

# Head Gasket Replacement Procedure

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Photos used by permission of Dave Swingle, John Hervey, and Martin Gutkowski, excerpts from the DeLorean Workshop Manual, with approval from DMC Houston, proof read by Dave Stragand and Martin Gutkowski.

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## Disclaimer:

Use this procedure at your own risk. I provide no warranties expressed or implied against personal injuries, damaged tools or vehicles.

## Preface:

I have created this procedure because the DeLorean Workshop Manual is written for professional mechanics, and certain steps are not listed because they are assumed common sense for a mechanic with a certain level of knowledge. Also, certain terminology may be unfamiliar to the non-professional mechanic. This procedure is an attempt to compile the necessary steps in manual, with the excellent advice I have received from DML/Forum members and employees of DMC Houston and translate it into every day Standard American English instead of Engineerspeak.

## Words to key on:

Whenever the word "**note**" in bold type is used, it is used to refer to a point of interest, a point at which a choice in procedure may be made, or a step that may save time and effort. When the word "**caution**" is used in bold type, it denotes a step that if not followed, may cause engine or tool damage. Lastly, when the word "**warning**" is used in bold type it denotes a step which if omitted or not performed correctly, will cause engine or tool damage and may result in personal injury.

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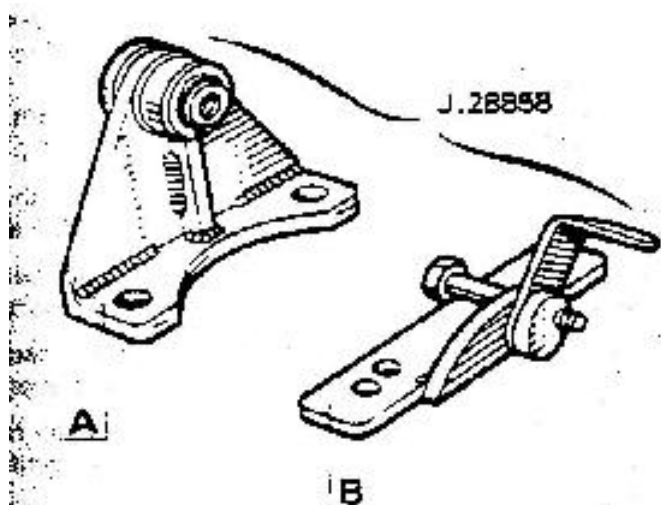
All right, let's get to it.

If you're like me, you like to be efficient and not take anything apart that you don't absolutely have to for fear of damaging something and making extra work for yourself. Especially if you're not a professional mechanic. Well you'd better swallow your fear right now because I caused more work for myself and more damage by NOT taking enough things apart.

If you have the workshop manual, refer to page C:05:04, "Changing Cylinder Head Gaskets". Quote:

**NOTE:**

If only one cylinder head is to be removed, the operation may be performed without removing the timing chain cover using camshaft sprocket support tool (B) No. J.28858 to support the timing sprocket and maintain tension on the timing chain. Unquote.

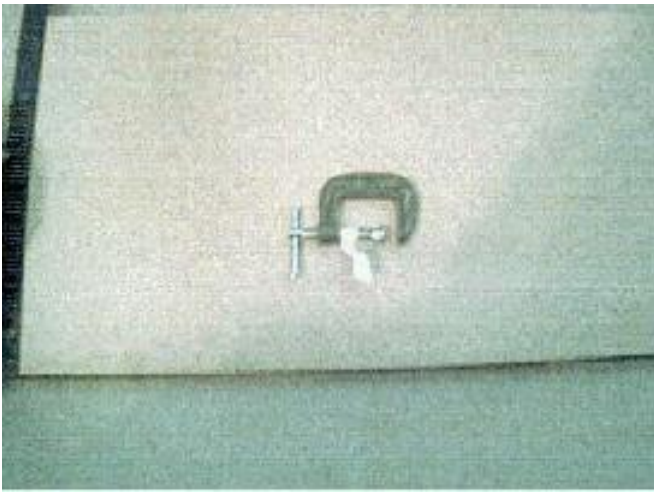


Here the book shows a pair of brackets.

The first question everyone asks is "Where can I get this tool?" You can't. It was originally made by Kent-Moore tools for Peugeot, Renault and Volvo (and subsequently obtained by DeLorean). Kent-Moore states it was discontinued seven years ago and those who still have the tool aren't inclined to lend it out.

