

# CRANE Gams®

Performance Motorcycle Products  
for Harley-Davidson® Motorcycles

Chris Rivas and the worlds first 200 mph bagger.  
See Chris Rivas "Rocket" Cams on  
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2013



**Crane Cams has been recognized** as a recipient of the 2012 Florida Companies to Watch award, an honor presented by the Florida Economic Gardening Institute (GrowFL) at the University of Central Florida. In its 2nd year, Florida Companies to Watch is presented by SunTrust Banks and the University of Central Florida in association with the Edward Lowe Foundation and with special support from the Florida Department of Economic Opportunity.

Florida Companies to Watch is unique because of its focus on second-stage companies and the wide-ranging industries they represent. Those second-stage companies employed nearly 2.5 million workers.



With the industry's largest camshaft database, which exceeds 80,000 grinds, an impressive manufacturing capability, and an experienced tech staff (most of whom have 15+ years service with Crane Cams), the company stands ready to provide customers with industry-leading quality products and superior service.

## Going Fast for 60 Years!



This year Crane Cams celebrates 60 years as the premier manufacturer of camshafts, valve train products, and electronic ignition systems for automotive and Harley-Davidson® motorcycle applications. Crane Cams was founded in 1953 and has grown to be an internationally respected leader in the industry. With a cadre of experienced engineers and technicians, plus newly enhanced manufacturing and R&D capabilities, Crane Cams stands ready to provide customers with technically superior, precision-made products, and excellent service.

Even though we've been "doin' it" for 60 years, we aren't sitting back and resting on our laurels. This year Crane Cams is moving ahead with several exciting products for Harley-Davidson motorcycles. The HI-4N ignition module offers up to date features and technology for older bikes. The new Chris Rivas "Rocket" signature cams, for late-model big twins, bring some new grinds, but also introduce the S&S® Easy Start compression release technology to the Crane Cams line-up. Going fast for 60 years. We've been there, and we've done that. Just watch where we go from here!



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## Some Things to Consider

Not everyone's bike or riding style is the same. Camshaft selection must be based on what you're looking for as well as the component parts and accessories being used on the motorcycle. The installation of the right cam can produce both performance and reliability. Here are the key factors to consider:

### 1. Riding Style

Is the bike for weekend use or your main form of transportation? Is the bike being used for short trips around town from light to light, or for touring long distances? What terrain do you ride? Is high performance or racing your primary concern?

### 2. Weight Of The Bike

What does it weigh? Is it light or weighted down with accessories? Do you tow a trailer or have a side-car? Do you ride solo or tandem?

### 3. Operating RPM Range

What gearing does the bike have? How many speeds to the transmission? Does the bike have international gearing? What RPM range are you most likely to be operating in?

### 4. Engine Displacement & Compression Ratio

What cubic inch is your engine and what compression ratio does it have?

### 5. Engine Modifications & Engine Accessories

To obtain the maximum potential from your bike it is important to have engine components that are compatible. The components, accessories and modifications to consider are:

- a. Air Cleaner Filter, Jetting
- b. Exhaust System
- c. Ignition System
- d. Carb Size, Style, or F.I.
- e. Compression Ratio
- f. Cylinder Head Modifications
  - i. Performance Valve Springs
  - ii. Enlarged Valve Diameters
  - iii. Porting, Polishing, Milling
- g. Aftermarket Cylinder Heads
- h. Nitrous Oxide
- i. Supercharger or Turbo

## The Heart of the Matter

An engine is a giant air pump and the more efficiently the air moves through it the more power the engine makes. The camshaft opens and closes the valves allowing the air to enter and exit. Camshafts differ in design, but the two main factors are the amount of duration and valve lift. The duration is the time the valve is open (measured in degrees of crankshaft rotation). Duration determines the RPM potential of the engine and power band. The longer the duration period the higher the RPM the power band will operate at. The lift is the distance the valve opens (it is measured in thousandths of an inch of travel). The more lift the more air/fuel mixture can enter and exit the engine, thereby producing more torque.

### Bigger Is Not Always Better

The camshaft provides an RPM power band that is approximately 3,000 RPM wide. This RPM power band can be produced in either the Lower Range (from off idle to 3,500 RPM), in the Mid Range (from 2,000 to 5,000 RPM) or in the High Range (3,500 to 6,500 RPM). Select the camshaft that will perform the best in the particular RPM band that the bike will be operating in. The amount of valve lift that the engine can accept is often determined by valve to piston clearance, valve to valve clearance, and the amount of travel the valve spring can handle before its coils touch one another and bind up. Big lift camshafts could require modified cylinder heads or pistons and performance valve springs with additional travel.

### Power vs Weight

The horsepower to weight ratio is very important. You must produce the right amount of power at the correct RPM range. A heavy bike normally needs a cam that will provide good lower RPM power (torque) to get the bike moving. Generally, a cam with less duration would work the best in a heavy bike. A lighter bike requires less low end power, therefore a cam that provides power in the higher RPM range would be better suited. But of course there are always the exceptions. A rider with a heavy dresser who rides the open highway might not care how long it takes for the bike to wind-up to speed. He likes to ride at 65 MPH and wants to pass up to 90 MPH! In this case, a cam with increased duration and RPM potential would work best.

## Balancing Compression

Generally speaking, the greater the amount of cylinder pressure the more power the engine will have. This is determined by the engine's compression ratio and the amount of duration the camshaft has. Cylinder pressure goes up with either an increase of compression ratio or a decrease in camshaft duration. Cylinder pressure goes down with either the increase of camshaft duration or the decrease of compression ratio. An excessive increase in the camshaft duration could lower the cylinder pressure causing a loss of performance. In order to counteract this effect the compression ratio of the engine would need to be increased (by milling the heads or changing the pistons) to gain back the loss in cylinder pressure.

Stock compression ratio for early Harley-Davidson® panhead and shovelhead engines was 7.0:-1 to 7.5:1. Later model Evolution® engines are around 8.5:1. Modified engines for street use can have 9.0:-1 up to 10.5:1 compression ratio depending on the circumstances. Racing applications use 11.0:1 and higher compression. Because the quality of the pump gasoline is decreasing, engines above 9.5:1 might need octane booster additives to avoid detonation and pinging.

**NOTE:** *It is important to mention here that cylinder pressure is also affected by altitude. The higher the altitude the less atmospheric pressure. This makes it more difficult for the engine to produce power. At high altitude (above 3,500 ft.) with a stock compression ratio engine, a camshaft with less duration is recommended. If a longer duration cam is selected you must raise compression.*

## When Bigger Is Better

Larger cubic inch engines work better with cams with increased duration and lift. The increase in cubic inches demands an increase of airflow. In this case the longer duration cam would be recommended. (The engine will also work better with a larger carburetor, high-flow exhaust, and cylinder head improvements.) Unlike the stock cubic inch engine that needs an increase of compression ratio with a larger duration camshaft, a large cubic inch engine will absorb the larger design cam without necessarily requiring an increase in compression. The larger cubic inch engine will also cause the larger duration camshaft to build max power at a lower RPM than is described in the catalog.

## A Perfect Match

It is important to choose component parts that will work together and enhance performance. If the bike is going to remain stock with only minor changes, a mild duration cam with a free flowing air cleaner, filter and a jetting kit is all that may be necessary. At the other extreme, with aftermarket heads, a big carburetor and large diameter exhaust pipes, a longer duration cam with big lift would be required. Superchargers, turbos or nitrous oxide systems require special consideration and perhaps a custom designed cam. Be sure that the accessories you purchase are compatible with one another to obtain the goals you desire.

## Which Crane Cam Is Right For My Bike?

### Crane FireBall® Camshafts

Crane FireBall Cams are computer designed to give reliability and power. They are manufactured to the industry's highest quality standards and are available in a variety of profiles for both street and performance applications for Evolution®, shovelhead, and panhead engines. Most FireBall grinds can be used with stock valve springs and do not require removal of the cylinder heads for machining. FireBall Cams are also competitively priced and backed by a one (1) year limited warranty.

### Crane Hi-Roller Cams

Crane Hi-Roller Cams are computer designed for bikes with more performance engine modifications. Hi-Roller Cams are specially designed to take full advantage of performance modifications. Hi-Roller cams come with our unique Multi-Index Cam Gear. This gear features three separate keyway positions which allows the cam to be advanced or retarded by four degrees. The cam gear can be removed and repositioned. If moved to the advanced keyway the power range will come on approximately 300 RPM sooner, building better bottom end power. If the gear is repositioned to the retarded keyway, the power range moves up approximately 300 RPM higher, for better top end power. Some Hi-Roller Cams require removal of the heads to install performance valve springs and to be checked for and to provide proper retainer to guide, piston to valve, and valve to valve clearances. All Hi-Roller Cams are made to the industry's highest standards and backed by a one (1) year limited warranty.

# Cams for Twin-Cam 88<sup>®</sup> (except 2006 Dyna<sup>®</sup>)

## Products for Twin-Cam 88<sup>®</sup> & 96<sup>™</sup> Engines (1999–up)

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**Camshaft Cross Reference Chart for Twin-Cam 88<sup>®</sup> & 96<sup>™</sup>**

Crane Cams <sup>®</sup> Part Number	Crane Cams <sup>®</sup> Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C
1-3000	HTC-300-2	226°	236°	.505"	.505"	13°/33°	42°/14°
1-3001, 1-3006GD 1-6001, 1-6006GD	HTC-310-2	236°	242°	.505"	.505"	20°/36°	47°/15°
1-3002, 1-3007GD 1-6002, 1-6007GD	HTC-316-2	242°	252°	.505"	.505"	19°/43°	48°/24°
1-3003, 1-3008GD 1-6003, 1-6008GD	HTC-290-2	240°	248°	.570"	.570"	18°/42°	46°/22°
1-6011	HTC-302-2	226°	252°	.585"	.585"	13°/33°	50°/22°
1-3005, 1-3010GD 1-6005, 1-6010GD	HTC-296-2	246°	254°	.619"	.619"	20°/46°	52°/22°
1-3004, 1-3009GD 1-6004, 1-6009GD	HTC-304-2	254°	260°	.600"	.600"	25°/49°	56°/24°
Crane Cams <sup>®</sup> Equivalent Part Number	Andrews <sup>®</sup> Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C
1-3000	TW21	220°	228°	.498"	.498"	10°/30°	40°/08°
	TW26A	226°	230°	.490"	.490"	11°/35°	41°/09°
1-3001	TW37B	236°	240°	.510"	.510"	14°/42°	48°/12°
1-3002	TW44	242°	246°	.495"	.495"	21°/41°	49°/17°
1-3003, 1-3005	TW55	248°	252°	.550"	.550"	22°/46°	52°/20°
1-3004	TW60A	260°	260°	.560"	.560"	24°/56°	58°/22°
1-6000	26H	226°	230°	.490"	.490"	11°/35°	41°/09°
1-6001	37H	236°	240°	.510"	.510"	14°/42°	48°/12°
1-6002	44H	242°	246°	.495"	.495"	21°/41°	49°/17°
	50H	248°	252°	.510"	.510"	20°/48°	54°/18°
1-6003, 1-6005	55H	248°	252°	.550"	.550"	22°/46°	52°/20°
1-6004	60H	260°	260°	.560"	.560"	24°/56°	58°/22°
Stock Harley-Davidson <sup>®</sup> Cams (for comparison) — Stock Cam Specifications							
Carbureted		216°	220°	.473"	.473"	-02°/38°	36°/04°
Fuel Injection		216°	220°	.473"	.473"	02°/34°	36°/04°

## Cams & Valve Train

for Twin-Cam 88® Engines (except 2006 Dyna®)



- Crane Cams' explosive dyno proven **HP, torque, RPM, and reliability** available for 1999–'06 Twin-Cam 88®, except 2006 Dyna®.
- Six computer designed hydraulic cams available for mild street cruising to killer race engine build-ups!
- Lobe-to-lobe cam profile accuracy for **off-idle torque** to **high-RPM horsepower!**
- A complete selection of performance/race valve springs, keepers, retainers, and pushrods, including our Time-Saver pushrods—**the strongest available!**

### Special Grinds Available!

We offer many cam lobe profiles that available space does not allow us to list in this catalog. Typical uses are unusual cylinder heads, extreme engine modifications, supercharging or exotic fuels such as nitromethane, and serious race-only applications. If your bike requires a non-cataloged cam grind contact our Motorcycle Tech Department 866-388-5120, Mon.–Fri., 8:00A.M. to 5:00P.M. for a personal cam recommendation. Be sure to have all technical information on your bike, engine, etc., available before you place your call.

# Cams for Twin-Cam 88® (except 2006 Dyna®)



## For 1999-'06 Harley-Davidson® Twin-Cam 88® (except 2006 Dyna®)

Part #/ Grind #	Description - Sets of Two	Duration at .053"		Gross Valve Lift		Gross Valve Lift @ TDC	
		Intake Open/Close	Exhaust Open/Close	1.65:1 Rocker Ratio		1.65:1 Rocker Ratio	
				Intake	Exhaust	Intake	Exhaust
<b>1-3000</b> <i>HTC-300-2</i>	<b>Mild-Street, Cruising, Touring</b> Bolt-in cam, low-end torque and mid-range HP. Good for heavy bikes. Stock comp. ratio. Best power w/perf. air cleaner, free-flow exhaust. Uses stock v/springs. Range: Idle to 5,000 RPM	<b>226°</b> 13°/33°	<b>236°</b> 42°/14°	.505"	.505"	.147"	.152"
<b>1-3001</b> <i>HTC-310-2</i>  <b>1-3006GD</b>	<b>Moderate Street, Cruising</b> Bolt-in, mild perf. for Dyna®, Softail®, or single riders. Stock comp. ratio or up to 9.5:1. Best power w/perf. air cleaner and free-flow exhaust. Uses stock v/springs. Range: 1,500 to 5,500 RPM	<b>236°</b> 20°/36°	<b>242°</b> 47°/15°	.505"	.505"	.185"	.157"
<b>1-3002</b> <i>HTC-316-2</i>  <b>1-3007GD</b>	<b>Street Performance, Some Engine Modifications</b> Bolt-in, okay w/stock comp. but works best with up to 10:1 c/r. Best power w/perf. air cleaner and free-flow exhaust. Uses stock v/springs. Range: 1,800 to 5,800 RPM	<b>242°</b> 19°/43°	<b>252°</b> 48°/24°	.505"	.505"	.178"	.205"
<b>1-3003</b> <i>HTC-290-2</i>  <b>1-3008GD</b>	<b>Hot Street Performance, Modified</b> Okay w/stock cubic inch or big-bore kits (95 c.i.). Best power w/ incr. comp. ratio, 9.5:1-up, head mods. Must use Crane v/springs, clearanced for .570" lift. Great low-end and mid-range torque w/ added upper RPM power. Must use perf. air cleaner and free-flow exhaust. Range: 1,800 to 5,800 RPM	<b>240°</b> 18°/42°	<b>248°</b> 46°/22°	.570"	.570"	.173"	.198"
<b>1-3005</b> <i>HTC-296-2</i>  <b>1-3010GD</b>	<b>Hot Street Performance, Modified</b> For modified engines with 10.25:1-up compression, big bore kits, head mods. Must use Crane valve springs, clearanced for .600" lift. Must use perf. air cleaner and exhaust. Designed for use with Edelbrock® Performer RPM heads for Twin-Cam 88®. Range: 2,000 to 6,000 RPM	<b>246°</b> 20°/46°	<b>254°</b> 52°/22°	.619"	.619"	.188"	.193"
<b>1-3004</b> <i>HTC-304-2</i>  <b>1-3009GD</b>	<b>Max Hot Street, Modified</b> For modified engines. Higher comp., 10.5:1-up, big-bore kits, head mods, etc. Must use Crane v/springs., clearanced for .600" lift. Strong mid-range torque with upper RPM power. Must use perf. air cleaner and free-flow exhaust. Range: 2,000 to 6,200 RPM	<b>254°</b> 25°/49°	<b>260°</b> 56°/24°	.600"	.600"	.211"	.206"

### NOTES:

Part numbers with GD suffix are gear drive cams for use with S&S gear drive. Twin Cam 88® is a registered trademark of Harley-Davidson® Engine Company. All cams are made for splined cam sprocket, 2000 models & later can use stock gear & bolt assembly. Use rear cam roller bearing assembly Harley Davidson® #8983.

