

Zipper's Hydraulic Lifter Preparation and Adjustment

472-800 Lifter Kits

Introduction

Thank you for purchasing a Zipper's Delphi lifter kit. Please review these instructions and procedures before installation. These instructions contain hydraulic lifter theory and provide the installer with two lifter adjustment procedures to choose from. *Top Down and Bottom Up*

Step 1 - Cleaning – Inspection – Clearance Checks

If the lifters are being replaced due to a failure of any kind, <u>make</u> <u>certain</u> that the reason for the failure has been found, and all debris has been removed from the engine and oiling system. <u>Refer to Zipper's Cleaning Contamination document for details.</u>

Clean ALL parts, including new parts, and inspect as follows:

- Inspect all parts for any signs of damage that may cause future failures.
- Push rod *components including* through holes must be free of any dirt or debris
- Visually check lifter bores for scratches, porosity, and signs of wear
- Look for advance wear on lifter guide plates or pin
- Make sure new lifter bodies and rollers are free of any nicks or damage.
- Check camshaft lobe surface condition.



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Check the following clearances:

- Lifter body to lifter bore .0012 inches or greater
- Lifter flats to roll pin (Twin Cam)

Recommended Clearance - Red Shift recommends between 0.002"to 0.004" *lifter flat to roll pin clearance*. Roll pins are available in +0.002" and +0.006" sizes. Most engines will require the use of +0.002" pins for proper clearance. Please note: Not enough clearance can cause the lifters to stick, and too much clearance will allow the lifter roller to turn and side load under operation.



Pushrod to pushrod tube
 Check for interference between the upper pushrod tube and the pushrod itself. This is more of an issue with a tapered pushrod, where it could contact the upper tube. If you find interference, open up the ID of the pushrod tube.

Hydraulic Lifter Operation Theory

The cut-away images below show hydraulic lifters, with the plungers set at various points of adjustment.

Figure 1 – In the diagram below, shows the "neutral position." This diagram shows the hydraulic plunger at the top travel limit. In this position the lifter cannot maintain valve lash and the engine would not operate correctly.

Figure 2 - Shows the hydraulic plunger fully bottomed out, with the Plunger return spring at coil bind. When using Zipper's bottom up adjustment method described below, the valve lifter is bled down to this position and adjustment is performed from this position.

Figure 3 – Shows the hydraulic plunger released by 4 flats, (pushrod shortened) to adjust the lifter plunger using Zipper's semi solid method.



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Hydraulic Lifter Operation Theory – continued



Step 2 – Choose a Push Rod Option

- One piece OE pushrods
- One piece aftermarket pushrods with added stiffness
- <u>Adjustable quick install pushrods</u>
- Adjustable tapered pushrods with added stiffness

Non Adjustable H-D factory and aftermarket push rods are good for aftermarket "bolt in" and high lift cams. Adjustable push rods are convenient to install by eliminating the need to remove <u>rocker box lids</u>. In addition, adjustable pushrods provide two methods to adjust lifter preload.

Step 3 - Push Rod Preparation

- Thoroughly clean the push rod internal oil passages.
- If using adjustable push rods, <u>check that the lifter end jam nut is tight</u>, as shown on the right.
- Fill the push rod with engine oil.
- Leave the top jam nut loose until the lifter adjustment is complete.
- Lubricate both pushrod tips with assembly lube before installation.



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Step 4 – Lifter Installation

- For Top Down and non-adjustable push rod applications, fill the lifter chamber using a lever type oil can through the oil feed hole as shown on the right.
- If using the bottom up adjustment method, do not fill the lifter with oil.
- Before installing lifters, lubricate cam lobes, lifter bores, lifter rollers and lifter bodies.
- Install lifters with lifter flats parallel to the crank centerline, and the oil feed holes facing outward (toward the cam plate.)
- Check that the lifter slides into the bore easily and smoothly and contacts the base circle of the cam.