**NOTE:**

At this point, you must make a choice. You can proceed without the bracket and allow the cam sprockets to slip down and just remove the timing chain cover and reset the tensioners when you reinstall the heads, or fabricate a suitable replacement support tool using a piece of 1" high angle "aluminum" cut to the width of the timing chain cover. Aluminum is soft enough to drill and cut easily, but rigid enough to hold the sprocket up. Drill oblong holes in the horizontal surface to aid in positioning the bracket, and use 2 small clamps C-clamps shown here:



to hold the sprocket to the bracket. You may also want to drill a large hole in the center for the sprocket to fit snugly to the bracket. Idea courtesy of Dave Stragand.



If you opt for the bracket, there are important steps the book doesn't call out that we'll discuss later. If you opt to drop the sprockets, buy an engine gasket set from your favorite DMC vendor.

During the procedure I will call out items on the engine as belonging to the Driver's side or Passenger's side. The manual is written for an engine installed in the front of a car and it gets confusing with left-hand/right-hand references. Use ziplock baggies with labels to organize your hardware as you disassemble things. I will also provide separate sets of steps as appropriate depending on whether or not you are using the sprocket support tool.

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### **Section One: Removing interference**

Disconnect the battery, Drain the coolant by removing the waterpump supply and return hoses. This will get enough of it out of your way for now. Remove the mixture control unit and intake. (See page C:13:01 for details. I will condense that procedure here) Pull the air cleaner off. Remove all of the fuel lines from the fuel distributor. Unplug the idle speed regulator. Loosen the hose clamps on the idle speed regulator, undo the body clamp and remove it. Pull out the metal pipe that the idle regulator was hooked to. Disconnect the small hoses from the fuel evap canister to the cold start valve. Disconnect the throttle linkage by removing the tiny clip on the ball and socket and popping the arm off of the ball. Unscrew and remove the throttle cable from the side of the intake. Disconnect the vacuum advance

solenoid at the very rear of the mixture control unit, the plug on the cold start valve. Remove the wires from the idle speed microswitch and unplug the "WOT", or "full-throttle" micro switch. Unscrew the 2 allen head bolts holding the mixture control unit to the intake on either side of the airflow sensor. Remove the "W" pipe by undoing the 4 corner screws and the semi-hidden, long bolt in the center.

Grab the mixture control unit at the rear, and lift it out. Use caution around the wiring harness. Use a long extension and remove the four corner bolts holding the intake down. Remove it, again use caution getting it out from underneath the wiring harness. The engine now looks like this:



Loosen the alternator adjustment bracket, and pivot bolt. Slip the belt off. Remove the alternator. Note where the wires go before you disconnect them. If anything snaps off or the wire studs slip, then it was time to rebuild it anyway. Remove the muffler support bracket from the side of the head.

#### **NOTE :**

A word about the exhaust manifolds. If your mounting hardware for the exhaust manifolds are really rusty and gnarly, you are in for a long, painful job disconnecting the exhaust from the heads while it's all still in the car. If your car sounds like a riding lawnmower you should replace the exhaust system gaskets anyway. Your choices are:

1. Remove the starter, starter shield and oil filter to get at the manifold. Use gross quantities of 3P, (penetrant, prayer and profanity) and stud extractors to get it off.

2. Undo the 2 exhaust crossover pipe studs and pull the head off with the exhaust manifold attached and remove it in the comfort of your garage and workbench. Your individual situation will have to dictate the choice. Your exhaust system may not be that bad. The DML is FULL of options for removing these. There is also an excellent exhaust "how-to" in the tech library on the DMCNews website.

If you opt not to use the cam sprocket support tool, you'll be removing the muffler to get the timing chain cover off. The detailed procedure is on page D:10:01. (Condensed here,) Remove 2 bolts holding driver's side support bracket to the engine. Pull the rubber mount off the pin and remove the bracket. Remove the 2 nuts and bolts securing the rubber mounting to the passenger side muffler support bracket. Remove the bolts holding the passenger side bracket to the engine. Pull the rubber mount off the pin and remove the bracket. Have a helper support the passenger side of the muffler and sit on the ground on the driver's side, facing the driver's side. Brace your foot on the cat converter and using a twisting motion, pull towards you, (the driver's side) It -should- slide off. Mine was very rusty and it still slid right off.