## Optional Accessories

Rocker Arms — See Page 11	Pushrods — See Page 12 & 13	Spring Kits — See Page 14	Ignitions — See Pages 16–17
4-1016, 4-1021	4-0021, 4-0031	5-1102, 5-1002, 5-1101, 5-1001	8-3170, 8-3180

## HTC-302-2 Bolt-In Performance Cams for Twin-Cam 96™ Engines



- Bolt-In .585 Lift—*No Head Modifications*
- Economical Chain Drive—*Retain Stock Drive Components*
- 96 to 110 Cubic Inch at 10.0:1 to 10.5:1 Compression
- Great Midrange Torque and Improved Horsepower
- 2007–'11 Harley-Davidson® Big Twins

### For 2007–Up Harley-Davidson® Twin-Cam 96™ & 2006 Dyna® Models

Part #/ Grind #	Description—Sets of Two	Duration at .053"		Gross Valve Lift 1.65:1 Rocker Ratio		Gross Valve Lift @ TDC 1.65:1 Rocker Ratio	
		Intake Open/Close	Exhaust Open/Close	Intake	Exhaust	Intake	Exhaust
1-6000 HTC-300-2	<b>Mild-Street, Cruising, Touring</b> Bolt-in cam, low-end torque and mid-range HP. Good for heavy bikes. Stock comp. ratio. Best power w/perf. air cleaner, free-flow exhaust. Uses stock v/springs. Range: Idle to 5,000 RPM	226° 13°/33°	236° 42°/14°	.505"	.505"	.147"	.152"
1-6011 HTC-302-2	<b>Street Performance, Stock &amp; Engines w/ Increased Displacement</b> Bolt-in cam, increases mid-range and top end HP. Works best for stock engines and big bore kits up to 10.5:1 compression. Retains use of stock valve springs and pushrods for economical installation. Range: Idle to 5,500 RPM	226° 13°/33°	252° 50°/22°	.585"	.585"	.060"	.118"
1-6001 HTC-310-2 1-6006GD	<b>Moderate Street, Cruising</b> Bolt-in, mild perf. for Dyna®, Softail®, or single riders. Stock comp. ratio or up to 9.5:1. Best power w/perf. air cleaner and free-flow exhaust. Uses stock v/springs. Range: 1,500 to 5,500 RPM	236° 20°/36°	242° 47°/15°	.505"	.505"	.185"	.157"
1-6002 HTC-316-2 1-6007GD	<b>Street Performance, Some Engine Modifications</b> Bolt-in, okay w/stock comp. but works best with up to 10:1 c/r. Best power w/perf. air cleaner and free-flow exhaust. Uses stock v/springs. Range: 1,800 to 5,800 RPM	242° 19°/43°	252° 48°/24°	.505"	.505"	.178"	.205"
1-6003 HTC-290-2 1-6008GD	<b>Hot Street Performance, Modified</b> Okay w/stock cubic inch or big-bore kits (95 c.i.). Best power w/incr. comp. ratio, 9.5:1-up, head mods. Must use Crane v/springs, cleared for .570" lift. Great low-end and mid-range torque w/added upper RPM power. Must use perf. air cleaner and free-flow exhaust. Range: 1,800 to 5,800 RPM	240° 18°/42°	248° 46°/22°	.570"	.570"	.173"	.198"
1-6005 HTC-296-2 1-6010GD	<b>Hot Street Performance, Modified</b> For modified engines with 10.25:1-up compression, big bore kits, head mods. Must use Crane valve springs, cleared for .600" lift. Must use perf. air cleaner and exhaust. Designed for use with Edelbrock® Performer RPM heads for Twin-Cam 96™. Range: 2,000 to 6,000 RPM	246° 20°/46°	254° 52°/22°	.619"	.619"	.188"	.193"
1-6004 HTC-304-2 1-6009GD	<b>Max Hot Street, Modified</b> For modified engines. Higher comp., 10.5:1-up, big-bore kits, head mods, etc. Must use Crane valve springs., cleared for .600" lift. Strong mid-range torque with upper RPM power. Must use perf. air cleaner and free-flow exhaust. Range: 2,000 to 6,200 RPM	254° 25°/49°	260° 56°/24°	.600"	.600"	.211"	.206"

**NOTES:** Part numbers with GD suffix are gear drive cams for use with S&S gear drive. Camshafts on all 2007–up Twin-Cam 96™ and 2006 Dyna® models use roller chain drives instead of silent chains. Camshafts made for 1999–'05 engines will not fit the '06 Dyna models or new 2007–up Twin-Cam 96 engines.

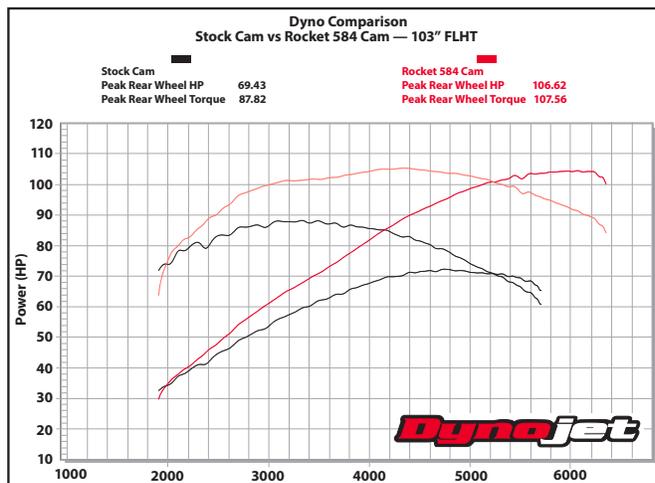
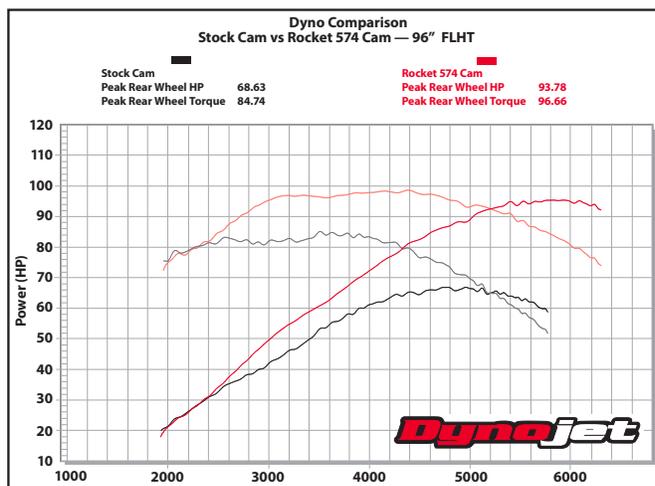
Twin-Cam 88® & 96™

## Chris Rivas Signature Series Rocket Cams

If you're looking for someone to make your bike go fast, you want to find the guy who knows how it's done. You want someone who has proven that they have the expertise to make their own bike a winner. That's why Crane Cams teamed up with Chris "Rocket" Rivas of Chris Rivas V-Twin in Fresno, California to design some new cams for late model 2007 and later Harley-Davidson® big twins.

Chris and the team at Crane came up with some new cams that will wake up just about any engine. The Rocket 574 is a .574" lift bolt-in cam set for stock or big bore engines with stock heads. The Rocket 584 cams are intended for larger engines with ported heads, but the moderate .584" lift makes it compatible with stock valve springs. The Chris Rivas Signature Series Rocket cams feature a distinctive black oxide finish and the patented S&S® Easy Start\* centrifugal compression release system.

As with all cam changes, a performance intake, exhaust system, and EFI tuning are a must to get the full benefit from the cams.



Top, Rocket 574 (red) gained 25hp over the stock 96" FLHT engine. Bottom, Rocket 584 (red) gained 37hp over the stock 103" FLHT engine. The 103" engine (bottom) also used CNC ported heads with a 10.5:1 compression ratio.

All runs were performed at Crane Cams on a Dynojet® 250i in 5<sup>th</sup> gear.

\*Easy Start compression release system licensed by S&S® Cycle, Inc.



Crane Cams' Chris Rivas Signature Series camshafts, for late model Harley-Davidson® big twins, feature a black oxide finish and the Easy Start centrifugal compression release system licensed by S&S® Cycle for easy starting even with large displacement and higher compression ratios.

Twin-Cam 88<sup>®</sup> & 96<sup>™</sup>

Chris Rivas Signature Series Rocket Camshafts		
Cam Name (Grind #)	Description	Part Number
Rocket 574 (HTC-248-R)	Powerful Street and Cruising bolt-in cam with .574" lift. 96" to 107" above average mid range power. Stock compression ratio or up to 9.5:1. Best power with free-flow air cleaner and performance exhaust. Uses stock valve springs. Range: 1,500 to 5,800 RPM	1-6012
Rocket 584 (HTC-298)	Hot .584" lift cam for upgraded engines 103" to 107" Cubic Inch. Ported heads with minimum 10:1 compression recommended. Delivers constant power while reducing detonation. Free-flowing air cleaner and performance exhaust recommended. Uses stock valve springs. Range: 2,000 to 6,000 RPM	1-6013

Specs											
Part Number	Grind Number	Intake					Exhaust				
		Open	Close	Duration	Max lift	TDC lift	Open	Close	Duration	Max lift	TDC lift
1-6012	HTC-284-R	25.1	38.5	240	0.574	0.122	53.5	16.5	250	0.574	0.101
1-6013	HTC-298	23.5	46.5	250	0.582	0.150	47.5	22.5	250	0.582	0.134

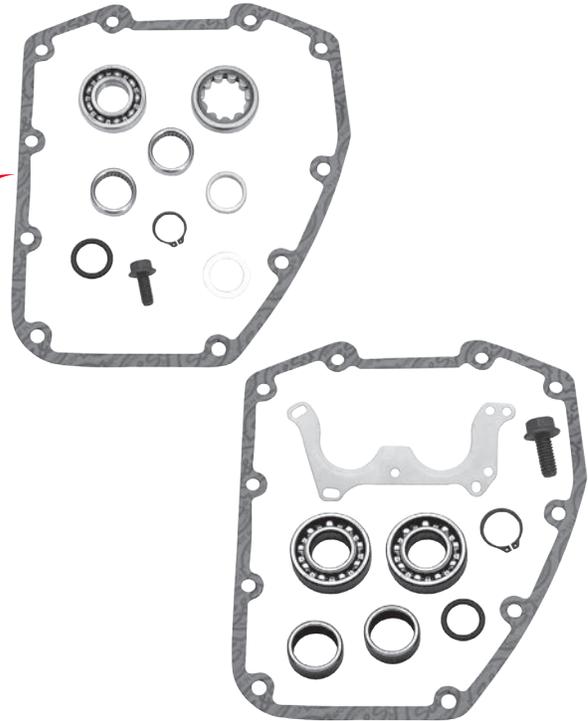
Performance Motorcycle Products

# Camshaft Installation Kits

## Installation Kit

Camshaft installation kits are a new product for Crane Cams, and they include the basic parts needed to install a cam kit. Of course you need a cam cover gasket, but an important item that is often overlooked is a new inner cam bearing. And not just any inner cam bearing! Crane only offers “full complement” inner cam bearings that contain more rollers than stock cam bearings. The increased load capacity is a must for handling the added stresses of high lift cams and high performance valve springs. These installation kits are a great item to have around the shop, so why not order a few extras?

Instalation Kit	
Part Number	Application
7-2001	1999-’06 Big twin (except ’06 Dyna®) Chain Drive
7-2002	1999-’06 Big twin (except ’06 Dyna®) Gear Drive
7-2003	2006-12 Big twin Chain Drive
7-2004	2007-’12 Big twin Gear Drive



## Bushing Style Roller Tip Rocker Arms

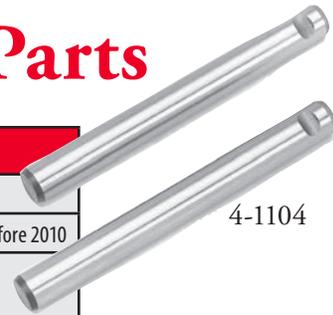


Crane roller tip rocker arms have a bushing fulcrum for long term performance and reliability. These rocker arms use the original equipment rocker arm shafts. Made from 8620 alloy steel, precision forged for greater strength, truer rocker arm ratio, and improved rocker geometry. Also our exclusive oil metering system fully lubricates the fulcrum and roller tip for cooler, smoother operation. These rocker arms fit with no machining, making them easy to install. This kit contains four premium rocker arms that install on your original rocker shafts.

Bushing Roller Tip Rocker Arms	
Part Number	Application
4-1016	1999–up Twin-Cam 88 <sup>®</sup> & 96 <sup>™</sup> stock ratio
4-1021	1.725:1 ratio (*See <i>techtips</i> below)

## Component Replacement Parts

Component Replacement Parts	
Part Number	Description
4-1100	Front roller kit (kit of four) will fit both needle and bushing style cast rockers, manufactured before 2010
4-1120	Rocker arm rebuild kit, will fit bushing style forged rockers, manufactured after 2010, includes bushings (not pictured)
4-1104	Rocker arm shafts (kit of two) for all the bushing style roller rockers and needle bearing cast rocker arms produced between late 1995–'08
4-1108	Rocker arm shaft for all bushing style rocker arms, set of two



## techtips

The installation of roller tip rocker arms will reduce the friction in the valve train. The roller tip reduces scuffing across the valve stem while the rocker arm is pushing the valve open. When the friction in the valve train is reduced, quicker acceleration rates can be obtained; power losses due to friction are reduced.

**Important Note:** We made a dimensional change to the needle bearings and shafts in rocker arms made after late 1995. These rocker arms are identified by the symbol “X” in the manufacturing code etched into the body of each rocker arm. Needle bearing rocker arms for the Evolution<sup>®</sup> engine with this code, must use rocker arm shafts **Part No. 4-1104**, if the rocker arms are reconditioned or serviced. (Rocker arms before late 1995 used a stepped shaft with a diameter of .5530"/.5525" on the ends, and .5505"/.5500" diameter in the middle. Rocker arms made after late 1995 use a straight shaft that is one diameter .5530"/.5525".)

### \*More HP with Longer-Ratio Rockers!

Increasing rocker arm ratio (Stock rockers are 1.625 ratio. Our **Part No. 4-1021** rockers are 1.725!) actually increases the lift at the valve without having to change the camshaft. This typically adds .030" to .035" valve lift to the engine, depending on the lobe lift of the camshaft. Using longer-ratio rockers typically increases engine torque and HP in the mid range, a plus for street bikes. After you install longer-ratio rockers be sure to check that your engine has adequate (minimum .040") piston-to-valve clearance before running the engine.

## Adjustable Chromoly Pushrods

- High-strength, seamless, aircraft quality, 4130 alloy chromoly steel tubing!
- Maximum strength and durability—*even with extreme spring pressures!*
- Heavy-wall, high strength tubing reduces pushrod flex and deflection!
- 3/8" diameter tubing for pushrod tube clearance!
- Precision-machined steel ends and adjusters are heat treated and hardened for strength and resistance to wear!
- Fits all Harley-Davidson<sup>®</sup> Twin-Cam 88<sup>®</sup> and 96<sup>™</sup> engines!
- Rocker covers must be removed for installation



### Adjustable Chromoly Pushrods

Part Number	Application
4-0021	All Twin-Cam 88 <sup>®</sup> & 96 <sup>™</sup> engines, set of four

## techtips

For adjustment of the pushrods, rotate the engine until the tappet is at its lowest position in the lifter block. This will assure that the tappet is on the base circle of the camshaft. Extend the pushrod until the pushrod end just touches the pushrod seat in the lifter. At this point the pushrod will have a slight drag while you rotate it. This point is called zero lash. Make a reference mark on the adjuster and extend the pushrod three turns past zero lash. Tighten the locknut.

