Assembly time of the 2.4L LE5/LE9 engine depends on your mechanical skill. If you are pretty handy with tools, the engine can be assembled in under an hour. However, we suggest you schedule a couple hours if it is your first time assembling an engine. This assembly is not suggested for someone not familiar with engines. If you assemble the engine incorrectly, severe damage may occur. This is only a guide to the assembly, please reference the service manual for complete assembly notes.

If you have any questions during the assembly you can call or text us at (864) 907-6004 Email support is also available - Tech@ddmworks.com.

Tools Needed for Install

- 10mm socket
- 13mm socket
- 18mm socket
- 32mm socket
- E12 Torx socket
- 1/2” 12 point socket
- 3/16” Allen key or socket
- 15/16” Wrench or 23mm Wrench
- Torque angle gauge
- Blue Loctite
- Torque Wrench

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These instructions are for assembling a 2.4L Ecotec block to cylinder head and timing the engine. Before starting this assembly the engine block and cylinder head should have been machined and assembled.

1. You should have the engine mounted securely to an engine stand so it can be rotated and is stable while being worked on.

2. We will be using ARP head studs on this build and will reference those torques and assembly instructions. Open the box of ARP head studs and insert the studs in each of the 10 holes in the top of the block. One end of the stud has a 3/16" Allen key drive in the end, that is the side that will be up, the other end will go into the engine block. Tighten each stud by hand only, do not over torque. A little blue loctite can be used on the threads of the studs going into the block if you plan to leave them in.
3. With the ARP head studs installed into the block, lay the head gasket over the head studs onto the engine block. Picture to the right is using a factory GM 2.4L LAF head gasket. Be careful when handling the head gasket, it is made of multiple metal layers and the edge can be extremely sharp. Make sure when installing the head gasket you have the correct side up. With the correct side up, the gasket will fit over the 2 locating dowels on the top of the engine block towards the front and back.

4. With the head gasket installed and in place, set the cylinder head over the head studs and onto the engine block. Make sure the alignment dowels on the engine line up with the recesses in the cylinder head. The cylinder should sit all the way down onto the engine block, but may need a little tap to set all the way down. If the cylinder head does not sit all the way down, lift the cylinder back off and determine what is preventing it from going all the way down, do not force the head onto the engine.
5. Using the lubrication supplied with the ARP headstuds, lubricate the top and bottom of the 10 washers and 10 nuts in the headstud kit thoroughly. Make sure that the top and bottom of the washer is lubricated. Also make sure the threads and the bottom of the nut is lubricated where it will contact the washer.

6. Install the washers and nuts on all of the studs finger tight. Then torque the nuts on the headstuds get torque to 80 ft/lbs in 3 equal steps using a 1/2” 12 point socket. There is a specific order to torque the cylinder head, follow the order to the right. Tighten the entire sequence of nuts to 20 ft/lbs first, then the entire sequence to 50 ft/lbs and then lastly to 80 ft/lbs.
7. Install the 4 bolts on the front of the cylinder head. They use a “e12” 6 sided Torx socket. Torque all 4 bolts to 22 ft/lbs.

8. The balance shafts slide into the front of the engine block. Note that each balance shaft says “intake” or “exhaust” on it. Make sure that they are installed in the correct side. Secure with the 10mm head bolt and tighten bolt to 89 in/lbs of torque.

9. Next slide the larger timing sprocket over the crank with the markings facing out, make sure to line it up with the key on the crank. The sprocket should be pushed all the way to the back until it stops against the shoulder on the crank.
10. Install the water pump onto the engine block. Use the 2 - M8x1.25x70mm bolts from the back and torque to 18 ft/lbs of torque. Install 1 - M8x1.25x100mm bolt from the front of the engine to secure the top of the water pump, torque to 18 ft/lbs of torque.

11. Rotate the crank clockwise until it is at top dead center (TDC). To rotate the crank, use the crank pulley for the belt(s), slide it over the key on the crank and then slide it back off. When the engine is at TDC the key in the crank will be facing straight up at the 12 o’clock position. With the engine at TDC, start to install the smaller timing chain over the 2 balance shafts, water pump pulley and crank sprocket.

12. You will see 3 colored marks on the timing chain. One mark will have 3 colored marks together (yellow, black, yellow in the picture to the right). The mark with 3 colored marks lines up with the arrow on the intake balance shaft.
13. With the 3 colored marks on the intake balance shaft, line up the single mark (black on this chain) to the arrow on the crank sprocket.

14. Line up the last mark (black on this chain) to the arrow on the exhaust balance shaft. There is no specific timing needed on the water pump pulley. The chain should be over both balance shafts, the crank sprocket and water pump at this point.

15. The plastic guides for the timing chain will be installed next. There is a shoulder on one side of the plastic guide that sticks out. That shoulder must be installed toward the block for the timing chain to track correctly.
16. Install the first plastic guide just below the intake balance shaft. Use 2 of the black shoulder bolts with 10mm heads. Torque these bolts to 11 ft/lbs of torque.

17. Install the next plastic guide between both balance shafts. Use 2 of the black shoulder bolts with 10mm heads. Torque these bolts to 11 ft/lbs of torque.

