



## INTRODUCTION

This handbook describes parts and procedures to prepare ECOTec Race Engines and Hydraulic Race Transmissions used by GM Racing in professional sport compact drag racing. This information in this handbook is for experienced and knowledgeable race engine and transmission builders only. The procedures described require specialized tools and skills. If you do not have the appropriate training and equipment to perform these modifications safely, this work should be performed by other professionals.

This handbook pertains exclusively to engines and vehicles which are used off the public highways. Federal law restricts the removal or modification of any part of a federally required emission controls system on motor vehicles. Further, many states have enacted laws which prohibit tampering with or modifying any required emission or noise control system. Vehicles which are not operated on public highways are generally exempt from most regulations, but the reader is strongly urged to check all applicable local and state laws.

Many of the parts described or listed in this handbook are merchandised for off-highway application only, and are tagged with the following "Special Parts Notice":

### SPECIAL PARTS NOTICE

This part has been specifically designed for Off-Highway application only. Since the installation of this part may either impair your vehicles' emission control performance or be uncertified under current Motor Vehicle Safety Standards, it should not be installed in a vehicle used on any street or highway. Additionally, any such application could adversely affect the warranty coverage of such an on-street or highway vehicle.

The information contained in this handbook is subject to change. General Motors also reserves the right to make changes at any time, without notice, in equipment, manufacturers, specifications, and materials, or to discontinue items.

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# All ECOTEC Powered





# Swap an ECOTEC LSJ Clutch

One of the first vehicle upgrades many enthusiasts perform on their Ecotec 2.0L LSJ-powered Cobalt SS or Ion Red Line is the installation of a performance clutch. This is not a negative comment on the stock clutch—it is an excellent piece. But this supercharged four-cylinder engine makes it so easy to add big horsepower—like when you install a Stage 2 Upgrade kit (check out the details in Chapter 4) and go from 205 hp to 241 hp—you will need a new clutch to enjoy that power! That means you'll need to upgrade the clutch.

## The Insider Tip

While some enthusiasts will pull both the engine and transmission to get to the clutch, there is a much easier and faster way to replace it. Instead, the inside line is to add a temporary engine support and remove just the transmission. Now, there

are some finesse aspects and special steps required to make this happen—but you're in luck. This chapter is going to show the details to complete this process.

So take some time and look through this chapter to understand what it looks like to remove and replace the stock clutch on the Cobalt SS Supercharged and Ion Red Line.

## When does your clutch need to be replaced?

Other than just changing the clutch to minimize the chances of having an unplanned clutch failure, many ask, "How do I know my clutch needs to be replaced?" Well, the simplest way to know is when your car doesn't move under power—as in, the engine is running and you've got the transmission in gear, but nothing is happening (except maybe some smoke). Now, if you have a clutch system issue, such as air in the hydraulic clutch slave cylinder system, a mis-matched clutch/flywheel/slave cylinder system, or a damaged clutch master cylinder the vehicle will not go in gear, but it's

not because your clutch is bad.

Another way to know you need to replace the clutch is when it is slipping. This situation is best described as when you're cruising along in gear and apply more throttle, but instead of speeding up, the engine just spins freely.

In general, a clutch problem never gets better, so if your vehicle is exhibiting any of these symptoms or you're increasing the power output of your engine, you need to read through this chapter and get ready to swap in a performance clutch.

## The short story: clutch removal process

The clutch will be accessed in this chapter by removing the transmission and leaving the engine in the Cobalt SS/Ion Red Line. To perform this, a temporary engine support will be used to hold the engine in the vehicle. The first steps of the process are performed under the hood, then everything else is performed from underneath the vehicle until the transmission is removed. The clutch is removed from under the vehicle.

This clutch swap was performed on a 4point lift, but you could do this work with this vehicle on floor jacks.

The transmission is reinstalled from under the vehicle and everything else reinstalled in reverse order from the disassembly process.

## Tools To swap a clutch



The recommended list of tools includes the common sockets, wrenches, pliers, side cutters and zip ties, but there are some specialized pieces that really make this job go smoothly—like the swivel sockets, impact socket guns and the one ‘shorty’ wrench (the 18 mm one). We’d suggest you do your best to buy, borrow or rent these pieces—as they are what make the job go quickly and easily.

### Tools List

- Sockets (7 mm, 10 mm, 15 mm, 16 mm swivel, 18 mm swivel, 19 mm, 30 mm)
- Socket Extensions (2, 4, 6 and 12 inch)
- 3/8 and 1/2-inch ratchet wrench
- 3/8 impact
- E10 Torx star socket
- Torque Wrench
- Temporary Engine Brace
- Brass hammer
- Rotary Grinder with scotchbrite pad
- Wrenches (8 mm, 15 mm, 16 mm, 18 mm and shorty 18 mm)
- Pushpin removal tool
- Large prybar
- Side cutters
- Pliers
- Long zip tie wraps (12 inches)

## Lefty loosey, righty tighty

Unless otherwise called out, all threaded fasteners discussed in this book are removed by turning them counterclockwise

around their axes (the “lefty loosey” theory) and tightening a threaded fastener is done by turning it clockwise (“righty tighty”).



The best way to replace the clutch on the Cobalt SS Supercharged and Ion Red Line is to remove just the transmission—not the engine—like this.



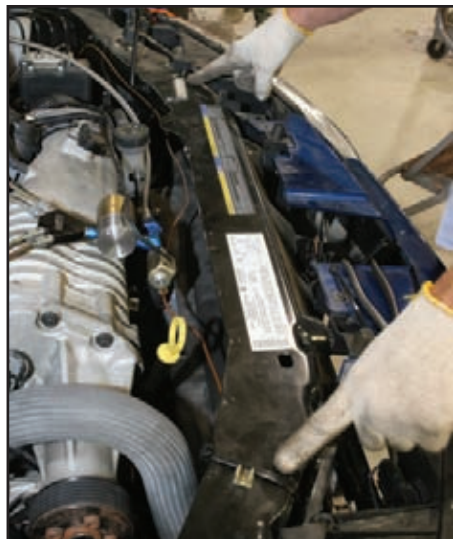
This transmission is being removed from an Ion Red Line, but the Cobalt SS supercharged is very similar in the removal, so whichever vehicle you own, this chapter will show you the basics to swapping the clutch.