# Time-Saver Adjustable Pushrods

- No need to remove rocker covers to install
- Made from 7/16" diameter, aircraft grade, 4130 alloy, seamless chromoly steel tubing—***strongest pushrods available!***
- Chromoly, steel tubing eliminates excessive pushrod flex, which can rob you of true cam lift and horsepower (Beware of cheap imitators!)
- Ends are 40% larger than our competitor's
- Female ends are press-fit and then high-temp silver brazed, others use only press-fit
- Adjust from 8.750" to 10.750", allows removal of lifters, lifter covers up to 75% quicker—***speeds up installation of cams and rockers arms and makes upper-engine work easy!***
- Can be installed with ***stock pushrod tubes***



## Timesaver Adjustable Pushrods

Part Number	Application
4-0031	1999–up Twin Cam 88 <sup>®</sup> and 96 <sup>™</sup> engines, set of four

# Hydraulic Roller Tappets

- Super strong steel billet body, CNC machined for strength and durability
- Specially designed for today's heavier valve springs, operates quietly

## Hydraulic Roller Tappets

Part Number	Application
3-2200	1999–up Twin-Cam 88 <sup>®</sup> engines and 2000–up Sportster <sup>®</sup> models and Buell <sup>®</sup>



Twin-Cam 88<sup>®</sup> & 96<sup>™</sup>

# Cylinder Head Components for Twin Cam 88® & 96™

Our valve springs are manufactured from the finest quality spring wire and precision wound. The highest quality and reliability is assured with rigid quality control procedures.

The chromoly 4140 steel retainers are the strongest and most durable steel retainers offered. They also eliminate inaccurate assembly heights and retainers that pull through with lesser quality steel retainers.

Our titanium retainers reduce weight and add strength to a performance valve train assembly. The reduced weight of a titanium retainer allows the valve to move more easily and will require less spring pressure to operate. This makes your engine rev quicker and will produce more power.



## 1999–2004 Twin-Cam 88® & 96™ Valve Spring and Retainer Kit Specifications (see techtips)

Part Number	Nominal Diameter		Description	Application	Seat Pressure and Installed Height	Nominal Open Pressure and Height	Coil Bind Height
	Inside	Outside					
5-1102	.800	1.460	Steel	Springs (155#) and steel retainers	155# @ 1.800	352# @ 1.280	1.080
5-1002	.800	1.460	Titanium	Springs (155#) and titanium retainers	155# @ 1.800	352# @ 1.280	1.080
5-1101	.800	1.460	Steel	Springs (175#) and steel retainers	175# @ 1.700	394# @ 1.180	1.080
5-1001	.800	1.460	Titanium	Springs (175#) and titanium retainers	175# @ 1.700	394# @ 1.180	1.080

## Premium Valve Spring Only

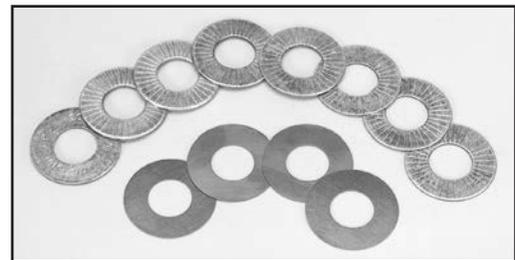
Part Number	Nominal Diameter		Description	Application	Seat Pressure and Installed Height	Nominal Open Pressure and Height	Coil Bind Height
	Inside	Outside					
5-0002*	.800	1.460	Premium quality spring wire	Premium valve springs for performance and racing applications. For use with up to .650" valve lift.	180-185# @ 1.800	480-485# @ 1.150	1.080

\*Springs Only. Use Part No. 5-1005 or 5-1103 retainers and keeper kit.

**NOTE:** All kits contain valve springs, retainers (upper collar), lower collars, and valve locks.

## Valve Spring Shims

Part Number	Description	Application
5-1200	Shims	1999–'04 Twin-Cam 88® (set of 12)



**NOTE:** Shims supplied four each .015", .030", & .060" thickness, with 1.480" O.D. and .703" I.D.

## Lower Spring Seat, Retainer, and Valve Keeper Kits

Part Number	Description
5-1005**	Lower spring seat, titanium retainer and valve keeper kit
5-1103**	Lower spring seat, steel retainer and valve keeper kit

\*\*For use with 5-0002 valve spring kit.

Our machined steel valve keepers (also known as "Valve Collar Retainers") are precision machined and carefully heat-treated hardened. These race-quality locks are far superior to stock stamped steel keepers, **with nearly twice the shear strength!**

## Crane Cams Machined Steel Keepers

Part Number	Description	Application
5-1300	Keepers	155 lbs. spring pressure (1.800" height) *Included in kit #5-1102, 5-1002
5-1301	Keepers	175 lbs. spring pressure (1.700" height) *Included in kit #5-1101, 5-1001



**NOTE:** Crane keepers can only be used with Crane retainers.

## Teflon® Valve Seals

Part Number	Description	Application
99822-4	Stock replacement seals (No machining required). (Set of four.) For 3/16" stem diameter, .415" guide O.D. and has .500" seal O.D.	1999–up Twin-Cam 88®
99824-4	Requires machining. For full size aftermarket guides (Set of four.) For 3/16" stem diameter, .531" guide O.D. and has .620" seal O.D.	1999–up Twin-Cam 88®



# techtips

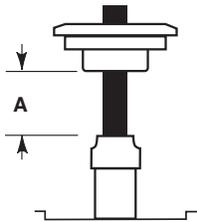
**NOTE:** 2004–later XL and 2005–later big twin models have 7mm valves and beehive springs. Crane springs can be used on these heads when changing to earlier style valves, guides and seals such as those used in Evolution® and 1999–’04 Twin Cam 88®.

Be sure to check the valve to valve clearance when installing any performance camshaft that may affect the lift and the duration at the valve. The minimum clearance that we recommend for the closest point of contact is .060".

The valve spring retainer to valve guide clearance should always be checked when installing a camshaft that increases the lift of the valve. The minimum recommended clearance is .060".

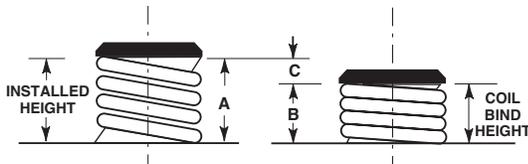
All of our spring and retainer kits for the Twin-Cam 88® engine come with the special Crane Super Duty style valve keepers. These keepers have an extra thick wall section and can only be used with our matching retainers.

Our valve keepers 5-1300 and 5-1301 are designed for two different valve spring installed heights, thereby affecting valve spring tension. (These keepers can only be used with our retainers.)

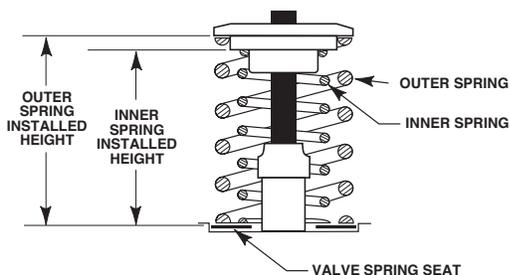


The valve spring retainer to oil seal travel (distance “A”) must be .060" greater than full lift of the valve. This will avoid mechanical interference during normal operating conditions.

Spring travel can be determined by subtracting the coil bind height (B) from the installed height (A). The difference “C” is the spring travel. This must always be at least .060" greater than full lift of the valve to avoid coil bind.



The installed height of the spring determines the valve spring pressure. Valve springs with the same recommended installed height should consistently produce equal pressure. You should always check the installed height of any spring and retainer combination to assure that the height is proper.



Twin-Cam 88® & 96™

# Ignition Systems For Twin Cam 88<sup>®</sup> & 96<sup>™</sup>

## For 1999-'06 Harley-Davidson<sup>®</sup> Twin-Cam 88<sup>®</sup> Only

Ignition	Single-Fire	Dual-Fire	Multi-Spark	Kickstart Mode	Controls	Advance	Recommended Coil Impedance
HI-4TC 1999-'03	Yes	No	Yes	No	BCD rotary switches for Mode, Rear Cylinder Offset, Initial Timing, Advance, and Rev Limit,	Full Electronic	2Ω to 3Ω
HI-4TC 2004-'06	Yes	No	No	No	BCD rotary switches for Initial Timing, Advance, and Rev Limit	Full Electronic	2Ω to 3Ω

## HI-4TC Performance Ignition for 1999-'03 Harley-Davidson<sup>®</sup> Twin-Cam 88<sup>®</sup> Engines (Carbureted)

**Crane FireBall<sup>®</sup> HI-4TC Performance Ignition (Part No. 8-3170)** for Twin-Cam 88<sup>®</sup>, 1999-'03, carbureted engines. The same performance and absolute reliability of FireBall<sup>®</sup> HI-4 and FireBall HI-4E, the world's favorite!

**Easy to install!** Mounts in place of the stock module with plug-in installation.

**True Single-Fire!** Crankshaft position sensor is used to establish accurate firing. Rear cylinder timing can be offset from -5° to +4°. Initial timing is set from -5° to +4°, both via easily adjusted, rotary switch.

**Ten advance curve families!** Easily selected via rotary switch. Lets you select the exact advance curve you want for factory-stock to wildly modified engines for maximum horsepower, torque, and reliability!

**Full multi-spark performance!** Up to nine sparks at idle, three sparks up to 6,000 RPM!

**Easier starting, hot or cold,** plus better low-speed drivability and off-idle response! Stops plug fouling and lean-surge!

**Built-In, digitally set rev-limiter!** Easily adjustable via rotary switches! Adjustable from 1,500 to 9,900 RPM, in 100 RPM increments. Sequential rev limiter eliminates popping and banging at rev-limit.

**Improved hot-starting!** Designed to start on the first revolution, even when hot, saving your starter and battery!

**Low-profile, black anodized, aluminum housing!** Looks great while it dissipates heat build-up for added longevity!

**Works with stock security system!** Lets you retain your stock security system for added protection!

**Bank Angle Sensor!** Maintains stock functions.



### HI-4TC Ignition for 1999-'06

Part Number	Application
8-3170	HI-4TC performance ignition (for 1999-'03 Harley-Davidson <sup>®</sup> Twin-Cam 88 <sup>®</sup> engines, carbureted)

# HI-4TC Ignition

for 2004-'06 Harley-Davidson® Twin-Cam 88® Engines (Carbureted)

- Wide timing advance adjustment range accommodates stock to highly modified engine.
- Digitally set RPM limit (100 RPM increments from 1,500 to 9,900 RPM)
- Full support for J1850 data bus used for communications with instrument cluster and turn signal/security module (TSM/TSSM)
- Compatible with Harley-Davidson® scan tool.
- Built-in data logging. Stores last 30 minutes of engine operation.

HI-4TC Ignition fo 2004-06	
Part Number	Application
8-3180	For 2004-'06 Harley-Davidson® Twin-Cam 88® engines, carbureted



Twin-Cam 88<sup>®</sup> & 96<sup>™</sup>

## Ignition Systems For Twin Cam 88<sup>®</sup> & 96<sup>™</sup>

# Single-Fire Performance Coil

for Most 1999–'06 Engines (Carbureted)



### Single-Fire Performance Coil

Part Number	Application
8-3010 Replaces H-D <sup>®</sup> #31655-99	1999–'06 Twin-Cam 88 <sup>®</sup> carbureted engines

## Firewire<sup>®</sup> Double Silicone Plug Wires

# FireWire<sup>®</sup> Spark Plug Wires

**Double Silicone Jacket, Reactive-Core Design Delivers Max-Spark Energy!**

- The ultimate 8.0 spark plug wires for all-out racing or serious street performance.
- Pure silicone, double jacketed, reactive core specifically engineered for high output competition ignition systems!
- Unique Reactive Core goes beyond suppression and actually filters out radio frequency interference (RFI) and electromagnetic interference (EMI).
- Large 8.0MM size with double silicone layer for protection from extreme temperatures!
- Easily installed universal kit allows you to tailor wires to fit your engine!



### FireWire<sup>®</sup> Race Plug Wires

Part Number	Application
8-5009	8.0MM FireWire <sup>®</sup> race plug wires, universal set, 1999–up Twin-Cam 88 <sup>®</sup> & 96 <sup>™</sup> engines

All reference to Harley-Davidson<sup>®</sup> part numbers is for identification purposes only. We in no way are implying that any of Crane Cams<sup>®</sup> products are original equipment parts or that they are equivalent to the corresponding Harley-Davidson part number shown..

**Performance Motorcycle Products**



# Products for Evolution® Engines (1984-'99)

Hi-Roller Cams ..... 20  
 FireBall® Cams..... 22  
 Rocker Arms ..... 24  
 Pushrods and Tappet Roller Kits ..... 26  
 Cylinder Head Components ..... 28  
 Ignition Systems ..... 30  
 Ignition Accessories ..... 34  
 FireWire® Spark Plug Wires..... 35

Camshaft Cross Reference Chart for Evolution®							
Crane Cams® Part Number	Crane Cams® Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C
1-1100	FB300-2B	226°	236°	.490"	.490"	12°/34°	41°/15°
1-1103	FB310-2	236°	242°	.490"	.490"	19°/37°	46°/16°
1-1004	*H290-2	240°	248°	.581"	.581"	17°/43°	45°/23°
1-1101	FB316-2B	242°	252°	.490"	.490"	19°/43°	48°/24°
1-1000	*H286-2B	242°	252°	.490"	.490"	19°/43°	48°/24°
1-1102	FB326-2	252°	262°	.490"	.500"	23°/49°	56°/26°
1-1001	*H296-2	252°	262°	.490"	.500"	23°/49°	56°/26°
1-1005	*H304-2	254°	260°	.600"	.600"	24°/50°	55°/25°
1-1006	*H314-2	260°	266°	.600"	.600"	26°/54°	65°/21°
1-1002	*H306-2	262°	272°	.500"	.510"	28°/54°	69°/23°
1-1003	*H310-2	266°	276°	.550"	.550"	23°/63°	68°/28°
Crane Cams Equivalent Part Number	Andrews Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C
1-1100	EV13	226°	238°	.485"	.495"	15°/31°	45°/13°
1-1103	EV27	236°	240°	.495"	.495"	20°/36°	44°/16°
	EV3	238°	238°	.495"	.495"	21°/37°	43°/15°
1-1101	EV38	238°	252°	.495"	.500"	21°/37°	52°/20°
1-1000	EV38	238°	252°	.495"	.500"	21°/37°	52°/20°
1-1102	EV5	252°	252°	.530"	.530"	28°/44°	52°/20°
1-1101	EV51	252°	256°	.510"	.510"	28°/44°	54°/22°
1-1005	EV57	252°	266°	.530"	.560"	26°/46°	59°/27°
	EV59	256°	260°	.560"	.560"	28°/48°	56°/24°
1-1006	EV7	266°	266°	.560"	.560"	31°/55°	59°/27°
1-1002	EV79	266°	276°	.560"	.550"	31°/55°	64°/32°
1-1003	EV9	276°	276°	.550"	.550"	36°/60°	64°/32°

**NOTE:** See catalog pages 20-22 for details and year application of Crane Cams®.  
 \*Indicates Crane Hi-Roller series cams with multi-index cam gear.

Evolution®

# Hi-Roller Series Cams for Evolution®

## Three Cams For The Price Of One!

With our multi-index cam gears you have the versatility of three cam timing settings with one camshaft. One position gives 4° advance to original cam timing and another position is 4° retarded to the original timing. Overall, an 8° timing range is available with the HI-Roller Crane camshafts for your big twin.

