

Installing a Reluctor Wheel on a GM LS Crankshaft

TEXT AND PHOTOS BY MIKE MAVRIGIAN

Any builder who has dealt with late model engines is fully aware that an engine's computer control system monitors both camshaft and crankshaft position in order to achieve correct spark and fuel delivery. Many crankshafts feature a press-fit toothed timing wheel, referred to as a reluctor wheel. A magnet sensor mounted stationary in the block is aligned to the wheel and picks up crankshaft position.

In order to refer to one specific example, we'll cite the GM LS engine platform's crankshaft.

LS engines feature a toothed reluctor wheel (also called a tone wheel or tone ring), which is press-fit onto the rear of the crankshaft. This toothed wheel is used by the crankshaft position sensor for ignition timing. There are two styles of wheels. The Gen III LS1/LS6/LQ4 engines originally used the 24-tooth reluctor wheel, while the Gen IV LS2/LS7LS3/LS9 engines featured a 58-tooth wheel. In most cases, you can identify a Gen III or Gen IV by the location of the camshaft sensor. Gen III engines featured the cam sensor mounted at the top rear of the block, while Gen IV engines feature the cam sensor mounted onto the timing cover.

This is important to note for those who plan to use an aftermarket timing control unit, such as MSD's 6LS timing control module. MSD's 6LS module part number 6010 is designed for use with the 24-tooth wheel, while their 6LS-2 part number 6012 is designed for the 58-tooth wheel.

Either tooth-count wheel can be installed on any LS crank, as long as you have a controller designed for the specific tooth-count. If you're starting from scratch and have a choice, it's best to go with a 58-tooth wheel and matching controller for a more accurate timing control.

If you opt to buy an aftermarket performance crankshaft (let's say you're building a stroker engine, for example), the new crankshaft may or may not include a reluctor wheel. In either case, pay attention to the number of teeth on the wheel. If you plan to use the factory engine management computer, you'll need to stick with the same version (24 or 58 tooth) of wheel that the engine's controller originally used. If you plan to use an aftermarket controller, it really doesn't matter, as long as you buy the correct timing controller that matches your wheel's number of teeth.

While aftermarket ignition controllers may be applicable to both fuel injected and carbureted engine applications, if you're prepping an LS engine and plan to go carbureted, you must have an ignition controller, and that controller must be matched to your choice of reluctor wheel (24 or 58-tooth).

Basically, the OE LS cranks are identical and will install in all LS blocks (variances exist in terms of stroke and engines that were originally fitted with dry-sump oil systems will feature a longer snout). Aftermarket



Tone wheel clock position and method of installation is critical. Don't attempt it if you don't know what you're doing, as you can easily ruin the wheel.

Pictured right is an aftermarket performance crankshaft with the reluctor wheel already installed. The wheel (also called a tone wheel or tone ring), as the teeth pass by a block-mounted crank position sensor, provides crankshaft position signals to the ECU.

Pictured below is an example of a performance aftermarket LS crank that was purchased without a tone wheel. Performance crank makers usually offer cranks with or without a tone wheel already installed.



cranks are available in a range of strokes to suit your planned build, based on deck height, rod length and piston compression distance. Regardless, one of the features common to all is the need for a toothed reluctor wheel.

The only exception is for those builds that will feature both a carburetor and a distributor. Such conversions from electronically managed ignition to a distributor are much less popular; primarily due to the high cost of the parts needed to utilize a distributor (this involves a unique distributor housing, a unique camshaft or cam nose gear extension, a unique water pump, and a new pulley system).

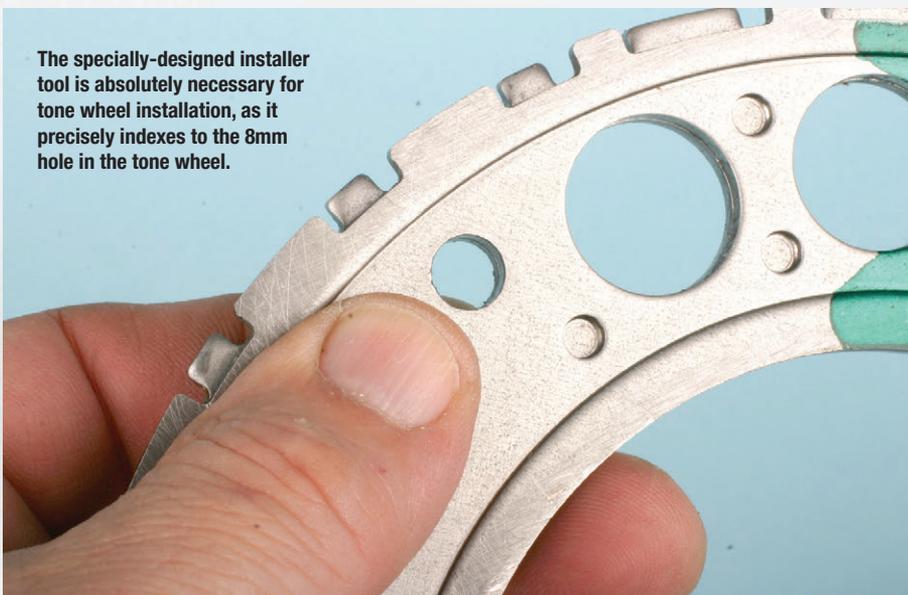
Whether you plan to re-use the OE crankshaft that was included in your new or used engine, or if you plan to install an aftermarket performance crankshaft, you may run into a situation where the reluctor wheel must be serviced. Perhaps the original tone wheel is damaged (teeth missing or bent), or maybe you have a crank with a 24-tooth wheel and you want to switch to a 58-tooth wheel, or possibly new crank that you bought does not include an already-installed wheel. Most aftermarket crank makers will sell their LS cranks with the wheel already installed, but you can run into a situation where the wheel is sold separately.

