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## GM A Body 68-72(Chevelle, Le Mans, GTO) Hydraulic Clutch Master Cylinder Installation Instructions

These instructions are to install a hydraulic master cylinder to be used with an external slave cylinder or internal slave cylinder with throw-out bearing. Some modifications of your firewall and pedals are required. This kit does not include pedals or slave cylinder.



## Tools

- Drill , 3/4" drill bit (when using Tilton or Wilwood Master) 1 3/8" hole saw, punch, marker, 7/16", 1/2", 9/16" wrenches and/or socket/ratchet
- Hydraulic Master Cylinder Kit utilizes existing opening in the firewall.
- Safety Equipment – Always wear approved safety goggles/glasses when working with metal and fluids. Wear proper gloves when working with hot surfaces and corrosive fluids.

Disassembly - If your vehicle is already disassembled, skip to the Assembly Instructions. If you are converting an automatic car, some disassembly steps do not apply.

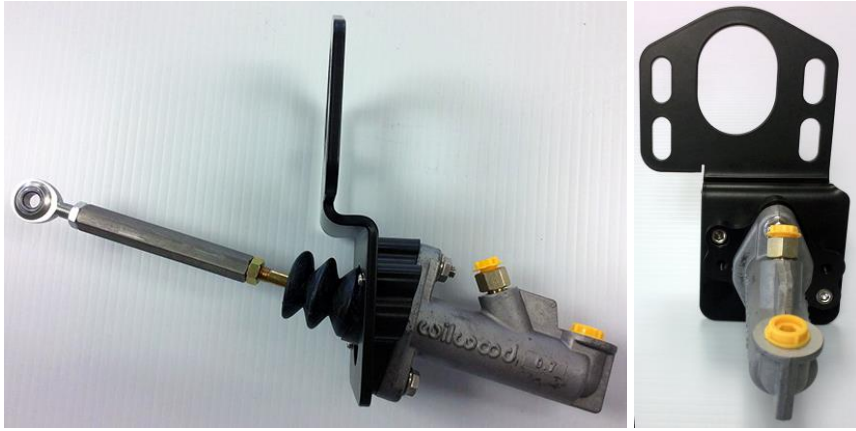
- Remove brake master cylinder and brake booster as required.
- Do not remove the clutch pedal. Remove all clutch linkage or automatic linkage from engine, transmission, frame and clutch pedal. If converting from an automatic car , go ahead and remove the brake pedal to either modify (trim) or change brake pedal for a manual car.

## Assembly

Note: our mock-up photos have certain items removed for clarity.