### What does a change of a cam timing do?

An advance in cam timing will lower the power band of the engine, while retarding the cam will raise the power band. Of course the amount of change will vary depending on other engine components. Generally we're talking about a two or three hundred RPM power band change each way.

### How can it help tune the engine?

Different applications of an engine may require a change in RPM ranges. More cam advance will add torque for low end performance for touring or heavy machines. For race applications, raising or lowering the power band may be needed to obtain better low end torque or high end speed.

## For 1984–Up Harley-Davidson® Evolution® Big Twin

Part #/ Grind #	Description	Duration at .053"		Gross Valve Lift 1.6:1 Rocker Ratio		Gross Valve Lift @ TDC 1.6:1 Rocker Ratio	
		Intake Open/ Close	Exhaust Open/ Close	Intake	Exhaust	Intake	Exhaust
<b>1-1004</b> <i>Hi-Roller</i> <i>H290-2</i>	<b>Hydraulic Performance Cam</b> Designed for stock cubic inch Evolution® models that have increased compression and/or performance head work. Must have the heads clearanced for .581" lift. Will produce strong low and mid range power with appropriate intake, heads and exhaust. Up to 88 cu. in. Basic RPM depends on the combination, approximately 1800-5800 RPM.	<b>240°</b> 17°/43°	<b>248°</b> 45°/23°	.581"	.581"	.166"	.192"
<b>1-1000</b> <i>Hi-Roller</i> <i>H286-2B</i>	<b>Hydraulic Bolt-In</b> Designed for speed or touring. Works well with engine modifications. Can be used with stock compression for touring. Works best with 9.5:1 compression ratio. Does not require valve spring change. Early Evolution® models that do not have notched pistons must be checked for valve to piston clearance. Basic RPM 2000-5800.	<b>242°</b> 19°/43°	<b>252°</b> 48°/24°	.490"	.490"	.176"	.203"
<b>1-1001</b> <i>Hi-Roller</i> <i>H296-2</i>	<b>Hydraulic Performance Cam</b> Mid range and upper RPM improvement. Works best with 10:1 compression ratio and performance carb and exhaust. Excellent for modified touring bikes. May require valve spring change. Check all clearances. Basic RPM 2500-6000.	<b>252°</b> 23°/49°	<b>262°</b> 56°/26°	.490"	.500"	.198"	.206"
<b>1-1005</b> <i>Hi-Roller</i> <i>H304-2</i>	<b>Hydraulic Performance Cam</b> Designed for higher compression and/or increased cubic inch Evolution® models that have performance heads. Clearancing and valve spring change required for .600" lift. Will produce strong mid range power in a stock cubic inch bike or a broad range in larger cubic inch bikes. Basic RPM depends on the combination, approximately 2500-6200 RPM.	<b>254°</b> 24°/50°	<b>260°</b> 55°/25°	.600"	.600"	.205"	.203"
<b>1-1006</b> <i>Hi-Roller</i> <i>H314-2</i>	<b>Hydraulic Performance Cam</b> Street-strip type performance for large cubic inch bikes with performance heads. Produces broad power range. Clearancing and valve spring change required for .600" lift. Basic RPM 2800-6500.	<b>260°</b> 26°/54°	<b>266°</b> 65°/21°	.600"	.600"	.216"	.181"
<b>1-1002</b> <i>Hi-Roller</i> <i>H306-2</i>	<b>Hydraulic Performance Cam</b> Mid range and upper RPM power. Works best with 10.5:1 compression ratio. Can be used with stock heads. Clearancing and valve spring change required. Excellent stroker cam. Basic RPM 2800-6500.	<b>262°</b> 28°/54°	<b>272°</b> 69°/23°	.500"	.510"	.216"	.195"
<b>1-1003</b> <i>Hi-Roller</i> <i>H310-2</i>	<b>Hydraulic Performance Cam</b> Designed for larger cubic inch and increased compression ratios. Street-strip type performance. 88 cubic inch, 10.5:1 compression ratio and up. Heads must be clearanced and have performance valve springs installed. Basic RPM depends on the combination, approximately 3000-6500 RPM.	<b>266°</b> 23°/63°	<b>276°</b> 68°/28°	.550"	.550"	.202"	.229"

Crane offers custom grind camshafts to suit your specific requests. Contact Crane's technical staff for details.



Optional Accessories			
Rocker Arms—See Page 24	Pushrods—See Page 26	Spring Kits—See Page 28	Ignitions—See Page 30-32
4-1016, 4-1021	4-0018, 4-0030	5-1101, 5-1102, 5-1001, 5-1002	8-6100, 8-6101, 8-2000, 8-3100, 8-3101

## Tune Your Power Band with Hi-Roller Cams

The Crane Hi-Roller camshafts allow you to optimize the performance of your engine to suit your application. The cam can be run as received with the advertised timing specifications, or it can be adjusted to produce either more low end torque or for more high RPM horsepower.

The cam gear has three key slots marked “O”, “A”, and “R”, with the “O” slot being the original position. The gear must be pressed off the cam to adjust the timing. If it is pressed back on with the cam key lined up with “A” slot in the gear, valve timing events will be advanced by 4° and the engine will produce more low end torque, but less top end horsepower—perfect for a heavy bagger, trike, or pulling a trailer. If the gear is pressed back on with the “R” slot lined up with the cam’s key, valve timing will be retarded by 4°, and the engine will respond with more top end horsepower, but less low end grunt. This works well in lighter bikes and in competition applications where top end power is more important. An adjustment will typically move the power band up or down by about 200 to 300 RPM.

Picture 1: Cams are sold with the key lined up with the “O” slot of the gear. This will yield advertised timing specs.

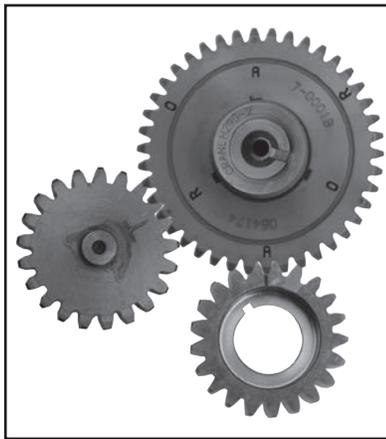
Picture 2: With the key lined up with the “A” slot, all timing specs will be advanced by 4° for more low RPM torque.

Picture 3: If the gear is pressed on with the “R” slot lined up with the camshaft key, all timing specs will be retarded by 4° for more high RPM horsepower.

**NOTE:** Only valve train timing events will be changed. Lift and duration remain the same.



Picture 1



Picture 2



Picture 3

## tech tips

We offer a variety of special grind camshafts for the Harley-Davidson®. This service is primarily for the racing enthusiast. Please contact one of our technical consultants for the required information. 1-866-584-3750, 1830 Holsonback Drive, Daytona Beach, FL 32117, tech@cranecams.com, www.cranecams.com

Performance Motorcycle Products

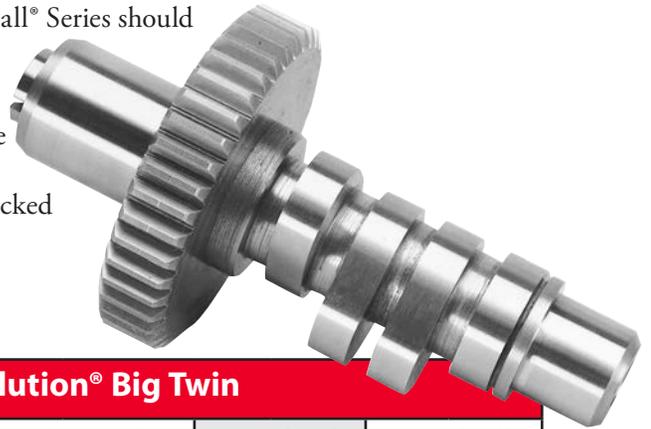
Evolution®

CRANE  
Cams

# Fireball® Series Cams for Evolution®

If you do not need the versatility of a Hi-Roller Series cam, then the FireBall® Series should be your choice.

The FireBall® Series cams are computer designed camshafts. They are manufactured to the industry's highest quality standards, and are available in various grinds. Most can be used with stock valve springs, in stock or modified engines. Best of all they are very competitive in price, and are backed by a one year limited warranty.



## For 1984–Up Harley-Davidson® Evolution® Big Twin

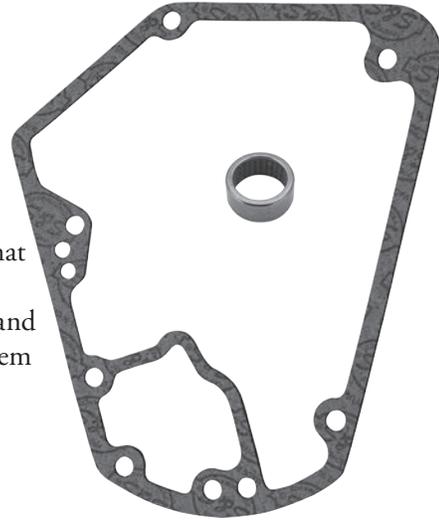
Part #/ Grind #	Description	Duration at .053"		Gross Valve Lift 1.6:1 Rocker Ratio		Gross Valve Lift @ TDC 1.6:1 Rocker Ratio	
		Intake Open/Close	Exhaust Open/Close	Intake	Exhaust	Intake	Exhaust
<b>1-1100</b> <i>FireBall®</i> <b>300-2B</b>	<b>Hydraulic Bolt-In</b> Designed for broad power range improvement. Good choice for heavy bikes with heavy load. Increases low and mid range performance. Works well with stock compression ratio and stock exhaust. No valve spring change required. Basic RPM Idle-5000.	<b>226°</b> 12°/34°	<b>236°</b> 41°/15°	.490"	.490"	.146"	.157"
<b>1-1103</b> <i>FireBall®</i> <b>310-2</b>	<b>Hydraulic Bolt-In</b> Street performance for heavier bikes that are slightly modified. Can be used with stock compression or increased up to 9.5:1. Complements exhaust and intake modifications. No valve spring change required. Basic RPM 1500-5500.	<b>236°</b> 19°/37°	<b>242°</b> 46°/16°	.490"	.490"	.184"	.162"
<b>1-1101</b> <i>FireBall®</i> <b>316-2B</b>	<b>Hydraulic Bolt-In</b> Designed for speed or touring. Works well with engine modifications. Works best with 9.5:1 compression ratio. Can be used with stock compression in lighter bikes. Early Evolution® models that do not have notched pistons must be checked for valve to piston clearance. Basic RPM 1800-5800.	<b>242°</b> 19°/43°	<b>252°</b> 48°/24°	.490"	.490"	.176"	.203"
<b>1-1102</b> <i>FireBall®</i> <b>326-2</b>	<b>Hydraulic Performance Cam</b> Mid-range and upper RPM improvement. Works best with 10:1 compression ratio. Works well with performance carb and exhaust. Excellent for modified touring bikes. May require valve spring change. Check all clearances. Basic RPM 2000-6000	<b>252°</b> 23°/49°	<b>262°</b> 56°/26°	.490"	.500"	.200"	.206"

## Optional Accessories

Rocker Arms—See Page 24	Pushrods—See Page 26	Spring Kits—See Page 28	Ignitions—See Page 30-32
4-1016, 4-1021	4-0018, 4-0030	5-1101, 5-1102, 5-1001, 5-1002	8-6100, 8-6101, 8-2000, 8-3100, 8-3101

## Installation Kit

Camshaft installation kits are a new product for Crane Cams®, and they include the basic parts needed to install a cam kit. Of course you need a cam cover gasket, but an important item that is often overlooked is a new inner cam bearing. And not just any inner cam bearing! Crane only offers “full complement” inner cam bearings that contain more rollers than stock cam bearings. The increased load capacity is a must for handling the added stresses of high lift cams and high performance valve springs. These installation kits are a great item to have around the shop, so why not order a few extras?



Installation Kit	
Part Number	Application
7-2000	1984–'99 Evolution® engines

## Inner Camshaft Bearing

- Full complement inner camshaft bearing
- Designed for the highest static and dynamic load rating, giving the most possible support
- Should be installed with each camshaft
- See *techtips*.

Inner Camshaft Bearing	
Part Number	Application
7-0400	1948–'99 panhead, shovelhead, Evolution® big twin



## techtips

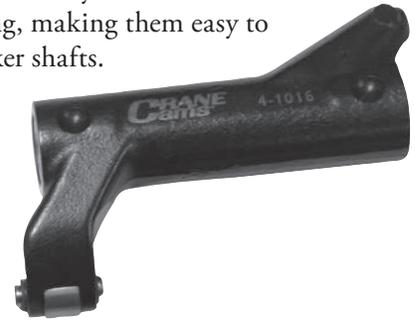
We now offer a full complement replacement Torrington® camshaft needle bearing for Harley-Davidson® big twin motorcycles from 1948 to 1999, **Part No. 7-0400**. This bearing is required whenever you install a Crane Cam in late model Evolution® engines built from mid-1992 to 1999 to replace the INA cage bearing that was factory installed. Why is this necessary? The INA caged bearing has fewer needles (19) that are separated from one another by a portion of the cage. The Torrington full complement bearing has more needles (29) and can support greater loads than the INA style. This ability to handle extra load is especially beneficial since valve train forces and spring tensions increase with the installation of any aftermarket performance camshaft. Why did the factory switch to the INA bearing? The reason is alignment. The INA style bearing is more forgiving of any misalignment between the location of the inner needle bearing in the case and the outer bushing in the nose cone. With the INA caged bearing, alignment is less critical and manufacturing tolerances can be greater. Since the **7-0400** Torrington full complement style bearing has more load capability, we believe it will be the proper design to use when increased performance and reliability are the main concerns.

### Special Grinds Available!

We offer many cam lobe profiles that available space does not allow us to list in this catalog. Typical uses are unusual cylinder heads, extreme engine modifications, supercharging or exotic fuels such as nitromethane, and serious race-only applications. If your bike requires a non-cataloged cam grind contact our Motorcycle Tech Department (1-866-388-5120, Mon–Fri., 8:00A.M. to 5:00P.M.) for a personal cam recommendation. Be sure to have all technical information on your bike, engine, etc., available before you place your call.

## Bushing Style Roller Tip Rocker Arms

Crane roller tip rocker arms have a bushing fulcrum for long term performance and reliability. These rocker arms use the original equipment rocker arm shafts. Made from 8620 alloy steel, precision forged for greater strength, truer rocker arm ratio, and improved rocker geometry. Also our exclusive oil metering system fully lubricates the fulcrum and roller tip for cooler, smoother operation. These rocker arms fit with no machining, making them easy to install. This kit contains four premium rocker arms that install on your original rocker shafts.



Bushing Roller Tip Rocker Arms	
Part Number	Application
4-1016 Bushing Style	1984–up Evolution® big twin and 1986–up Evolution, Sportster® 883 and 1200cc stock ratio.
4-1021 Bushing Style	1.725:1 Ratio. (*See <i>techtips</i> on next page)

## Component Replacement Parts

Component Replacement Parts	
Part Number	Description
4-1100	Front roller kit (kit of four) will fit both needle and bushing style cast rockers, manufactured before 2010
4-1120	Rocker arm rebuild kit, will fit bushing style forged rockers, manufactured after 2010, includes bushings (not pictured)
4-1104	Rocker arm shafts (kit of two) for all the bushing roller rockers and needle bearing cast rocker arms produced between late 1995–'08
4-1108	Rocker arm shaft for all bushing style rocker arms, set of two





# tech tips

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The installation of roller tip rocker arms will reduce the friction in the valve train. The roller tip reduces scuffing across the valve stem while the rocker arm is pushing the valve open. When the friction in the valve train is reduced, quicker acceleration rates can be obtained; power losses due to friction are reduced.