Here we'll explain the procedure involved in installing a reluctor wheel. It's not a simple matter of hammering the wheel onto the rear of the crank. The tone wheel must be indexed correctly to the crank. If not timed correctly relative to the crank's rod throws, the engine either won't fire at all or it will run so out of time that it'll be worthless.

(continued)



The specially-designed installer tool is absolutely necessary for tone wheel installation, as it precisely indexes to the 8mm hole in the tone wheel.



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REMOVING/INSTALLING THE RELUCTOR WHEEL

The reluctor wheel (also referred to as a timing wheel or tone wheel) is interference-fit onto the rear of the crankshaft, with no key or other registering device. If you've removed the tone wheel from a production crank, or if you're faced with installing a new tone wheel onto a new aftermarket crank, where the two components were purchased separately, it's critical to understand how the wheel is to be installed.

If an original tone wheel is to be removed, first place match marks on both the tone wheel and crank rear flange. The position of the wheel is critical.

Note: Do not attempt to remove the wheel with a puller, since you'll bend/distort the relatively thin wheel. Instead, carefully and evenly heat the wheel with a torch to roughly 200 degrees F. As the wheel expands as a result of heat, it can easily be pulled off by hand (obviously you'll need to wear heavy welder's gloves). This can also be done in your cleaning oven.

The reluctor wheel features a series of teeth that provide crankshaft position signals (via a sensor) to the ECM. The wheel interference-fits to the rear of the crank, immediately forward of the No. 5 main bearing. Typically the wheel features about a 0.007" interference fit.

Since LS cranks feature no keyway or other index point (thanks a lot, GM), how do you know where to locate the wheel? Luckily, aftermarket indexing tools are available, such as the unit developed by Goodson Shop Supplies that we're featuring in this article. They offer a very handy and absolutely essential indexing and installation tool for LS reluctor wheel mounting.

The RRJ-350 Reluctor Ring Jig is comprised of a short steel tube that's equipped with two indexing pins. An external tang secures a threaded stud, with the stud tip turned down to 8mm diameter. This pin engages into the



Tone wheels are available in both 24-tooth (LS1/LS6 versions) and 58-tooth (Gen IV/LS2, LS3, LS7, etc.). Selecting the tooth count all depends on your ECU (if you plan to use an OE harness and computer) or an aftermarket timing control module. The two need to match...if you have a 24-tooth wheel, you need a controller for a 24-tooth wheel. The same goes for the 58-tooth wheel (where you'd need a 58-tooth controller). If you already have a controller, then you need to buy the correct tone wheel to match up to that controller.



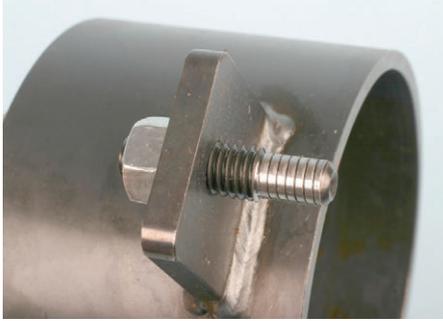
Goodson's reluctor wheel installation tool (Goodson refers to this as their RRJ-350 Reluctor Ring Jig) enables you to accurately locate and install the tone wheel.

The Goodson RRJ-350 tool will accommodate either the 24 or 58-tooth wheel (a 24-tooth wheel is shown below).



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The jig tool's 8mm locating dowel (shown above) engages into the tone wheel and is located on a welded tang on the outside of the tool body.



The installation tool's internal dowel engages into the crankshaft's rear flange dowel hole.



