

South Bend Dual Disk Clutch Upgrade

www.CarboniteCummins.com

By Flopster843

01 July 2011

The time has come for me to upgrade the clutch in my truck. This is my attempt to document the entire procedure in hopes that it might help someone out when they have to do the same. The “Clutch 101” section is to help describe what a clutch is, how it works, and some of the different options for an upgrade. If you’re familiar with what it is and how it works, just skip down to the “Removal” section on page 7 and start from there. This article is based on installing a South Bend SDD3250-GK dual disk clutch into a 2008 Dodge Ram 2500. The procedures should be similar for other clutch installs, but I can’t make any guarantees, so use at your own risk. As always, I highly recommend familiarizing yourself with the entire procedure before you start, ensure you have all the parts and tools you need, and to always wear your personal protective equipment.

Clutch 101

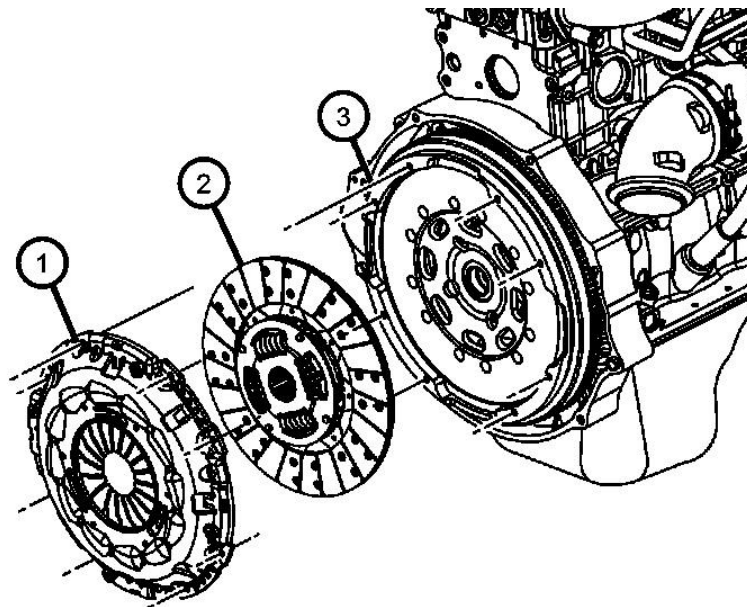
Ah, the clutch. That mysterious component that is so vital to the operation of a manual transmission. It’s the single disconnection device between the engine and transmission, allowing you to remove power from the rest of the drive train so you can stop or shift gears. Generally they are extremely robust and will last for a long time, but like everything else, they do have a failure point. It is a wear item, just like brakes, and your driving habits will directly contribute to failure. Things such as riding the clutch (driving with your foot on the pedal all the time and/or depressing the clutch slightly to slow the truck), excessive slipping during takeoff, towing/hauling very heavy loads, increasing the power, or a combination of these items dramatically decrease the life span of the clutch.

My clutch met an early demise because of added power. The tale-tell sign of a failing clutch is slipping without the pedal being depressed. It will generally start during high-load situations, such as high gears/speed or while towing something heavy. I first noticed the clutch slipping when I had my power box cranked up traveling in high gear. When I would accelerate on the interstate my engine RPMs would increase but my speed would not until I let out of the throttle and let the clutch re-catch. This exact same scenario also happened when my power box was off and I was towing the trailer around. Once the clutch slips the first time, it will only get worse until you can’t drive the truck anymore. A clutch replacement, and preferably an upgrade, will soon result.

So now that you’ve got to replace your clutch, what are you going to replace it with: another OEM stock clutch, an upgraded stock clutch, or a high-performance aftermarket clutch? Do you want an organic clutch, a ceramic clutch, a clutch with Kevlar in it, or a combination of materials? Do you want a single disk, a dual disk, a triple disk, or something else? What plate load would you like; 2500, 3000, 3500,

4000, etc.? Are you replacing the flywheel? Do you need to upgrade anything else with the clutch, such as the hydraulic assembly or the clutch fork? Will a new clutch have any clearance issues with the engine or inside the bell housing? These are key questions that you need to answer before you decide on a replacement clutch. If you need help, which almost everybody does, give the guys at South Bend Clutch a call and they'll help you out.

To help you make your decision, we'll start with how a clutch works. The basic clutch design is fairly simple. You have a flywheel (3) and a pressure plate (1) that are directly connected to the engine. Sandwiched between those two items, you have a clutch disk (2) that is directly connected to the transmission input shaft. The pressure plate pushes against the flywheel and squeezes the clutch disk in the middle, which creates a solid connection between the engine and transmission. When you press on the clutch pedal, the pressure plate and flywheel are forced apart, releasing the clutch disk, and causing the connection between the engine and transmission to be broken.