As always when working on your car, start your servicing by removing the 10 mm (5/16-inch on Ion) negative cable on the battery, wrapping it in a rag and pushing the cable down next to the battery to minimize the chances of it coming close to the battery stud as you work on the vehicle. Also, set the steering wheel in the straight position and lock it there by removing the key.



## — Zip tie radiator in place —



The engine/transmission cradle will be removed during this process—and the cradle has the lower radiator mounts on it. To avoid having to remove the radiator with the cradle, loop two large zip ties around the



top of the core support and the inlet and outlet hoses of the radiator in the areas where the two hands are pointing (left photo)—this will hold it in place—and save you from having to refill the coolant system.



## — Disconnecting Powertrain Control Module (PCM) plugs and removing PCM —

The PCM and its holder need to be removed to gain access to the upper transmission mounting bolts that need to be removed to get the transmission out of the vehicle.



Start the removal of the PCM plugs by lifting the pivoting lock tab up and wiggling the connector off the PCM pins. Start by removing the top (blue) connector and work your way down to the black and gray connectors.



Remove the PCM by peeling back the lock tab on the controller holder and pulling up on the controller to remove it from the holder.

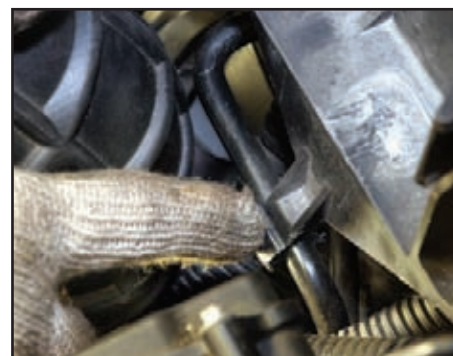


This is what the engine bay will look like with the PCM removed. You'll need to remove the black plastic PCM bracket next.

## — Removing PCM bracket —



Peel the PCM bracket plastic clip up off the black metal rod on the top.



Then peel the plastic clip off the metal rod near the bottom of the backside of the bracket.





Pull the plastic PCM bracket forward and remove.



This is what the area will look like with the PCM bracket removed.

## — Removing air inlet tube

The upper inlet tube needs to be removed from the vehicle. This creates more room to access the upper transmission-mount bolts.



Loosen the air tube clamps with a 7 mm socket on a 1/4-inch drive ratchet (8 mm on the Cobalt SS).



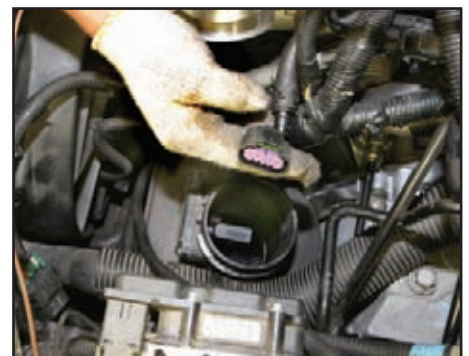
Twist the tube at its base to 'break it loose' from the airbox and throttle body flange. Pull the air inlet tube off the engine.



Remove the PCV (positive crankcase ventilation) tube that feeds into the inlet tube by pulling it off the main inlet tube.

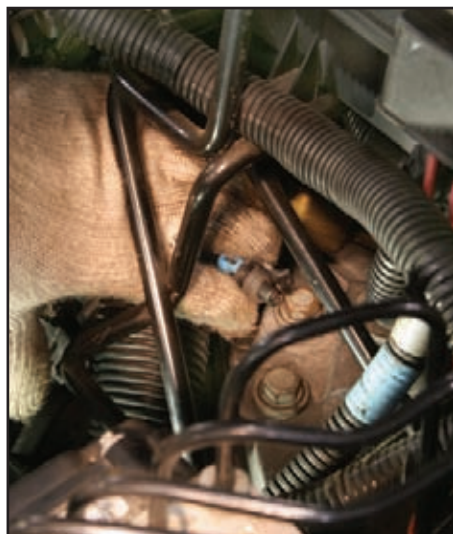


Remove the Mass Air Flow (MAF) sensor electrical connector by pulling back on the safety tab and pushing down on the lock tang to remove it from the MAF sensor. The Cobalt SS MAF is in the driver's side corner of the front fascia—reach the Cobalt SS MAF there.





## Disconnecting reverse light connector



Remove the reverse lights electrical connector (located on top of the transmission by the shift arms) by lifting the lock tang and wiggling the connector off the transmission connector.

## Installing temporary engine support



Install the temporary engine hanger bar across the engine bay. These are commercially available from OTC (P/N 1722) or you can make one out of a large metal beam. Make sure the ends of the support beam rest on the inner fender upper rail and not the exterior edge of the fender to avoid any body damage.



Feed the hook of the temporary engine hanger through the factory engine lift point (located on the driver's side of the engine). Adjust the threaded hook anchor on the temporary engine hanger to make the hook loosely touch the lift point—don't pull the engine up with the hanger—this will allow the engine to relax slightly in the engine bay which gives you some room to get clear the shift levers as you lower the transmission out of the engine bay.

## Removing upper engine-mount bolts

You'll need to remove these three bolts before moving under the vehicle for the rest of the removal process.



The best way to access these three bolts is with a 3/8 or 1/2-inch drive 16 mm swivel socket on an impact gun or breaker bar.



The bolts are located on the driver's side of the engine compartment, slightly underneath the electrical wiring box—which is why you'll need the swivel head socket. You can't get a 'straight down' orientation on them without removing the electrical box—which you don't want to remove unless you have to!