Non-Adjustable Pushrod installation

Follow the procedures in the H-D manual for non-adjustable push rod installation. Measure push rod lengths and check for correct lengths in the table below before installing pushrods

Non-Adjustable Push Rod Lengths

Milwaukee 8 Engines	Push rod length	Twin Cam Engines	Push rod length
Intake Length	10.301 inches (Light Blue Stripe)	Intake Length	10.418 inches (Plain Finish)
Exhaust Length	10.531 inches (Yellow Stripe)	Exhaust Length	10.536 inches (Black Oxide)

Procedure 1 - Top Down Lifter Adjustment using adjustable pushrods

- 1. Identify the adjustable push rod's thread pitch.
- 2. Install and adjust push rods one cylinder at a time.
- 3. Set the cylinder, to adjust, at TDC compression so the cam lobes are at their lowest point.
- 4. See Table 2 on page 7 for push rod length changes.
- 5. Zipper's recommends to position the lifter plunger between (.075"-.085") below the neutral position

When performing the top down lifter adjustment, the lifter plunger position is adjusted from the neutral (push rod cup at the top) position, as shown in Figure 1. Top down lifter adjustments are made by increasing the length of the adjustable push rod by a specific number of turns or flats

The lifter is adjusted by extending the adjustable push rod length in steps as shown in Chart 1 to achieve the target plunger position.



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Top Down Adjustment - continued

Tighten the push rod lower jam nut before installing the push rod as explained above in push rod preparation.

Install the push rod

Lengthen the pushrod until the pushrod tips contact with the lifter cup and the rocker shaft cup.

With the push rod seated in the cups and with the push rod rotating freely, the lifter is now ready to adjust downward from the position shown in Figure 1.

To prevent value to piston contact, the push rod is lengthened in steps. Table 1 on page 7 shows adjustment steps for 24 and 32 threads per inch adjustable push rods.

With each step, allow the valve spring to compress the plunger for 10 minutes.

After 10 minutes, the push rod should freely rotate which means the lifter is bled down and the plunger position has changed. Repeat this step until the lifter is adjusted. Tighten the top adjusting nut and double check for push rod rotation.

Example - Top Down Adjustment using adjustable push rod:

As mentioned above, using a lever type oil can, fill the lifter chamber, through the oil feed hole as shown above, with light oil until the chamber is full.

If using Zipper's 403-088 or S&S 498-122 with 32 TPI, increase the push rod length in three steps. First step 6 flats, second step 6 flats, and the third step 4 flats for a total of 16 flats or approximately 2-2/3's turns. Again wait 10 minutes between steps for the lifter to bleed. Check that the push rod rotates freely before going on to the next step. After completing the third step, and allowing the lifter to bleed, the plunger will be .075 to .085 inches below the neutral position. Tighten the top adjusting nut and double check for push rod rotation. If the push rod doesn't rotate freely between steps or after step 3, something is wrong and must be fixed before continuing.

If using Zippers 403-145 push rod with 24 TPI, increase the push rod length in three steps, first step 4 flats, second step 4 flats, and the third step 4 flats. Again wait 10 minutes between steps for the lifter to bleed. Check that the push rod rotates freely before going on to the next step. After completing the third step, and allowing the lifter to bleed, the plunger will be 0.080 inches below the neutral position. Tighten the top adjusting nut and double check for push rod rotation. If the push rod doesn't rotate freely between steps or after step 3, something is wrong and must be fixed before continuing.

While lengthening the push rod, do not apply excessive force. Excessive force may cause lifter, valve, valve spring, piston and or valve damage.



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Procedure 2 – Bottom Up Lifter Adjustment using adjustable pushrods

Do not fill the lifter chamber with oil.

The bottom up adjustment procedure is a process used by experienced engine builders using aggressive cam profiles and higher valve spring loads. This method limits lifter plunger travel and effectively makes the lifter a "semi-solid" lifter. Zipper's extensive testing has proven to provide more valve train control over other lifter adjustment procedures. Adjusting the lifter plunger position from the bottom up will prevent the lifters from collapsing.

If using the bottom up adjustment procedure, the push rod is lengthened to bleed the lifter plunger to the fully compressed position as shown in Figure 2. This is followed by adjusting the plunger to the target position by shortening the push rod length as shown in Figure 3.