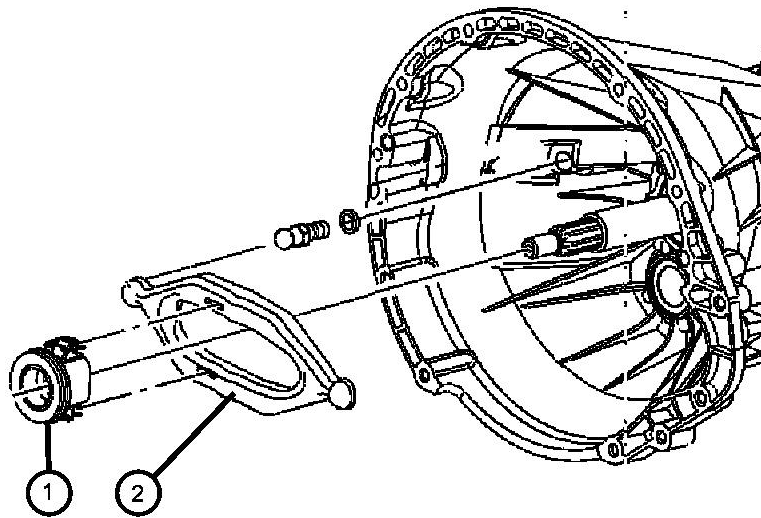
The flywheel is usually a solid piece that is bolted to the crankshaft. The inner part is machined to create a smooth area for the clutch disk to contact it. The outer part has provisions to allow the pressure plate to bolt to it. On the outside of the flywheel, a “ring gear” is installed. This is where your starter contacts when you start your vehicle. The OEM flywheel installed behind the 6.7L Cummins in Dodge trucks is a “dual-mass” model. It is comprised of an inner section that bolts to the crank, and an outer section. These two sections are held together with internal springs and allow flex between the crank and the rest of the clutch assembly. Dodge utilized this design to dampen the harmonic vibrations that naturally occur in a diesel engine. These vibrations would normally travel through the clutch assembly and into the transmission, resulting in a “growl” noise from the transmission. Transmission noise doesn’t sell trucks, so this was designed to eliminate the noise. On paper it looks good, but in real life it’s a horrible design that is very prone to failure. Ford tried a similar experiment in 2003, but quickly realized how horrible it was and canceled the dual mass flywheel; Dodge has yet to figure it out. If you replace the dual mass flywheel with a solid flywheel, you will dramatically increase reliability but you will develop a transmission growl at low RPM. The growl is noticeable below 1500 RPMs on my truck, but manageable.

The clutch disk resides between the flywheel and pressure plate. It is splined in the center and slides over the transmission input shaft. When the clutch disk turns, it forces the input shaft to turn with it. The clutch disk is a metal disk that has wear pads riveted to the outside, similar to a set of brake pads. These pads come in contact with both the flywheel and the pressure plate to create the friction required to turn the transmission. These pads are commonly made up of two types of materials; organic and ceramic, but can be constructed from a variety of materials or a combination of materials. Organic pads are installed in OEM applications. They are softer, quieter, have a smoother engagement, and usually can accept more mistreatment before failure. The other type is a ceramic material. It will engage quicker, engage more aggressively, and will hold longer than organic. It will also create more heat when slipped and the engagement isn’t as smooth.

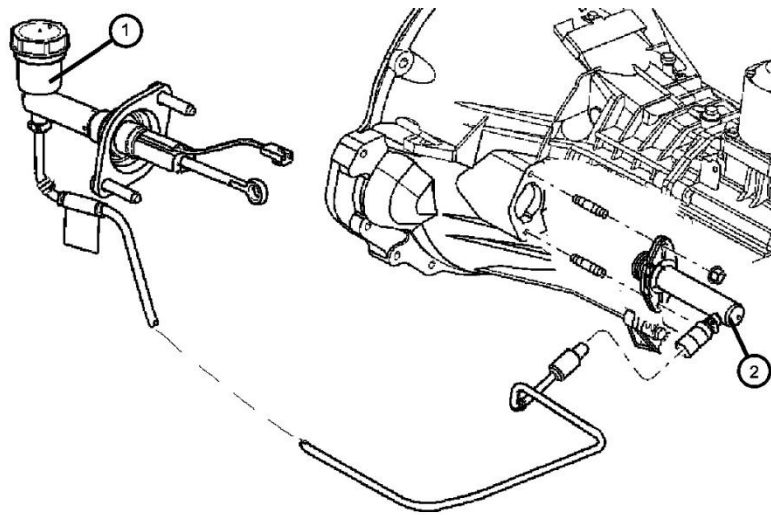
On a dual disk clutch assembly, you will have a “floater plate” and a second clutch disk. The floater plate acts as an intermediate flywheel between the clutch disks. The floater plate sits into notches built into the flywheel so they rotate as a single unit. Dual disk clutch assemblies are notorious for making a lot of rattling and clanking noise when at idle and whenever the pedal is depressed. The noise is a direct result of the floater plate vibrating when there is no load on it. The newer style dual disk clutch utilizes several methods for keeping the floater plate quiet, such as non-metallic bushings on the ears of the plate, but they still make some noise.

The pressure plate is a spring loaded device. It defaults to applying pressure to the clutch disk. The amount of pressure applied is called “plate load.” A clutch with a 3,000 lb. plate load is applying 3,000 lbs of pressure to the clutch disk. The center of the backside of the pressure plate is equipped with “fingers” or “levers”. When pressure is applied to the fingers, it pulls the pressure plate back away from the flywheel, releasing the clutch. Typically, fingers are utilized on automotive clutches where the clutch is designed to be cycled many times. Levers are utilized on clutches with a very heavy plate load and are not designed to cycle as frequently. On a daily driver, you generally want fingers.