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## **Section Two: Passenger side head removal**

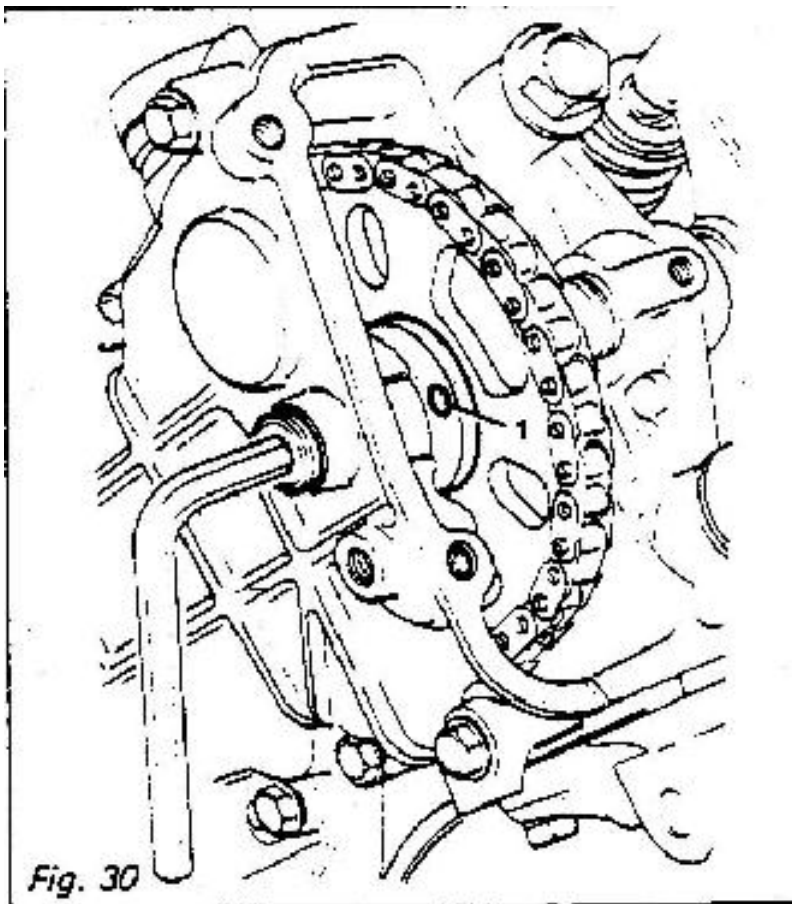
### **NOTE:**

Everyone's favorite phrase on the DML is "While you're already in there..."

So, while you're in there and if you can afford it, you should replace the rear waterpump and heater hose, maybe even the waterpump itself. Also, for most folks, the sensors and switches in the coolant distribution ("Y") pipe are 20 odd years old and you might consider replacing them. You don't want to go in there again if you can help it. If you've snapped off any bolts so far, don't panic. There are a variety of stud extraction tools. Check Sears and Napa and the DML archives for examples. I use these two:



Remove all of the screws in the top of the valve cover. Lay the throttle cable off to the side. Undo the frequency valve and lay to one side. Observe fig 30



Use a breaker bar and a 36 mm -OR- a 1 3/8" socket on the crank pulley to rotate the engine so the drive pin on the camshaft sprocket is at the top. Use an 8mm allen key to remove the access plug at the top of the timing chain cover. Use a 10mm allen key to just break free, but do -NOT- remove the cam sprocket bolt.

**NOTE :**

Choose your method.

1. Attach the bracket you've fabricated to the top of the timing chain cover and C-clamp the sprocket to it or,

2. Prepare to just remove the bolt and let the sprocket slip down and the tensioner will suck up the slack. (It won't go far).

Remove the large bolts holding the rocker assembly (and head) down. These are usually very tight and may be slightly rusted in place. They are very long so they tend to "twist" before they give. A long breaker bar helps with leverage. Remove the rocker assembly and set aside. Look carefully behind the cam sprocket. You'll see a 10 mm bolt and a small "flange" or flat piece of metal. Just loosen this enough to lift the flange out of the groove on the camshaft. Don't completely remove the little bolt.

**CAUTION:**

Sprocket Support Bracket Procedure Only

There is a small cover plate on the back of the head, held on by two small bolts. Remove this cover. The cam will back out through this hole as you undo the 10 mm allen bolt that holds the cam sprocket to the cam. DO NOT UNDO THE 10 MM ALLEN BOLT YET. The manual doesn't even mention this. The 10mm allen bolt has a large "head" and does NOT come out the access hole. FAILURE TO UNDO THE REAR ACCESS COVER MAY RESULT IN A WARPED OR SNAPPED TIMING CHAIN COVER, VACUUM LEAKS AND/OR RUIN THE THREADS FOR THE CAM SPROCKET BOLT AND HOLE. Remove the 4 bolts on the timing chain cover face that attach the head to the timing chain cover.