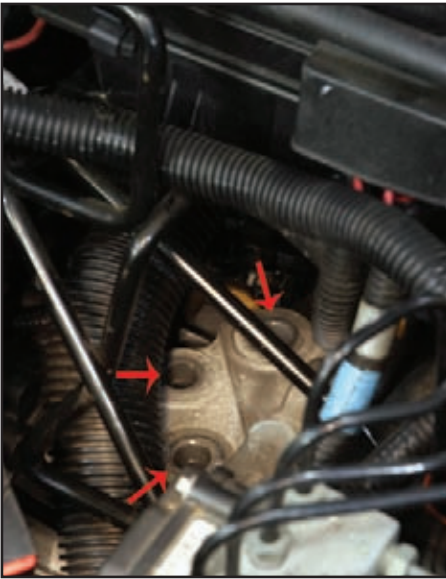


This is what the bolts will look like loosened and removed (one has been taken out of the mount).



## — Removing inner fenderwells and side covers —

The engine/transmission cradle needs to be lowered out of the vehicle to remove the transmission—and to get that out, the front portion of the inner fenderwells and inner splash panels need to be removed—and that's the next activity.



Here are the three holes the 16 mm bolts seat in. This is what the mount will look like when you are ready to move to underneath the car for the rest of the transmission removal process.



Start by pulling out one of the inner pins on the pushpins on the lower portion of the front fenderwell. Then pry the pushpin body out of each hole in the plastic fenderwell.



Continue pulling the inner pins on the pushpins to release it and prying the pushpin bodies out of the holes in the fenderwells until the inner fenderwell from the centerline of the front axle is loose.



There are two 7 mm bolthead screws holding the front section of the inner fenderwells on the chassis. Remove and save these for reinstallation.



On the left is what the pushpin will look like after you have pulled up on the inner pin to release the pushpin "lock". The pushpin on the right shows you how the center 'pin' locks the pushpin in place when pushed down. When you reinstall these, just push the body into the hole of the inner fenderwell and mount, then push the center pin down to lock it in place.



This is what the inner fenderwell will look like after all the fasteners have been removed. Carefully pull the fenderwell back and slightly outward to clear the front suspension.



With the inner fenderwell pulled back, the side cover closeouts will be exposed. These need to come out now—pull the pins on the pushpins and pry out the pushpin bodies. These panels will also have 7 mm bolthead screws that need to be removed—once out, save all fasteners for reinstallation.



Remove the side cover closeouts on both sides of the vehicle.



With the inner fenderwells and side covers removed, you will have a good view of the engine/transmission cradle that will be removed soon.



## — Removing lower radiator mounts —

With the radiator supported by the zip ties, the lower radiator mounts should now be unbolted and set aside until the reinstall.



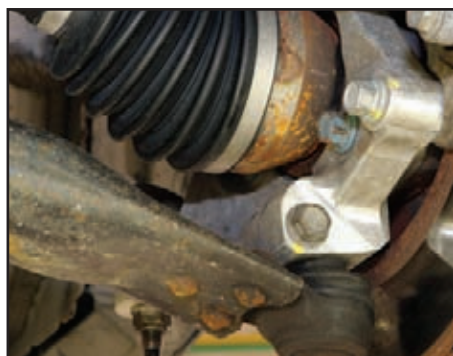
The lower radiator supports are located at the front driver and passenger corners of the engine/transmission cradle and each is held in place with three 13 mm bolts.



Remove the 13 mm bolts, mark the brackets 'passenger' and 'driver' (this will save time during the reinstall) and set them aside.



## — Removing lower ball joints —

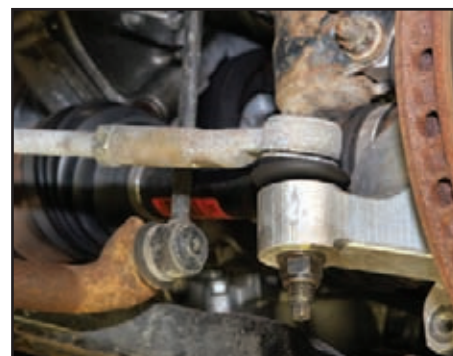


The lower ball joint is held in place with a 16 mm pinchbolt and 15 mm nut. Remove the bolt/nut combo now.



Once the bolt is out of the steering knuckle (as shown), pull down on the A-arm to release the ball joint from the steering knuckle.

## — Removing tie rod ends —



The steering tie rod is held on the steering knuckle arm with an 18 mm nut.



Remove the 18 mm nut with a socket—preferably on an impact wrench as this will usually get these off without "spinning" the tie rod shaft. If the shaft comes loose before the nut comes off, grab the shaft with a 5 mm socket as you loosen the nut with an 18 mm open-end wrench.



This is what the tie rod will look like after the nut has been removed.



If the tie rod shaft doesn't lift out of the steering knuckle arm by hand, lightly hit the knuckle arm with brass hammer to release the taper lock of the tie rod shaft.

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## — Removing swaybar mounts —

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Remove this 18 mm nut to release the upper swaybar mount on the shock strut. Notice the small visegrip pliers being used to hold the swaybar shaft that was spinning.

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## — Removing steering U-joint —

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The steering U-joint needs to be removed from the rack and pinion steering shaft. This is because the steering rack is attached to the engine cradle and that is going to be lowered out of the vehicle. Make sure the steering wheel is locked in the 'wheels straight forward' position before

removing the U-joint from the shaft to make the reassembly go faster. Also, locking the steering wheel prevents someone from spinning it after the shaft is disconnected and breaking the wires coiled on the steering shaft in the process—an expensive and unnecessary mistake!



The steering U-joint is accessed through the driver-side wheelwell, just behind the axle assembly. A 13 mm bolt on the U-joint locks the U-joint on the steering shaft and needs to be removed at this point.



This is what the U-joint looks like with the bolt removed.



You'll probably need to apply some force to separate the steering U-joint and shaft. The easiest way to do this seems to be to use a large pry bar and hammer—place the tip of the pry bar up under the lip of the U-joint and hit it with the hammer until the two components separate.



This is what the U-joint and shaft will look like when separated. Notice the location of the tip of the pry bar on the lower edge of the U-joint—this is where it was placed to help remove the U-joint from the shaft.