Behind the pressure plate you will find a throw-out bearing (1) and sometimes a clutch fork (2). Dodge utilizes a clutch fork. The throw-out bearing is what comes in contact with the fingers of the clutch when you try to disengage it. The clutch is turning at engine RPM, the transmission housing is not, so a bearing is used. You should always replace this bearing whenever the transmission is out of the truck, regardless of its condition. It gets a lot of wear and is easy and cheap to change when the transmission is out, rather than having to remove the transmission again later to replace it. The throw-out bearing rests on the clutch fork. It is a lever that sits on a pivot ball on one side of the bell housing, crosses behind the clutch assembly, and sticks out of the other side. It is used as a mechanical advantage to the hydraulic assembly to press the throw out bearing into the pressure plate. Some vehicles have a setup that places the hydraulic slave cylinder directly behind the throw-out bearing and do not utilize a clutch fork.



The last major component is the hydraulic assembly utilized to operate the clutch. The clutch pedal in the cab is connected to a hydraulic cylinder mounted to the firewall called the “Master Cylinder” (1). When you push the clutch pedal it pushes on the master cylinder, converting your manual push force to hydraulic pressure. This hydraulic pressure travels down a line to the side of the transmission to a second hydraulic cylinder called the “Slave Cylinder” (2). The slave cylinder transfers the hydraulic pressure back into a mechanical force and pushes on the clutch fork assembly. If the truck utilizes an internal slave cylinder, the slave cylinder will be located inside the bell housing and will push directly on the throw-out bearing. Older vehicles and some smaller vehicles utilize a mechanical linkage between the clutch pedal and the clutch fork instead of the hydraulic assembly.



There are many ways to upgrade a clutch. Replace the dual-mass flywheel with a solid flywheel, upgrade the clutch pad material, upgrade the pressure plate, upgrade hydraulics, special trade secrets, or a combination of everything. You could keep a lighter pressure plate and upgrade the clutch material. Or, keep the organic clutch material and get a stronger pressure plate with upgraded hydraulics to keep stock-like pedal pressure. You could upgrade everything for more holding power. If that's not enough, you can add a second clutch disk, or a third. You could also add a second disk and keep a light flywheel. The possibilities are endless.

Choosing a replacement clutch is a very technical situation. You need one that will hold what you want, without ruining the driving experience of your truck. You need one that's reliable backed by a company who will help you out and take care of you if something were to happen. You need to contact a company who has worked with clutches for a long time, who knows clutches and how they work, and who will help you find the perfect clutch for your setup. These are the reasons I contacted Peter from South Bend Clutch. (www.SouthBendClutch.com) These guys know clutches inside and out. They design and build their own performance clutch upgrade kits, and will help you find the perfect clutch for your setup. I have used clutches from South Bend Clutch in several vehicles and have had nothing but great success. If you're looking for a clutch, there is no need to look anywhere else.

After speaking with South Bend Clutch about my truck and what I intended to do with my truck, they suggested I go with the SDD3250-GK with the hydraulics upgrade. This clutch is a dual-disk clutch with a solid flywheel. It has two clutch disks with ceramic pads and a 3250 lb plate load. It includes a modified clutch fork assembly and when coupled with the optional hydraulic upgrade (highly recommended), the pedal pressure is only slightly more (25-30%) than a stock clutch. It is rated for 550-750 HP and designed to be in a truck utilized as a daily driver/work truck.

As with any performance upgrade, you can't have all the good stuff without getting some of the bad with it. There are a few minor downsides to installing a performance clutch that you should be aware of, but none that should steer you away from the upgrade.

First off, EVERY dual disk clutch on the market will rattle at idle and when you hold the clutch pedal down. This is due to the center "floater" plate between the clutch disks. When there is no load on it, it will vibrate and create a chatter noise. The chatter used to be really bad with old dual disk clutches, but due to technological advancements the noise has been severely dampened. In the cab I can just barely hear it unless the radio is on at all, at which time it disappears completely.

Second, the G-56 will growl when you lug the truck around. The OEM clutch's dual mass flywheel dampens this noise so you can't hear it, but when you replace the dual mass flywheel with a solid flywheel all the harmonic vibrations of the engine are transferred into the transmission. The growl will go away with higher engine speed. Gears 1-3 and 6 will quiet down after about 1200 RPM, Gears 4 and 5 need to be above 1800. I adjusted my driving style a little and don't hear it very much anymore.

Third, the weight of the clutch pedal is slightly heavier than stock. It'll feel really heavy at first, but I adapted after about a week of driving.

Forth, the ceramic buttons on the clutch will make it grabby. This is especially noticeable while trying to back up a trailer. Slipping the clutch causes the truck to buck some, which makes it harder to gently maneuver the trailer. In my opinion, this is the only big downside to a performance clutch upgrade, but like everything else, you'll adapt to it and it won't be much of an issue after a while.

