Instructions For

# Sportsman Series Shaft-Mount Rocker Arms

**Big Block Chevrolet (Most applications similar to OEM valve layout)**

**Part No. 13809-1**

## For more information, see www.cranecams.com

**Applications:** **Big Block Chevrolet Cylinder heads; OEM or Aftermarket having standard valve and stud locations. These include but are not limited to: World Products® Merlin®; most Dart® (except Big Chief®); Edelbrock® Performer® and Performer RPM® O/R, Edelbrock® Victor Jr.®; many Brodix® (except Big Duke®); most AFR® applications; and many others!**

Crane Sportsman Shaft-Mount Rocker Arms are designed for serious Sportsman and Professional racers. This system was designed to take advantage of the latest developments in advanced composite materials technology and metallurgy. These rockers were designed and engineered using the latest in *Finite Element Analysis* software, have undergone hundreds of hours of *Spintron®* laser traced valve-train analysis, and enhanced with the many decades of design, fabrication and testing experience of Crane Cams' Research & Development Department.

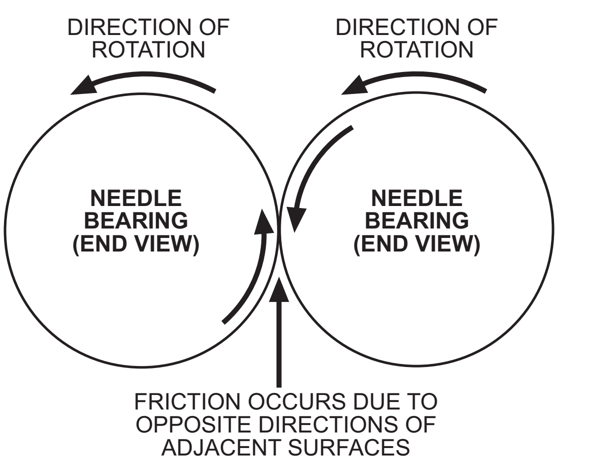


**Figure 1.**

## How Crane Shaft-mounted Rockers Increase Power and Endurance

During the opening and closing of the valves, the needles in traditional needle bearing roller rocker arms actually *roll in one direction* as the valve opens. They then *stop rotation* at maximum valve lift and then as the valve closes *must reverse their direction*. This stopping and starting of the bearings is called *"bearing inertia."*

Simply put, *bearing inertia consumes horsepower.* What's more, this effect *increases significantly* as engine rpm rises and valve spring loads increase. In addition, needle bearing rocker arms use what are termed *"full complement"* bearings, meaning the needles lay against each other. Since *hundreds of needle bearings* are used in a set of rockers, this friction accumulates to create significant rolling friction. One "solution" could be using "caged bearings", with separated needle bearings. However, the added weight of the bearing cages and the decrease in load bearing strength would make this option obviously undesirable. With a *"full complement"* bearing rocker, all the needles *roll in the same direction*, but the adjoining surfaces move in the *opposite direction.* This "back-and-forth" motion plus the need to move the weight and mass of the needle bearings with each up and down motion creates a significant amount ***power-robbing friction!*** **(See Figure No. 1)**

The knowledge of *bearing inertia* has been known and of concern for many years. The most common way to minimize *bearing inertia* has been to *reduce the diameter of the fulcrum shaft.* Unfortunately, this creates at least three other problems, all of which are made even worse when the valve spring load on the smaller shaft increases "unit loading" on the shaft and bearings. This results in: (1) Increased **friction** (2) Increased ***shaft wear*** (3) Increased shaft flex, resulting in nose wheel chatter and accelerated valve guide wear.

Crane Cams new Shaft-Mount Rockers ***have no needle bearings!*** Instead, they utilize an advanced ***polymer-matrix composite bearing*** riding on a ***specially finished shaft*** of ***substantially larger diameter.*** This delivers a rocker system with ***exceptional strength, zero bearing inertia, and unequalled structural rigidity.*** Crane Cams Shaft-Mount Rockers ***operate with less friction, deliver more horsepower, reduce valve guide wear,*** and ***have a longer operational life*** than any other rocker arm system!

In addition to *reduced friction* and *elimination of needle bearing inertia,* additional power gains are also realized through the ***unique geometry*** of the Crane Shaft-Mount ***rocker body design.*** Unlike other rocker arm systems, Crane Shaft-Mounts lift the valve off the seat at a rate ***higher than the advertised rocker ratio.*** For example: A 1.72 ratio Crane Shaft-Mount rocker **opens the valve from the seat with a starting ratio of 1.80 to 1.** As the valve is opening the ratio reduces due to the geometry so that the "stated" 1.72 ratio is achieved at about .250" valve lift and maintained throughout the remainder of the valve lift until the valve is within .250" of going back on the seat at which point the ratio increases back to 1.80 to 1. (Note: The change of ratio occurs automatically due to the shape of the rocker body). This feature improves flow to the cylinder in this critical early period of the crankshaft rotation and helps **maximize cylinder pressure and peak power.** This unique action is not unlike changing to a more aggressive cam lobe profile while maintaining the same operational duration!