**Important Note:** We made a dimensional change to the needle bearings and shafts in rocker arms made after late 1995. These rocker arms are identified by the symbol “X” in the manufacturing code etched into the body of each rocker arm. Needle bearing rocker arms for the Evolution® engine with this code, must use rocker arm shafts Part No. **4-1104**, if the rocker arms are reconditioned or serviced. (Rocker arms before late 1995 used a stepped shaft with a diameter of .5530”/.5525” on the ends, and .5505”/.5500” diameter in the middle. Rocker arms made after late 1995 use a straight shaft that is one diameter .5530”/.5525”.)

### **\*More HP with Longer-Ratio Rockers!**

Increasing rocker arm ratio (Stock rockers are 1.625 ratio. Our Part No. **4-1021** rockers are 1.725!) actually increases the lift at the valve without having to change the camshaft. This typically adds .030” to .035” valve lift to the engine, depending on the lobe lift of the camshaft. Using longer-ratio rockers typically increases engine torque and HP in the mid range—*a plus for street bikes!* After you install longer-ratio rockers be sure to check that your engine has adequate (minimum .040”) piston-to-valve clearance before running the engine.

Evolution®

## Adjustable Pushrods

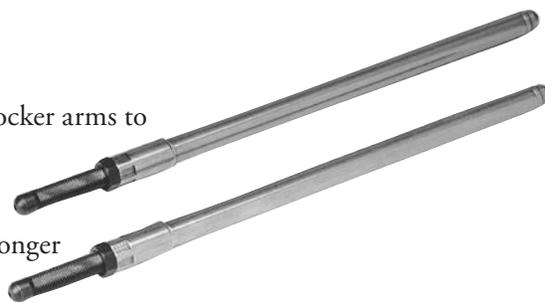
- Allows engine builder to set the identical preload for each tappet
- Proper tappet preload will prevent tappet noise and pump up
- Made of aircraft quality steel tubing—**stronger than original equipment pushrod**
- Larger in diameter than the original equipment—**much stronger to eliminate valve train flex**
- Each set of pushrods contains two exhaust and two intake length pushrods for the correct valve train geometry
- Requires top end disassembly or camshaft removal to install



Adjustable Pushrods	
Part Number	Application
4-0018	1984–up Evolution® big twin
4-0019	1984–up Evolution® big twin with long stroker cylinders
4-0020	1986–'90 Evolution® Sportster® models
4-0023	1991–up Evolution® Sportster® models using aftermarket collapsible tubes

## Time-Saver Pushrods

- Eliminate the need to disassemble the top end and remove the rocker arms to change pushrods or camshafts
- 75% savings in installation time!
- Larger in diameter than the original equipment so it is much stronger to eliminate valve train flex
- Single adjuster end changes from 9.5" to 11.5" and is a large 9MM diameter that provides superior strength and durability
- Kit includes set of four pushrods and installation instructions



Timesaver Pushrods	
Part Number	Application
4-0030	1984–up Evolution® big twin

# tech tips

For adjustment of the pushrods, rotate the engine until the tappet is at its lowest position in the lifter block. This will assure that the tappet is on the base circle of the camshaft. Extend the pushrod until the pushrod end just touches the pushrod seat in the lifter. At this point the pushrod will have a slight drag while you rotate it. This point is called zero lash. Make a reference mark on the adjuster and extend the pushrod three turns past zero lash. Tighten the locknut.



# Precision-Made Hydraulic Roller Lifters

## Standard Axle Hydraulic Roller Tappets

- Super strong steel billet body, CNC machined for strength and durability.
- Our unique design stops tappet noise and increases durability.

Standard Axle Hydraulic Roller Tappets	
Part Number	Application
3-2000	1984–up big twin and 1986–’90 Sportster® Models



Standard Axle Big Twin

## Big Axle Performance Hydraulic Roller Tappets

- Designed specifically for high performance street applications in stock or mildly modified Evolution® engines.
- Precision CNC machined with improved high-pressure chamber and large diameter axle.

Big Axle Hydraulic Roller Tappets	
Part Number	Application
3-2050	1984–up big twin and 1986–’90 Sportster® Models



Big Axle Big Twin

## Hydraulic Roller Tappets

- Precision steel billet body CNC machined for strength and durability.
- Our unique design stops tappet noise and increases durability.

Hydraulic Roller Tappets	
Part Number	Application
3-2100	1991–’99 Evolution® Sportster® Models

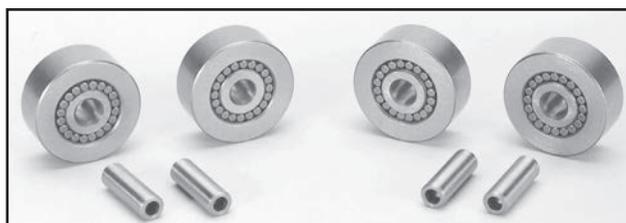


Sportster® Models

# Tappet Roller Kits

- High quality rollers and axles for replacement on all Evolution® big twin and Sportster® models.
- Set of four

Tappet Roller Kits	
Part Number	Application
3-0105	1984–up Evolution® big twin and 1986–’90 Evolution Sportster® Models



# Evolution®

# Cylinder Head Components for Evolution®

Our valve springs are manufactured from the finest quality spring wire and precision wound. The highest quality and reliability is assured with rigid quality control procedures.

The chromoly 4140 steel retainers are the strongest and most durable steel retainers offered. They also eliminate inaccurate assembly heights and retainers that pull through with lesser quality steel retainers.

Our titanium retainers reduce weight and add strength to a performance valve train assembly. The reduced weight of a titanium retainer allows the valve to move more easily and will require less spring pressure to operate. This makes your engine rev quicker and will produce more power.



## Valve Spring & Retainer Kit Specifications (see techtips)

Part Number	Nominal Diameter		Description	Application	Seat Pressure and Installed Height	Nominal Open Pressure and Height	Coil Bind Height
	Inside	Outside					
5-1102	.800	1.460	Steel	Springs (155#) and steel retainers	155# @ 1.800	352# @ 1.280	1.080
5-1002	.800	1.460	Titanium	Springs (155#) and titanium retainers	155# @ 1.800	352# @ 1.280	1.080
5-1101	.800	1.460	Steel	Springs (175#) and steel retainers	175# @ 1.700	394# @ 1.180	1.080
5-1001	.800	1.460	Titanium	Springs (175#) and titanium retainers	175# @ 1.700	394# @ 1.180	1.080

## Premium Valve Spring Only

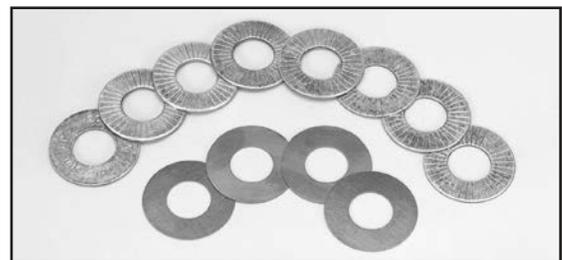
Part Number	Nominal Diameter		Description	Application	Seat Pressure and Installed Height	Nominal Open Pressure and Height	Coil Bind Height
	Inside	Outside					
5-0002*	.800	1.460	Premium quality spring wire	Premium valve springs for performance and racing applications. For use with up to .650" valve lift.	180-185# @ 1.800	480-485# @ 1.150	1.080

\*Springs Only. Use **Part No. 5-1005** or **5-1103** retainers and keeper kit.

NOTE: All kits contain valve springs, retainers (upper collar), lower collars, and valve locks.

## Valve Spring Shims

Part Number	Description	Application
5-1200	Shims	1999-'04 Twin-Cam 88® (set of 12)



NOTE: Shims supplied 4 each .015", .030", & .060" thickness, with 1.480" O.D. and .703" I.D.

## Lower Spring Seat, Retainer, & Valve Keeper Kits

Part Number	Description
5-1005**	Lower spring seat, titanium retainer, and valve keeper kit
5-1103**	Lower spring seat, steel retainer, and valve keeper kit

\*\*For use with 5-0002 valve spring kit.

Our machined steel valve keepers (also known as "Valve Collar Retainers") are precision machined and carefully heat-treated hardened. These race-quality locks are far superior to stock stamped steel keepers, **with nearly twice the shear strength!**

## Crane Cams Machined Steel Keepers

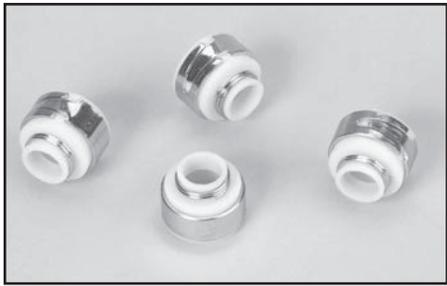
Part Number	Description	Application
5-1300	Keepers	155 lbs. spring pressure (1.800" height) *Included in kit #5-1102, 5-1002
5-1301	Keepers	175 lbs. spring pressure (1.700" height) *Included in kit #5-1101, 5-1001



NOTE: Crane Keepers can only be used with Crane retainers.



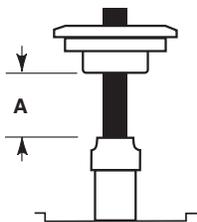
Teflon® Valve Seals		
Part Number	Description	Application
99823-4	Stock replacement seals (No machining required). (Set of four.) For 3/16" stem diameter, .415" guide O.D. and has .500" seal O.D.	1984–up Evolution® (80 cu. in.)
99824-4	Requires machining. For full size aftermarket guides (Set of four.) For 3/16" stem diameter, .531" guide O.D. and has .620" seal O.D.	1984–up Evolution® (80 cu. in.)



# techtips

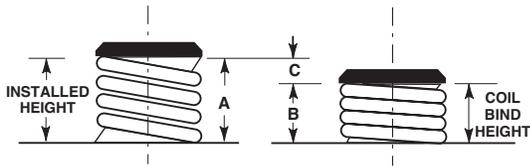
Be sure to check the valve to valve clearance when installing any performance camshaft that may affect the lift and the duration at the valve. The minimum clearance that we recommend for the closest point of contact is .060".

The valve spring retainer to valve guide clearance should always be checked when installing a camshaft that increases the lift of the valve. The minimum recommended clearance is .060".



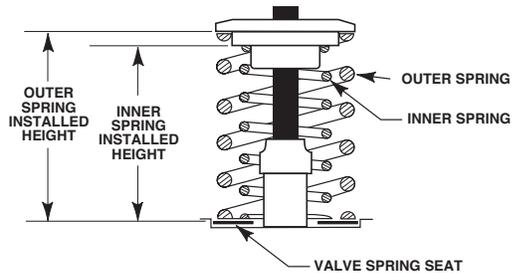
All of our spring and retainer kits for the Evolution® engine come with the special Crane Super Duty style valve keepers. These keepers have an extra thick wall section and can only be used with our matching retainers.

Our valve keepers 5-1300 and 5-1301 are designed for two different valve spring installed heights, thereby affecting valve spring tension. (These keepers can only be used with our retainers.)



The valve spring retainer to oil seal travel (distance "A") must be .060" greater than full lift of the valve. This will avoid mechanical interference during normal operating conditions.

Spring travel can be determined by subtracting the coil bind height (B) from the installed height (A). The difference "C" is the spring travel. This must always be at least .060" greater than full lift of the valve to avoid coil bind.



The installed height of the spring determines the valve spring pressure. Valve springs with the same recommended installed height should consistently produce equal pressure. You should always check the installed height of any spring and retainer combination to assure that the height is proper.

Evolution®

# Ignition Systems for Evolution®

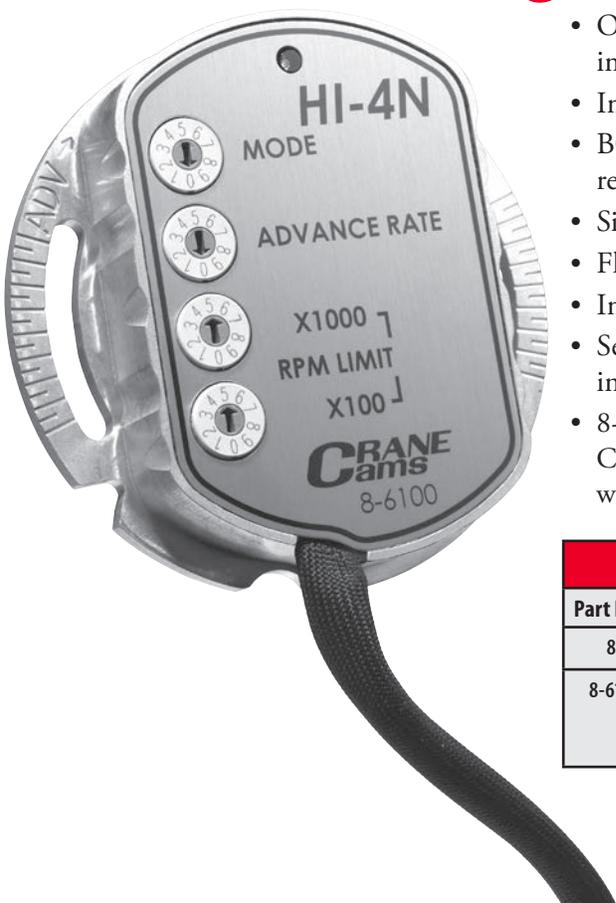
This chart shows at a glance, the Crane ignition options for Harley-Davidson® Evolution® engines.

Note that the the previous line of HI-4 ignition modules have been replaced by the new HI-4N multifunction ignition module. The HI-4N is capable of doing everything that all the previous HI-4 modules could do and more.

## For 1984–Up Harley-Davidson® Evolution® Big Twin

Ignition	Single Fire	Dual Fire	Multi-Spark	Kick Start Mode	Controls	Advance	Recommended Coil Impedance
HI-2 Single Fire Ignition	Yes	No	No	Yes	None	Mechanical	2Ω to 3Ω
HI-4E Multi-Spark Ignition (External Module)	Yes	Yes	Yes	Yes	BCD rotary switches for Advance, Rev Limit, and Rear Cylinder Offset Rocker Switches for Mode Selection	Full Electronic	2Ω to 3Ω
HI-4N	Yes	Yes	Yes	Yes	BCD rotary switches for Mode, Advance, and Rev Limit	Full Electronic	2Ω to 3Ω

## HI-4N Multi-Function Performance Ignition



- One piece machined aluminum housing reduces vibration and improves heat dissipation and reliability
- Improved kick start algorithm designed to start as easily as points
- BCD switches with solid detent and legible marking allow easy and repeatable adjustments of mode, advance rate, and rev limit
- Single-fire and dual-fire function built into a single module
- Flexible wiring harness makes installation easier
- Initial timing marks allow precise adjustment and reinstallation
- Sensor covers integrated into housing to provide protection during installation
- 8-6101 includes: Crane Cams® HI-4N Ignition, Crane Cams Single-Fire Coil, and Crane Cams 8.5MM double silicone, premium quality spark plug wires!

### HI-4N Performance Ignition

Part Number	Application
8-6100	1984–'99 Big Twin & 1971–'02 Sportster® models. Ignition only.
8-6101 (kit)	1970–'98 and some '99 big twin w/ Evolution® engine, (non-fuel inj.) and 1971–'02 Sportster® models. Includes Crane Cams® HI-4N Ignition, Crane Cams Single-Fire Coil, and Crane Cams 8.5mm double silicone, premium quality spark plug wires!

# FireBall® HI-4E Multi-Spark Ignition for 1984–Up Harley-Davidson®

## Improved Spark Advance Curve Increases Torque and HP

Crane Cams' FireBall® HI-4E external-mount, multi-spark ignition is the most powerful system available for 1984–'99 Harley-Davidson® Evolution® engines! **Part No. 8-3100** fits 1984–'94 seven-pin connectors. **Part No. 8-3101** fits 1995–up eight-pin connectors.