REMOVAL

After speaking with South Bend Clutch and deciding what clutch I needed, I got in contact with James at Rollin Smoke Diesel (<http://www.rollinsmokediesel.com>) and ordered my SDD3250-GK with the hydraulics upgrade. South Bend Clutch encourages people to buy their clutches through their dealer network. This allows them to spend less time taking orders and more time designing/building clutches. After about a week my clutch and hydraulic upgrade kit arrived at my house. I heard the UPS guy make a horrible grunting noise when he had to pick up the 119 lb box out of his truck. On my next day off, I headed to the shop to install the clutch. I highly suggest you utilize a lift and a transmission jack to remove the trans. It's rather large and you're not strong enough to lie on your back in your driveway and pick it up.

1. Position the truck on a lift and lay all your parts out. If you forget and leave the clutch in the bed of your truck, you're going to have an interesting time trying to get it out after the truck is lifted. Be sure to inspect the contents of the clutch kit to ensure you have everything listed. If you're missing something, contact the place you bought the clutch from or South Bend Clutch directly to get what you need.



2. Start by removing the 4X4 shift lever boot (or the black plastic piece if you don't have the boot), the rubber cup holder insert, and the shifter boot from center console assembly; everything just pops out without any hardware. Once that is out of the way remove the three screws holding the plastic center console piece down, pick it up and set it out of the way. Then remove the two screws holding the forward section on. Slide it straight back to remove it (there's a notch that slides around the shifter) and set it out of the way.



3. Remove the 6 screws holding the inner shifter boot to the transmission hump. There are two screws on the back and two on either side, nothing in the front. These are under the carpet and are a little tricky to get out. Once the screws are out, slide the center boot assembly up through the hole in the carpet and invert it over the shifter. Remove the two nuts holding the shift lever to the shift tower and set the entire shifter, boots still attached, out of the way. Remove the 4 bolts holding the shift tower to the top of the transmission and pull it up out of the trans. These bolts are external torx bolts (where the head of the bolt looks like a torx bit) but I was able to get them out with a 12pt socket. If they're super tight, you might need a special socket. Stuff some rags in the hole to keep any debris from falling into the transmission. You're now finished in the cab.



4. Raise the lift and get under the truck. Start by marking the rear driveshaft where it connects to the differential yolk. (I scratched it with a screwdriver) This is so you can install the driveshaft exactly as it was removed. In theory this is not needed, but it's a good practice to get into and I like to do it anyway. Remove the 4 bolts from the rear yolk and pull the driveshaft off, then slide it out of the rear of the transmission. Be careful not to drop it or damage the shiny end that goes in the transmission, this will cause a leak. Lay it somewhere where you won't trip on it while working.



5. Repeat this process for the front driveshaft where it connects to the transfer case. Remove the two bottom bolts and then you must remove the weight from one front tire by jacking it up so you can rotate the driveshaft over to get to the two bolts that were on the top. I didn't feel like completely removing the driveshaft from the truck, so I left the front connected and utilized a ratchet strap to hold it to the frame rail. This idea worked great and it wasn't in my way. After both drive shafts are disconnected, I suggest placing the truck in to 4X4 to lock the transfer case. This will make your job of re-aligning the transmission a lot easier. I'll explain more during step 7 of the install phase.



6. If you haven't deleted the DPF yet, remove the two rubber hoses on the passenger side of the transmission that go to the exhaust pressure sensor.



7. The wiring harness for the transmission reverse light switch, DPF pressure sensor, transfer case, and all of the exhaust system must be pulled out of the way. It starts on the driver's side top of the transmission and runs back towards the transfer case. It then drops down under the transfer case, crosses the truck on the cross member, attaches to the passenger side frame rail, runs back forward for the exhaust sensors, then loops around and follows the frame rail back. Remove every plastic clip and connector from the driver's side front of the transmission all the way to where it reaches the passenger frame rail. This will allow you enough slack to loop it over the top of the transfer case and slide the transmission out from under it. There is no need to remove it from the passenger side frame rail.



8. Remove the clutch slave cylinder from the driver's side of the bell housing by removing the two nuts holding it on, it will slide out in your hand. Loop it over to the driver's side frame rail and set it out of the way. The front driveshaft makes a nice shelf for this.



9. Support the transmission with a good transmission jack and securely strap it down. It will try to rotate with the transfer case hanging off of the side and if the jack isn't centered it may try to slide forward or back.



10. Remove the three nuts in the center of the cross member that hold the transmission mount. Raise the jack to remove the weight off of the cross member. Now remove the 4 bolts (two on either side) that hold the cross member in place and remove it from the truck. I heard rumor that if you lift up the front of the engine it will help the transmission come out and go back in easier. I decided to attach a ratchet strap between the frame rails to pull up on the front part of the oil pan. I'm not sure if it helped or not, but I did it anyway.



11. Remove the two bolts on the passenger side bottom corner of the bell housing that attach the exhaust mount to the transmission. You can apply some force to this and rotate it counter clockwise so you can slide it off of the hanger rod on the downpipe. Then remove the other six bell housing bolts. The top two bolts on the driver's side are holding a bracket assembly that's used to support a wiring harness and vent hose. It's easy to remove, just be aware of it.



NOTE: There is not enough clearance between the exhaust hanger on the downpipe and the transmission bell housing for you to slide the transmission back. You will need somebody to pry between the transmission and the hanger while you wiggle the transmission back to get enough clearance. If you don't want to do this, you must remove the downpipe.