Considerable strength and durability increases have also been realized by building these rockers from a ***new alloy of extruded aluminum billet material!*** This new alloy has ***far greater strength*** in the critical 250-300°F temperature range seen by today's high output engines. By comparison, other aluminum rockers are made from alloys designed for high altitude aircraft use, where temperatures are extremely low. These alloys ***typically lose as much as 50% of their strength*** when operated in the 250-300°F environment common to a street or race engine! New Crane Shaft-Mount rockers are ***alloy-engineered*** to be ***substantially stronger*** and ***far more durable*** than other stud-mount or shaft-mount rockers.

Crane Shaft-Mount rockers are manufactured using CNC (computer numerical control) machinery and quality control verified continuously during all manufacturing operations. We use only the finest materials in all phases of manufacturing and all required heat treat hardening is performed in our Daytona Beach facilities.

## Design considerations and suggestions for use

1. Shaft mounted rocker arms are designed to improve valve train stability and increase power under high valve spring pressures and high RPMs associated with roller camshaft/lifter systems. While shaft mount rockers will work well with flat tappet valve trains, their prime advantages are realized with roller systems.

2. The high airflow capabilities of roller cams are usually maximized with the use of aftermarket cylinder heads with larger than stock intake and exhaust ports, and longer than stock valve lengths. Your BBChevy Sportsman shaft-mounts have been designed for use with the standard 1.880" installed height valves. If you have longer than stock valves, you will need to shim the rocker stands to provide the correct rocker arm geometry as explained later in these instructions.

3. This Crane Shaft-mount Rocker Kit features a unique "turnbuckle" adjuster to allow for proper nose wheel alignment on applications where the valve spacing has been widened to "unshroud" the valves. This unique feature allows this one kit to fit many different brands of heads and still assure perfect nose wheel alignment.

## Cautions Before Installation

1. The shafts in your Crane Shaft-Mount system have been treated to a ***special metal finishing process. Do not scratch, dent, ding or damage these shafts.*** Treat them exactly as you would main or rod bearing inserts! Any damage to the shafts will negatively affect the performance and life of the system.

2. Do not run the pushrod seat adjuster (in the backside of the rocker arm body) more than 2 turns out from the seated position. If proper geometry cannot be achieved within 2 turns of the pushrod seat, ***change pushrod length.*** This is required to achieve proper operational geometry, assure adequate internal oiling to the composite bearings, and minimize wear of the pushrod seat and tip.

3. All of the shaft-mount stands and rocker arms in this kit are the same. (There are no "intake only" or "exhaust only" stands or rockers.) Check the fit of the shaft-mount stands (Item 5, Figure 2) on your cylinder heads. On a few heads, there might be a slight amount of interference between the bottom of the stand and the top of the intake runner. It is acceptable to remove enough metal from the bottom and side edge of the stand to eliminate this interference. Remove only enough metal to provide a stable stand mount against the head. If you have any questions on the fit of a stand or how much material you can remove, contact the Crane Technical Service Department at 1-386-258-6174.

4. ***Do not use oil restrictors*** **in the lifter galleries** ***or restrict oil*** **to the rockers in any way!** High valve spring pressures generate heat that builds in the rocker body. Full oil flow to the rockers must be provided to cool the rocker body and reduce friction.

5. Check the cylinder heads for pushrod clearance through the pushrod holes. Be sure that clearance exists through the ***full range of valve motion.*** Grind clearance in the pushrod holes as needed. Grind in the plane of operation; which is in line with the pushrod and valve stem. Be careful not to grind through the sides of the intake ports.

6. Clean all rocker stud holes with a clean tap (7/16 x 14) to assure that no debris has collected in the bottom of the holes that might interfere with proper torquing of mounting bolts.

7. Use liberal amounts of the supplied Crane Cams "red" Assembly Lube ***on the shafts, rocker arm bearings, and rocker nose wheel.***

8. Use oil or fastener torquing lube on all fasteners before tightening to proper torque spec.

9. Do not over torque or under torque fasteners.

10. Do not install or remove shaft bolts with spring pressure working against the rockers.

11. Check for adequate ***valve cover and breather clearance*** before starting engine. Do this by turning the engine through several revolutions with the spark plugs removed.