Crane's FireBall® HI-4E ignition features an improved adjustable spark advance curve that produces significant increases in torque and horsepower! The HI-4E FireBall® ignition features proven multi-spark technology, for greatly improved start-up, clean idling and quicker off-idle response. The HI-4E can be used with the stock H-D® coil, a Crane **Part No. 8-3006** replacement coil, or, for maximum performance, a Crane **Part No. 8-3001** or **8-3005** single-fire coil.

The HI-4E also features an adjustable rev-limit that can be adjusted from 1,500 to 9,900 RPM, in 100 RPM increments. An added feature of the HI-4E allows easy rear cylinder timing offset. The externally mounted HI-4E housing is made from black anodized billet aluminum and is easily installed in the stock location. The HI-4E is also switchable between single-and dual-fire.



HI-4E Multi-Spark Ignition	
Part Number	Application
8-3100	HI-4E ignition, 1984–'94 Evolution® with 7-pin connector. (1984-90 requires use of H-D® Part No. 32408-90 wiring harness kit.) Does not fit FLT or 1994 Sportster® Models
8-3101	HI-4E ignition, 1995–up Evolution® with 8-pin connector. Also, 1994–'97 Sportster® Models
8-3006	Replacement coil (dual-fire)
8-3001	Single-fire coil
8-3005	Single-fire coil

## FireBall HI-4E Multi-Spark Ignition & Coil Kit *Includes FireWire®!*

- Crane FireBall® HI-4E multi-spark, “Plug-N-Go” performance ignition
- Crane FireBall® high-output single-fire ignition coil
- Crane double silicone, 8.5MM FireWire® spark plug wires

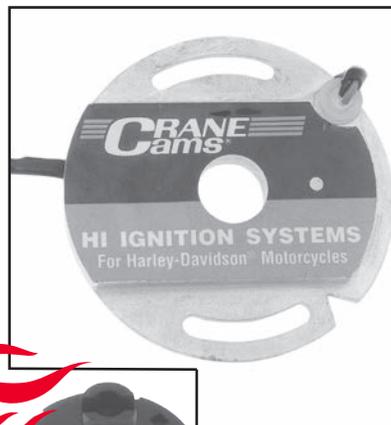
HI-4E Multi-Spark Ignition & Coil Kit	
Part Number	Application
8-4101	1984–94 Evolution® with 7-pin connector. (1984–'90 must use H-D® Part No. 32408-90 wiring harness kit.) Does not fit FLT or 1994 Sportster® models
8-4102	1995–Up Evolution with 8-pin connector. And 1994–'97 Sportster models.



Evolution®

## HI-2 Single-Fire Inductive Ignition System

- All the benefits of the HI-1 as well as increased performance of a single-fire ignition
- Will improve fuel mileage, prolong spark plug life, provide easier starting and deliver a smoother ride
- Requires use of a single-fire ignition coil like the Crane HI-Intensity single-fire performance ignition coil (Part No. 8-3001 or 8-3005)
- Requires the use of a mechanical advance assembly (not included)
- Can be used with dual plug heads, in which case two dual-fire ignition coils are used (Part No. 8-3002 or 8-3002)
- Will require a tachometer adapter (Part No. 8-2050) if your bike has an electric tachometer



**Limited Quantity!**



### HI-2 Single-Fire Inductive Ignition System

Part Number	Application
8-2000 Single-Fire	1970-'98 and some '99 big twin w/Evolution® engine, (non-fuel inj.) and 1971-'02 Sportster® models
8-2001	Replacement rotor

## Single-Fire Performance Ignition Coils

**50% Longer Spark Duration! 15% Greater Spark Current!**

HI-Intensity Ignition Coils that are two coils in one. Designed for single-fire ignition systems that have a current limiting feature. Will out power any other ignition system when used with Crane's HI-4 Single-Fire Ignition.

- Greater Spark Energy increases HP, torque, and RPM!
- Eliminates lean-surge. Improved fuel mileage!
- Quicker, easier starting!
- Precision molded, super-durable housing!
- Designed for max-output with Crane HI-4 and HI-4E ignitions!
- Works with most aftermarket single-fire ignitions with a current limiting feature!
- 3 Ohm primary resistance
- Original heavy-duty and light-weight designs available



Easy, no-hassle installation, fits under stock coil covers, no extra bulky brackets. Mounts like Stock! 25% Lighter! 20% Smaller! **Part No. 8-3005**



Original heavy-duty design. Requires special brackets.  
**Part No. 8-3001**

### Single-Fire Performance Ignition Coils

Part Number	Application
8-3001*	1970-'98 and some '99 big twin w/Evolution® engine, (non-fuel inj.)
8-3005*	and 1971-'02 Sportster® models

\*For use with most single-fire ignitions that have current limiting control and require a 2-3 ohm coil.



# HI-Intensity Dual-Fire Performance Ignition Coils

**Greater horsepower, torque, & rpm!**

- Computer designed to improve starting and throttle response
- Greater spark energy increases HP, torque, and RPM
- Eliminates lean-surge. Increases fuel mileage!
- Designed for max-output with Crane Cams® HI-4 and HI-4E ignitions!
- Works with most aftermarket dual-fire electronic ignitions!
- Easy, no-hassle installation! Fits stock mounting brackets!
- Precision molded, super-durable housing!
- **8-3006** is 30% lighter and 15% smaller
- 3 Ohm primary resistance

HI-Intensity Dual-Fire Performance Ignition Coils	
Part Number	Application
8-3002 Replacement Coil	1970-'98 and some '99 big twin w/ Evolution® engine, (non-fuel inj.) and 1971-'02 Sportster® Models
8-3006 Lightweight Design	



Part No. 8-3002



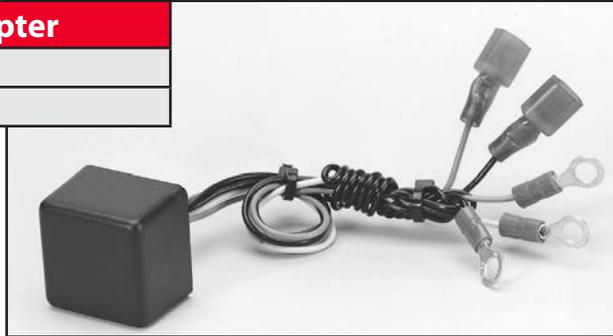
Part No. 8-3006

**Evolution®**

## Single-Fire Tachometer Adapter

- This adapter will allow the use of any electronic tachometer
- Quick and easy to install
- Works with HI-2, Rev Tec®, Compufire®, and a wide range of other single-fire ignitions

Single-Fire Tachometer Adapter	
Part Number	Description
8-2050	Single-fire ignition tachometer adapter



## Ignition Rotor

- Replaces OEM #32402-83
- Comes with bolt and star washer

Ignition Rotor	
Part Number	Application
8-1150	1984–up Evolution®



## Start Boost Relay

- Provides full battery voltage to coil during cranking, eliminating the 1-2 volt drop through the wire harness in single-fire applications
- Makes start-up quicker and easier, especially with high-compression or stroker engines!

Start Boost Relay	
Part Number	Description
8-3000	Start boost relay



All reference to Harley-Davidson® part numbers is for identification purposes only. We in no way are implying that any of Crane Cams® products are original equipment parts or that they are equivalent to the corresponding Harley-Davidson part number shown..

# Chrome Finish, Performance Replacement Voltage Regulators

- Performance-designed as direct bolt-on replacement for stock Harley-Davidson® voltage regulator.
- Delivers full range of normal operating and charging with stock Harley-Davidson® charging system or any 26–32 amp alternator.
- Attractively finished in bright nickel-chrome double-plating.
- Comes complete—ready for bolt-on installation on any stock chassis.
- Traditional Crane Cams® quality, performance and value in a budget priced, performance replacement voltage regulator.

Chrome-Finish Replacement Voltage Regulators	
Part Number	Application
8-4061	1981–'88 Harley-Davidson® big twin
8-4060	1988–'99 Harley-Davidson® big twin Evolution® models



## Firewire® Double Silicone Plug Wires

## FireWire® Spark Plug Wires

- The ultimate 8.5MM spark plug wires for all-out racing or serious street performance.
- Pure silicone, double jacketed, reactive core specifically engineered for high output competition ignition systems!
- Unique Reactive Core goes beyond suppression and actually filters out radio frequency interference (RFI) and electromagnetic interference (EMI).
- Large 8.5MM size with double silicone layer for protection from extreme temperatures!
- Easily installed universal kit allows you to tailor wires to fit your engine!



Firewire® Reactive Core Wire Sets	
Part Number	Application
8-5000	Universal kit with 90° plug caps
8-5001	Universal kit with 135° plug caps
8-5002	1986–98 XL
8-5003	1979–85 XL, XLCH, XLX 1985–86 FXWG 1979–85 FXEF, FXSB 1984–90 Softail® 1991–98 Dyna®
8-5004	1980–84 FLT, FLHT, FLHTC, FLTC
8-5005	1985–95 FLT
8-5006	1979–82 FLH
8-5007	1982–95 FXR, FXRT, FXRS
8-5008	1991–99 Softail

Performance Motorcycle Products

Evolution®



# Products for Shovelhead & Panhead

## Products for Shovelhead & Panhead Engines (1966–1984) (1948–1965)

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### Camshaft Cross Reference Chart for Shovelhead

Crane Cams Part Number	Crane Cams Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C	
1-0010, 1-0011	OE Replacement Hydraulic	Front	220°	245°	.389	.391	0°/40°	53°/12°
		Rear	233°	245°	.391	.390	20°/33°	53°/12°
1-0100, 1-0101, 1-0102	FB300H	248°	248°	.455"	.455"	24°/44°	44°/24°	
1-0103, 1-0104, 1-0105	**FB296A	244°	244°	.455"	.455"	20°/44°	44°/20°	
1-0106, 1-0107, 1-0108	**FB308B	256°	256°	.490"	.490"	26°/50°	50°/26°	
1-0021, 1-0022	*H288B	244°	244°	.450"	.450"	22°/42°	42°/22°	
1-0024, 1-0025	*H288-2B	244°	254°	.450"	.450"	18°/46°	51°/23°	
Crane Cams Equivalent Part Number	Andrews Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C	
1-0103, 1-0104, 1-0105	"F" Grind	244°	244°	.450"	.450"	16°/48°	48°/16°	
	"A" Grind	244°	244°	.450"	.450"	21°/43°	43°/21°	
1-0106, 1-0107, 1-0108	"B" Grind	256°	256°	.485"	.485"	26°/50°	50°/26°	

**NOTE:** See catalog pages 37 for details and year application of Crane Cams.

\*Indicates hydraulic series cam. \*\*Indicates mechanical series cam.

### Camshaft Cross Reference Chart for Panhead

Crane Cams Part Number	Crane Cams Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C
1-0100	FB300H	248	242	479	479	22°/44°	44°/24°
1-0103	FB296A	244	244	479	479	20°/44°	44°/20°
1-0106	FB308B	256	256	516	516	26°/50°	50°/26°
Crane Cams Equivalent Part Number	Andrews Grind Number	Intake Duration	Exhaust Duration	Intake Lift	Exhaust Lift	Intake O/C	Exhaust O/C
1-0103	"F" Grind	244	244	470	470	16°/48°	48°/16°
	"A" Grind	244	244	470	470	21°/43°	43°/21°
1-0106	"B" Grind	256	256	507	507	26°/50°	50°/26°

**NOTE:** See catalog pages 40 for details and year application of Crane Cams.

# Cams for Panhead & Shovelhead

## FireBall® Series Cams for Panhead & Shovelhead



The FireBall® Series cams are computer designed camshafts. They are manufactured to the industry's highest quality standards, and are available in various grinds. Most can be used with stock valve springs, in stock or modified engines. Best of all they are very competitive in price, and are backed by a one year limited warranty.

### For 1948-'84 Harley-Davidson® Big Twin

Part #/ Grind #	Description	Duration at .053"		Gross Valve Lift		Gross Valve Lift @ TDC	
		Intake Open/Close	Exhaust Open/Close	1.425:1 Rocker Ratio		1.425:1 Rocker Ratio	
				Intake	Exhaust	Intake	Exhaust
1-0010 1970-'77 1-0011 1978-'84 <i>OE Replacement Hydraulic</i>	<b>Original equipment replacement hydraulic.</b> Stock specifications for restoration or replacement of the stock camshaft. Notice that the front and rear cylinders each have their own cam profile.	Front					
		220° 0°/40°	245° 53°/12°	.389"	.391"	.076"	.131"
		Rear					
233° 20°/33°	245° 53°/12°	.391"	.390"	.076"	.131"		
1-0100 1948-'69 1-0101 1970-'77 1-0102 1978-'84 <i>FireBall® 300H</i>	<b>Hydraulic Bolt-In</b> Broad power range for streetable performance. Works well with stock compression or increased up to 10:1. Low and mid range improvement. Does not require valve spring change. Works well with stock carb and exhaust or performance parts.	248° 24°/44°	248° 44°/24°	.455"	.455"	.180"	.185"
1-0103 1948-'69 1-0104 1970-'77 1-0105 1978-'84 <i>FireBall® 296A</i>	<b>Mechanical Bolt-In</b> Broad power range for streetable performance. Works well with stock compression or increased up to 10.5:1. Will increase torque for heavy bikes with heavy loads. Does not require valve spring change. Stock carb and exhaust or performance parts may be used.	244° 20°/44°	244° 44°/20°	.455"	.455"	.154"	.154"
1-0106 1948-'69 1-0107 1970-'77 1-0108 1978-'84 <i>FireBall® 308B</i>	<b>Mechanical Performance Cam</b> Can be used with stock compression but works well with 10.5:1 compression ratio. Mid range and top end improvement. Heads must be clearanced and may require valve spring change to install. Works well with performance exhaust, carb and cylinder head work.	256° 26°/50°	256° 50°/26°	.490"	.490"	.184"	.184"
1-0021 1970-'77 1-0022 1978-'84 <i>Hydraulic H288B</i>	<b>Hydraulic Bolt-In</b> Broad power range for streetable performance. Works well with stock compression or increased up to 10:1. Low and mid range improvement. Does not require valve spring change. Will increase torque for heavy bikes with heavy loads. Stock carb and exhaust or performance parts may be used.	244° 22°/42°	244° 42°/22°	.450"	.450"	.178"	.182"
1-0024 1970-'77 1-0025 1978-'84 <i>Hydraulic H288-2B</i>	<b>Hydraulic Bolt-In</b> Dual pattern cam that will deliver broad power range for performance and street use. Will increase horsepower through the RPM range. Does not require valve spring change. Can be used with stock compression or increased up to 10.5:1. Stock carb and exhaust or performance parts may be used.	244° 18°/46°	254° 51°/23°	.450"	.450"	.157"	.188"

### Optional Accessories

Pushrods—See Page 42-43	Spring Kits—See Page 45	Ignitions—See Page 47-49
3-1003, 3-1005	5-1100	8-6100, 8-6101, 8-2000, 8-3001, 8-3005, 8-3002, 8-3006

# Shovelhead & Panhead

## techtips

We offer a variety of special grind camshafts for the Harley-Davidson®. This service is primarily for the racing enthusiast. Please contact one of our technical consultants for the required information. Phone: 1-866-584-3750  
Email: tech@cranecams.com

Nineteen eighty and 1981 shovelhead big twin models have limited valve spring travel. If you are installing a camshaft with more than .425" gross valve lift, you will have to replace the valve springs with a spring set that has more travel capability. Some 1974 and 1975 shovelhead big twin models have a variance (from other year models) in the ignition drive locator. This variance can cause difficulty when properly adjusting the ignition timing if you have installed an aftermarket camshaft. You may have to modify the ignition timing plate in order to have a full range of adjustability by elongating the adjustment slots in the points plate.