Procedure without Support Bracket

You did remove the muffler right? If not, find the procedure above in "Section One: Removing interference". Remove the bolts securing the lower lip of the fascia to the metal heat shield plate. Remove the bolts securing the plate to the frame. Remove the plate. Remove all of the timing chain cover bolts. You must now remove the crankshaft pulley nut and pulley.

**WARNING:**

The pulley nut is held on by 135 ft/lbs of torque (at least). If you use a breaker bar and 36 mm socket, you -MUST- lock the flywheel or the piston liners may lift off of their seats when the engine rotates. The lower piston liner seals cannot just be reseated, and you will have the equivalent of a

blown "lower head gasket". Coolant in the oil, and air in the cooling system. FAILURE TO FOLLOW THIS PART OF THE PROCEDURE WILL RESULT IN ENGINE DAMAGE AND WILL REQUIRE REMOVAL AND REBUILD OF THE ENGINE TO INSTALL A NEW LINER SEAL. The head is loose at this point and not held down. The recommended way, is an air impact wrench. It will hammer the nut off without rotating the engine at all. I felt the pain and bought \$375.00 worth of air tools and compressor to get it off.

Remove the timing chain cover and carefully walk the pulley off with a pair of long screwdrivers (omit this step if you are using the support bracket).



Remove the 10 mm allen bolt from the cam sprocket. Make sure you're not bending the timing chain cover and the cam is backing out of the rear of the head if you are using the support bracket. The manual instructs you to use a metal object and hammer to tap the guide pins (locating roll pins) down flush with the engine block. Mine were rusted and wouldn't depress.

#### **WARNING:**

By now you're sick of the "warnings" and "cautions" but they are essential! They are here because I almost ruined my engine doing it the wrong way! DO NOT LIFT THE HEAD STRAIGHT OFF OF THE ENGINE BLOCK!! If you do, the gasket may stick to the piston liners and you may unseat them. Remove the head by rapping it with a rubber or wooden mallet at the corners and the center. This will help unstick the head from the gasket and block. Cock the head and pull it up at any angle you can other than straight up. Removal complete!

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#### **Section Three: Cleaning the head**

Remove the spark plugs and fuel injectors from the head. If you're not out of cash yet, get the head checked for warpage, cracks and pressure. If your engine has a lot of miles replace the valve guide seals. The manual states that you should NOT get the head "shaved" to make it true. DMC Houston employees have told me to have it "baked" at high temperature to make it



true again. If you're out of cash and desperate, you can place the head on a glass plate and use the smallest feeler gauge you can find and go all around the edges to see if you can slip it under. If you can, find out how thick a gauge you can get in there. If it's not too thick you may get away with using it. I'm not recommending either way. Use acetone or paint thinner to clean the gasket surfaces. I also used a palm sander with very fine sandpaper. It was faster than the gasket scraper. Some may disagree with this. You'll have to decide for yourself. Either way, the surface **MUST** be clean or you'll have all kinds of leaks. Make sure nothing gets into the oilways and coolant jacket paths on either the head or the engine block. Clean the surface on the engine block as well. Don't look for head re-conditioning procedures here. That's another tech article.

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#### **Section Four: Head re-installation**

You may consider pre-lubing the cylinders with a dab of 10W30. If you removed the head with the exhaust manifold attached you may consider installing it attached as well. I didn't. Installing them is a lot easier than removing them because the hardware isn't rusted out. Re-check that the cam drive pin on the cam sprocket is still at the top of its rotation. If you're using the sprocket support, be sure not to slack the chain. This isn't really worth a formal note, but please observe that the head gaskets are not identical. Match up the replacement gasket with the one you removed from the engine to identify the correct gasket for that side of the engine. Before you install the gasket, if you have removed the guide posts (locating pins) for cleaning, re-install them. You may have to insert a punch in the side of the block to keep them from sinking in when you put the head on per the manual. The gasket only goes on one way. The guide pin holes are larger than the oilway holes. Don't force it. If it doesn't fit, flip it over. **DO NOT USE RTV** or any other gasket sealant. Fit the gasket **DRY** just as it says in the manual. The gasket has an adhesive on it which will bond when the engine is first run. Carefully fit the head back onto the block. Replace the exposed timing chain cover gasket sections if you're using a sprocket support tool.