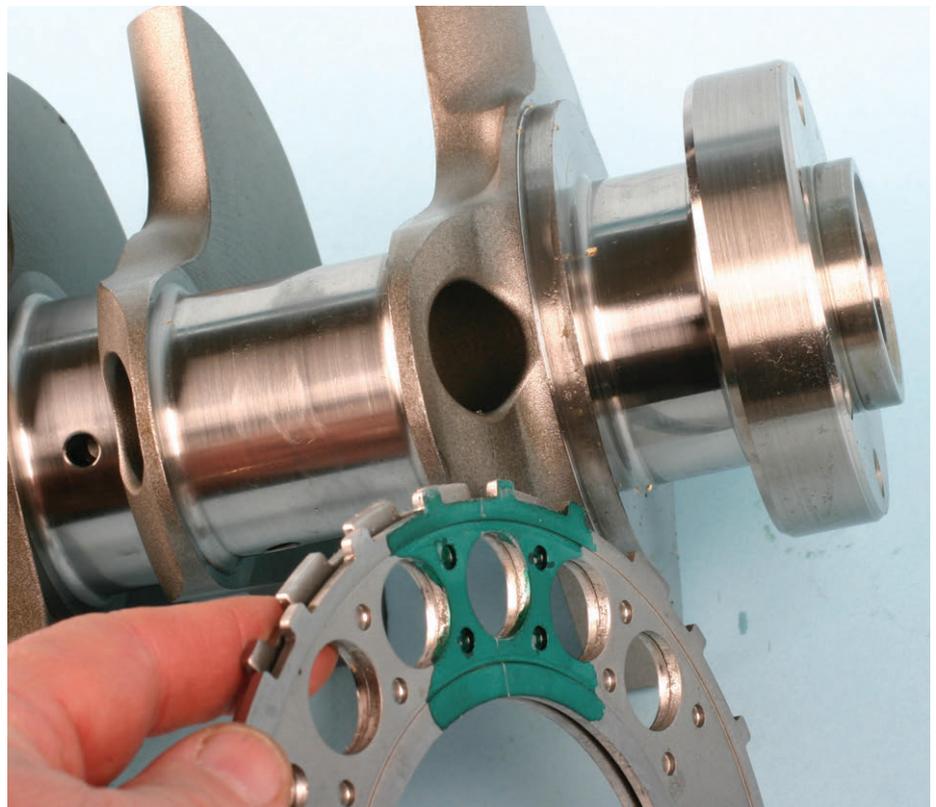
Shown here is the dowel pin hole in the crank's rear flange. The tool's internal locating pin fits this hole very precisely.

single 8mm indexing hole in the reluctor wheel. An internal guide pin (a threaded stud with the tip turned down to 11mm) engages into the 11mm blind dowel hole in the crank's flywheel flange. This jig orients the reluctor wheel precisely in the correct timing position. The two dowel studs feature jam nuts, to allow depth adjustment (you simply want to make sure that the 8mm dowel passes through the wheel's 8mm hole, and that the 11mm dowel projects out far enough to engage into the crank flange dowel hole).

For purposes of this article, I performed a sample installation. First, I lightly chamfered the entry hole of the reluctor wheel, and lightly chamfered the edge of the crank's reluctor wheel flange. Goodson's instructions advise this chamfering to ease installation. The instructions also state that the wheel may be pressed onto the crank or heated to 450 degrees F for a slip-on fit. Attempting to cold-press the wheel onto the crank can be tricky since maintaining a square alignment of the wheel to the crank may be difficult. Pre-heating the wheel (resulting in the center hole expanding) makes the job easier and easier to control. I heated the reluctor wheel's I.D. lip with a torch, slipped the wheel onto the Goodson jig, and the wheel slid onto the crank as easily as a rock drops into water.

My advice: install the ring by pre-heating it, instead of potentially ruining the ring by cold pressing. Pressing, if not done with a high degree of precision and care, can easily warp the reluctor wheel, rendering it useless. DO NOT try to force the wheel onto the crank by striking it with a hammer. That's a guaranteed way to ruin the wheel.

Caution: The tone ring is made of two plates riveted together. If you are using a press, and if you cock it out



An LS reluctor wheel typically features an interference fit of about 0.007" onto the smooth outer surface of the crankshaft's rear flange. The crank flange must be clean and free of burrs. Do not attempt to "make the job easier" by grinding material from either the crank flange or the inside edge of the tone wheel's center hole.



Here we see the installer tool's outer dowel pin engaged into the tone wheel's 8mm indexing hole.