Bottom up adjustment

Tighten the push rod lower jam nut before installing the push rod as explained above in push rod preparation.

Install the push rod followed by the rocker assembly, provided the rocker assembly previously removed. Lengthen the pushrod until the pushrod is in contact with the lifter and rocker arm shaft cups. Once the push rod is lengthened and contacting the lifter push rod cup and rocker shaft cup, the push rod should rotate freely. The lifter plunger is now ready to compress to the bottom position as shown in Figure 2.

When performing bottom up lifter adjustments, the push rod is lengthened in six steps to compress the plunger to the bottom. These steps are necessary to prevent damage to valve train components. Table 2 on page 6 shows push rod adjustments by thread pitch.

Example – Bottom UP Adjustment:

If using S&S "Quickie" push rods part number 498-122 with 32 TPI, increase the push rod length in seven steps of 4 flats plus and additional flat for a total of change in length of approximately .150 inches. Wait 10 minutes between each push rod length adjustment to allow time for the lifter to bleed. Then check the push rod for free rotation before going to the next step.

If using Zippers 403-145 push rod with 24 TPI, increase the push rod length in five steps of 4 flats plus 2 flats for a total of change in length of approximately .150 inches. Wait 10 minutes between each push rod length adjustment to allow time for the lifter to bleed. Then check the push for free rotation before going to the next step.

When the lifter plunger is fully compressed, the adjusting nut will be hard to rotate. After allowing the lifter to bleed down for another 10 minutes consider the following:



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If the push rod spins freely, the lifter plunger it is not fully on the bottom. If you need to further increase push rod length to reach the bottom, **proceed extremely carefully** to avoid damage to the lifter assembly.

If the push rod does not rotate freely, **Shorten** the push rod until it rotates freely by hand while seated in both the lifter and rocker arm cups. The plunger is now fully compressed. This is the starting point for the lifter adjustment.

Once the plunger is bottomed as shown in Figure 2, The push rod is <u>shortened by 2.5 flats</u> if using a 24 thread per inch adjustable push rod and **3.5 flats if using a 32 threads per inch push rod**. Tighten the top adjusting nut and double check for push rod rotation. This will place the plunger 0.018 inches from solid creating a "semi solid" lifter.

Before installing rocker box lids, start the engine and verify oil flows to all 4 rocker arms.

Push Rod Part Number	Push Rod Thread (TPI)	Length Change Per Turn	Length Change Per Flat	First Adjustment	Second Adjustment	Third Adjustment	Total Number of Flats	Total Number of Turns
Zipper's 403-145	24	0.0417	0.0069	4	4	4	12	2.0
Zipper's 403-088	32	0.0277	0.0052	6	6	4	16	2+4 Flats
S&S 498-122	32	0.0417	0.0052	6	6	4	16	2+4 Flats

 Table 1

 Adjustable Push Rod Chart – Top Down Lifter Adjustment

Table 2Adjustable Push Rod Chart – Bottom Up Lifter Adjustment

Push Rod Part Number	Push Rod Thread (TPI)	Length Change Per Turn	Push Rod Length Change Per Flat	Approximate Turns to Compress Lifter Plunger	Flats to Compress Lifter Plunger	Bottom Up Flats to Target Plunger Position (.018)
Zipper's 403-145	24	0.0417	0.0069	3 Turns + 4 Flats	22	2.5
Zipper's 403-088	32	0.0313	0.0052	4 Turns + 5 Flats	29	3.5
S&S 498-122	32	0.0313	0.0052	4 Turns + 5 Flats	29	3.5

If using Zippers 403-145 push rod with 24 TPI, <u>decrease</u> shorten the push rod length by 2.5 flats (.018 inches.) If using Zipper's 403-088 or S&S 498-122 with 32 TPI, <u>decrease</u> shorten push rod length by 3.5 flats (.018 inches)

For questions email Zipper's Product Support <a>ProductSupport@ZippersPerformance.com

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