#### **If you are using the sprocket support**

Lift the small flange up and feed the cam back into the head until it comes in contact with the 10mm allen bolt. Line up the drive pin on the sprocket with the drive slot on the cam. It should all ready line up unless you moved something you shouldn't have. Begin screwing in the 10mm allen bolt and feed the cam to it. It should move smoothly. Don't force anything. Ensure the flange will drop into it's slot on the cam. Tighten the small flange bolt. Re-attach the cam access cover at the back of the cam. Use a new O-ring or you'll have an oil leak onto the hot crossover pipe. You may notice the timing chain is a bit tight. Remember, you haven't torqued down the head yet. This is normal.

#### **If you are not using the sprocket support**

##### **NOTE:**

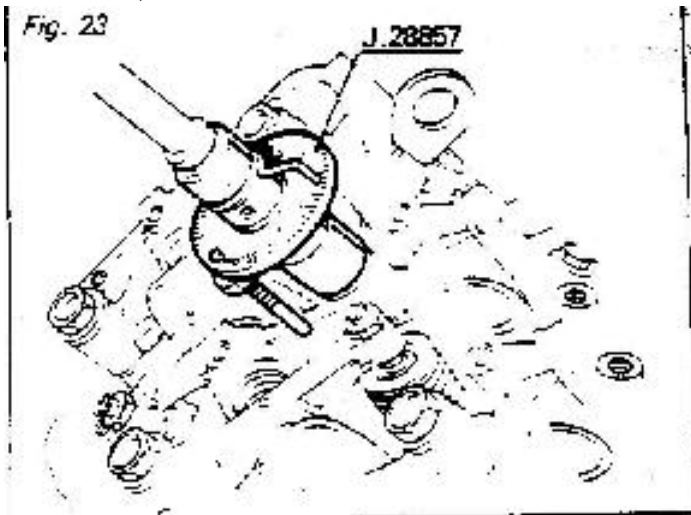
The sprocket should have slipped down, but not fallen out of the chain, or been removed. This will disturb the timing. If it has, skip to Section Five or consult the manual, pages C:07:10 and 11.

Ensure the cam drive peg on the sprocket is still at it's peak (uppermost). Lift up on the sprocket, removing any slack in the chain. Use a very small flat head screwdriver to release the tensioner. There is a slot for the screwdriver. You may have to completely retract the tensioner by hand as the spring is strong. An extra pair of hands is useful here. Once the tensioner is released, you'll notice that the sprocket now lines up with the cam. Install the 10mm allen bolt and tighten it most of the way but place no tension on it yet. Ensure the flange is in the groove on the end of the cam. Tighten the small bolt down. Tighten the 10mm allen bolt (cam sprocket bolt). You may notice the timing chain is a bit tight. Remember, you haven't torqued down the head yet. This is normal.

Remove the pin punches from the block if you used them to hold up the guide pins. Install the rocker arm. There are guide pins to keep you from installing it backwards. Don't force it!

### CAUTION:

The manual has a specific torquing procedure on page C:05:07 called "angle torquing". This requires a graduated disk, like a compass (part number J.28857).



Again, I was unable to procure one of these. If you can obtain one, great. If not, don't fret. DMC Houston torques their heads down to 65 ft/lbs and Martin Gutkowski and his Renault mechanic tighten as far down as 90 ft/lbs. I split the difference at 80 ft/lbs. Don't go crazy though. If you snap one of these babies you'll never get it out! Tighter isn't always better. Use a calibrated torque wrench.

Following the pattern in fig 39, page C:05:07, (starting in the center, and working outwards in a counter-clockwise circle) lube the head bolts with a bit of copper grease and snug them down to 15 ft/lbs. Do the pattern again to 45 ft/lbs. Walk away for 10 minutes and get a drink. This will give the metal gasket time to compress. Starting the pattern yet again, loosen them up, to 15 ft/lbs and immediately angle torque them to 115 degrees or ft/lb torque them to a number that you've decided on. Loosen and tighten only one bolt at a time. Don't loosen them all up at once and then tighten them down.

### Driver's side head removal and installation

You can tell just by looking that there is more interference on the driver's side to remove than on the passenger side. Start by marking the position of the distributor body, and remove the cap and mark the rotor position so your timing isn't off when you put it all back together. Undo the two bolts holding the diagnostic socket bracket to the head at the rear. Tie it up out of the way. If it isn't too rusted, undo the nut holding the dipstick tube to the exhaust manifold. Mine was rusted so bad I had to dremel the tube clip off of the manifold. Next, undo the electrical connection on the A/C compressor. Loosen the belt tensioner pulleys and remove the entire tensioner assembly. Keep track of where the spacers were installed or your belt won't line up later. You have to remove this assembly to get at the 10mm allen bolt on the driver's side head. Undo the four bolts holding the compressor to the valve cover. There are two on the "inside" (facing the waterpump) and two on the "outside", facing the fender. I was loathe to detach the pressure hoses from the compressor because A/C systems aren't my area of expertise. You can remove yours totally, or just flip it upside down, towards the front of the car and rest it on the shelf. Use caution around the glass. Now repeat the removal and replacement procedure as for the passenger side.