12. Ensure that you have looped the wiring harness over the top of the transmission. Then slide the transmission back a little at a time while lowering the jack. Step it down slowly and you'll be able to get it out without much hassle. There is enough clearance with the complete DPF system intact for it to come out. Lower it down to a safe level (the lower it is, the more stable it is) and wheel it back towards the back axle.



13. Now that the transmission is down you can finally see the OEM clutch. Start by removing all the bolts that hold the pressure plate to the flywheel so you can remove it and the OEM disk. Be careful when removing the bolts, the pressure plate is heavy and the clutch disk will fall out on your toes when pressure is removed. Be ready for it to come out so you can catch it or move your feet out of the way so it can bounce off the ground and hit you in the shins. That felt nice. Just for fun, reach up and grab the OEM dual mass flywheel and turn it back and forth. Feel all the play that has already happened due to normal wear? How can this be a good design?



14. Locate the cover for the engine barring tool on the front of the passenger side of the bell housing adapter. Loosen the two screws and rotate the cover out of the way, no need to remove it. Utilize a socket through the top inboard hole to access the bolts to remove the dual mass flywheel. There are 8 bolts that hold the back half of the dual mass flywheel to the front half. You must remove one, rotate the engine, remove another, and repeat until it's off. I was able to turn the engine over by rotating the flywheel by hand, but wear some leather gloves or it will cut your hand apart. Once the last bolt is removed, the flywheel will literally fall off, and it's very heavy. I suggest having somebody hold the flywheel while somebody else removes the bolts. Once the heavy part is off, remove the front half by taking out the 8 bolts that hold it to the crank. On some applications, there is a small stamped steel plate attached to the crank, this plate must be removed and is not to be reinstalled with the new South Bend Clutch assembly. My truck did not have this plate installed.



15. Remove the clutch fork assembly and the throw out bearing from the transmission bell housing. It is sitting on a pivot ball on the passenger side and will pop out with very little pressure.

STOP!

Now that the clutch is removed, there are a few **VERY** important things to do before you start installing the new clutch. The entire area must be thoroughly inspected for any defects prior to install. If you fail to detect a major defect in your engine/transmission assembly during this step, **CATASTROPHIC FAILURE WILL RESULT.**

At a very minimum you must perform the following actions:

- Inspect the rear main seal for any signs of leakage. If so replace it with a new one. If it's leaking and you don't fix it now, you'll have to pull the transmission back out later to fix it.
- Inspect the transmission adapter on the engine for any signs of cracking, distortion, or any other visual defects.
- Inspect the gear on your starter. If the gear is damaged or worn out, you'll ruin the ring gear on the new flywheel.
- Inspect the rear section of the crank shaft for any signs of cracking or visual damage.
- Inspect the transmission bell housing for any signs of cracking or visual damage.
- Inspect the clutch fork pivot ball for damage, excessive wear, and ensure the nylon cap is on it.
- Inspect your transmission input shaft for any distortion, discoloration, twisting, and excessive play. It will have some play in it, but if you can move it in and out and wiggle it around an inch, you've got a major problem.
- Inspect any other areas that you can see. Look for any visual defects of any kind. Repair/replace whatever you can now before you put the transmission back in the truck.
- Clean out any excessive buildup in the transmission bell housing.

INSTALLATION

Before you start installing anything, be sure you have inspected everything mentioned in the page above. If this has not been accomplished, go back and do it now.

1. Start by removing the pivot ball inside the bell housing on the passenger side. There is a washer behind it, you must remove this washer and re-install the pivot ball. This is for clearance reasons for the new clutch fork. Cover the pivot ball with a light coat of grease.



2. Install the new throw out bearing onto the clutch fork included with the kit. It is held on with some metal clips that slide through two holes in the clutch fork. The new clutch fork has been modified to give the appropriate clearance for the dual disk clutch. My OEM clutch fork had a small metal clip on the pivot ball side that clipped on. The instructions from SBC didn't mention anything about this clip, so I reinstalled it on the new clutch fork. The clutch fork should have a sticker on it that says "pivot ball side," obviously this side goes on the pivot ball. If yours doesn't have the sticker, the "thicker" side is the one that goes on the pivot ball. In the picture below, the left hand side goes on the ball. Put a light coat of grease inside either end of the clutch fork where the pivot ball and slave cylinder contact it, the throw out bearing slide surface (where it sits on the input shaft,) and on the input shaft splines. Slide the clutch fork and throw out bearing over the transmission input shaft and push it onto the pivot ball.



3. The new clutch assembly comes completely assembled in the box. Disassemble it now by loosening the pressure plate bolts in a star pattern. The instructions say 1/4 turn at a time, but I did a full turn each time with no ill effects. Pay special attention to the red paint that's on the side of the clutch. This paint covers part of the flywheel, floater plate, and the pressure plate. It is imperative that you re-align these red marks when you install the new clutch. Clean all the surfaces that come in contact with the clutch disks with a residue free solvent, such as brake cleaner, to remove all grease and dirt from the surface. Don't touch those surfaces with your bare hands because you will re-contaminate the area with oil from your fingers. Inspect the pilot bearing to ensure the snap ring that helps to hold it in is securely in place and then put a light coat of grease in the pilot bearing. Take both clutch disks and ensure they slide freely onto the input shaft of the transmission. This will ensure everything fits properly and will save you some frustration while trying to get the transmission installed because you think the disks don't fit.