## Special tools necessary for installation

T-45 Torx® (6-lobe) socket

T-50 Torx® (6-lobe) socket

5/8-12 pt socket

7/16-12 pt socket

Snap ring pliers

## BBC Sportsman Shaft Mount Parts List 13809-1 (Reference Figure's 2 & 3)

| Item No. | Part Number | Description | Quantity |
|---|---|---|---|
| 1 | **138115ZB** | Intake/Exhaust Rocker Arm | 16 |
| 2 | **7875ASP** | Pushrod Seat Adjusting Screw | 16 |
| 3 | **99785JNP** | Jam Nut 3/8" 12 point | 16 |
| 4 | **7865B** | .583 x .378 x .032 jam nut flat washer | 16 |
| 5 | **13810C1SP** | BBC Shaft Mount Stand In/Ex | 16 |
| 6 | **7880B** | BBC Shaft Mount Shaft | 16 |
| 7 | **7883B** | Turnbuckle body | 8 |
| 8 | **7882B** | RH Shaft Stand Turnbuckle Hook | 8 |
| 9 | **7881B** | LH Shaft Stand Turnbuckle Hook | 8 |
| 10 | **7863B** | #45, 6-lobe Bolt 5/16 x 18 x 1.25" | 32 |
| 11 | **7872B** | #50, 6-lobe BBC Stand Bolt (1.215OAL) | 16 |
| 12 | **7808B** | Thrust Washer, 1.125 x 625 x .031 | 32 |
| 13 | **7887B** | .030 thick, Rocker Stand Shim | 16 |
| 14 | **7888B** | .060 thick, Rocker Stand Shim | 16 |
| 15 | **7886B** | Geometry Checking Fixture (Figure 2) | 1 |
| 16 | **99726B** | Checking Pushrod (not shown) | 1 |
| 17 | **99008B** | Assembly Lube (not shown) | 1 |

## Fastener Torque Specifications (With SAE 30 Wt. Oil)

| Bolt Description | Torque (lbs/ft) |
|---|---|
| 7/16-14; 12-point stand bolts (iron heads) | 65-70 |
| 7/16-14; 12-point stand bolts (aluminum heads) | 60-65 |
| 5/16-18; 6-lobe shaft bolts | 26-28 |
| 7/16; 12-point pushrod seat adjuster nut | 22-24 |

## Assembling Crane Shaft-Mount Rockers On Heads

1. Install intake rocker stands on the cylinder heads. (Note: all rocker stands are the same, intake and exhaust.) When installing the #50 6-lobe stand mounting bolts, check to see if the hole breaks into an intake port or the water jacket. If it does, apply a suitable sealant such as Permatex #2 or Loctite Pipe Sealant with Teflon to assure against vacuum or coolant leaks. Snug the stand bolt lightly. Do not torque to spec at this time.

2. Install one exhaust stand on the cylinder head. Lightly snug the stand-mounting bolt.

3. Install the **"geometry-checking fixture"** (Item #15 on the parts list, Part # 7886B) onto a shaft and bolt the shaft to the exhaust stand. Lightly snug the shaft to the stand with two #45 6-lobe stand mounting bolts. (See Figure 2). Gently slide the **"geometry-checking fixture"** adjacent to the valve or over the valve. The stand is at the proper height if the tip of the valve is within + or - .030" of the bottom of the **"geometry-checking fixture"** as shown in Fig.6. Note: The rear stud of the "geometry-checking fixture" must be **resting on the shaft stand** when comparing valve tip height. Repeat for intake. Check the geometry on each head.

4. If the tip of the valve is higher than .030" from the bottom edge of the "geometry- checking fixture", it will be necessary to install a shim under the rocker shaft stand to achieve the correct fixture/valve tip relationship. This kit contains 16, .030" thick stand shims (Part # 7887B) and 16, .060" thick shims (Part #7888B). These shims can be stacked as necessary to achieve the correct fixture/valve tip relationship. If the tip of the valve is more than .030" below the edge of the checking tool, the rocker arm stud bosses must be milled that amount to allow the correct position to the bottom edge of the "geometry-checking fixture". **(NOTE: longer valves or valve stem lash caps could also be used if the valve tip is too far below the bottom edge of the fixture.)** Shaft mount height and rocker geometry is considered correct when the rocker arm nose wheel is just inboard of the valve stem centerline when the valve is closed. See Figure # 7 for proper nose wheel position as the rocker body moves through its entire range of movement. Notice, that at mid-lift, the nose wheel travels just outboard of the valve stem centerline and at maximum lift, it comes back close to the valve stem centerline (See Figure #7).

5. Assemble the "turnbuckle" adjusters by threading a "right-hand thread" hook into one end of the turnbuckle and a "left-hand threaded" hook into the "left-hand" end of the turnbuckle (the left-hand end and the left-hand hooks are identified by an identifying line on the end of the turnbuckle and hook). See Figure 2. The turnbuckle/hook assemblies allow precise alignment of the rocker arm nosewheel with the valve stem. When the rocker stands are tightened to specifications (later in the installation instructions), the turnbuckle assemblies will tighten and not be adjustable.