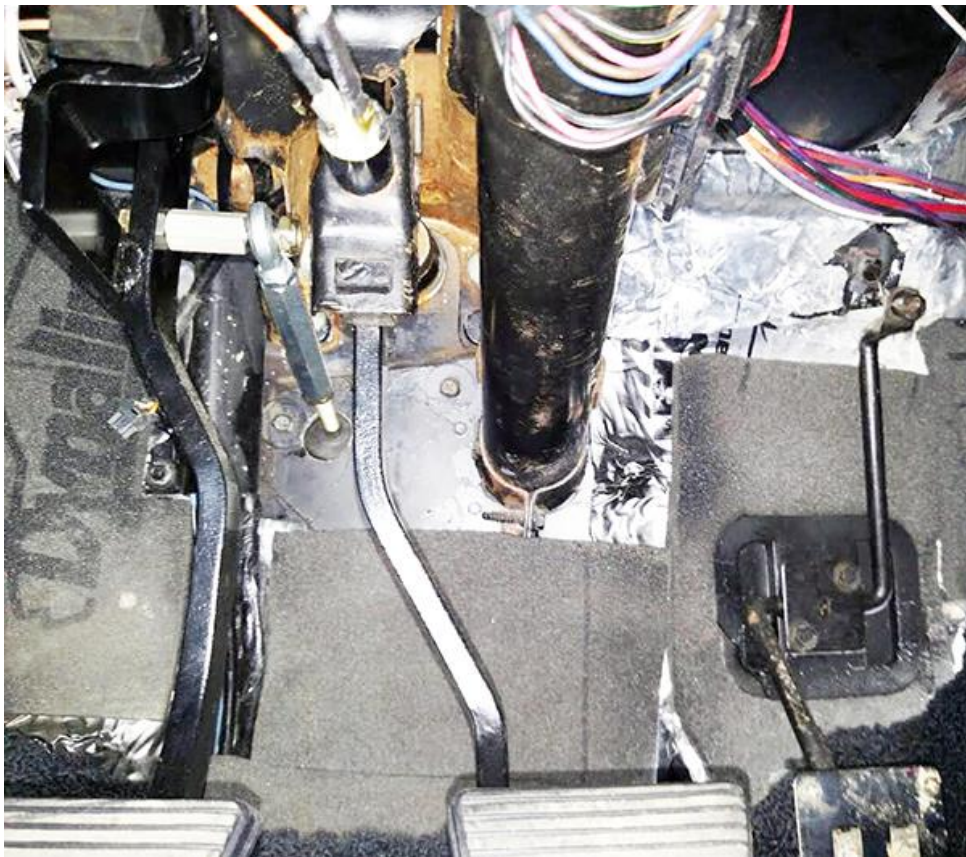
Pre-assemble the Master Cylinder and firewall plate assembly as shown. This kit is designed to work with a Tilton or Wilwood master cylinder. The billet angle adapter bracket has the ability to mount the master cylinder at a 90\* rotation from the pictured assembly. This may be necessary to clear certain brake systems.





- Install master cylinder with plate by sliding the rod end linkage through the opening in the firewall where the original clutch rod was located. The mounting plate will locate on the studs that attach the brake master cylinder to the firewall, you can then reattach the brake master cylinder and tighten all fasteners.
- Install the supplied clutch pedal stud on to the clutch pedal and tighten fastener. You will want to use the lower of the 2 holes in the clutch pedal for the rod end attachment. \* Use Blue Loctite on all threads. We have found that on some cars the clutch pedal profile is different than on other cars. If your clutch pedal has a fairly straight profile you should be able to achieve proper push rod alignment by bolting the spherical rod end directly to the pedal. In some cases your clutch pedal may have a profile that bends the clutch pedal out towards the left then back in to the center at the bottom. In that instance you may need to use the supplied hex spacer to achieve proper push rod alignment. The end goal is to align the master cylinder push rod with the attachment point on the pedal to get a straight shot with no side load. See the pictures below for the different attachments.





- The rod-end and linkage will need to be set to the length that gives you the correct height for your clutch pedal. It can be lengthened or shortened to get the desired pedal height. If adjustments are made, make sure there are at least 5 full threads penetrating the rod end.
- Install hardware thru rod end, washer and clutch pedal bracket and tighten. See photo above on hooking the clutch rod to the clutch pedal bracket.



- Locate and mount the reservoir anywhere above the master cylinder. You may shorten the reservoir hose if you are using a universal style reservoir with hose. If you are using -4AN braided lines then we recommend ordering or having a custom line made to the correct length. Mark the hole locations for the reservoir. If using the universal plastic option, pre-drill holes using a #7 drill bit prior to attaching reservoir, then use sheet metal screws to attach to the fire wall. If you are using the Billet reservoir, drill the correct holes through the fire wall and use the supplied Allen head bolts to attach with the supplied lock nuts on the inside of the firewall. Do not over-tighten. Make sure reservoir line does not interfere with any moving parts.
- Attach one end of the provided 24” stainless braided line to the output port on the master cylinder and attach the other end to your input line on the hydraulic release bearing.
- Re-install brake lines and distribution block as required. \* You may need to bleed the brakes if you did separate any brake lines.

