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## LC Adjustable Cam Gear Part #1022003 and #1022006

Thank you for purchasing an adjustable cam gear from LC Engineering!! This adjustable gear is the only way to accurately adjust your cam timing and gain the most potential from your engine. LC Engineering always recommends using an electric fuel pump whenever possible but if you have a mechanical fuel pump then you will need to trim the bolts on the adjustable cam gear down to be flush with the nut. If you don't trim them down they will interfere with the fuel pump arm and cause engine damage. You will also need to modify your fuel pump eccentric to accommodate your new adjustable cam gear or LC Engineering can supply you with a fuel pump eccentric that has already been modified (part #1021028).

**Note:** If you remove the fuel pump eccentric you must use a distributor drive gear spacer (part #1081025). These spacers are found on most 22RE/RET engines since they use electric fuel pumps.

### Camshaft Degreeing Procedures

You will notice on your new adjustable cam gear that there are 3 separate sets of degree marks. There is a "STOCK", a "RACE 1" and a "RACE 2" (see pic). The "STOCK" degree marks are based on a stock, non-adjustable cam gear. Because of the numerous variations in engines; including head decking, block decking, camshaft size etc... there is no way to know exactly where your specific engines cam timing true "0" is at. LC Engineering always recommends that you degree your camshaft in with the new gear so that you can find the true "0" on your engines. If this is not an option for you then LC Engineering has come up with an alternate method that will work but is not nearly as accurate. Read through both the "Basic" and "Advanced" installation guidelines below to determine which method you will use.



#### Basic Camshaft Gear Installation (less accurate method):

If you line up the "0" from the "STOCK" set of marks with the line scribed in the outer gear, your new adjustable gear will match the stock gear exactly. You can then adjust the cam timing accordingly.

- Advancing the cam timing (turning cam so the outer gear line moves towards the "A" on the hub) will move the power band lower in the RPM range.
- Retarding the cam timing (turning cam so the outer gear line moves towards the "R" on the hub) will move the power band higher in the RPM range.

When a cylinder head or block has been decked or re surfaced your stock cam timing will be retarded. That means you will want to advance the timing to get it back to where it was originally.

#### Advanced Camshaft Gear Installation (recommended method):

We recommend the Intake Lobe Center Method to degree the camshaft. This will achieve the most accurate settings available, resulting in the best performance from your engine package. The new versions of the cam gear have 2 separate "RACE" settings for different set-ups. This will allow you to log different cam timing adjustments in each set of marks for different race tracks or vehicle set-ups.

#### Finding True Top Dead Center (TDC)

1. The first step is to install the degree wheel on the crankshaft, then make a pointer for the degree wheel using a stiff piece of wire, such as a metal coat hanger. Loop the opposite end of the wire onto one of the engine bolts (usually you can use a timing cover or water pump bolt).
2. Remove all spark plugs to make it easier to turn the engine by hand.
3. Rotate the crankshaft to approximate TDC on the #1 cylinder, compression stroke. The camshaft dowel pin will be in the 12 O'clock position.
4. Adjust your fabricated pointer to the "0" mark on the degree wheel.
5. Rotate the engine by hand (not using the starter) 90°. Remove #1 cylinder spark plug.



