



Installation Instructions for Red Shift Sportster Cams

This product is legal in California only for racing vehicles which may never be used upon a highway.

Thank you for your purchase of a Red Shift Cam set. During installation, certain areas must be checked for adequate clearance, and modifications must be made if proper clearances are not available in stock form. When installing any camshaft with increased timing and lift, valve-to-valve clearance must be checked at piston top dead center. This is easy to do on an unassembled head. Clamp the head (gently) in a vise on its side. Insert both valves in the guides, bottomed on the valve seats. Measure the valve stem from the top of the guide to the top of the valve. Using the specifications provided, open the intake valve the specified amount, then the exhaust valve. The distance between the open valves must be a minimum of .050". If more clearance is needed, the valve must be recessed further into the head. This is done before any valve spring packing. Make sure you recalculate for a modified rocker ratio if yours is different from the stock specifications shown.

5 Speed Sportsters & Buells (Engines with On-Center Tappets)

Rotate each cam in the case and check clearance between the lobe and case. Clearance should be a minimum of .060". Remove material from the case if needed for clearance. 2000 and later models require clearance at the underside of the tappet bores and require removal of some of the protruding pinion bearing race. Zipper's tool # 713-908 greatly simplifies this process. We also recommend machining and installing a buttonhead screw in the case just outside of the pinion race, capturing the race so it cannot walk out under severe service. Install cams, then check lifter travel in the lifter bore with the guide pins in place. A minimum of .060" of free travel at max lift is recommended. If more travel is needed, machine the flat on the lifter body for additional clearance, or purchase aftermarket lifters that are machined for additional travel (call for suggestions). Please note: In '94-'99 engines, H-D has shortened the depth of the tappet alignment pin bores. The pins no longer have full contact across the flat machined on the tappet. We strongly suggest the installation of our tappet pin kit, P/N 413-091, for full pin-to-flat engagement, to prevent the tappets from side-loading in the tappet bores. Use our travel limiters (part #498-339) in the lifters for more precise valve control. Our adjustable pushrods (part #403-088) and telescoping pushrod cover kit ('91-'03 XL models #417-110, '04-up XL #417-111, '02-up Buell XB #417-115) will simplify valve adjustments. Do not use non-adjustable pushrods.

Set the heads up to the TDC and travel specifications shown below. Use a quality valve spring kit with seat pressure set at a minimum of 180-200 pounds, and coil bind a minimum of .040" over valve lift. If you're converting 883 heads to 1200 size valves, we recommend using Baisley Pro-Street 883/1200 valves (part #'s 526-603, 526-607) for improved rocker geometry. Check clearance between rocker arms and rocker lids at full lift, and .060" valve-to-piston clearance using lightweight checking springs in place of the valve springs for accurate readings.

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Cam Model	Cam ID	Valve Lift	Hyd. OK	Solid Only	Tappet Clearance	Timing @.053 Open/Center/Close	T.D.C. at Valve	Rocker Ratio	Min.Seat Pressure
567V2	In 567	.567"	Yes			24/101/49	.211"	1.62	180#
	Exh 567	.567"	Yes			54/108/19	.172"	1.62	180#
575V2	In 567	.575"	Yes			26/96/38	.204"	1.62	180#
	Exh 567	.575"	Yes			44/102/20	.172"	1.62	180#
585V2*	In 585	.583"	Yes			22/108/59	.183"	1.62	180#
	Exh 585	.583"	Yes			66/117/13	.139"	1.62	180#
630*/585V2	In 630	.630"	Yes			26/95/40	.224"	1.62	200#
	Exh 585	.583"	Yes			59/108/21	.181"	1.62	200#
643V2*	In 643	.643"	Yes			28/104/62	.235"	1.62	200#
	Exh 643	.643"	Yes			71/116/19	.172"	1.62	200#
729V2*	In 729	.729"	No	Yes	.004-.006"	34/104/65	.279"	1.62	220#
	Exh 729	.729"	No	Yes	.004-.006"	71/112/28	.228"	1.62	220#
790V2*	In 790	.790"	No	Yes	.004-.006"	36/104/66	.282"	1.62	220#
	Exh 790	.790"	No	Yes	.004-.006"	66/106/36	.280"	1.62	220#

* Check the large gear on the #2 cam. If it has been welded to the shaft, install the cam in the cam cover and check for clearance between the welded area and the bushing. Increase the chamfer on the bushing if additional clearance is required.

4 Speed EV Sportsters and 4-Cam Engines (Engine with Off-Center Tappets)

4 speed EV Sportsters generally have lots more room for lobe swing and it's not usually a problem, but check it anyway. Check lifter travel in the lifter block (at least .060" over max cam lift), again there is normally sufficient travel with the stock components. If the hydraulics are retained, use our travel limiters (part #498-339) in the lifters for more precise valve control. Do not use non-adjustable pushrods.

Set the heads up to the TDC and travel specifications shown below. Use a quality valve spring kit with seat pressure set at a minimum of 180-220 pounds (see spec chart), and coil bind a minimum of .040" over valve lift. If you're converting 883 heads to 1200 size valves, we recommend using Baisley Pro-Street 883/1200 valves (part #'s 526-603, 526-607) for improved rocker geometry. Check clearance between rocker arms & rocker lids at full lift, & valve-to-piston clearance using lightweight checking springs in place of the valve springs for accurate readings.