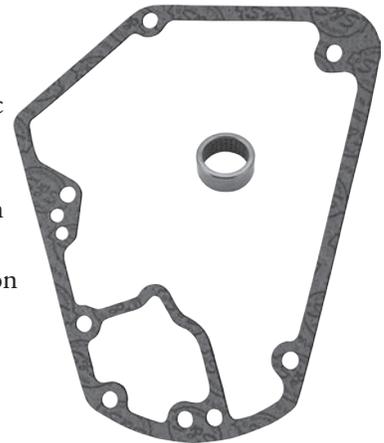
All of the camshafts that we produce for the panhead engine require the 1958 and later cam bearing to be installed in the inner case (**Part No. 7-0400**). If your engine has the early cam bushing installed you must remove the original bushing and install the cam bearing. Our cams have a different dimension inner bearing journal and failure will occur if the conversion is not performed.

Camshafts having over .450" valve lift in 1948–69 engines will need to have the front intake lobe-to-case clearance checked and increased if necessary. The minimum clearance should be .050". This clearance may be achieved by grinding a minimum amount of material from the engine case.

The panhead rocker arm ratio is 1.5:1. Cam lobe lift can be obtained by dividing the valve lift by the rocker arm ratio. (Example  $.474"/1.5 = .316"$  lobe lift)

## Installation Kit

Camshaft installation kits are a new product for Crane Cams, and they include the basic parts needed to install a cam kit. Of course you need a cam cover gasket, but an important item that is often overlooked is a new inner cam bearing. And not just any inner cam bearing! Crane only offers "full complement" inner cam bearings that contain more rollers than stock cam bearings. The increased load capacity is a must for handling the added stresses of high lift cams and high performance valve springs. These installation kits are a great item to have around the shop, so why not order a few extras?



Installation Kit	
Part Number	Application
7-2000	1970–'84 alternator style shovelhead engines

## Inner Camshaft Bearing

- Full complement inner camshaft bearing
- Designed for the highest static and dynamic load rating, giving the most possible support
- Should be installed with each camshaft
- Included with Installation Kit (above)
- See *techtip*, page 23



Inner Camshaft Bearing Only	
Part Number	Application
7-0400	1948–'99 panhead, shovelhead, Evolution® big twin



## Bushing Roller Tip Rocker Arms

Crane roller tip rocker arms have a bushing fulcrum for long term performance and reliability. These rocker arms use the original equipment rocker arm shafts. Made from 8620 alloy steel, precision forged for greater strength, truer rocker arm ratio, and improved rocker geometry. Also our exclusive oil metering system fully lubricates the fulcrum and roller tip for cooler, smoother operation. These rocker arms may require clearancing of stock rocker boxes. This kit contains four premium rocker arms that install on your original rocker shafts.

Bushing Roller Tip Rocker Arms	
Part Number	Application
4-1025 Bushing Style	1966-'84 shovelhead engines



## Component Replacement Parts

Component Replacement Parts	
Part Number	Description
4-1107	Rocker arm rebuild kit, fits Crane Cams® forged rocker arms for shovelhead engines



# Shovelhead & Panhead

# Pushrods & Tappets for Shovelhead

## Time-Saver Pushrods

- Eliminate the need to disassemble the top end and remove the rocker arms to change pushrods or camshafts
- 75% savings in installation time!
- Larger in diameter than the original equipment so it is much stronger to eliminate valve train flex
- Single adjuster end changes from 9.5" to 11.5" and is a large 9MM diameter that provides superior strength and durability
- All kits include a set of four pushrods and installation instructions

Time-Saver Pushrods	
Part Number	Description
4-0030*	Time-Saver pushrods only
3-1002	Time-Saver pushrods with solid lifter tappets
3-10020S	Time-Saver pushrods with solid lifter tappets +.003"
3-1102	Time-Saver pushrods with solid lifter adaptors

*\*Not compatible with stock shovel hydraulic tappets. Will work with tappets with 3/8" diameter cup.*

Part No. 3-1002



Part No. 3-1102



## Mechanical Tappets

Precision machined and heat treated steel tappet bodies reduce the weight and improve the valve train geometry. The pushrod seat is relocated to decrease the tappet guide block wear. Requires Time-Saver adjustable pushrods. Mechanical tappets cannot collapse like hydraulic tappets. Increase usable RPM of your engine.

MECHANICAL ROLLER TAPPETS	
Part Number	Application
3-1010	1966-'84 shovelhead big twin, mechanical tappets only, must be used with Crane Cams® Time-Saver adjustable pushrods, set of two
3-10100S	+.003" oversize tappets, set of two



TAPPET ROLLER KITS	
Part Number	Application
3-0101	Shovelhead big twin and 1957-'85 Sportster® models, high quality tappet roller kits, set of four



## Pushrods & Tappets for Shovelhead

# Adjustable Mechanical Tappets with Non-Adjustable Pushrod Kits

The tappet bodies are precision machined, ground for roundness and heat treated for maximum strength and durability. The adjuster and seat are made from heat treated steel and secured with an aircraft locking nut. The threaded adjuster allows you to adjust the valve lash at the tappet. Does not require machining to install. This kit requires the removal of the top end or the camshaft to install.



### Adjustable Mechanical Tappets with Non-Adjustable Pushrod Kit

Part Number	Application
3-1005	1966-'84 shovelhead big twin, adjustable mechanical tappets with non-adjustable pushrod kit, set of four
3-10050S	With +.003" oversize tappets, set of four

### Adjustable Mechanical Tappet Kit

Part Number	Application
3-1015	1966-'84 shovelhead big twin, adjustable mechanical tappet only, set of two
3-10150S	+.003" oversize tappets, set of two
3-1016	1966-'84 shovelhead big twin, adjustable mechanical tappet adjuster and jam nut kit, set of two



### Non-Adjustable Pushrod Kit

Part Number	Application
4-0014	1966-'84 shovelhead big twin, non-adjustable pushrods for Crane Cams adjustable mechanical tappets, pushrods only, set of four



# Adjustable Pushrods and Pushrod/Hydraulic Tappet Kits

Hydraulic tappet and adjustable pushrod kits. Precision machined, ground and heat treated steel tappet bodies with premium quality hydraulic inserts. Hydraulic tappets provide high performance and do not require any periodic adjustment. Eliminate the noise from your mechanical valve train. Adjustable pushrods do not require the removal of the top end or the camshaft to install.

Hydraulic Tappet and Adjustable Pushrod Kits	
Part Number	Application
3-1003	1966-'84 shovelhead big twin, 61-80 cu. in., hydraulic tappet and adjustable pushrod kit, set of four
3-100305	With +.003" oversize tappets, set of four



Adjustable Pushrod Kits	
Part Number	Application
4-0009	1966-'84 shovelhead big twin, adjustable pushrods only, set of four, can be used with Crane Cams or original equipment hydraulic tappets



## techtips

We offer special or custom pushrods if your combination requires something other than the standard catalog item. Please contact one of our technical consultants for assistance in ordering special length pushrods. 1-866-584-3750, 1830 Holsonback Drive, Daytona Beach, FL 32117, tech@cranecams.com, www.cranecams.com

*Performance Motorcycle Products*

Shovelhead & Panhead

## Pushrods & Tappets for Shovelhead

# Hydraulic Tappet & Hydraulic Insert

Crane Cams® hydraulic tappets for 1953–'84 big twins are ideal for stock replacement. Precision machining and close tolerances make these U.S. made tappets less susceptible to bleed-down than OEM or imported tappets. Quieter at idle and able to handle mild performance cams.

Update your current stock tappets with Crane hydraulic inserts. These are the same units used in Crane hydraulic tappets.

Hydraulic Tappets	
Part Number	Application
3-1013	1953–'84 big twin, hydraulic tappets only, set of two
3-101305	+.003" oversize tappets, set of two



Hydraulic Insert	
Part Number	Application
3-0150	1953–'84 big twin, precision machined hydraulic insert, high quality replacement for original equipment or Crane Cams® hydraulic tappets



Tappet Body Only	
Part Number	Application
3-0001	1966–'84 big twin, hydraulic tappet body only. Sold individually.
3-000105	+.003 oversize tappet body. Sold individually.



## techtips

The shovelhead big twin engine grows with temperature and the valve lash will increase as the temperature increases. This lash can create noise and begin to shock the valve train if the lash is incorrectly adjusted. The valve lash should always be adjusted when the engine is cold. Hydraulic tappets compensate for the growth of the engine when they are adjusted properly. Mechanical tappets have the ability to rev higher than hydraulic tappets in most cases due to the fact that they are lighter and are not affected by lifter pump up.

# Cylinder Head Components for Shovelhead

Our valve springs are manufactured from the finest quality spring wire and precision wound to the industry's highest specifications. The highest quality and reliability is assured with rigid quality control procedures like magnaflux and computer aided calibration equipment.

The chromoly 4140 steel retainers are the strongest and most durable steel retainers offered. These retainers are manufactured with precision and repeatability to make sure that you have a completely balanced valve assembly. They also eliminate the trouble of inaccurate assembly heights and retainers that pull through with lower quality steel retainers.

## Valve Spring and Retainer Kit Specifications

Part Number	Nominal Diameter		Description	Application	Seat Pressure and Installed Height	Nominal Open Pressure and Height	Coil Bind Height
	Inside	Outside					
5-1100	.982	1.635	Steel retainer	1966-'84 big twin	140# @ 1.500"	296# @ 1.080"	.890"

**NOTE:** Kit contains valve springs 5-0000 and steel retainers (upper collars).

## COMPONENT PARTS AVAILABLE SEPARATELY

Part Number	Description
5-0000	Performance valve springs, set of four
6-0100	Chromoly steel retainers, upper collars, set of four



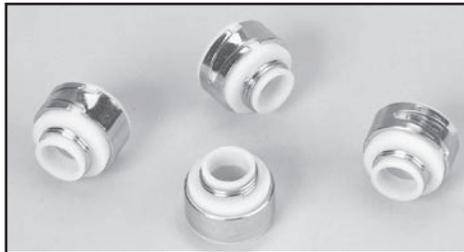
# Shovelhead & Panhead

# Cylinder Head Components for Shovelhead

## Teflon® Valve Seals

Part Number	Description	Application
99822-4	For $\frac{3}{8}$ " valve stem diameter, .531" guide O.D. and has .620" seal O.D., set of four	1966–84 shovelhead big twin

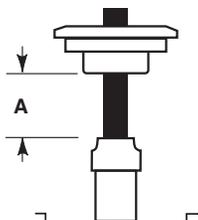
**NOTE:** These Teflon® seals are sized for automotive application and may be a tight fit on a shovelhead valve stem. Removal of the tiny upper spring on the top of the seal may assist installation. (Do not replace spring after removal.)



## techtips

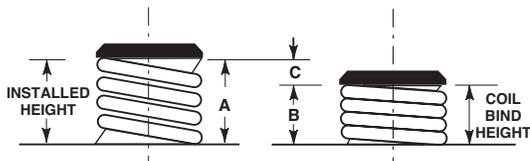
Shovelhead big twin may require the removal of the original equipment lower valve spring seat in order to achieve the recommended spring assembled height. A hardened valve spring shim may be used for a lower valve spring seat.

Be sure to check the valve to valve clearance when installing any performance camshaft that may affect the lift and the duration at the valve. The minimum clearance that we recommend for the closest point of contact is .060".

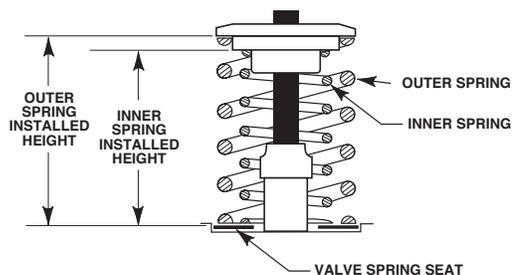


The valve spring retainer to valve guide clearance should always be checked when installing a camshaft that increases the lift of the valve. The minimum recommended clearance is .060".

The valve spring retainer to oil seal travel (distance "A") must be .060" greater than full lift of the valve. This will avoid mechanical interference during normal operating conditions.



Spring travel can be determined by subtracting the coil bind height (B) from the installed height (A). The difference "C" is the spring travel. This must always be at least .060" greater than full lift of the valve to avoid coil bind.



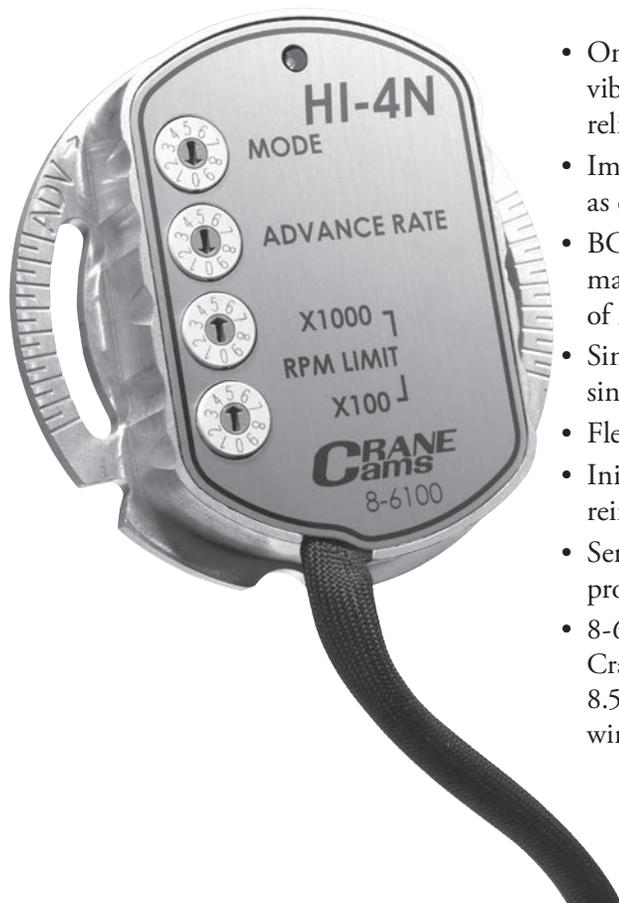
The installed height of the spring determines the valve spring pressure. Valve springs with the same recommended installed height should consistently produce equal pressure. You should always check the installed height of any spring and retainer combination to assure that the height is proper.

# Ignition Systems for Shovelhead

This chart shows the Crane Ignition options for shovelhead engines. These ignitions are designed for 1970–'84 alternator style engines, but may be used in 1966–'69 generator style engines if equipped with a timer that will accommodate an alternator style ignition.

For 1966–'84 Harley-Davidson® Shovelhead Big Twin							
Ignition	Single-Fire	Dual-Fire	Multi-Spark	Kickstart Mode	Controls	Advance	Recommended Coil Impedance
HI-2 Single-Fire Ignition	Yes	No	No	Yes	None	Mechanical	2Ω to 3Ω
HI-4N	Yes	Yes	Yes	Yes	BCD rotary switches for Mode, Advance, and Rev Limit	Full Electronic	2Ω to 3Ω

## HI-4N Multi-Function Performance Ignition



- One piece machined aluminum housing reduces vibration and improves heat dissipation and reliability
- Improved kick start algorithm designed to start as easily as points
- BCD switches with solid detent and legible marking allow easy and repeatable adjustments of mode, advance rate, and rev limit
- Single-fire and dual-fire function built into a single module
- Flexible wiring harness makes installation easier
- Initial timing marks allow precise adjustment and reinstallation
- Sensor covers integrated into housing to provide protection during installation
- 8-6101 includes: Crane Cams® HI-4N Ignition, Crane Cams Single-Fire Coil, and Crane Cams 8.5MM double silicone, premium quality spark plug wires!

HI-4N Performance Ignition	
Part Number	Application
8-6100	1970–'84 shovelhead. Ignition only.
8-6101 (kit)	1970–'84 shovelhead. Includes Crane Cams® HI-4N Ignition, Crane Cams Single-Fire Coil, and Crane Cams 8.5mm double silicone, premium quality spark plug wires!