6. Adjust your piston stop so that the bottom of the stop is exactly 2" from the spark plug seat part of the stop. This is very important; if you adjust it too far down it can damage your valves and/or piston.
7. Rotate the engine (by hand) counterclockwise until the piston contacts the piston stop. Mark and record the number that the pointer is at on the degree wheel.
8. Rotate the engine (by hand) clockwise until the piston contacts the piston stop. Mark and record the number that the pointer is at on the degree wheel.
9. Add the 2 recorded numbers together and divide the answer by 2. Record that answer.
10. The answer from the previous step will be where your pointer will go now. For example: If you get 11° after top dead center (left side of "0" on degree wheel) and then you get 5° before top dead center (right side of "0" on degree wheel). You will add  $11^\circ + 5^\circ = 16^\circ$ . Then  $16^\circ \div 2 = 8^\circ$ . You will now adjust your pointer to point at the 8° mark before top dead center (right side of degree wheel).
11. Recheck TDC by rotating the engine (by hand) counterclockwise until the piston contacts the piston stop. Record the number that the pointer is at on the degree wheel.
12. Rotate the engine (by hand) clockwise until the piston contacts the piston stop. Record the number that the pointer is at on the degree wheel.
13. The numbers recorded this time around should be the same. If not readjust the pointer and recheck TDC. For example: If you use the same example from step #9 your pointer should be at 8° on both sides of "0".
14. Once you have found true TDC remove the piston stop from cylinder head.
15. Install a dial indicator (with magnetic base and fixture plate). Position the indicator on the #1 intake valve retainer so that the dial indicator shaft will travel parallel to the valve.

**Cam Card Specifications** - Review the cam card provided with your camshaft. Find the intake center line the cam was ground on. If not provided you can compute the center line by adding the intake opening degrees at .050" valve lift to the intake close degrees at .050" valve lift plus 180° crank rotation. Divide this number by 2 and subtract the smaller number. This is your intake center line of the cam you are about to degree. Check every cam, they will differ from cam to cam. Example below.

$$\text{Opens } 13^\circ + \text{Closes } 37^\circ + 180^\circ = 230^\circ$$

$$230^\circ \div 2 = 115^\circ$$

$$115^\circ - 13^\circ = 102^\circ \text{ Lobe Center}$$

**Note:** Always rotate the crankshaft in the running rotation (clockwise looking at the front of the engine). Never reverse crankshaft rotation to achieve a reading when degreasing the camshaft.

**Step 1: Find Valve Open @ .050" Lift** - With your indicator on the retainer and the rocker set at zero lash on the base circle, zero the dial indicator. Rotate the crank until the indicator reads .050" valve lift off base circle. Read the degree wheel and record. Example would be 11° on the degree wheel BTDC.

**Step 2: Find Valve Closes @ .050" Lift** - Rotate the crankshaft until the dial indicator reads .050" off the base circle (valve closing). Read the degree wheel and record. Example 39° on the degree wheel ABDC.

**Step 3: Calculate Lobe Center** - To figure the exact lobe center add intake open number and intake close number plus 180°. Divide this total by 2 and subtract the smaller number (usually the intake open number). Example below.

$$\text{Intake open } 11^\circ + \text{Intake close } 39^\circ + 180^\circ = 230^\circ$$

$$230^\circ \text{ Duration} \div 2 = 115^\circ$$

$$115^\circ - 11^\circ = 104^\circ \text{ Lobe Center}$$

In our example your cam is currently set to a 104° Lobe Center. Compare your actual findings with the information from your cam card and adjust the cam accordingly.

**Step 4: Adjusting The Camshaft** - Loosen the three 10mm lock nuts on the cam gear. Advance or retard the gear to achieve the proper intake center line for your specific cam. Torque the nuts to 8ft.-lb. And recheck your numbers to assure a proper setting.

Once indexed correctly, using a sharp small chisel, align with the zero mark on the gear hub and make a reference mark on the outer gear for future reference. You have now completed the degreasing process.

**Calculating Duration.** To calculate duration at .050 valve lift. Add the degrees when the valve opens @ .050" to the degrees the valve closes @ .050" plus 180°. Example below.

$$\text{Opens } 11^\circ + \text{Closes } 39^\circ + 180^\circ = 230^\circ \text{ Duration @ .050" Valve Lift}$$

## Performance Tips

To change the performance of your engine, you can advance the cam to achieve a lower RPM torque curve (bottom end power) or retard the cam to achieve a higher RPM torque curve (top end power). Make small adjustments and record your results. This way you can always refer back to your previous settings.

Ignition timing and cam timing are not the same. Since the distributor is turned by the camshaft, always recheck your ignition timing after adjusting the cam timing