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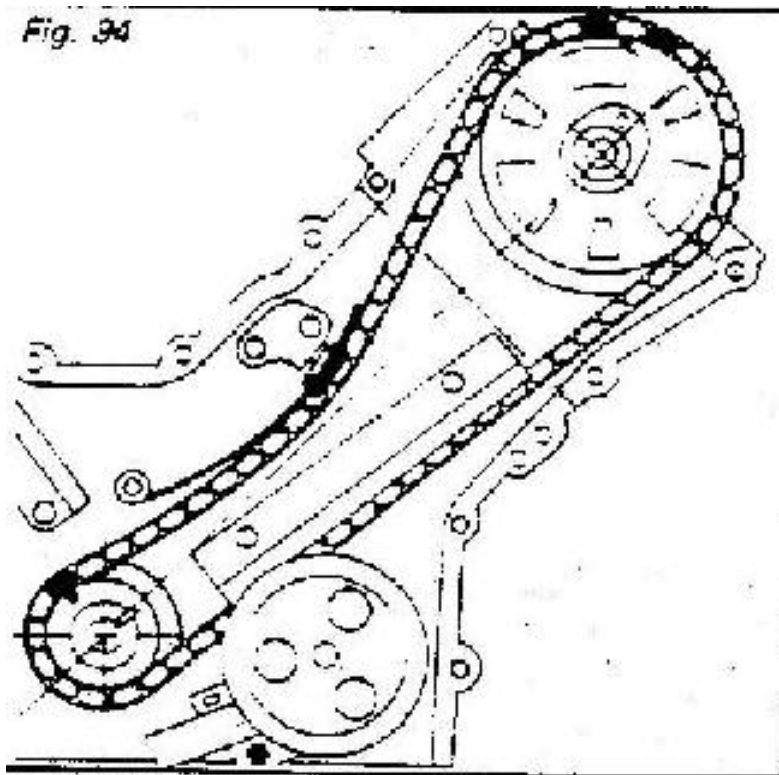
### **Section Five: Engine Timing Procedure**

If you suffered the unfortunate event of having your timing sprocket slip, fall out of the chain, or have otherwise disturbed the valve/piston timing, don't fret. Engine timing isn't that difficult. The procedure is called out on pages C:07:10 and 11 in the workshop manual. I'll cover it here briefly. Perform this procedure only after the heads are bolted down tight.

#### **Passenger side:**

First, without putting the chain cover back on, put the pulley on the crank, and put the 36mm nut on. Use a breaker bar to hand crank the engine until the timing mark on the crank shaft double-sprocket is in line with the DRIVER'S SIDE bank of pistons. This will be approximately 45 degrees to the left from being vertical. Examine your timing chain. Note that there are two orange colored marks close to each other at one point on the chain, and one mark near the other end of the chain. Place the chain on the rearmost of the double sprockets, aligning the single mark on the chain with the mark on the double sprocket. Next, examine the cam sprocket. Note that there is a "1" and a notch or mark on one of the teeth. DISREGARD THE "1". That is NOT the timing mark. Use the other notch or mark. Place the chain on the sprocket so that there is one mark ON EACH SIDE OF THE NOTCH ON THE SPROCKET. Now slip the sprocket on to the cam. Ensure the drive pin on the sprocket fits completely into the slot on the cam. It should be close because you weren't supposed to rotate the cam. If you did, or it was re-assembled that way by your local machine shop, rotate it so that the drive slot is on top. If it's close, but not quite, just rotate the engine until the drive peg goes in. Torque the sprocket down. The end product should look like Figure 94:

Fig. 94

**Driver side:**

Hand crank the engine clockwise until the the timing mark on the double sprocket is aligned with the bottom oil pump cover mounting bolt. If that sounds crazy, it's about 130 degrees right of vertical, or nearly opposite of where it is to time the passenger side bank. Follow the procedure above to properly place the chain, only placing it on the middle sprocket. The oil pump drive chain fits on the outermost sprocket. The end product looks like Fig 95:

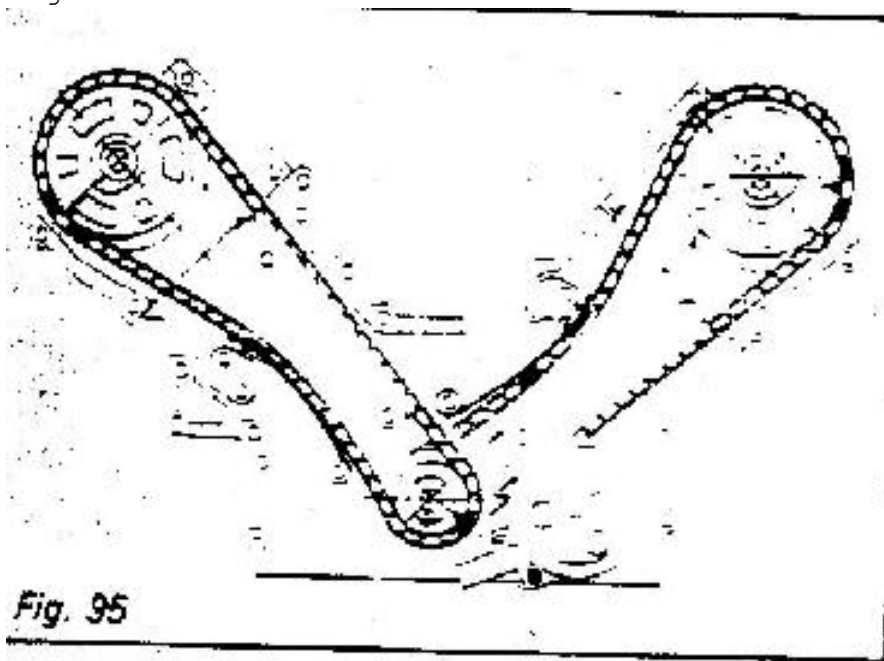


Fig. 95

The spots on the drawing sprockets and chains are the timing marks on the real sprockets and chains.

**WARNING:**

It is **STRONGLY** recommended that you rotate the engine by hand with the breaker bar at least 2 full revolutions to ensure the timing is set correctly. If the procedure is incorrectly performed, when using the starter a piston could strike a valve, bending it and causing head damage. If you feel a sudden stop, or hear a metal-to-metal contact, **STOP** and repeat the timing procedure.

**Distributor:**

If you have **NOT** disturbed the valve timing, simply re-install the distributor and align the body and the rotor to the marks you made earlier. The rotor is driven by a worm gear so make sure it doesn't rotate off of your mark when you push it down into the head.

If you did disturb the engine timing, hand crank the engine until #1 piston (passenger side, towards the front of the car), is top dead center. Examine the distributor body. Note that there is a small notch cut into the lip. Align the rotor to the mark on the distributor body, and install the distributor. Again, the worm gear may cause it to rotate clockwise as you push it down. If it does, remove the distributor and move the rotor back to the left of the mark. When you push it down, it should align with the mark on the body.



Photo courtesy of John Hervey. Again, the worm gear may cause it to rotate clockwise as you push it down. If it does, remove the distributor and rotate

the rotor back to the left of the mark. When you push it down it should align with the mark on the body.

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### **Section Six: Pressure Check and Re-installing Interference:**

A pressure check is recommended to ensure that everything went back together the way it should. You can purchase a cooling system pressure checker from a parts house such as Napa, or if you're desperate hook a low pressure pump to the overflow fitting on the coolant bottle. Remove the thermostat, or you'll only be testing one side of the cooling system because the thermostat is shut when cold. The maximum pressure of the cooling system is low at 13 lbs so use caution. Over pressurizing the system may damage gaskets or seals. Once you have the cooling system pressurized, time how long it takes for the pressure to bleed off. It should take several minutes, or maintain pressure indefinitely. A very slight amount of leakage at this point is permissible because you haven't run the engine yet to heat the adhesive on the head gaskets which will perform the final seal. Use a spray bottle with a soap and water solution and spray it on the head gasket/engine block mating surfaces, waterpump fittings, and coolant fill bottle fittings. Look for bubbles. At hose fittings, if there are bubbles, re-tighten your hose clamps. If you have bubbles at head/block mating surfaces, they should be very very few if any. A very small amount is permissible. Gross amounts of leakage may mean a warped head. On an unstarted engine, with new head gaskets a very small leak may be permissible due to the adhesive not being melted down and filling in imperfections in the mating surface, also the block when warm will expand. Lastly, the re-torquing procedure needs to be performed after the engine has been run. So if you have a tiny bubbler, don't panic.