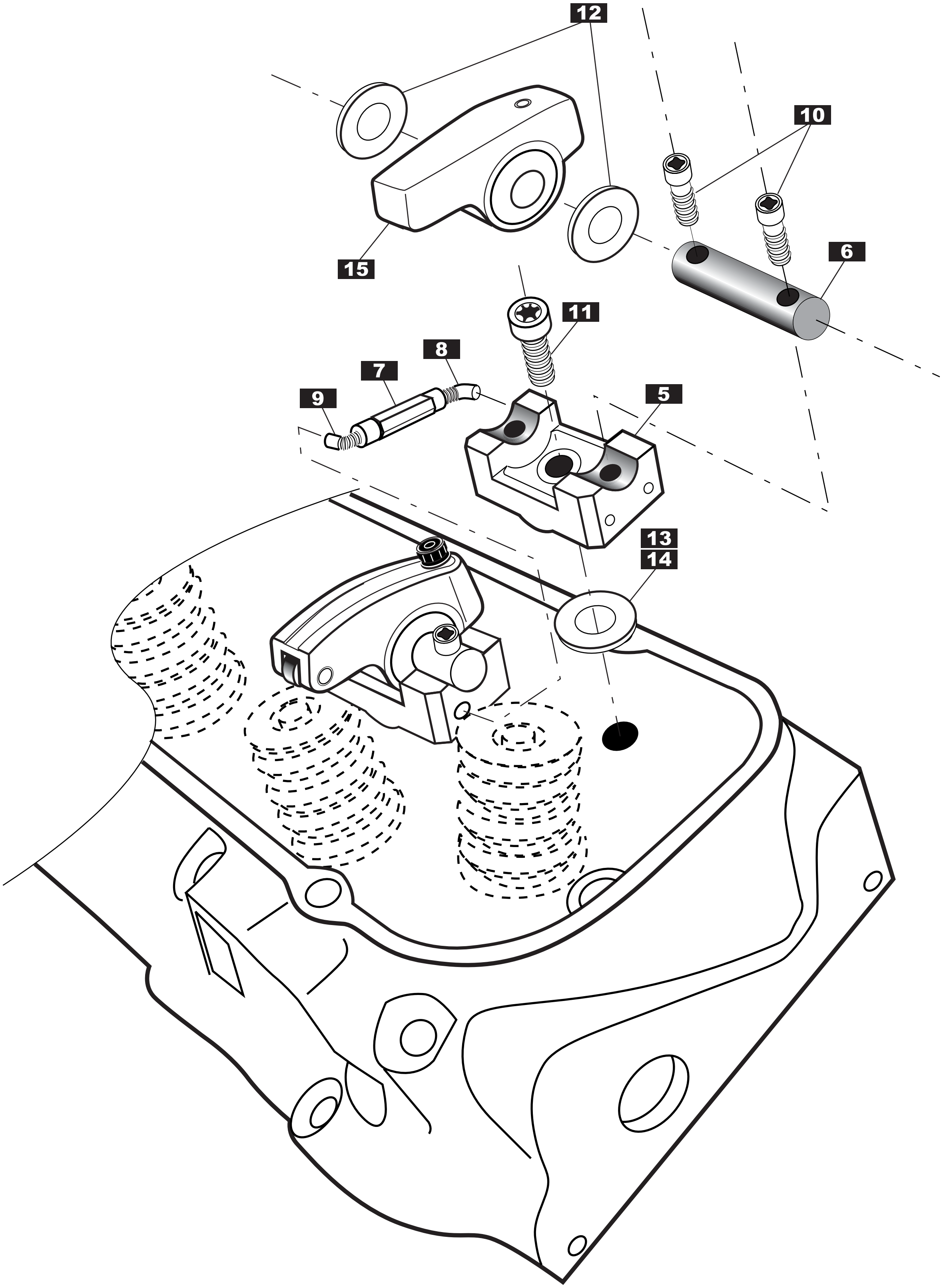


**Figure 2.**

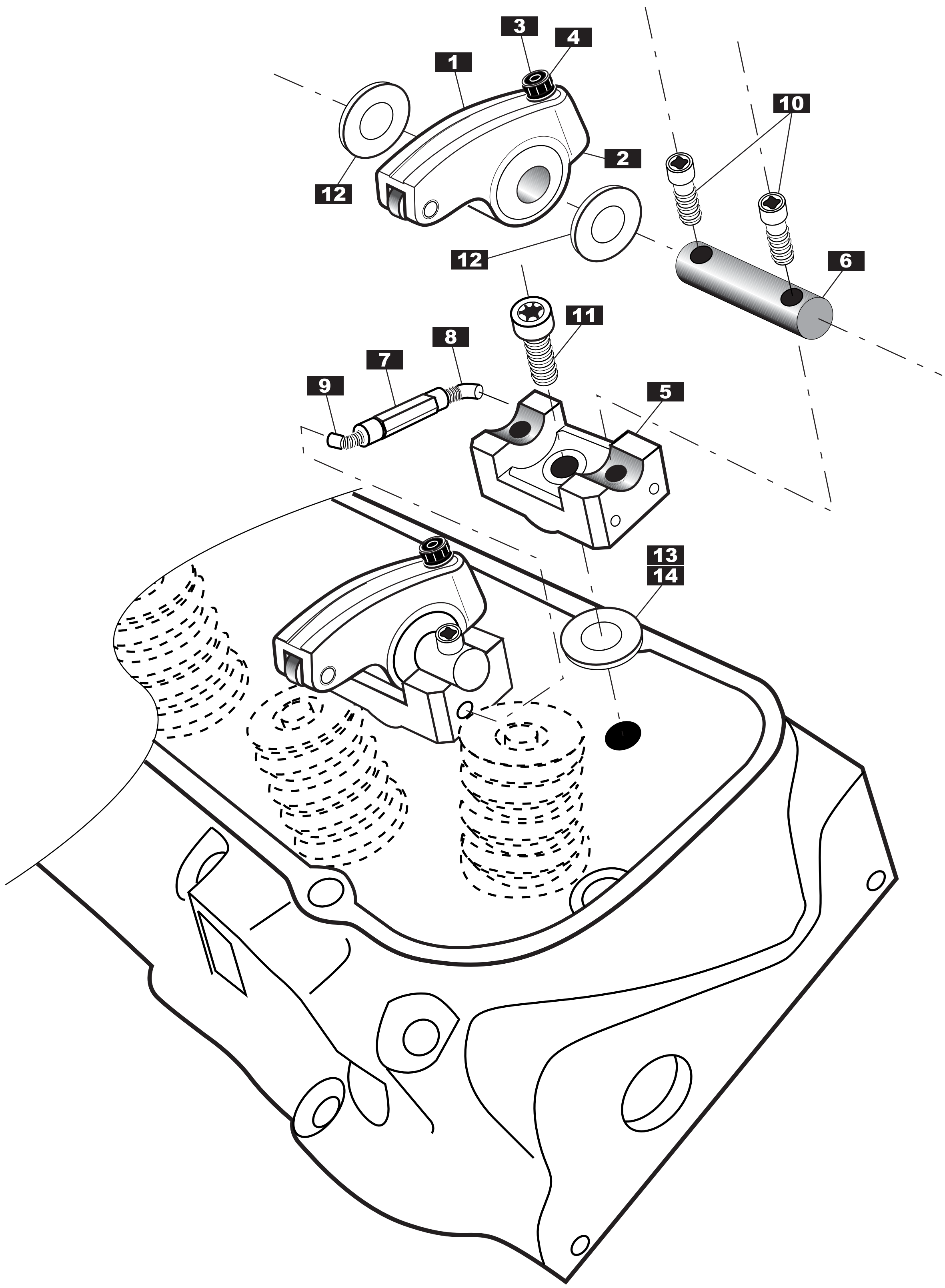


**Figure 3.**

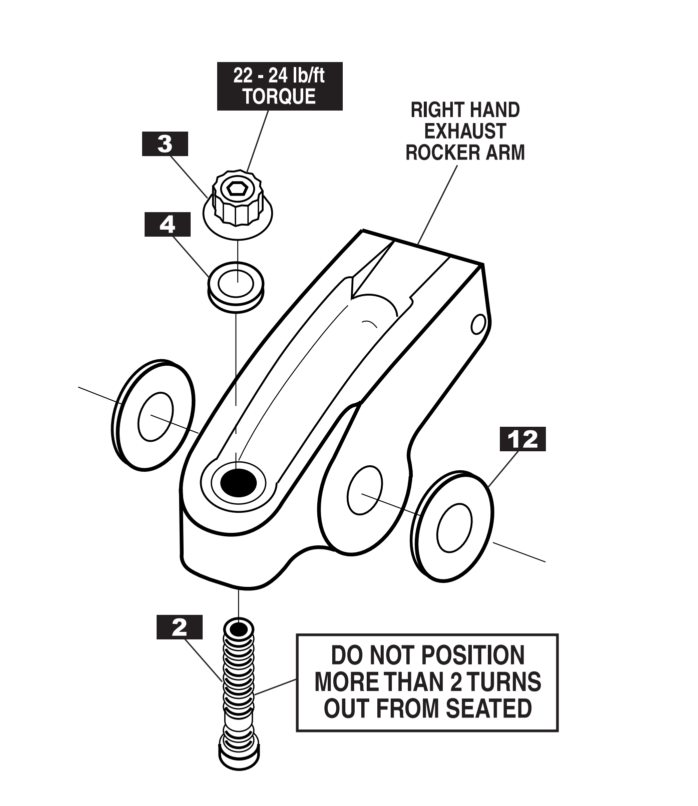


**Figure 4.**

6. Lubricate the **pushrod seat adjuster** threads (Item # 2, Part # 7875ASP) and install them in the rockers from the bottom side. Screw in until the adjuster **bottoms** in the recess in the rocker body and then **back out one full turn from seated.** See Figure 4.

