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PROPER INSTALLATION OF HOWE G3 MASTER CYLINDERS

1. The cylinder will bolt to any standard racing pedal with three connections per cylinder: two 3/8 x 1-1/4", grade 5 or better bolts, and the 5/16 NF push rod.
2. Remove the jam nut and boot from the cylinder and install it through the firewall. Install the 3/8" mounting bolts through the pedal and into the master cylinder and loosely install the 3/8" lock nuts onto the bolts.
3. Replace the boot then the jam nut onto the push rod. To thread the push rod into the pedal clevis or rod end bearing push back the boot & turn the rod clockwise into the right hand thread leaving the jam nut loose.
4. Tighten down the 3/8" mounting bolts.
5. If you are installing a single master cylinder, then adjust the push rod until the pedal is at the desired height with at least 1/2" of thread into the clevis. Then tighten the jam nut. **IMPORTANT! If you are installing dual cylinders with a balance bar assembly, adjust the push rods after bleeding so that the balance bar is parallel with the firewall when the pedal is pressed to braking pressure.** Then tighten the jam nuts.
6. The pressure outlet of the cylinder is threaded with 1/8" pipe thread, and will accept any matching fitting; we prefer brass for a more positive seal. Fittings should be installed with Teflon tape or liquid thread sealer.
7. Remove the cap and fill the fluid reservoir up to the molded mark on the reservoir with new racing brake fluid (not silicon). We recommend **Wilwood 570, Motul 600, and AP 600**. Brake fluid exposed to the atmosphere will draw moisture, so use a sealed can. Date unused brake fluid containers and seal tightly. Fluid unused after 10 days should not be used in high temperature applications.
8. Bleeding a single master cylinder is easily accomplished with two people by simply pumping up pedal pressure and opening the bleeder several times until the air is removed from the system. Bleeding dual cylinders with a balance bar can be done as a two man operation.
 - a) The person bleeding should have a wrench on the bleeder with a fluid recovery hose and bottle attached to the bleeder.
 - b) Starting with the end that will have the most braking, adjust the brake bias all the way favoring the cylinder that you are bleeding. The balance bar bearing will cause more brake pressure in the master cylinder that it is closest to. Pump the pedal several times to generate pressure in the line with all bleeders closed.
 - c) While holding the pedal down, open the bleeder of one of the calipers that are connected to the cylinder you are favoring until the air pressure is relieved from the line. Close the bleeder and repeat the process until there is a steady stream of fluid coming out of the bleeder.
 - d) Check the fluid level then go to the other bleeder and repeat the procedure. **Do not remove cap to look into the fluid reservoir while the pedal is operated, be sure the pedal has been fully released first!** Adjust the bias to the second master cylinder and repeat steps a through c.
 - e) By now you should have at least a fair brake pedal. Adjust your bias bar to the center and make a final round of bleeding until you can see no more air coming out of the calipers & you have a firm pedal. Tighten the caps, making sure that the fluid level is correct & the bellows is not extended.
 - f) Often a new system will work more air bubbles into the calipers after it has been run on the track. It is then a good time to "hot bleed" the system.
 9. The brake system should be inspected weekly. Boiled or dirty, murky looking fluid should be changed. If you have any problems with the Howe master cylinders, see the trouble shooting chart or call Howe Racing Enterprises for assistance.
 10. Forward facing crashes can damage master cylinders and pedals. They should be carefully inspected and tested prior to their next use. Look for bent bias bars and push rods, as they are the most frequent victims.

CAUTION: Never use a petroleum based fluid in the master cylinders as it will damage the seals. **Use of DOT 4 silicone based brake fluid such as Castrol SRF or AP PRF has been found to reduce seal life and if used seals should be replaced annually.** Using DOT 3 and lower rated fluids will not require the seals to be replaced annually.

TROUBLE SHOOTING

NO PEDAL PRESSURE:

- **Low Fluid.** Fill and bleed.

POOR PEDAL PRESSURE COLD:

- **Air in the Line.** It could just need bled, or there may be air trapped in a high spot between the cylinder and caliper that will need bled or lowered.
- **Crooked Caliper Bracket** that twists when brakes are applied, pushing the pistons back when released. Watch the caliper brackets and straighten them.

POOR PEDAL PRESSURE HOT:

- **Wet, Contaminated or Poor Fluid.** Moisture in fluid turns to steam when hot and creates air in the system. Contaminated or lower grade fluid boils at a lower temperature. Replace the fluid with new high temp racing fluid. The highest temperature fluids we have found are **Castrol SRF and AP PRF, however using them will require the annual replacement of seals.** There are several good lower priced racing fluids listed in descending order of boiling point and cost that will not damage the seals: **Motul 600, AP600, Wilwood 570.**
- **Fluid Lock.** This is most often caused from the driver not allowing the master cylinder to completely release. This prevents the hot fluid from circulating, leading to early boiling of the fluid. The piston in the cylinder must return fully, even after the calipers have disengaged to allow the fluid in the line to return to the reservoir. The Driver should make an effort to leave air between his/her foot and the pedal when the brakes are not being applied.
- **Too Darn Hot!** Brake fluid can reach its boiling point for a lot of reasons that can not be attributed to the master cylinder. Boiling occurs from exceeding the capacity of the system. You have two choices; use the brakes less or increase the capacity of the system. To upgrade your system consider the following options: A) Add cooling ducts. B) Upgrade to a higher boiling temperature fluid. C) Use larger or better insulated calipers. D) Uses less aggressive pads. E) Use larger rotors. F) Install a fluid circulator.

PADS DRAG COLD:

- **Worn Caliper O-rings.** Replace them. Heat and wear flatten out the o-rings and they fail to pull back the pistons.
- **Crooked Caliper Brackets.** Straighten them so that the piston or pistons are parallel to the rotor and floating caliper move freely.

PADS DRAG HOT:

- **Reservoir Over Full.** The fluid must have room to expand with heat or it will force out the caliper pistons.
- **Pedal or Piston Not Returning.** Make sure the driver is removing his/her foot from the pedal, or inspect the master cylinder.

FLUID IN BOOT:

- **Damaged Seals or Bore.** Inspect bore and replace seals. New master cylinders without defect should never leak fluid into the boot. This can be caused from dirt in the brake fluid.