4. Clean the crank shaft and the bolt holes with the same solvent used to clean the clutch. Lift the new flywheel up (very heavy) and put it on the crank shaft. Have somebody else coat the bolts with red loctite and install them. Once you have all the bolts in, tighten down in a star pattern to 90-100 ft lbs. I like to torque the bolts down in steps, but it's probably not needed in this application. First I snugged them down with a ratchet, then torqued to 50 ft lbs, then went to 95 ft lbs. The engine will turn over as you try to torque the flywheel. I had my helper hold the flywheel by inserting a pry bar into one of the ring gear teeth and prying against something solid under the truck. Just be real careful not to damage the teeth. I don't suggest inserting the pry bar into the grooves on the flywheel for the center plate; you'll probably damage something important.



5. Both clutch disks will have a sticker on them. One disk will say “flywheel side” and the other disk will say “pressure plate side.” Put the “flywheel side” of the first disk against the flywheel, then the center plate, then the “pressure plate side” of the second disk against the pressure plate. It’s not required to remove the stickers from both disks, but I tried to remove them before I installed the disks and was unable to get them off. I found it easiest to create a sandwich of both pressure plates with the center plate in the middle on the alignment tool, and then set the entire assembly on the flywheel as one unit. Be sure to align the red mark on the side of the center plate with the red mark on the flywheel. The alignment tool is strong enough to hold the clutch disks in place once the center plate is lined up on the flywheel, but I recommend having your helper keep a hand on it to be sure it doesn’t fall off.

Here’s a very important tip that will make the install a lot easier. The plastic alignment tool included with the kit is not the greatest thing in the world, specifically the little plastic loop on the end that you use to pull it back out. The first time you grab that loop and try to remove the alignment tool, it will break off in your hand. There’s not enough sticking out to grab it with something to pull it out, so you must remove the pressure plate, center plate, and both disks to get it out. Do yourself a favor and break that ring off right from the start. Drill a hole through the alignment tool at the top of the splines and run a piece of heavy gauge wire through it. This is strong enough to pull the tool out. Guess how I figured this out.

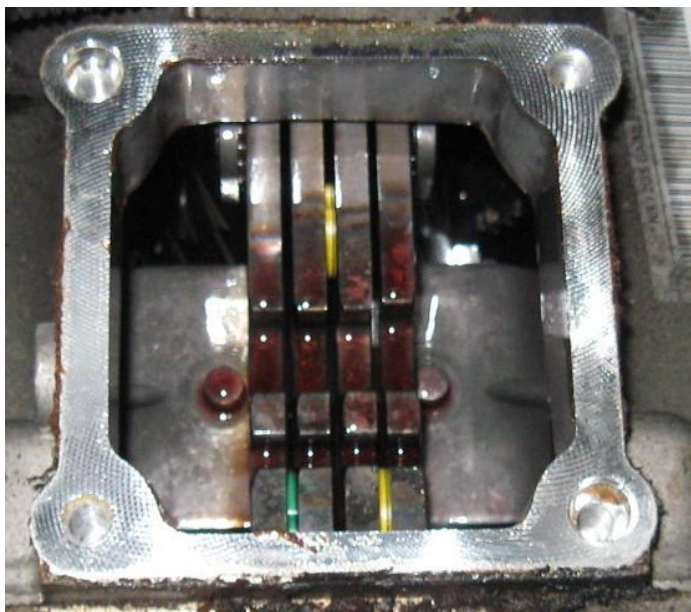


6. Install the pressure plate over the alignment tool. Here's a tip that will make your life easier. I installed 4 bolts on the pressure plate 3, 6, 9, and 12 o'clock, but I only put them in just tight enough to hold the clutch disks in place without the alignment tool, no more. Pull the alignment tool out, it will be tight. Utilizing your eyeballs and some various tools, visually align the clutch disks by inserting something down the center and moving them around a little. The weight of both disks hanging off of the plastic tool will cause it to bend down, and your transmission will never go back in. It took 3 hours of trying to re-stab the transmission before I figured this out. You should be able to align everything so you can fully insert and fully remove the alignment tool with one hand. If you have to jerk, yank, or use a pry bar to pull it out, it's not aligned. Once you have it perfect, cover the other bolts with red loctite, insert them into the flywheel, and tighten them down to match the first 4 bolts. Then remove the first 4 bolts one at a time, cover them with loctite, and reinsert them. Once all 8 bolts are covered with loctite and screwed in, torque all of them down in a star pattern to 45 ft lbs. Again, the instructions said 1/4 turn at a time, but I did it in 1/2 turn increments. Once it's fully torqued down, recheck the alignment tool. If you can pull it out and fully insert it with one hand you're good, if you can't you need to loosen all the pressure plate bolts and try again. Just trust me on this one.



Note: The next few steps are the exact opposite of the removal steps. I have decided not to include pictures for these since they are the exact same pictures posted in the removal steps. This helps to keep the size of this document to a minimum so it's quicker to download and easier to print. If you would like to see the pictures, scroll back up to the removal steps. Any new procedures will have pictures included.