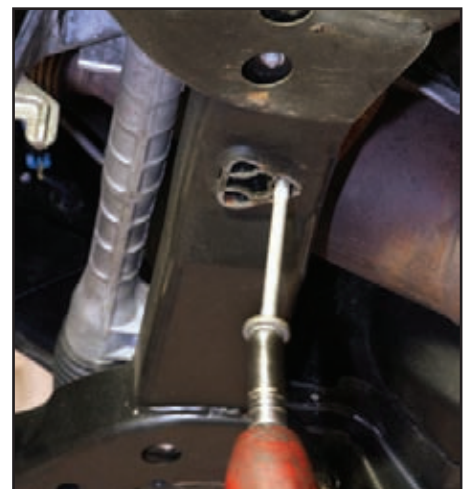
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## — Removing lower engine mounts —

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With the engine supported by the temporary engine hanger and many of the engine cradle-mounted components released, you can now remove the two main lower engine mounts as the last step in preparation to remove the engine/transmission cradle.

Remove the three 15 mm engine mount bolts at the rear of the cradle. This will leave the large aluminum engine mount structure on the engine, but now the cradle is free of the engine.







Remove the 18 mm engine mount through-bolt at the front of the cradle



This is what the underside of the vehicle will look like when the engine cradle is clear to be removed.

## — Removing engine cradle —

This can't be emphasized enough: Use caution when lowering any large components out of a vehicle, like the engine cradle. Use specially designed transmission jacks (they can be rented) and ask for help from at least one other person to steady the cradle.



Remove only two of the four 21 mm cradle bolts (the front left and the rear right bolts) before sliding the transmission jack under the vehicle as this will make it easier to lower the vehicle down for transmission removal. Be sure the two removed bolts are diagonal from each other.



Position the engine/transmission cradle on the transmission jack and clamp it in place to stabilize this large component. Ask for help from at least one other person to hold it in place as you lower it out of the vehicle.



With the jack firmly in place on the engine/transmission cradle, remove the two remaining 21 mm cradle bolts.



If you are on a vehicle lift, it seems easier to raise the vehicle off the cradle. If you are working on a fixed lift (like jackstands), you can drop the cradle down. But, if it doesn't immediately come loose, recheck to make sure everything is unbolted! Once out, set aside the cradle until reinstallation

## — Prepping steering shaft —



The steering shaft gets rusty pretty quickly, which can make it tough to reinstall. Now is the time to correct this issue.



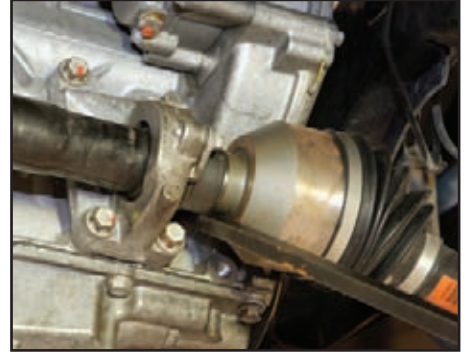
An easy way to address this is to lightly buff the metal of the steering shaft with a scuff pad (either by hand or as shown on a rotary grinder); remove only the rust—do not remove any metal!

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## — Removing intermediate shaft —

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With the cradle lowered out of the vehicle, the transmission is exposed to be unbolted and removed to access the clutch. The first step towards this is removing the drive axle from the intermediate shaft on the passenger's side of the engine compartment.



Begin the removal of the passenger-side axle from the intermediate shaft by prying between the axle collar and intermediate shaft engine mount with a 24-inch prybar in this location. Use the closeup photo to really see how to pry on these two components. Pry the two shafts apart less than 1/2 inch before moving to the next step.



Once the axle is loose from the intermediate shaft, pull the entire front suspension assembly away from the engine and let the axle hang off the strut assembly.

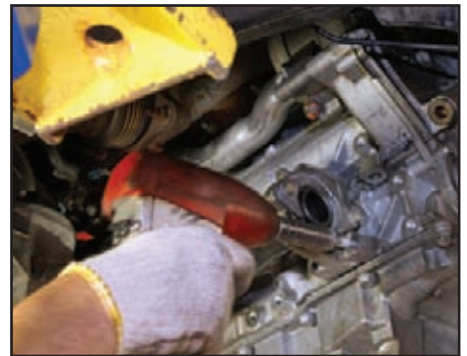


This is what the backside of the engine will look like with only the intermediate shaft on it. Now, you'll need to remove the intermediate shaft engine mount as this will go with the transmission when it is removed.

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## — Removing intermediate shaft mount

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Remove these three 15 mm bolts to release the intermediate shaft engine mount.

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## — Removing engine-mount bolts and accessories

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The easiest way to remove the entire lower engine mount bracket is to unbolt it from the transmission. Prepare to remove this bracket by removing the plastic pushpin holding the O<sub>2</sub> sensor in place. This bracket needs to be removed to allow you to maneuver the transmission out of the vehicle.



These bolts can be removed with a ratchet and socket, but if you've got access to compressed air, an impact gun with an 18 mm socket on it will make this job go very quickly.



This is the bracket coming out of the engine compartment.



### — Removing driver's side axle —



To avoid damaging it, remove the small dust shield in front of the halfshaft at the engine mount by taking out these two 10 mm bolts.



With a buddy in the car holding the brake pedal down, loosen the 30 mm nut on the drive axle (this has the standard lefty-loosey threads).



Unthread the 30 mm nut until the nut is just above the last few threads on the axle so you can ...



Hit the nut on the halfshaft to help release the axle splines from the inner splines of the drive hub. Remove the nut and washer.



Peel the hub assembly out from the engine bay until the shaft falls loose from the hub assembly.

### — Removing transmission cables —

The shifter for the 5-speed manual transmission in the Chevy Cobalt SS Supercharged and Saturn Ion Red Line selects gears through two cables that mount to two armatures on the transmission. These cables need to be removed from the arms and their anchor points as the

next step in removing the transmission from the vehicle.

**Important:** The shifter arms must be put back into the exact position they were in when the cables were removed for the shifter to work properly.