18. Install the tensioner guide and tensioner using the 10mm head bolts. Torque all 3 bolts to 89 in/lbs of torque. With all 3 guides in place, visually make sure the timing chain is riding in the middle of all 3 guides. Once you are satisfied that the chain is in the middle of all the guides, pull the pin on the tensioner to release it. The balance shaft/water pump chain install is complete.
16. The next chain to install and set is the camshaft timing chain. Start by sliding the smaller sprocket over the crank. Make sure the small dot is facing out and the sprocket slides over the key in the crank. Slide the sprocket all the way back until it is against the larger sprocket installed earlier for the water pump/balance shafts. Then rotate the crank clockwise until the keyway is at the 3 o'clock position.

17. With the crank keyway at the 3 o'clock position, rotate the intake cam with a 15/16” or 23mm wrench until the timing key on the front of the cam is roughly at the 5 o'clock position. Next rotate the exhaust cam until its timing key is roughly at the 7 o'clock position.

18. Slide the long timing chain tensioner guide from the top down roughly into the position, do not install a bolt in it yet. Also at this point, rotate the crank clockwise until the key is back at the 12 o'clock position.
1. Install the larger timing chain roughly into place by feeding the chain in from the top of the engine. There is a boss sticking out where the timing chain goes inside the engine. Looking down from the top, you will need to gently guide one side of the chain to the intake side of this boss and once side of the chain to the exhaust side of that boss. Look at the front of the timing chain, you will see 3 colored marks, 2 marks will be the same color and one mark will be a different color. Rotate the chain around until the 1 mark that is a different color is close to the front of the intake cam.

2. Line the pyramid on the front of the intake cam sprocket up with the colored mark on the timing chain. Then line the key in the back of the sprocket where it slides onto the cam with the recess in the front of the cam. Slide the sprocket onto the cam, it should push all the way on until the back of the cam sprocket touches the shoulder on the camshaft. Install one of the 18mm head cam bolts finger tight into the front of the sprocket.
3. Line up the next mark on the timing chain with the dot on the smaller sprocket on the crank. You can rotate the crank slightly to help line up the chain to this mark and keep the slack off the timing chain between the intake sprocket and crank.

4. The last mark on the timing chain will line up with the pyramid on the exhaust sprocket. With the timing chain on the mark, slide the sprocket onto the cam, it usually will not install into place, you will need to rotate the cam about 15-20 degrees clockwise with a 15/16” or 23mm wrench for the key to line up. Before installing the cam sprocket into place you can note the position of the keyway in the cam and the key on the back of the sprocket to get a better idea of how much you will need to rotate it. Once you rotate the cam, the sprocket will slide all the way back against the shoulder on the cam, install a 18mm head cam bolt by hand.

5. Make sure that the timing chain is in the center of the tensioner guide you slide into place earlier. Once the chain is in place, install a single 10mm head bolt and torque to 89 in/lbs.
6. Install the timing chain tensioner in side of cylinder head. Use a 32mm socket and torque to 55 lb/ft.

7. Verify the timing chain is still in the center of the tensioner guide, the timing marks are lined up with the pyramids on the cam sprockets and the mark lines up with the dot on the crank sprocket. Once you are satisfied that all marks are lined up, release the timing chain tensioner. To release the timing chain tensioner it needs to be compressed at least 2mm. To do this, we use a long metal rod that has a rubber tip on to prevent damage to the timing chain. You will need to use a suitable tool similar to this to release the tensioner and not damage the timing chain. Feed the tool into place from the top of the engine and place the rubber tip against the timing chain. Then give a sharp jolt diagonally downwards against the timing chain using a quick blow of a hammer to release the tensioner. Typically you will hear a little “click” and the chain will feel tighter.
8. Verify the timing marks again to make sure all marks are still lined up. If everything still looks correct, tighten the 18mm bolts on the front of both cams. Hold the hex on the cam with a 15/16” or 23mm wrench and torque the bolt to 22 ft/lbs +100 degrees of rotation.

9. Install the black timing guide over the timing chain between the crank sprocket and the intake cam sprocket. It will slide up from the bottom into place. Hand tighten one of the black shoulder bolts in the bottom hole of the guide, do not tighten yet. For the top, you can use another black shoulder bolt with a 10mm head or the Dorman 917-954 bolt/guide combo. Start either one in the top, once both bolts are started on the guide, torque the black shoulder bolts to 106 in/lbs. Torque the Dorman guide/bolt to 66 ft/lbs. If you used 2 of the black shoulder bolts, there is a large plug that will cover the top bolt, torque that plug to 66 ft/lbs.

10. Install the black plastic timing chain oiler just above the crank sprockets. It is held in place with a single 10mm head bolt. Torque the bolt to 89 in/lbs of torque.
11. Install the metal guide between the cam sprockets using 10mm head bolts. Torque to 89 in/lbs of torque.

12. Install the front plate gasket over the alignment pins on the front of the engine.

13. Install the front plate onto the engine using 10 - M8x1.25x25mm bolts. Torque to 18 ft/lbs. Install qty 1 - M8x1.25x100mm bolt just below the small water pump access plate and torque to 18 ft/lbs.

14. Turn the engine over and install the oil pan. Before installing the pan, apply a thin coat of gray RTV to both the pan and the bottom of the engine, follow the directions on the RTV. Torque the oil pan bolts to 18 ft/lbs of torque.

The engine is now assembled and timed. Your choice of intake, exhaust and accessories will need to be installed.