Re-install all the interference in the reverse order called out in Section One.

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### **Section Seven: Re-Start and Re-tightening procedure**

After ensuring that everything is re-installed and hooked up properly, fill the engine with critical fluids (coolant, oil, fuel). I recommend having a friend bypass the RPM relay for just a couple of seconds to prime the fuel system and check for leaks at your fuel distributor while you watch in the engine compartment. The bypass procedure is in the "Fuel, Emissions & Exhaust" section of the manual. As much as you'd like to be the one to turn the key at such a proud moment, it's best to have a friend do it while you adjust the distributor if necessary to get the engine running. Once started, IMMEDIATELY verify oil pressure is within normal operating range, then begin an aggressive leak check. Run the engine for 30 minutes to heat everything up, Ensure the engine fans kick on. Ensure engine temperature does NOT exceed 210 degrees for more than 5 minutes. If the fans don't engage, but they did work before you dismantled the engine, then the cooling system needs to be bled. Open the bleed screw on the thermostat cap on the waterpump. If necessary, there is also a bleed point on the high point of the radiator on the front, passenger side. Shut down the engine.

Using a socket swivel, loosen the four intake bolts. Remove the valve covers (including the A/C compressor and other interference) Retighten the head bolts as called out in the manual, condensed here:

As you did when installing the heads, loosen each bolt to 15 ft/lbs, then retorqe to 115 degrees if you have the disk, or whatever ft/lbs you decided you could live with (65, 80, 90). Do this one at a time as recommended before, do not loosen them all at once and then tighten them down.

The final seating of the head gaskets is important to prevent leaks. You may be tempted to skip it to avoid tearing up the engine again. I recommend completing the procedure to the bloody, bitter end. I'm certain there's a reason for the retightening procedure.

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### **Tips and Personal Observations:**

If yours is a typical DeLorean that was a "garage queen", or worse yet was stored outside for years like mine, Most of your hardware will be rusty. If you're lucky to get it all out, you should replace as much as you can because it may snap off when you torque it down. That would be a Bad Thing. Anyway, this is a project that rarely is "just" replacing the head gaskets. On a neglected car, it can evolve into completing several projects at once, refurbishing the exhaust, reconditioning the cooling system with a new pump and sensors, and a general, light recondition of the engine by replacing all of the gaskets and seals. You usually won't be able to get by with reusing old gaskets and O-rings. I fought this project tooth and nail. I didn't want to take extra things apart. I came to the realization that it's just better if you pull the chain cover off and skip the cam sprocket support tool. You MUST buy a complete gasket set. Don't try to reuse 20 year old gaskets. The only thing I didn't do to my engine was replace the rings and main bearings and the valve work in the heads. It was expensive, labor intensive but it was completely worth it. It's a domino effect so be prepared.

For better access to the crank pulley, you may decide to remove the rear fascia. It sounds scary but it only took me 45 minutes. Remove the tail lights, there are four bolts per side. Remove them, undo the latch for the engine cover. You've already detached the metal heat shield plate. It should pull right off.

There has also been some discussion recently on "angle torqueing" versus standard pressure torqueing. Some feel that due to the extreme stretching of the bolts that angle torqueing places on the material, that head bolts should never be reused. To my knowledge, no one has snapped a head bolt in an attempt to re-use them. Many other owners have stated that they have re-used them without consequence. There are 3 basic types of people on the DML. Those who are anal and replace things even if they don't need replacing, those who do the job right and replace whatever needs replacing, and those who try to get by without replacing things. Whether to reuse the bolts is a decision that you will have to make for yourself.

Vacuum leaks are common when you put the engine together again. The engine won't run perfectly until you hunt them all down and seal them. Key points to check are: Idle speed regulator tube O-ring where it fits into the mixture control unit, valve covers, timing chain cover, the CO adjustment screw plug, "W" pipe gaskets and O-rings, cold start valve tube seals, injector seals and believe it or not, the oil dipstick tube gasket. There

are many methods of detection. Consult the archives to find the one that best suits you.

One last important note. If for some reason you feel you absolutely have to rotate the engine with the head loose or removed, purchase or fabricate clamps or straps out of some flat steel or aluminum to hold the liners down. Lay them across the cylinder and bolt them down at the head bolt holes. Again, if the liners lift off of their seats, the seals underneath will be ruined and the engine will have to be removed and completely dismantled to replace them.

Procedural questions can be addressed to me at: [racutil\(AT\)delorean.com](mailto:racutil(AT)delorean.com)

Good Luck!

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