Peel the two white plastic shifter cable ends off their respective transmission arms with the pushpin tool.



Remove the cable anchor points from their brackets by pulling back on the white and black collars, respectively, then lifting up on the collar to remove the cable from the bracket.



This is what the transmission shift cable bracket will look like after the cables have been removed.



## — Removing wiring —



Disconnect the electrical vehicle speed sensor connector that is installed on the top of the transmission by lifting the lock tang and wiggling it off the transmission.

## — Removing air filter housing on Ion Red Line —



The Ion Red Line (Cobat SS is different, so skip this step if you have an SS) lower air inlet tube and air filter housing need to be unbolted from the transmission case.



Use a 7 mm socket to loosen the two clamps holding the lower air inlet tube in place. Wiggle it off the air scoop and air filter housing mounting flanges.



No, that's not the factory air cleaner housing—the bottom has been cut off this unit to allow more air to get into this performance tuned engine. This works great on a performance car that won't be driven in the rain. If you plan on driving in the rain or even on wet roads, don't make this modification to your stock airbox!

After removing the three 13 mm nuts on the transmission stud/bolts, you can remove the air filter housing from the transmission. This is a snug fit, so don't be surprised if you have to pry the airbox off the studs.



## — Removing two bellhousing bolts —

There are seven bellhousing bolts that need to be removed to pull the transmission off the back of the engine. The removal of the bolts is

interrupted by a few secondary steps that need to be performed, so those steps are detailed in sequence.



Start by removing one 18 mm bellhousing bolt situated behind the starter on the front side of the engine. There is another 18 mm bolt next to the starter.



To fit in the tight space these two bolts are located in (both side-to-side and out front where the wrench will need to be turned), a 'shorty' 18 mm open end wrench will be needed for the outside bolt and a 6" extension on an 18 mm shorty socket to get the bolt behind the starter.



This is one of the two 18 mm bellhousing bolts near the starter being removed from the bellhousing.



## — Removing clutch slave distribution block —

On the top of the transmission, there is this distribution block for the clutch pedal hydraulic line. This needs to be removed to pull the transmission. As a note, the clutch and brake systems on these vehicles use the same reservoir (the brake reservoir)—this comes into the process when the clutch is being “bled” of air.



To remove the clutch distribution block, use a small dental pick to pull this (arrow) C-clip out of the distribution block and another C-clip that holds the hydraulic line in the block. Don't lose these! You'll need them during the reinstall process. Pull the distribution block straight up to remove it from the transmission.



Put a rubber cap on the end of the hydraulic line (like this) otherwise it will continue to drool brake fluid down onto you (not pleasant).

## — Removing more bellhousing bolts —



Unbolt the two top 18 mm transmission stud/bolts using an 18 mm deep swivel socket on an extension. These stud/bolts will most likely be covered by a plastic clip holding a wire on the engine—peel that off with the pushpin tool to get to the bolt head.



These two 18 mm bolts are between the engine and the firewall on the bellhousing, and need to be removed.



This overall shot should give you a better idea of where these two bolts are located. After these are removed, the bottom bellhousing bolt will be the only fastener holding the engine/transmission assembly together. You'll want to get the transmission jack in place before removing this last bellhousing bolt.

## — Preparing to remove transmission —



Position the transmission jack under the main case of the transmission with a 2x4 block of wood under the driver's side of the transmission case to stabilize the non-flat transmission on the jack face.

Now, remove the final (of the seven in total) 18 mm bellhousing bolt on bottom of engine, while a helper holds the transmission with you (it shouldn't come loose with just the removal of the bolt—but you want to focus on safety with this).







Use a small pry bar or screwdriver to separate the engine/transmission and move the transmission off the engine a few inches before lowering it out of the vehicle. This is where not having the engine held tightly up in the engine compartment pays dividends—it leaves lots of room to lower the transmission out of the vehicle. Again, have a helper hold the transmission with you as you lower it down out of the vehicle.



Tape the factory transmission-to-engine shim in place with some masking or duct tape.

## — Removing clutch —

With the transmission out of the vehicle, you'll be looking at the clutch bolted to the back of the engine (which is still bolted in the car). Now is the time to remove the clutch and flywheel as the first step in replacing the clutch. The flywheel also should be replaced.



To unbolt the clutch, remove the six external E10 Torx (known as a 'star socket') bolts holding it in place, with a criss-cross pattern.



Use a pry bar to start the removal of the clutch and pressure plate assembly from the flywheel pins.



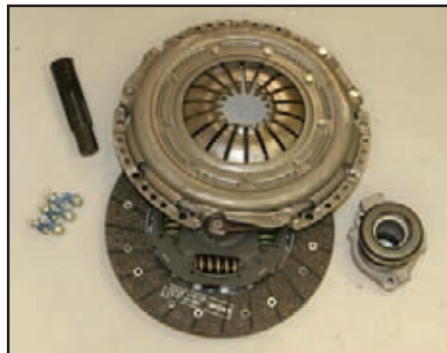
Be careful as you remove the stock clutch and pressure plate assembly as these are heavy components with distinct edges—you'll want to have a firm grip on them and get them down out of the vehicle with care.

## — Prepping for new clutch —



Remove the stock flywheel from the engine by unbolting the eight 17 mm bolts and replace if needed.

## — Installing new clutch —

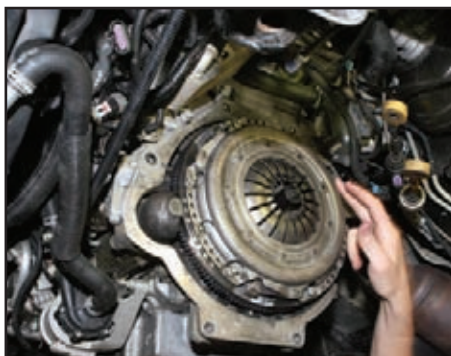


Here is what you'll want to buy for your Cobalt SS or Ion Red Line: a performance clutch, pressure plate, bolts, alignment tool and, if needed, a new throwout bearing. The throwout bearing might be required if the clutch uses one different than the stock piece—if it doesn't, most enthusiasts don't swap out the throwout bearing as they are very durable.