Performance Motorcycle Products

Shovelhead & Panhead

## Ignition Systems for Shovelhead

# HI-2 Single-Fire Inductive Ignition System

- All the benefits of the HI-1 as well as increased performance of a single-fire ignition
- Will improve fuel mileage, prolong spark plug life, provide easier starting and deliver a smoother ride
- Requires use of a single-fire ignition coil like the Crane HI-Intensity single-fire performance ignition coil (*Part No. 8-3001* or *8-3005*)
- Requires the use of a mechanical advance assembly (not included)
- Can be used with dual plug heads, in which case two dual-fire ignition coils are used (*Part No. 8-3002* or *8-3006*)
- Will require a tachometer adapter (*Part No. 8-2050*) if your bike has an electric tachometer



HI-2 Single-Fire Inductive Ignition System	
Part Number	Application
8-2000 Single-Fire	1970-'84 shovelhead
8-2001	Replacement rotor



## Single-Fire Performance Ignition Coils

**50% Longer Spark Duration! 15% Greater Spark Current!**

HI-Intensity Ignition Coils that are two coils in one. Designed for single-fire ignition systems that have a current limiting feature. Will out power any other ignition system when used with Crane's HI-4 Single-Fire Ignition.

- Greater Spark Energy increases HP, torque, and RPM!
- Eliminates lean-surge. Improved fuel mileage!
- Quicker, easier starting!
- Precision molded, super-durable housing!
- Designed for max-output with Crane HI-4 ignitions!
- Works with most aftermarket single-fire ignitions with a current limiting feature!
- 3 Ohm primary resistance
- Original heavy-duty and light weight designs available



Easy, no-hassle installation, fits under stock coil covers, no extra bulky brackets. Mounts like stock! 25% Lighter, 20% Smaller! **Part No. 8-3005**

Original heavy-duty design. Requires special brackets. **Part No. 8-3001**



Single-Fire Performance Ignition Coils	
Part Number	Application
8-3001*	1970-'84 shovelhead
8-3005*	

\*For use with most single-fire ignitions that have current limiting control and require a 2-3 ohm coil.

# HI-Intensity Dual-Fire Performance Ignition Coils

**Greater HP, Torque, and RPM!**

- Computer designed to improve starting and throttle response
- Greater Spark Energy increases HP, torque, and RPM
- Eliminates lean-surge. Increases fuel mileage!
- Designed for max-output with Crane HI-4 ignitions!
- Works with most aftermarket dual-fire electronic ignitions!
- Easy, no-hassle installation! Fits stock mounting brackets!
- Precision molded, super-durable housing!
- For 1979-'98 and some '99 Harley-Davidson® (Except fuel-inj.)
- 8-3006 is 30% lighter and 15% smaller
- 3 Ohm primary resistance

HI-Intensity Dual-Fire Performance Ignition Coils	
Part Number	Application
8-3002	1970-'84 shovelhead
8-3006	



Part No. 8-3002 Replacement Coil



Part No. 8-3006 Lightweight Design

Shovelhead & Panhead

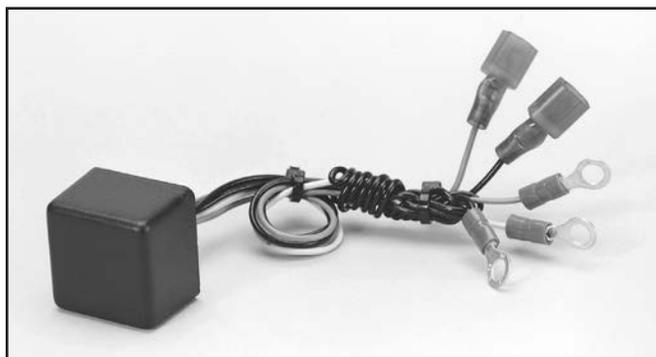
## Ignition Accessories for Shovelhead

# Single-Fire Tachometer Adapter

- This adapter will allow the use of any electronic tachometer
- Quick and easy to install
- Works with HI-2, Rev Tec®, Compufire®, and a wide range of other single-fire ignitions

### Single-Fire Tachometer Adapter

Part Number	Description
8-2050	Single-fire ignition tachometer adapter



# Ignition Rotor

- Replaces OEM #32402-83.
- Comes with bolt and star washer

### Ignition Rotor

Part Number	Application
8-1150	1970–up shovelhead



All reference to Harley-Davidson® part numbers is for identification purposes only. We in no way are implying that any of Crane Cams® products are original equipment parts or that they are equivalent to the corresponding Harley-Davidson part number shown..

# Start Boost Relay

- Provides full battery voltage to coil during cranking, eliminating the 1-2 volt drop through the wire harness in single-fire applications
- Makes start-up quicker and easier, especially with high-compression or stroker engines!

Start Boost Relay	
Part Number	Description
8-3000	Start boost relay



# Chrome-Finish, Performance Replacement Voltage Regulators

- Performance-designed as direct bolt-on replacement for stock Harley-Davidson® voltage regulator.
- Delivers full-range of normal operating and charging with stock Harley-Davidson® charging system or any 26-32 amp alternator.
- Attractively finished in bright nickel-chrome double-plating.
- Comes complete, ready for bolt-on installation on any stock chassis.
- Traditional Crane Cams quality, performance and value in a budget priced, performance replacement voltage regulator.

Chrome-Finish Replacement Voltage Regulators	
Part Number	Application
8-4061	1981-'84 Harley-Davidson® big twin



## Firewire® Double Silicone Plug Wires

# FireWire® Spark Plug Wires

- The ultimate 8.5MM spark plug wires for all-out racing or serious street performance.
- Pure silicone, double jacketed, reactive core specifically engineered for high output competition ignition systems!
- Unique Reactive Core goes beyond suppression and actually filters out radio frequency interference (RFI) and electromagnetic interference (EMI).
- Large 8.5MM size with double silicone layer for protection from extreme temperatures!
- Easily installed universal kit allows you to tailor wires to fit your engine!



### Firewire® Reactive Core Wire Sets

Part Number	Application
8-5000	Universal kit with 90° plug caps
8-5001	Universal kit with 135° plug caps
8-5002	1986-'98 XL
8-5003	1979-'85 XL, XLCH, XLX 1985-'86 FXWG 1979-'85 FXEF, FXSB 1984-'90 Softail® 1991-'98 Dyna®
8-5004	1980-'84 FLT, FLHT, FLHTC, FLTC
8-5005	1985-'95 FLT
8-5006	1979-'82 FLH
8-5007	1982-'95 FXR, FXRT, FXRS
8-5008	1991-'99 Softail

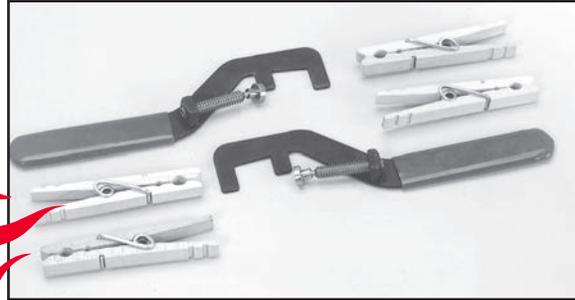


# Tools & Accessories

**Camshaft Installation Tool..... 54**  
**Tappet Block Alignment Tool ..... 54**  
**Oil Pump Pressure Relief Spring ..... 54**  
**Engine Assembly Lube..... 54**  
**Tune-A-Cam Kit..... 55**  
**TDC Piston Stop ..... 55**  
**Crane Cams T-Shirt ..... 55**

# Camshaft Installation Tool

- Will hold all of the tappets while you remove and reinstall the camshaft
- This prevents tappets from falling out of tappet blocks

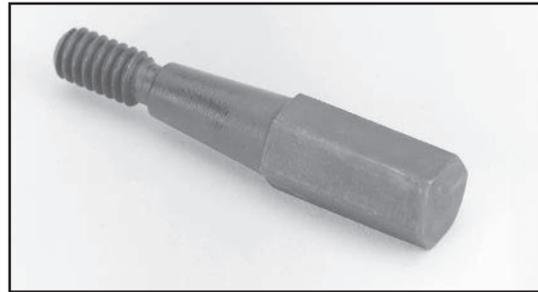


Cam Installation Tool	
Part Number	Description
9-0020	Cam installation tool



# Tappet Block Alignment Tool

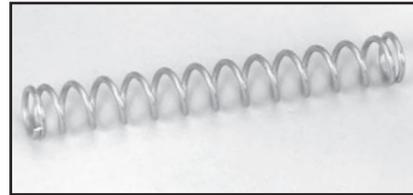
- Will align the block so the tappet roller runs straight on the cam lobe
- If you remove the tappet block you must align the block with the camshaft when reinstalling to prevent camshaft wear



Tappet Block Alignment Tool	
Part Number	Description
9-0021	Tappet block alignment tool

# Oil Pump Pressure Relief Spring

- Made of premium quality, steel alloy
- Heat set oil pump pressure relief spring actually increases engine oil pressure by 2-3 psi
- Does not interfere with critical bearing lubrication needs
- Added oil pressure is necessary when using aftermarket cams and valve train components, highly recommended for extended engine life



Oil Pump Pressure Relief Spring	
Part Number	Application
7-0200	1966-'98 big twin, including Evolution®

**NOTE:** Harley-Davidson® engines operate at extremely low oil pressure, both while at idle and during upper RPM operation.

# Engine Assembly Lube

Maximize friction and wear protection for professional engine assembly work

Engine Assembly Lube	
Part Number	Description
99008-1	Engine assembly lube



# Tune-A-Cam Kit

- Allows you to degree your camshaft into your engine for maximum performance
- Check crankshaft, camshaft end play and shaft, and gear runout
- Makes it easy to performance tune your engine



Tune-A-Cam Kit	
Part Number	Description
9-0010	Tune-A-Cam kit
9-0011	Degree wheel only

**Limited Quantity!**

# TDC Piston Stop

- TDC (top dead center) piston stop is used for finding true top dead center
- Can be used for degreasing the camshaft and marking the flywheels for the most accurate cam and ignition timing

TDC Piston Stop	
Part Number	Description
99412-1	TDC piston stop 14MM
99410-1	TDC piston stop 12MM



# Crane Cams T-Shirt

- 6.1 oz., pre-shrunk 100% cotton
- Grey
- Front of shirt has a small red Crane Cams logo
- Back of shirt has a large red Crane Cams logo

Crane Cams T-Shirt	
Part Number	Description
106-6107	T-Shirt, Crane Cams® logo, Short sleeve. Large.
106-6108	T-Shirt, Crane Cams® logo, short sleeve. XLarge.
106-6109	T-Shirt, Crane Cams® logo, short sleeve. XXLarge.



**Tools & Accessories**

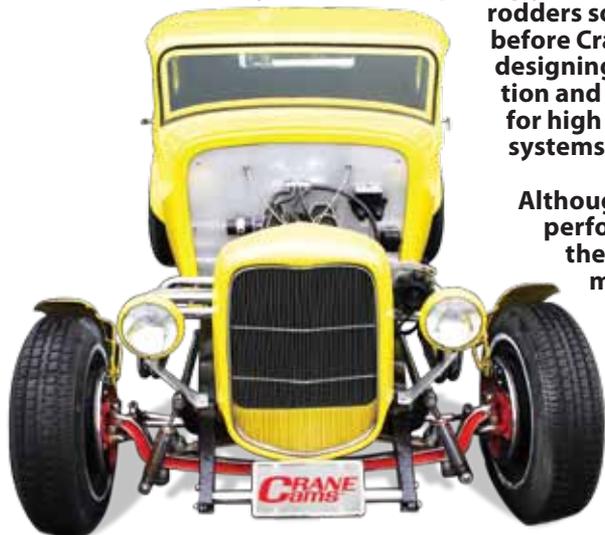
# Notes:

**The story of Crane Cams began** in 1953 when Harvey J. Crane, Jr. set about grinding his first camshaft in the corner of his father's machine shop in Hallandale, Florida. An apprentice machinist, young Harvey became interested in "souping-up" his flathead Ford V-8 hot rod. Like most others, he was strongly influenced by the various "hot rodding" magazines, ordering his first cam from a California cam company's ad.

The first cam Harvey purchased performed well, but when he ordered another, he found it was not at all like the first, mostly due to manufacturing and machining inaccuracies. Harvey's machinist's training and hot-rodder's ingenuity had already taught him that camshaft design and accuracy exerts a critical effect on engine power. He also knew he was easily capable of designing and manufacturing camshafts. What's more, he knew he could design more powerful, far more accurate and repeatable camshafts.

Although money was scarce, Harvey traded his way into a well-used cylindrical grinder. In rebuilding this old, used machine he quickly developed cam manufacturing and design knowledge. Harvey's initial "home made" cams were accurately made and surprisingly more powerful than anything he'd previously purchased. Other local hot rodders soon found out, and began buying his camshafts. And it wasn't long before Crane had a loyal and ever-expanding following. Over the years, by designing better cams and helping more racers win, Crane grew their reputation and following until the company became an internationally known source for high performance valve train products and later, high-energy ignition systems.

Although Crane Cams initially made its name in the industry by providing performance cams for automotive applications, it is interesting to note that the first cam Harvey Crane ever ground was for a Henderson 4 cylinder motorcycle. Coming back to the bikes in 1987, Crane published an eight page catalog offering cams for Harley-Davidson® motorcycles. Electronic ignitions were added in 1992. In 2013, our 60<sup>th</sup> anniversary year, Crane Cams offers a full line of valve train components and ignition systems for vintage to modern Harley® engines.



## Crane Cams® Limited Warranty

Crane Cams warrants that all of its products are free from defects in material and workmanship. All Crane Cams performance products are subject to the conditions established in this policy.

Crane Cams warrants that when our products are properly installed in their correct application, they will be free from defect and will function as specified.

Due to the variety of modifications made on performance engines that may affect performance, economy and engine life, Crane Cams' obligation under this warranty is limited to the repair or replacement, only of Crane products, when the consumer returns these Crane Cams products directly to Crane Cams, Warranty Department, 1640 1830 Holsonback Drive, Daytona Beach, FL 32117.

There is absolutely no warranty, implied or otherwise, on Crane Cams parts used in competition (racing) engine applications.

This limited warranty begins on the date of purchase and is good for a period of one year from the validated date of purchase unless otherwise specified to the original purchaser.

This warranty will be void on all products that show evidence of misapplication, improper installation, abuse, lack of proper maintenance, negligence, racing engine use, or alteration from their original design.

Crane Cams reserves the right to make necessary changes in the products it manufactures and markets at any time to improve product performance. These changes in products will be made without obligation to change or improve products that were previously manufactured.

This warranty limits any implied warranty to one year, and no person, company or organization is authorized to assume for Crane Cams any other liability in connection with the sale of Crane Cams products. Some states do not allow limitations on how long an implied warranty lasts.

This limited warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

The words, Dyna® Glide, Evolution®, Twin-Cam 88®, Twin-Cam 96™, HD®, H-D®, Harley®, Harley-Davidson®, Heritage® Softail®, Sportster®, are registered trademarks of Harley-Davidson®, Inc. Milwaukee, WI, U.S.A. The following model designations for Harley-Davidson® motorcycles are used in this publication for reference only: FL, FLH, FLHR, FLHS, FLHT, FLHTC, FXB, FXDB, FXDC, FXDG, FXDL, FXDS, FXDWG, FXE, FXEF, FXLR, FXR, FXRC, FXRD, FXRDG, FXRP, FXRS, FXRSE, FXRS-SP, FXRT, FXS, FXSB, FXST, FXSTC, FXSTS, FXWG, WLA, XL, XLCH, XLCR, XLH, XLH 883, XLH 1100, XLH 1200, XLR, XLS, XLT, AND XLX.



## **Crane Cams**

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