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## REF: Tools - 150

# The Origin of the Grindlock Pinion Gear Locking Tool

From XLFORUM member, " ~Grind~ " <sup>1)</sup>

(I) broke a tooth off the pinion gear upon applying 70 ft./lbs. of torque to the pinion gear nut per the Zipper's cam installation instructions. <sup>2)</sup>



I torqued the pinion gear to 70 ft. lbs. using a tool I made just for this purpose (below). I had another friend of mine scribe "HAMMER PERFORMANCE" on it and then sent it to Hammer Dan as a token of my appreciation for all of his help. <sup>3)</sup>



The folks at Hammer Performance worked out the bugs on a CNC and named it the "Grindlock 2000" (homage to the creator, ~Grind~).<sup>4)</sup>

It is machined out of 6061 T6 billet aluminum. The Grindlock 91-99 was soon to follow.

It holds the pinion gear and shaft securely while you loosen or tighten the pinion nut, without transmitting the torque through the flywheel assembly.

This is critical, because applying torque through the flywheel assembly can easily knock it out of true, necessitating a full tear down to fix.<sup>5)</sup>



Note the tips of the teeth are cut down. If the point on the nut happens to line up to the valley between two teeth on the gear,

You need to still be able to get the tool on.<sup>6)</sup>

The tool slides over the gear, it doesn't slide in from the side.

The Grindlock Pinion Shaft Locking Tool engages for the full depth of the pinion gear for max. strength.<sup>7)</sup>

Due to a change in the pinion gear in 2000, there are 2 different versions of this tool:  
1. (91-99) year models & 2. (2000 to present) year models<sup>8)</sup>



Grindlock 91-99 & Grindlock 2000

(designed by XLFORUM member, "~Grind~" and Built by Hammer Performance<sup>9) 10) 11) 12)</sup>

## How It's Made

Article by aswricing of the XLFORUM<sup>13) + 14)</sup> ... and Hammer Performance<sup>15)</sup>

(click on a pic to enlarge)

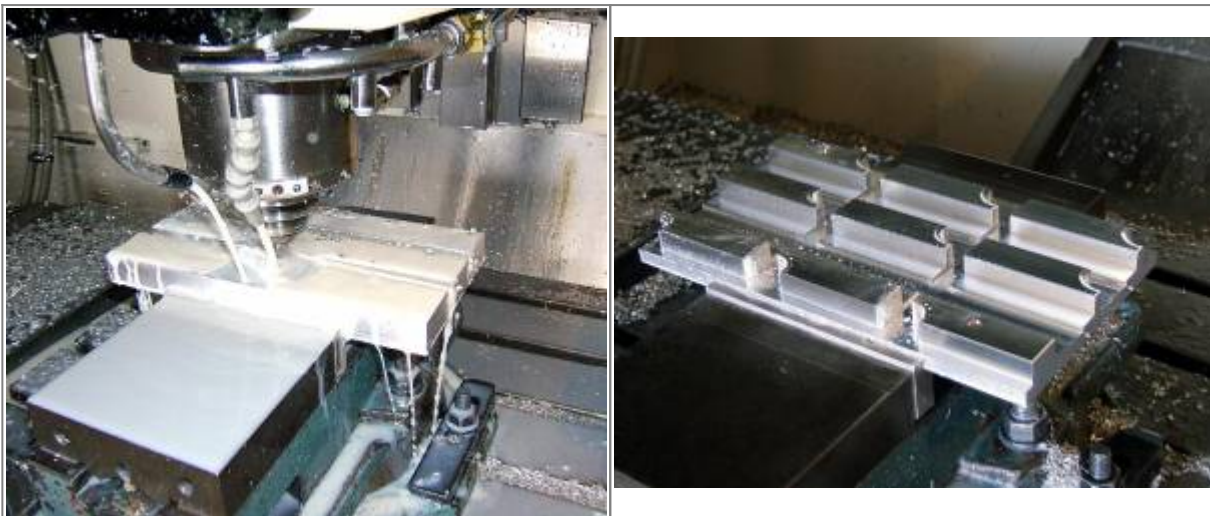
The tool is CNC made with CAD/CAM software.

Grindlock 2000 This is the first tool off the production line.	Grindlock 91-99 This one followed shortly after
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### Step 1

It starts with a slab of aluminum clamped in the step jaws of a vise. The back side is cut with mainly flat end mills and some chamfering with ball mills. Note that the upper left and lower right pieces have a hole in them. This hole doesn't go all the way through. It's used for alignment to the dowels in the fixture jig.



### Step 2

The material is flipped over and clamped to the protruding portion of the pieces cut in step 1. Holes are cut and counter-bored with small end mills (a 3/16" for the hole and a 1/4" for the counter-bore).



This jig was made to allow each tool to be cut from the material block.

Threads are tapped into the fixture and it will bolt to the material block with 18 screws (9 blocks with 2 bolts each).

It's got protrusions to support each block (there's a step in the back of each) and dowels in the corners. It's very important to maintain proper registration and the dowels work very well.



### Step 3

Each tool is cut out of the material block, engraved and the pieces are faced off (clean straight ends).



### Step 4

 The teeth are cut next.