When taking the clutch/pressure plate out of its packaging, make a note of how they go together (like these two pieces). Most clutch/pressure plate combos will only assemble one way—but there are those that can be improperly installed, and taking your car back apart because of this is miserable! As a note, most clutches are marked "trans" and "fly-wheel" to show how to assemble them.





With the replaced flywheel torqued to 39 ft-lb (53 N-m) on the crankshaft and each bolt rotated another 25 degrees, it's now time to install the new clutch on the engine. Start by positioning the clutch on the three small pins at the outer edge of the flywheel. Then, finger start all the bolts in their threaded holes.



Slide the clutch alignment tool through the clutch and into the pilot hole on the crankshaft. This might require some wiggling and pushing—but shouldn't take more force than that.



Tighten the clutch bolts onto the flywheel with an impact gun (set on low) or a socket wrench.



Pull the alignment tool out and you should have a new clutch installed like this.



Torque the clutch bolts in a radial pattern to 21 ft-lb (28 N-m).

## — Reinstalling transmission in vehicle —

Congratulations, you are over the hump to getting your Cobalt SS or Ion Red Line back on the road and stronger than ever. The transmission will now be reinstalled. As a suggestion, if you are performing this work on the floor it will help to have a floor jack placed under the transmission to hold the transmission securely as it is maneuvered into position to thread the three upper transmission mount bolts in place (this can take some time).



Lift the transmission back up into the vehicle while keeping the intermediate shaft mount face flat against the backside of the engine (because it's practically impossible to re-clock this once installed, so get it right!). Install at least one bellhousing bolt to just past hand tight once the engine and transmission are mated to hold them together. As a tip, you might need to knock the transmission into gear and rotate the engine slightly to get the splines to line up, but this should be a relatively rare situation.



Here's something that could trip you up: Make sure this little 'cap' is on the fitting for the hydraulic clutch line on the top of the transmission and is seated properly before the transmission is reinstalled. If it's not there, the system will leak profusely when you go to pressurize the clutch system and you'll be unhappy—because a lot of rework will need to happen to properly install this piece.



This is what the cap will look like when properly installed on the clutch hydraulic fitting on the top of the transmission.

## — Installing bellhousing bolts —



Here is the intermediate shaft mount properly positioned.



The bellhousing holes are very close to the size of the bellhousing bolts, so the engine and transmission will need to be perfectly aligned for the threads to “grab” on the bellhousing bolts. This is good, as the chance of “cross threading” the bolts is minimized—but don’t force any bolts that don’t thread in smoothly! Take them out, reposition the transmission and start again.

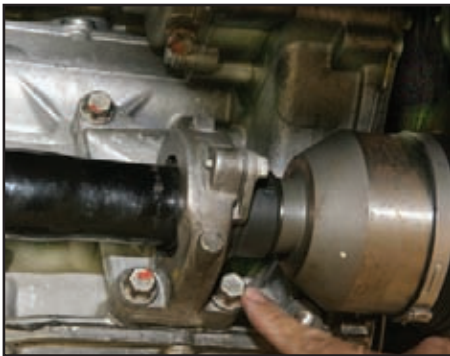


Getting all seven 18 mm bellhousing bolts started and hand tight is a two-person job. One to help repositioning the transmission, the other to work the bolts into the threaded holes.



Once all the bellhousing bolts are hand started on the threads, tighten them to just past hand tight.

## — Installing intermediate shaft engine mount



Install the passenger’s side intermediate drive-shaft mount on the engine with the three 15 mm bolts. Torque these bolts to 37 ft-lb (50N-m).

## — Installing passenger’s side axle in intermediate shaft



Install the passenger axle shaft into the intermediate shaft by pulling back on the suspension assembly and sliding the axle into the intermediate shaft. Add a light wipe of anti-seize compound on the splines before installing the axle to ease removal in the future. Be careful to keep the axle centered in the intermediate shaft as you feed it in, to avoid damaging the seal. As the splines meet, you might need to turn the axle slightly to align the splines. Slide the axles together until they are fully mated.



## Installing driver's side axle in hub



Lift the driver's side suspension assembly outward and position the axle so it will feed into the drive hub in the steering knuckle.



You might need to rotate the drive hub slightly to align the splines—once they are aligned, push the two together until the threaded end of the axle pokes through the drive hub.

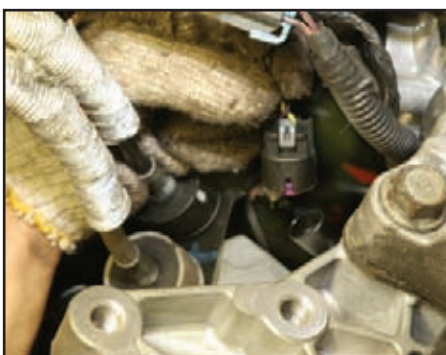


Hand start the 30 mm nut on the axle threads (you did put the washer on first, right?) and tighten with an impact wrench set on low (shown), or a ratchet wrench to just past hand tight. Torque the nut to 155 ft-lb (210 N-m) by having a helper hold the brake pedal down to keep the axle from turning.

## Installing shifter cables



Reinstall the transmission shifter cable anchor points in the brackets by pulling back on the lock collars and pushing the cables into the metal bracket. Place the cable with the white connector in the lower bracket hole, then install the black collar in the top opening of the bracket.



Make sure the transmission arms are in the same position as when the cables were removed. Then, snap the shifter cable ends onto the transmission armatures they are laying on and plug in the vehicle speed sensor at the back of the engine (not shown in photo).

## Installing dust shield



Install the dust shield on the back of engine/transmission assembly with the two original 10 mm bolts.

## Installing rear engine mount



Install the rear engine "torque reaction" mount with the three 18 mm bolts. The mount attaches to the cradle, which is not in the car yet—so that will just hang in the breeze for right now.

## Torquing bellhousing bolts



Now, use an impact wrench on a lower setting to tighten all seven bellhousing bolts.