7. On the top of the rocker body, install the **thin washer** (Item #4, Part # 7865B) and **adjuster jam nut** (Item # 3, Part # 99785JNP) and lightly snug. See Figure 4.

8. This shaft-mount system uses the same rockers on both intake and exhaust valves. Lube the bearings in the rocker bodies and the rocker shafts with the assembly lube provided.

9. Start installation with No. 1 cylinder at TDC at the end of the compression stroke (both lifters will be on the cam base circle). Install the **adjustable pushrod** (Item # 16, Part # 99726B) in a pushrod hole and assure that the bottom end is engaged in the lifter cup. Lubricate the pushrod tip where it engages the **pushrod seat adjuster.**

10. Install the #1 intake rocker body and shaft with **thrust washers** (Item # 12, Part # 7808B) on each side of the rocker arm. See Figure # 3. **CAUTION: Do not install or remove the rocker arm/shaft assembly under spring load (lifter not located on the base circle of the cam).**

11. Lightly lube shaft bolts, install and lightly snug shaft bolts. **Note: Assure that "flat" side of shaft bolt holes is facing up so that the shaft bolts seat against the flat surface!** Recheck rocker nosewheel alignment on the valve stems. Adjust the turnbuckle assembly as necessary to correct alignment. Remove shaft and torque rocker stand bolts to specifications. Install shaft/rocker arm assemblies on stands and torque to specifications.

12. Determine pushrod length by adjusting valve lash with the adjustable pushrod. Measure the pushrod length and record. Measure pushrod length on at least two cylinders on each bank. When checking pushrod length, keep in mind that custom pushrods are available in .050" length increments. Also, there is about .070" of useful adjustment in the pushrod seat adjuster in the rocker body. **NOTE: the adjustable checking pushrod supplied must be used to determine pushrod length with the valves closed. It is not strong enough to open the valves against the pressure of high-rate springs. Do not use this pushrod with any spring pressure over 75#!**

13. Repeat #12 above on cylinder #1 exhaust rocker.

14. With correct length, heavy-duty pushrods installed, rotate the engine through several revolutions and recheck pushrod clearance through the pushrod holes in the heads. Start with cylinder #1, positioned so that the lifters are on the base circle of the camshaft; and adjust the valve lash (for mechanical camshafts) or set the lifter preload (on hydraulic camshafts, pushrod length must be determined with the hydraulic lifters at proper preload). Proceed through the firing order rotating the crankshaft 90* between each cylinder adjustment.

15. With all rocker and shafts installed, recheck shaft bolt torque and recheck valve lash. Assure that all pushrod seat jam nuts are tightened to proper torque specifications. See Figure 5.

16. Install valve covers and rotate the engine to make sure there is no interference with the valve train. Correct as necessary.

17. Prime the oil pump with a drill motor and priming tool before firing the engine. **Do not start the engine until oil is seen coming out of all of the rockers at the shafts or nose wheel area.**

18. Fire the engine, and allow it to warm up to operating temperature. Shut off the engine and verify valve adjustment.

19. **Do not operate this rocker arm system with restrictors in the oiling passages to the lifters or the rocker arms.**

## Additional Information on "Quick-Lift" Rocker Geometry

The use of the "Geometry Checking Fixture" to determine the proper stand height is correct for the majority of applications. However, to achieve the very most from your rocker arm geometry, you really need to plot several lift curves using the adjustable pushrod and a "light checking spring" (any spring with a very light rate that is strong enough to hold the valve closed and still will not exceed 75# at the maximum lift point) to determine the exact pushrod length that will maximize power. Additionally, you will need a dial indicator, a degree wheel, and some graph paper.