7. Now comes the fun part. Before you start to reinstall the transmission, reach into the hole where your shift tower was and slide one of the shift forks to put it in gear. It doesn't matter which one you choose or which way you push it, just put it into any gear. This allows you to rotate the input shaft by rotating one of the driveshaft outputs to help you align the splines. If I thought about it before hand I would have put my transfer case in 4X4 so I could spin the transmission utilizing the front drive shaft yolk, instead I had to insert the rear driveshaft and rotate that thing.



Move the transmission back into position by reversing the step-down procedure you used to get it out. Move it forward a little, lift a little, forward a little, lift a little, etc. Do this until the input shaft aligns with the new clutch disks. You'll have to pry over the exhaust hanger on the downpipe again to get the bell housing past it. Once it's lined up, push the transmission forward to insert the input shaft into the disks. You're going to have to do a bunch of wiggling lifting, lowering, etc. to get it in. Insert the rear drive shaft (or grab the front driveshaft yolk on the transfer case if you were smart enough to put it in 4X4) and rotate it back and forth while pushing the transmission into the clutch. You will be able to feel when the splines align. When everything is absolutely perfect, it will fall into place. The transmission should fully mate with the bell housing adapter on the engine. If it doesn't fully touch, **DO NOT TRY TO PULL IT IN WITH THE BELL HOUSING BOLTS!** The only thing trying to pull it in with the bolts will do is break the ear off of the aluminum bell housing, now you've got a busted unaligned transmission. Keep working with it and eventually it will seat.

8. Once it's fully seated, install the 8 bell housing bolts around the transmission. Be sure to install the bracket on the top driver's side of the transmission that holds the wiring harness and the exhaust hanger bracket on the lower passenger side when you put those bolts in.

9. Install the cross member and tighten down the 4 bolts that secure it to the frame. Then lower the transmission jack down to set the transmission mount on the cross member. Install the three nuts that hold the transmission mount and remove the jack.

10. Re-route the wiring harness back around the transfer case, attach it to the cross member and transmission, and then reconnect all of the electrical connectors. Double and triple check to ensure you have all the connections secure and the harness isn't going to chafe or come in contact with anything that could rip it off.

11. If you're not going to install the hydraulics upgrade, reinstall the slave cylinder by bolting it back in its original spot with the two nuts. If you're going to install the upgraded hydraulics, leave it off and remove the two plastic clips holding the hydraulic line to the bottom of the cab. One is almost directly across from the slave cylinder on top of the frame rail and the other is directly forward of the first one, where the cab starts to turn up by the firewall.

12. Climb in your truck and place the transmission back into neutral by sliding the shift fork that you moved earlier back to the center and take your truck out of 4X4. Then reinstall the rear driveshaft making sure to align the marks you made earlier.

13. Reinstall the front drive shaft and be sure to align the marks. Loosely install the bottom two bolts, and then elevate the front tire so you can rotate it over to install the other two. Once all 4 are started, tighten down the two on the bottom then rotate the shaft over again to tighten the other two.

14. Reattach the two rubber lines for the DPF pressure sensor on the passenger side of the transmission. Then reinstall the dust cover on the passenger side of the transmission adapter that you loosened earlier to remove the dual mass flywheel. Double and triple check everything under the truck to ensure you didn't miss anything.

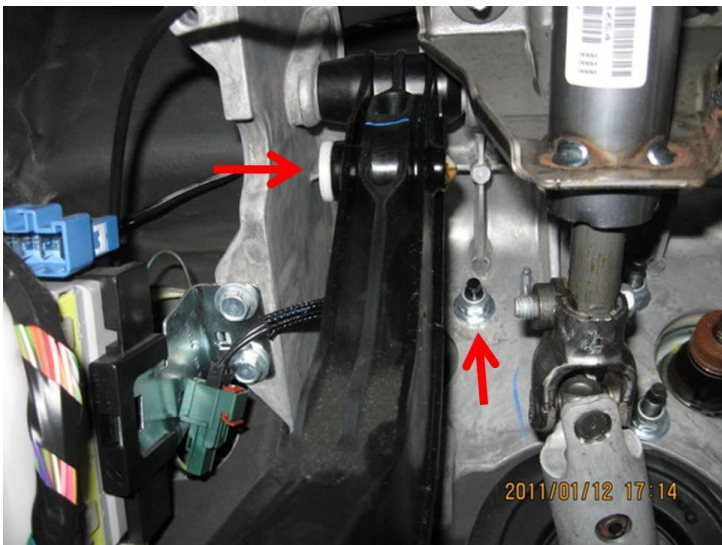
15. Climb back in the cab and remove the rags from the hole in the transmission. Thoroughly clean the area around the hole where the shift tower sits, and the bottom of the shift tower. Lightly coat this area with some high temp RTV gasket maker and set the shift tower back on the transmission. If you use too much RTV it will squeeze out and you'll have gobs of it floating around in your transmission. Install the 4 bolts holding the shift tower on the transmission.