Torque all bellhousing bolts to 55 ft-lb (75 N-m) in a radial pattern. Install any plastic grommet cable holders onto any stud/bolts (these stud/bolts go in the top two bellhousing holes).

## — Installing hydraulic clutch slave distribution block —



In preparation for reinstalling the clutch slave distribution block, reinstall the big and small “C-clips” using the two red arrows as a guide for the direction to push the clips into the body.



This is what the clutch slave distribution block will look like with the C-clips properly installed. **Note:** The clutch slave hydraulic system bleeder screw (lower right arrow). An easy way to bleed the system is to pump up the clutch pedal and release this bleeder until the clutch pedal bottoms out. Close the bleeder and repeat until you have pedal pressure.



Reach up from under the engine bay to the top of the transmission with the clutch slave distribution block positioned with the hose end pointing toward the passenger’s side of the vehicle. The block needs to be “clocked” properly to “click” into place—so don’t push too hard on this if it doesn’t go on right away. Reposition and push until the block snaps onto the fitting on the transmission (you do have that little, black tip on the fitting, right?—see “Reinstall the Transmission” a few pages back for what that should look like)



This is what the clutch slave distribution block will look like when it is fully installed. Now the clutch line needs to be installed on the distribution block.



Install the hydraulic clutch line on the transmission. Push the line in until it “clicks” into place, then lightly tug on it to ensure it’s locked in place.

## — Installing Ion Red Line air filter housing —

It’s now time to reinstall the air filter housing in the Ion Red Line (remember, the Cobalt SS air box will not need to be removed to swap the clutch).



Reposition the air filter housing in the vehicle and on the three stud/bolts on the transmission. As a note, this housing **MUST** be installed before the cradle is installed—forget and you’ll have to remove the engine cradle to get the air filter housing in place.

**Note:** The Cobalt air filter housing is outside of the frame rail and does not require this step.



Install the three 13 mm nuts, the lower inlet tube and tighten the 7 mm adjusters on the clamps to complete the installation of the air filter housing.



## Installing engine cradle in vehicle



With a helper and the transmission jack, lift the engine/transmission cradle back up under the vehicle in preparation for bolting it in place. In case you get confused as to the positioning of the cradle, the steering rack-&-pinion unit bolted to the cradle is located behind the axle centerline.



As the cradle gets closer to the vehicle, you'll need to position it close to the four cradle bolt holes. This is not as easy as it seems, so sneak up on it. Get the passenger's side two holes lined up—you're going to install the ball joints before tightening all the bolts as this will help to align the cradle to the vehicle.



Keep "repositioning" the cradle up to the vehicle until you can hand start two passenger's side 21 mm bolts (of the four total bolts) in the framerail. The engine will need to be lifted slightly to fully install the cradle bolts on the driver's side, so they can wait.

## Installing ball joints



To help align the cradle in the vehicle and continue the reinstallation, push the ball joint shaft up into the steering knuckle.



Install the "pinch bolts" on each side (15 mm bolt, 16 mm nut).



Tighten the bolt/nut combo to past hand tight and torque the fasteners to 37 ft-lb (50 N-m), then add 30 degrees of twist to the bolt/nut combo.

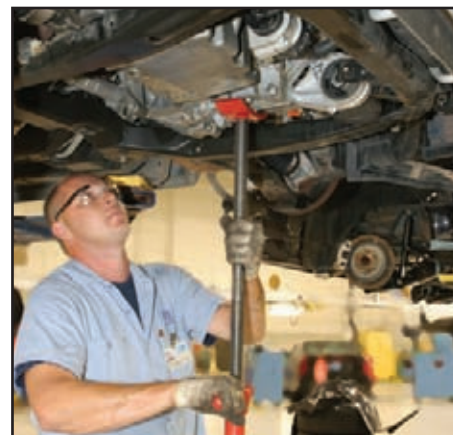
## Installing engine cradle bolts



This is what the 21 mm cradle bolts will look like when hand started in the threaded chassis holes.



The passenger's side bolts are tightened to past hand tight to help align the cradle in the vehicle.



A jack is used to raise the engine up to hand start the remaining 21 mm cradle bolts into the chassis. Torque all four bolts to 74 ft-lb (100 N-m), then twist 180 degrees.



### — Installing rear lower engine mount



The three 18 mm rear lower engine mount bolts are then reinstalled and torqued to 37 ft-lb (50 N-m).

### — Installing front engine mount



Install the one 18 mm bolt through the front torque reaction mount for the engine. Use an extension with a 18 mm swivel socket to tighten and torque to 74 ft-lb (100 N-m).

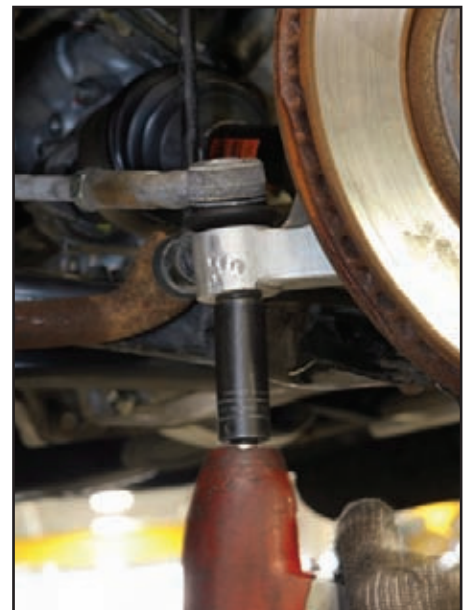
### — Installing tie rod ends



Push the tie rod end shaft into the tapered hole in the steering knuckle arm in preparation for bolting it in place.



Hand start the 18 mm nut on the tie rod.



Torque the 18 mm nut to 44 ft-lb (60 N-m).

### — Installing swaybar ends



Push the swaybar end up to mate with the hole in the bracket on the strut and push the shaft through the hole.



Hand start the 18 mm nut and tighten to 59 ft-lb (80 N-m).