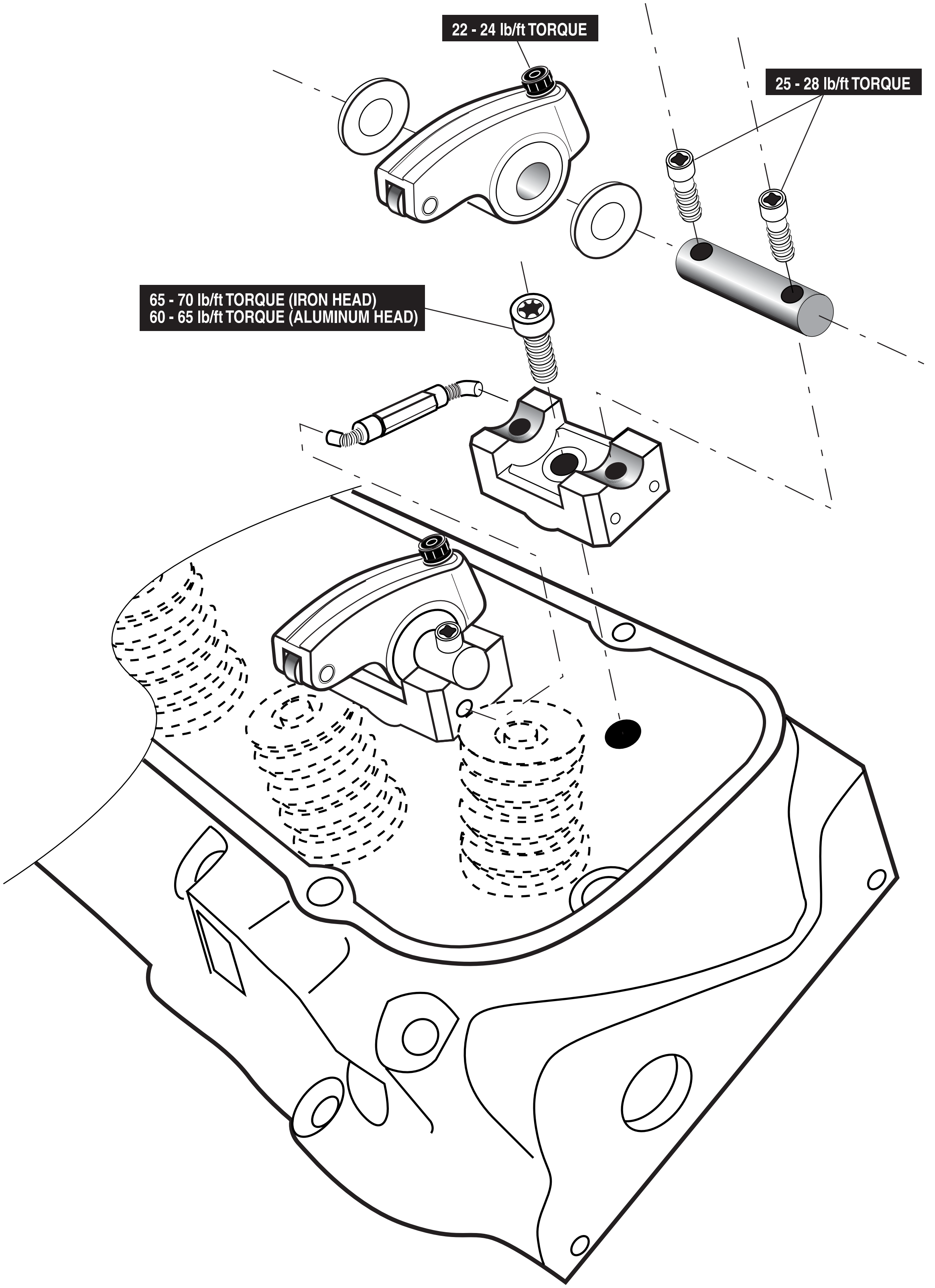
22 - 24 lb/ft TORQUE
25 - 28 lb/ft TORQUE
65 - 70 lb/ft TORQUE (IRON HEAD)
60 - 65 lb/ft TORQUE (ALUMINUM HEAD)