**\*\*\*IMPORTANT\*\*\***

**Depending on how you set your pedal height it may be necessary to install a pedal stop to ensure the release bearing is not over-traveled and to prevent damage to the master cylinder piston and rod. This is a critical part of the set up. Please see the below section on setting the pedal stop before doing the final system bleeding and setup.**

## **Important information regarding setting pedal stop, free play, and height adjustment.**

**\*\*Note that this information is specific to the Tilton 6000 series hydraulic release bearing used by Bowler Performance Transmissions. If you are using a hydraulic release bearing by another manufacturer please refer to their instructions on setting up the clutch pedal.\*\***

The Tilton 6000 hydraulic release bearing assembly is self-adjusting in that the bearing stays close to the clutch spring at all times, even though the spring changes position with clutch wear. There is no extra return spring that pulls the piston back all the way to the bottomed position. In this respect, the piston in the hydraulic bearing assembly works like the piston in a disc brake caliper, returning only as far as forced. This is why with a Tilton hydraulic release bearing assembly the clutch pedal feel does not change with clutch wear allowing the driver to make more consistent shifts. The piston of this assembly has .700" of total stroke. Precision measurement of clearances and the correct adjustment of the pedal stop are extremely important to the correct function of this unit.

### **RELEASE BEARING FREE PLAY AND HEIGHT ADJUSTMENT**

At this point of the installation you should already have the flywheel, clutch and bellhousing onto the engine. Tighten all components in place following their respective manufacturer's instructions. Do not install the transmission at this time. Using a pair of dial calipers or a depth micrometer, measure the distance from the transmission face of the bellhousing to the bearing contact point of the clutch spring. Record this distance as Dimension A. Subtract .125" from Dimension A. This new number will be Dimension B. This should be the installed distance (with the bearing and piston completely compressed into the hydraulic base) from the face of the release bearing to the face of the transmission where it contacts the bellhousing. Install the supplied threaded sleeve into the bearing base and push these onto the bearing retainer sleeve or bolt on the threaded base to the front of your transmission. A small amount of petroleum jelly may be used during assembly. ( For slip on adjusters, the o-ring end of the sleeve should be towards the transmission.) Thread the bearing onto the threaded sleeve until Dimension B is achieved. There is a small ear and slot machined into the hydraulic base. The supplied stud fits through this slot to prevent rotation. Once the correct height of the HRB has been determined, locate and remove the transmission bearing retainer bolt closest to the ear. The removed bolt will be replaced by the anti-rotation stud provided. Remove HRB and threaded sleeve from bearing retainer, being careful not to change HRB height adjustment on the threaded sleeve. Install anti-rotation stud through the slot on the hydraulic base and reinstall HRB and sleeve onto bearing retainer. Using Loctite 272 (red) thread locking compound, install anti-rotation stud into hole that original retainer bolt was removed. Torque to 16 lb-ft. **DO NOT OVERTIGHTEN.** Note: If anti-rotation stud is too long and extends past face of release bearing, cut shorter to avoid any interference with clutch. If you have a bolt on bearing adjuster use one of the supplied bolts and utilize one of the threaded holes provided in the bolt on adjuster to prevent bearing rotation. The hydraulic lines supplied have been installed at the factory using the proper tooling and assembly lubricant. They are designed to rotate once while installed. There is no need to remove these prior to assembly. Double check that the bearing to clutch clearance is .125" (tolerance +/- .025").

## DRIVELINE ASSEMBLY

While installing the transmission, carefully route both lines through either the release fork window or holes that have been drilled to accommodate the lines. Ensure that the lines do not interfere with the clutch or flywheel. A string may be used to help guide the lines around any obstacles during installation. Once the transmission is seated, confirm that all parts of the release bearing clear the clutch and flywheel. Complete the driveline installation.

## HYDRAULIC LINES

This bearing is supplied with two identical lines installed for the supply and bleed ports. Both lines are sized AN-4 and should only be used with AN type fittings. It is important that whichever line is on the bottom is used as the supply line (connected to the master cylinder) and whichever line is on top is used as the bleeder. 1. Attach the supply line to the master cylinder using supplied stainless braided line and fittings. If using a Tilton master cylinder (which have AN-3 outlets) you will need a AN-3 male to AN-4 male adapter that is supplied in the master cylinder kit. Attach the supplied bleed adapter and bleed fitting to the bleed line.