### — Installing steering U-joint



Position the steering knuckles in the "straight forward position" and push the steering U-joint down onto the rack-&-pinion shaft. Hand start and tighten the 13 mm bolt to 25 ft-lb (34 N-m) to hold the U-joint on the shaft.



## — Installing lower radiator brackets



You did mark the two radiator brackets, didn't you? No matter, you'll be able to tell what you're looking at by comparing these to your brackets.



Install the passenger's side bracket like this and hand start the three 13 mm bolts through the bracket into the cradle. Torque to 18 ft-lb (25 N-m).



Install the driver's side radiator bracket on the cradle and hand start the other three 13 mm bolts. Torque the fasteners to 18 ft-lb (25 N-m).

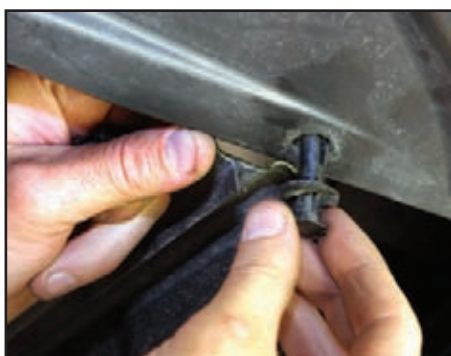
## — Reinstalling closeout panels and inner fenderwell lip



Reinstall the inner splash panels with the pushpins and 7 mm bolt-head screws.



Peel the front portion of the plastic wheel liners back into position.



Fasten the wheel liners in place with the push pins they were originally held in place with.



Install the 7 mm bolt-head screws and tighten to hand-tight.

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## Reinstalling upper engine mounts

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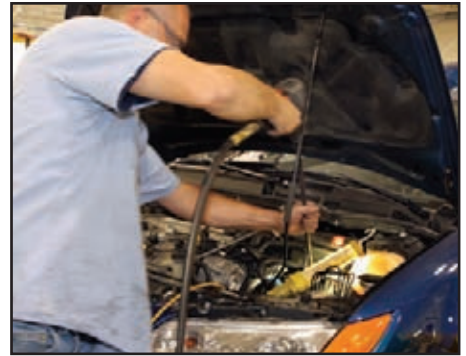
You're now in the final stages of this reinstallation process. The action will now move to the top of the engine bay.



Loosen the hook on the factory lift point of the engine and remove the temporary engine support cradle.



Hand start the three 16 mm upper engine mount bolts with a swivel head socket on an extension.



Torque the upper engine mount bolts in a radial pattern to 37 ft-lb (50 N-m).

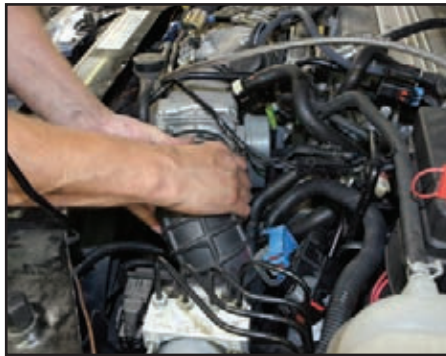
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## Installing inlet tube

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Lower the upper inlet tube that goes between the air filter housing and the throttle body down into the engine bay. Install the EGR tube by pressing it on the tube fitting.



Push the inlet tube on the mounting flange of the throttle body.



Push the inlet tube on the mounting flange of the air filter body.



Carefully tighten the 7 mm adjuster nuts to just past hand tight. Install the front wheels/tires on the vehicle at this time also (not shown) and torque the lugnuts to 100 ft-lb (136 N-m).

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## Reinstalling PCM and electrical connectors

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Reinstall the PCM holder in this area and push on it until the clips snap onto the metal tubing structure it attaches to.







Snap the PCM back into the holder and start to reattach the electrical connectors (gray first). Snap the lockdown clip down to lock the connector onto the PCM.



Reinstall the black and blue connectors next until your PCM looks like this. Reinstall the reverse electrical connector on transmission (not shown) at this time.

### — Removing zip ties — on radiator



You can now cut the zip ties off that were holding the radiator in place.

### — Bleeding the clutch Pedal —

(**Note:** This is part of the brake system!)

This is a critical aspect of the clutch installation, so take your time here. The most important point is that the clutch and brake system utilize the same fluid reservoir—so the process of getting pressure in the clutch pedal also involves getting brake pedal pressure. **DO NOT DRIVE YOUR VEHICLE UNTIL YOU HAVE PEDAL PRESSURE IN THE CLUTCH AND BRAKE PEDALS.**



To start the process of 'bleeding' the air out of the clutch pedal, you'll need a vacuum bleeder. Install the vacuum plug on the fill opening of the brake/clutch reservoir.



Pump up the vacuum bleeder until it is pulling 15 Hg vacuum on the master cylinder/clutch reservoir. Leave this system pulling a vacuum for about 10 minutes. Release the vacuum and move to the next step—but keep the vacuum bleeder installed as you will repeat this ‘pulling the vacuum’ process a few times.



Inside the vehicle (and with the vacuum released), pump the clutch pedal 5 to 10 times. Take a note of the “pedal feel”—the pedal will not have any ‘resistance’ in the beginning, but this should build as you repeat the vacuum/release/pump process.



Take your foot off the clutch pedal. Reapply the 15 Hg vacuum on the brake/clutch reservoir. Hold that vacuum on the system for approximately 4 minutes. Bleed off all the vacuum and pump the clutch pedal again 5 to 10 times. Repeat this process until you have suitable clutch pedal pressure.

**NOW READ THIS!** Perform multiple brake pedal pumps to pressurize the brake system again. This needs to be performed as the clutch bleeding process will pull fluid out of the brake lines, pulling the pistons in the brake calipers away from the rotor. Once you have clutch and brake pedal pressure, you are ready to hit the road again.

## — Breaking-in the clutch —

Driving your car with that new clutch should be done with care for the first few heat cycles—so don’t plan on drag racing in the first 10 minutes out. Once you have a few easy engagements in the clutch and at least one heat cycle, the clutch should be ready for regular usage—if there is such a thing with one of these rockets!