No	4367173		4376244	Closed	Low	Reduced	Yes	Dual Camshaft
4923743	4089894	Open	High	Non	No								
3684467	4955923	Closed	High	Non	No								



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.