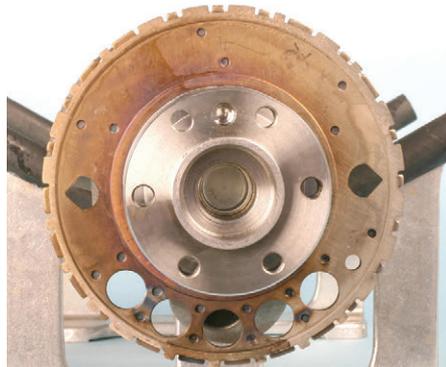
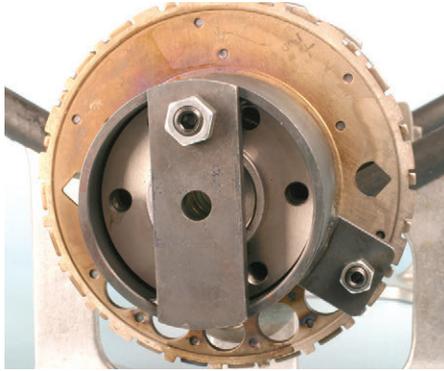


A closeup view of the tone wheel's indexing hole.

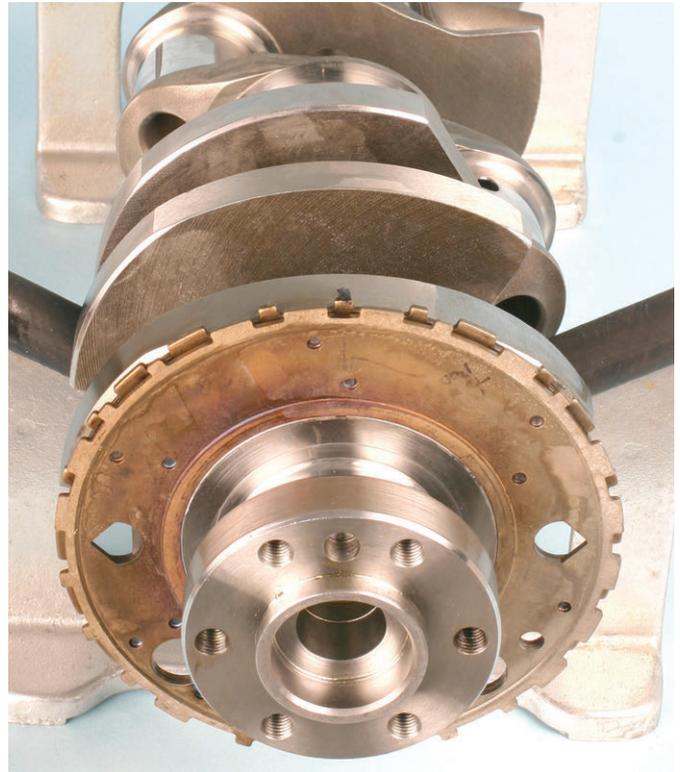
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With the tone wheel heated and installed to the tool, the tool and tone wheel, as an assembly, will slip onto the crank flange. Do not whack the tool or the tone wheel with a hammer. Heating the wheel can be accomplished in a convection oven or by careful use of a torch.



This photo shows the reluctor wheel installed onto the crank, with the installer tool removed.



ABOVE: The tone wheel is positioned on the crankshaft with the two "arrowhead" shaped holes at 90° to the number 1/2 rod pin, with the series of large holes in the wheel positioned opposite from the first rod pin. That's only a rough description. DO NOT attempt to install a tone wheel by eyesight. It is absolutely critical to use the proper installation tool.

LEFT: Here's a view of a 4.000" stroker crank positioned onto the block's upper main bearings. Notice the tone wheel at the far right in this photo.

BELOW: Notice the tight clearance of the tone wheel relative to the counterweight and main cap. With all main bearings lubed and main caps fully installed to final torque, carefully rotate the crank to check tone wheel runout. If you find more than about 0.002" runout, the tone wheel is probably bent, in which case you'll probably need to replace it.

of alignment and continue to press, the plates can begin to separate. If this happens, you can pinch the plates together with C-clamps and carefully tack-weld it back together at the rivet hole locations. Just be careful to avoid creating a warp/runout condition.

Again, because the jig indexes to both the wheel and to the crank, misalignment isn't an issue. If you expect to build LS engines, I highly recommend buying this jig. It takes all of the guesswork and time consuming measuring out of the equation. Don't even try to press it on

cold. Simply heat the ring, seat it onto the jig, and place the jig and wheel onto the crank. With heat and the right tool, it's easy.

Once the wheel has been installed and allowed to cool, test fit the crankshaft into the block and carefully inspect to verify that the wheel won't come into contact with the rear main cap area. Check to make sure that the wheel features no discernable runout, and make sure that it aligned with the crankshaft position sensor, which is located at the left rear side of the block. ■