**Figure 5**

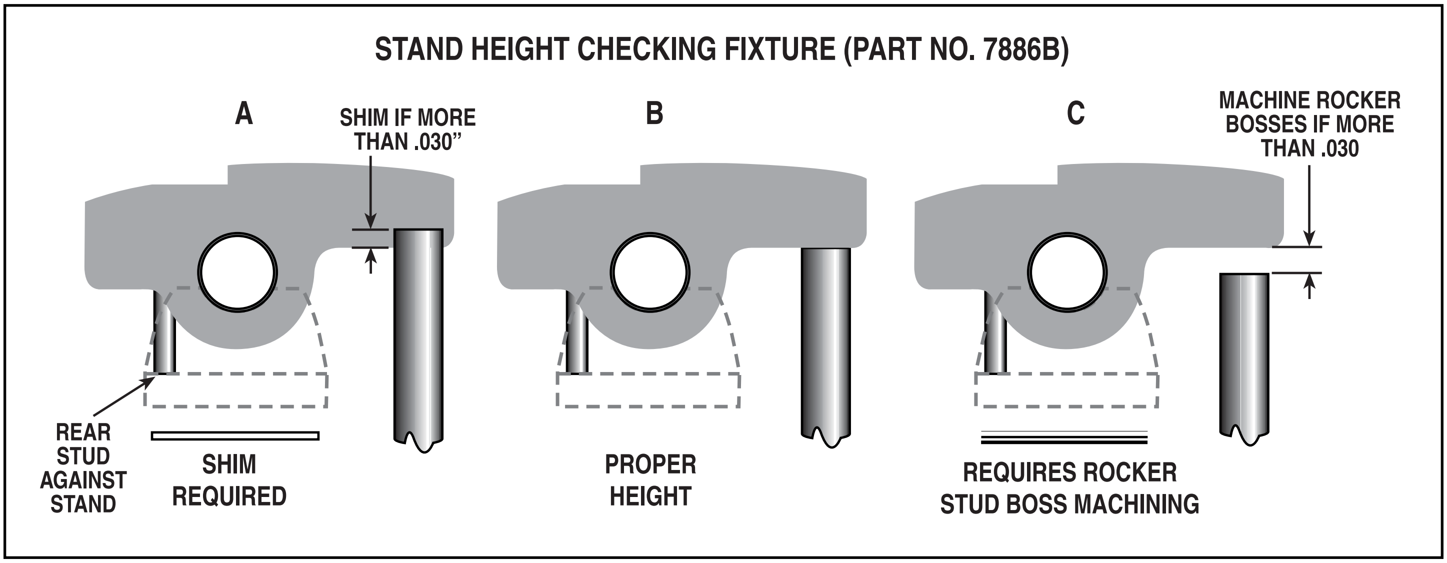


**Figure 6.**

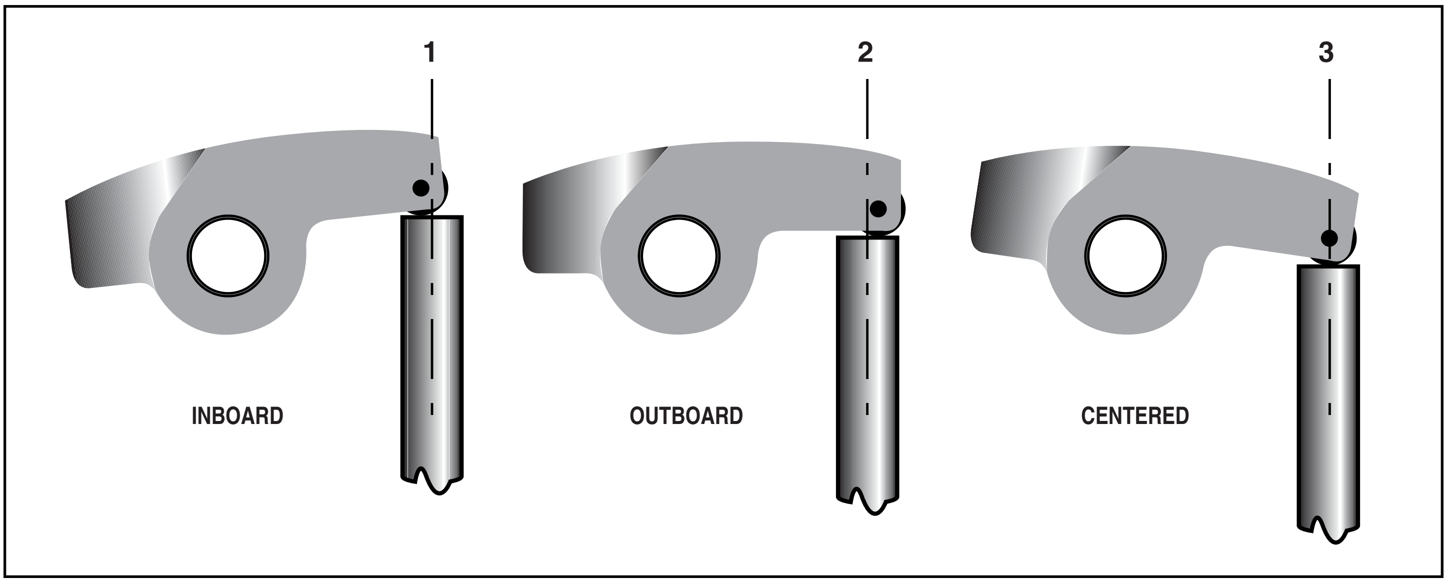


**Figure 7.**

Set up the dial indicator on the top of cylinder #1's intake spring retainer. Install the degree wheel in the manner used for degreeing in a camshaft.

Install the adjustable pushrod and adjust to 0 lash. Now rotate the crankshaft 5 degrees at a time and measure the valve lift and record the amount. Do this in 5-degree increments for the entire lift of the lobe. Now shorten the pushrod length by .050" and repeat the process. Each time, plot the results of your data on a graph to see the difference in lift rate. Keep shortening the pushrod in .050" increments until the peak lift (at the nose of the cam) starts to decrease. The point where the peak lift just starts to decrease is usually the point that provides **the greatest area under the lift curve;** but that is up to you to evaluate. This pushrod length should be the exact pushrod length that maximizes performance and power.

This exercise takes a little patience and time, but if you are interested in maximizing your engine's performance, it is well worth doing. Good Luck!