Because H-D has used at least 4 different combustion chamber designs in the XL head, tuning problems can result from too much or too little compression and you should verify the final compression ratio by oiling out the combustion chamber. Builders using big valve heads will find it easier to use a domed piston such as our Axtell 20 or 30 degree models and cutting the dome to achieve the desired compression ratio.

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Cam Model	Cam ID	Valve Lift	Hyd. OK	Solid Only	Tappet Clearance	Timing @.053 Open/Center/Close	T.D.C. at Valve	Rocker Ratio	Min.Seat Pressure
573V2	In 573	.575"	Yes			25/105/55	.215"	1.62	180#
	Exh 573	.575"	Yes			65/115/15	.157"	1.62	180#
615V2	In 615	.615"	Yes			28/103/58	.225"	1.62	200#
	Exh 615	.615"	Yes			59/106/25	.207"	1.62	200#
723V2*	In 723	.723"	No	Yes	.004-.008"	39/105/62	.284"	1.62	220#
	Exh 723	.723"	No	Yes	.004-.008"	75/116/25	.207"	1.62	220#
723/719V2*	In 723	.723"	No	Yes	.004-.008"	39/105/62	.284"	1.62	220+#
	Exh 444	.719"	No	Yes	.004-.008"	82/113/35	.290"	1.62	220+#
745/719V2*	In 460	.745"	No	Yes	.004-.008"	36/109/73	.279"	1.62	220+#
	Exh 444	.719"	No	Yes	.004-.008"	82/113/35	.290"	1.62	220+#
785V2*	In 485	.787"	No	Yes	.004-.008"	27/112/71	.237"	1.62	220+#
	Exh 485	.787"	No	Yes	.004-.008"	78/119/20	.190"	1.62	220+#
786V2*	In 486	.787"	No	Yes	.004-.008"	28/111/72	.219"	1.62	220+#
	Exh 486	.787"	No	Yes	.004-.008"	78/119/20	.183"	1.62	220+#

** Check the large gear on the #2 cam. If it has been welded to the shaft, install the cam in the cam cover and check for clearance between the welded area and the bushing. Increase the chamfer on the bushing if additional clearance is required.*

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10/10 Thank You for Purchasing a Zippers Performance Product!

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RED SHIFT SPORTSTER AND XB CAMS: WHAT WE DO AND WHY WE DO IT.

Replacing high-contact gears:

2000 XL/XB's use a high-contact pinion and #2 gear. 2001 and up use high-contact gears on all the cam chest components. These gears are quieter and less expensive to produce than the '91-'99 style gears, but also are not as strong as the '91-'99 style. When high-contact gears are exposed to increased RPM and valve spring pressure, gear tooth failure becomes more common. On aggressive grinds such as the Red Shift 643, we strongly recommend changing the pinion and #2 gear to the '91-'99 style gears. If the machine will see severe duty such as racing, all the gears should be changed to the '91-'99 style.

Welding the #2 gear:

Back in the '80's, Harley stopped installing a drive key on the driven gear (the big gear) on the #2 cam. Now only the press fit of the gear to the shaft prevents the gear from rotating on the shaft. High spring pressures and severe duty can cause the gear to rotate on the shaft. If the gear turns enough, valve to piston collision occurs. At the very least all the valve timing is off.

The solution is to put a small weld where the shaft meets the gear. The excess weld is then machined away. The #2 gear should always be placed in the bushing of the cam cover after this modification to check for free rotation. Increase the amount of chamfer at the edge of the bushing as needed. This can be done with a burr knife or cartridge roll sander. Zipper's recommends this for Red Shift cams 585 and larger.

Pinion shaft notes:

Since the end of the pinion shaft is not tapered, the only devices driving the pinion gear are a small key and the torque of the pinion gear nut. The factory torque spec is 35-45 ft-lbs. We recommend increasing the torque to 70 ft-lbs. Use green loctite and always properly support the end of the wrench to prevent bending of the shaft. We sell tools to hold the gear and support the shaft for this step, see below.

A second solution in this area is the use of an S&S crank and pinion shaft, as this product uses a six-spline drive for the pinion gear. This is the most expensive solution but certainly the most effective. If this method is used pay close attention to the alignment marks on the pinion shaft and gear. If this step is not observed, the valve timing can be off by any factor of sixty degrees!

No-Weld cams:

This allows final cam timing to be set by the engine builder. Many times if cams are timed in a factory cam chest and then checked in an after-market engine case, the timing can vary by several degrees. No-weld cams can be degreed during engine assembly, then welded in place. If proper welding facilities are not available at your shop, no-weld cams can be delivered to the engine builder then returned to Zipper's for final weld and lobe polish.

List of Parts and Services:

AP398200 – '91-'99 style #2 Gear

698-162 to -166 – '91-'99 style Pinion Gear (various sizes available)

416-600 – '86-'90 4 speed style new cam cores

[Zipper's cam cores use a keyed #2 gear, do

416-601 – '91-'99 5 speed style new cam cores

not require the welding step described earlier.]

758-065 – Pinion gear lock tool for 2000-up XL and Buell engines (fine pitch gear)

758-066 – Pinion gear lock tool for 91-99 XL and Buell engines (wide pitch gear)

Labor Codes:

ZM9238A – Replace #2 gear with proper type, time/weld/machine

ZM9238B – Weld/machine existing #2 gear

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