This requires another jig to hold the tools (3 at a time) for the tooth cuts.

It sits on the face of the rotary table.

Alignment and registration is provided by both a dowel and also by a notch on the back side that you can't see.

The slots are at a 45° angle and are very precisely cut to provide registration to the blocks.

The cutter used is a carbide burr, straight 20 degree included angle.

It has pretty fine serrations for cutting steel and doesn't seem to plug up while cutting (.010" per pass).

The CAD/CAM has a lot of advantages in terms of being able to;

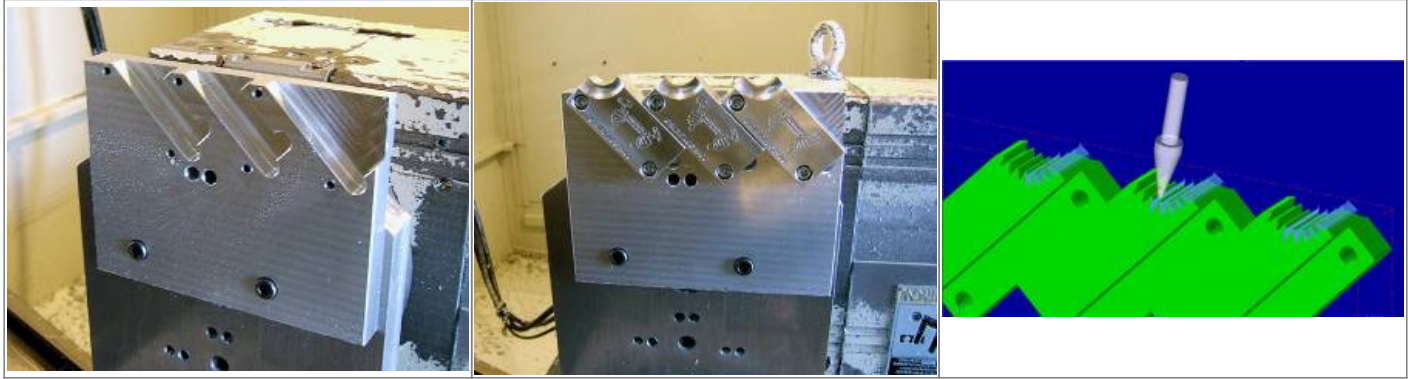
A). Backplot & simulate to spot problems.

B). Easily adjust things and adapt and make changes.

Plus when doing rotary work it solves a whole lot of the math for you.

The picture below and to the right is a backplot of the tooth cuts.

Note how the tool is at an angle. It simulates the rotary.



The table turns to one angle and cuts one tooth on each block. Then the table turns to another angle and cuts one tooth on each block, etc.

The cutter's shape is not an exact match for the tooth. But, two passes are made at each depth (each at a slightly different "Y" location ... just a few thou apart).

This allows precise control of the tooth fit by varying this distance between the two parallel cuts. That way, the tool fits just right over the pinion gear (not too tightly or too loosely).



Here's what they look like when they're all done being cut.

The very last tool path goes in and knocks down the very tip of each tooth.

This is necessary because if you don't do it, the tip of the tooth hangs up on the pinion nut.

Next, to de-burr the teeth at each end with a small scotchbrite pad on an air operated die grinder.



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1)  
<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-engine-conversions/134422-~grinds~-hammer-performance-1250-build?t=1448694>

2) , 3)  
photos by ~Grind~ of the XLFORUM  
<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-engine-conversions/134422-~grinds~-hammer-performance-1250-build?t=1448694>

4) 9)  
aswricing of the XLFORUM  
<https://www.xlforum.net/forum/vendors/hammer-performance/149240-pinion-gear-locking-tools-now-available-from-hammer-performance?t=1618841>

5)  
photos by aswricing of the XLFORUM  
<https://www.xlforum.net/forum/vendors/hammer-performance/148188-new-product-sneak-peak?t=1609924>

6)  
<https://www.xlforum.net/forum/vendors/hammer-performance/149240-pinion-gear-locking-tools-now-available-from-hammer-performance/page4?t=1618841&page=4>

7)  
aswricing of the XLFORUM  
<https://www.xlforum.net/forum/vendors/hammer-performance/149240-pinion-gear-locking-tools-now-available-from-hammer-performance/page4?t=1618841&page=4>

8)  
Hammer Performance <http://www.hammerperf.com/xlvalvetrain.shtml#grindlock>

10)  
Left photo by aswricing of the XLFORUM  
<https://www.xlforum.net/forum/vendors/hammer-performance/149240-pinion-gear-locking-tools-now-available-from-hammer-performance/page4?t=1618841&page=4>

11)  
Middle photo by Hippysmack

12)  
Right photo by aswricing of the XLFORUM  
<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-general-discussion-and-problems/178765-oil-pump-drive-gear-question?t=1920827&highlight=pinion+gear+locking+tool>

13)  
<https://www.xlforum.net/forum/vendors/hammer-performance/148188-new-product-sneak-peak?t=1609924>

14)  
<http://xlforum.net/forums/showthread.php?t=1618841>

15)  
<http://www.hammerperf.com/>

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