16. Reinstall the shift lever to the shift tower using the two OEM nuts. Slide the inner shifter boot back down under the carpet and install the 6 screws holding it on. These are fun to get back in. If you don't install all 6, you'll hear a lot more outside noise coming from around the shifter area, which will include the transmission growl and the clutch rattle.

17. Reinstall the forward part of the lower center console and insert the two screws holding it in place. Then reinstall the aft part of the center console and the 3 screws holding it in place. Snap the outer shift boot, the 4X4 boot or plastic cover, and the rubber cup holder back in place. If you're not doing the hydraulics upgrade then you're done, if you are continue to the next step.

18. Look up under the dash and you'll see where the master cylinder connects to the clutch pedal with a white plastic pin. Push this pin out to release the master cylinder from the clutch pedal. Then unhook the plug for the clutch safety switch that is on the rod going into the master cylinder. Remove the two nuts holding the master cylinder to the fire wall.



19. Open your hood and locate the clutch master cylinder by the brake reservoir. Gently pull it out of the firewall and snake the entire hose assembly and the slave cylinder up and out of the truck.



20. Take the new hydraulics out of the box, but **DO NOT PUMP THE MASTER CYLINDER**, no matter how tempting it looks. Snake the new slave cylinder and hose down the engine bay towards the transmission. Pay attention to how the hose is routed. You want to avoid any kinks, pinch points, possible chafe spots, heat sources, or anything that could possibly catch the hose and rip it out. Insert the master cylinder into the hole in the firewall where the old one was. The pictures below show a comparison between the old and the new hydraulic assemblies. The old is on top, the new is on the bottom. Notice how much bigger the new hydraulics are.



21. Get back in the cab and install the two nuts that hold the master cylinder to the firewall. Reattach the electrical connector for the clutch safety switch. Adjust the length of the rod coming out of the master cylinder so your pedal position is close to where it was before. Lubricate the plastic pin with some grease and attach the master cylinder to the clutch pedal by reinserting the pin. Note: This hydraulic upgrade kit fits multiple vehicles; therefore it has a small plastic busing and a metal clip of some sort that wasn't used on my truck.

22. Get back under the truck. Check the routing of your hydraulic hose again to ensure it's in a safe spot. Insert the slave cylinder into the transmission, but DO NOT cut the tabs that hold the plastic end cap on the slave cylinder rod. Those tabs are there to ensure the cap stays in place while you install the kit and will break free on their own after the install. Tighten the two bolts that hold the slave cylinder to the transmission. Note: the hose on the new kit is not long enough to reach the two clips that held the OEM line in place. However, I was able to reach the forward clip with the hose. I had to split the protective wire loom at that specific spot to get the hose to connect in the OEM clamp.



23. Find a place to secure the remote reservoir for the new hydraulic assembly. I attached mine utilizing a spot on the top part of the fire wall just below the hood. I did have to remove the driver's side battery to get my drill in there to install the self tapping screws. Put it where ever you want, just be sure it's not in the way of anything and isn't going to be damaged.



24. Climb back in the truck and pump your clutch assembly, a lot. I put about 30 pumps on it to ensure the slave cylinder fully extended into the clutch fork and everything was working well. Put the truck in neutral and start it. Be sure it's in neutral because if for some reason that clutch isn't releasing, the truck will take off when you start it, usually right into the wall of the shop. Let it run for a bit while you pump the clutch several times. You should be able to hear when the clutch releases and when it's engaged. Once you think everything is good, shut it down and go re-inspect everything to ensure nothing is leaking and everything is installed properly. If everything is good, start it up and drive it out of the shop.

You're done. I suggest following the proper break in procedures and driving suggestions detailed in the next section to ensure you get the maximum life and performance out of your new clutch. The new clutch is going to be different and feel "weird" when you first start driving it. You're also going to need to adjust your driving habits to fit the new clutch. After about a week of driving it, you'll be fully adjusted to the new clutch and you won't even notice it anymore. Enjoy your new clutch.

BREAK-IN

The break in phase for a street twin disk clutch is very simple. Simply drive it normal for the first 300-500 miles. Don't do any boosted launches, burnouts, extremely heaving towing, or anything else that is extremely hard on the clutch. Fill your truck up with fuel and run a full tank out of it, then your clutch will be good to go for whatever you decide to throw at it.

DRIVING PROCEDURES

The big thing to remember about driving with any aftermarket clutch is to not lug the motor. The growl you hear from your transmission after putting a solid flywheel in your truck is extremely bad for your transmission and the clutch assembly. You gain nothing by rolling around town at 1400 RPMs, you actually use more fuel that way because the engine has to work harder since you're not on top of the turbo. 1,800 - 2,000 RPMs is a Cummins' "happy spot" and you should try to keep it there.

The other thing to keep in mind is to try not to slip the clutch excessively. The ceramic buttons generate a lot of heat when you slip the clutch. I'm not saying you need to dump the clutch every time you take off, just be mindful of the slipping. You have an extremely low 1st gear, use it when you're on a hill or pulling a heavy trailer.

Special Thanks To



709 W Jefferson Blvd

Mishawaka, IN 46545

1-800-988-4345

www.southbendclutch.com

sbendclutch@aol.com



7642 N 400 W

Michigan City, IN 46360

219-851-1195

rollinsmokediesel@yahoo.com