## HYDRAULIC RELEASE BEARING BLEEDING

1. Fill the master cylinder reservoir with DOT3 or DOT 4 brake fluid. **Do not use DOT 5, silicone based or high temperature resistant brake fluids designed for more than 550°F as some will cause the seals to swell.** 2. Apply light force on the clutch pedal. You want enough force to hold the bearing out against the clutch diaphragm spring, but not enough to compress the clutch diaphragm spring. 3. Open the bleedscrew that is attached to the bleed line on the hydraulic release bearing. 4. Completely stroke the pedal and hold the pedal down. 5. Close the bleed screw that is attached to the bleed line on the hydraulic release bearing. 6. Let the pedal return to its relaxed position and wait a few seconds. Repeat Steps 2 through 6 until all air is removed from the system. **Note: Do not stroke the pedal again before the pedal stop is set.**

## SETTING THE CLUTCH PEDAL STOP

You **MUST** use a pedal stop to limit the amount of bearing travel. Failure to do this WILL result in clutch, bearing and/or transmission damage and will not be covered under warranty. It may be necessary to fabricate a pedal stop for your application as most cars with a factory mechanical linkage did not have a pedal stop. 1. Lift the drive wheels off the ground and support the car on jackstands. 2. With the engine off, put the transmission into 1st gear and have someone attempt to rotate the drive wheels. 3. Depress the clutch pedal slowly until the clutch disengages and the drive wheel can be rotated. Do not push it any further. 4. Note the clutch pedal position at this point. Measure for and/or adjust the pedal stop to allow an additional 1/4" of pedal travel.

- The clutch pedal should bottom out on the carpeting at the same time the master cylinder bottoms out. If you have no carpeting or insulation under the clutch pedal, a stop block is recommended so the master cylinder will not be damaged. If the pedal bottoms out on the carpeting without bottoming out the master cylinder no further adjustments are necessary until the hydraulic system is activated with the clutch. If the pedal stops before hitting the carpeting, adjust male rod end to lower the clutch pedal. Adjust pedal stop as necessary and know the pedals may not be at the same height. Verify no binding of rod-end and clutch pedal. Verify parallel alignment of all the components. Actuation should be smooth. Verify the master cylinder rod travels the full stroke of 1.4” with the FBody & Willwood and 1.12” with the Tilton for proper clutch release.
- If you find the clutch pedal does not have enough travel up, the end of the bracket may be trimmed to accommodate more pedal stroke as needed.
- Do not over tighten fittings – this will cause damage to the seat of the hose end and fittings. Attach the steel braided line to the master cylinder and slave cylinder or hydraulic throw out bearing making sure line has clearance to exhaust system and will not interfere with any moving parts.
- If the clutch feels spongy or releases too close to the floor, repeat the bleeding procedure. Repeating the bleeding is recommended, before or after test driving.

### **BEARING MAINTENANCE**

Spin the bearing race and check how it feels. If it has a higher than normal resistance or has a slightly notchy feel, replace the bearing. The piston can be removed and replaced without having to break the hydraulic seal or performing the bleeding procedure. Remove the piston assembly and check for any scoring in the bore or on the piston surface. Wipe the piston and orange wiper seal before installing. You may find that the piston is not dry. This could be the rubber grease used when installing the new seal at the factory. Do not mistake this for brake fluid. If the seal needs to be replaced, the seal replacement kit is Tilton part number 62-905. Remove the piston assembly to access the hydraulic seal. Inspect the piston and hydraulic assembly bore for scratches. To remove the hydraulic seal from the release bearing assembly, block one hydraulic port and apply 5 PSI of air pressure to the other port. Wear safety glasses and point the seal exit path away from you! Never try to pry the seal out of the assembly. Always use rubber grease, such as Tilton P/N RG-17, when installing the seal. Take care not to damage the seals during installation.

- Further assistance and tech support is available by calling Bowler Performance at 618-943-4856 M-T 8-4 CST time. Please call us first for any issues.
  - Thank you for your trust in our company.