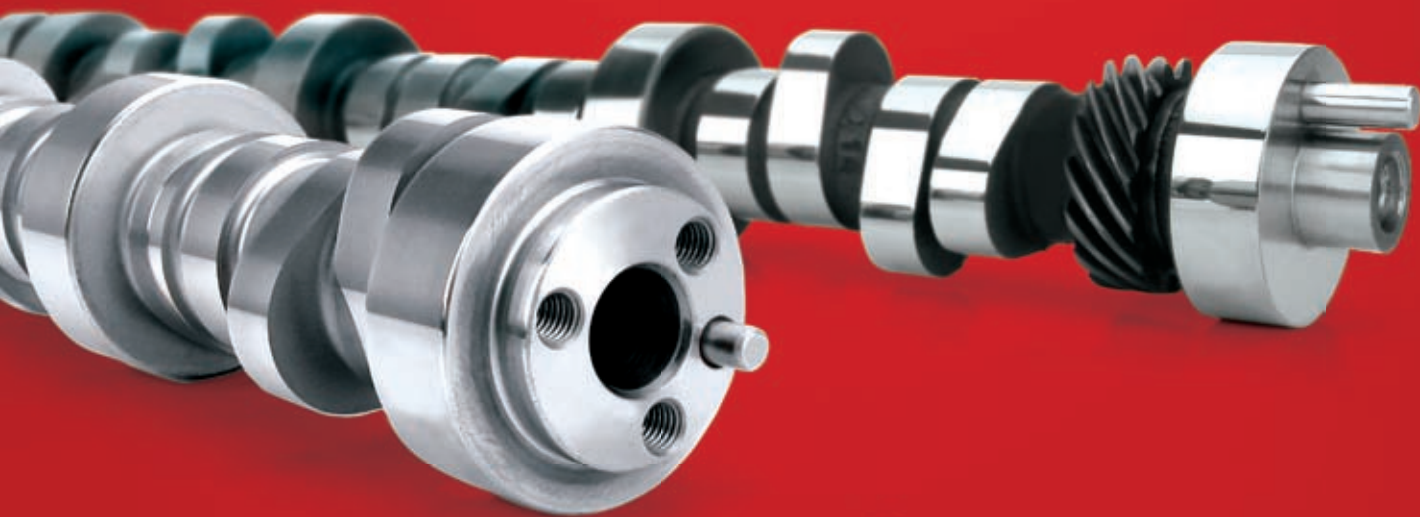


Engineered To Finish First.



THE ABSOLUTE LEADER IN VALVE TRAIN TECHNOLOGY



Thumpr™ Cams



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Break-In Oils



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Ultra Pro Magnum™ Rockers



Page 315

Ultra Dual Valve Spring



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Lightweight Tool Steel Retainers



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EZ-EFI®



Inside Back Cover

TECHNICAL ASSISTANCE is available through a variety of sources:

Toll Free CAM HELP®: 1.800.999.0853
Website: www.compcams.com
Email: camhelp@compcams.com
24 Hour Fax: 901.366.1807

CAMHELP®
WWW.CAMHELP.COM

Technical and Sales Personnel are available from 7:00 a.m. to 8:00 p.m. CST, Monday through Friday and from 9:00 a.m. to 4:00 p.m. on Saturday. COMP Cams® is closed on Sunday and legal holidays.

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Camshaft Section

This catalog is divided into two major sections: camshafts and components. The camshaft section begins on page 16 and the component section begins on page 274.

The part numbered cams are listed by corporate sections according to engine make and model. The facing pages of these listings show the components that are designed to complement overall performance of the cam. Below are portions of two sample pages.

Camshaft Listing By Lifter Type

Hydraulic Flat Tappet

Hydraulic Roller

Solid/Mechanical Flat Tappet

Solid/Mechanical Roller

Camshaft Series Designation

After lifter type, the camshafts are listed by cam family: Pure Energy™, High Energy™, Magnum, Xtreme Energy™, Thumpr™, Xtreme 4x4™, Xtreme Marine™, Dual Energy™, Nostalgia Plus™, Nitrous HP™, Computer Controlled, XFI™, Tri-Power Xtreme™, Blower/Turbo and LS_R™.

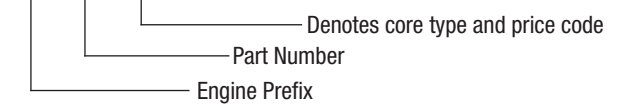
Part Numbered Camshafts

The camshafts listed on the following pages are “part numbered” cams. These are the most popular cams that COMP® offers, however this is not a complete listing. COMP® has an almost infinite number of cams available, so a permanent part number has been assigned to the cams that are kept in stock at all times. The part numbers consist of three distinct sections.

Camshaft Numbering System

1. The first “00” or “000” denotes engine prefix.
2. The three middle numbers denote the part number. A “000” denotes a custom grind or a “999” denotes a regrind.
3. The final “00” denotes the core type (flat tappet, roller, etc.) and price code. Refer to the COMP Cams® price sheet for price codes.
4. All custom grind camshafts are uniquely serial numbered.

00-000-00



Component Section

This section provides a complete list of all recommended valve train related components that COMP Cams® offers, along with detailed descriptions, application information and part numbers.

Component Numbering System

1. All numbers before the dash “-” make up the actual part number.
2. All numbers after the dash “-” represent the quantity of parts required.

00000-00



Emission-Sensitive Product Information

SEMA (Specialty Equipment Market Association) member manufacturers have developed a program whereby all emission products can be identified by placing color coded labels on product packaging and listing a corresponding numeric code next to each of the affected part numbers in catalogs and price sheets.

The product identification color codes are as follows:

- 1** The product accompanying this document has been granted a California Air Resources Board (C.A.R.B.) exemption, an “EO” number, direct or it may be a consolidated replacement part. It is 50-state legal, per the manufacturer’s application guide.
- 2** The manufacturer of the product accompanying this document represents that it has not been found nor is believed to be unlawful for use under the provisions of the Clean Air Act, per the manufacturer’s application guide, this product is not legal for sale in the state of California (or in states which have adopted California emission standards) except on pre-emission controlled motor vehicles/motor vehicle engines (pre-1966 models).
- 3** The product accompanying this document is legal only for off-highway use (except in California or states that have adopted California emission standards), racing use or for use on pre-emission controlled motor vehicles/motor vehicle engines (pre-1966 domestic vehicles certified to California standards, pre-1968 domestic vehicles certified to federal standards and all 1968 foreign vehicles), per the manufacturer’s application guide.

For more than three decades, the COMP Cams® mission has never changed: produce the highest performing products possible, provide superior customer service and lead the industry in technological development. Today COMP Cams® is part of the COMP Performance Group™ family and has grown to include multiple companies and hundreds of employees, yet we still retain the competitive spirit and desire that has positioned COMP Cams® as the absolute leader in valve train technology.



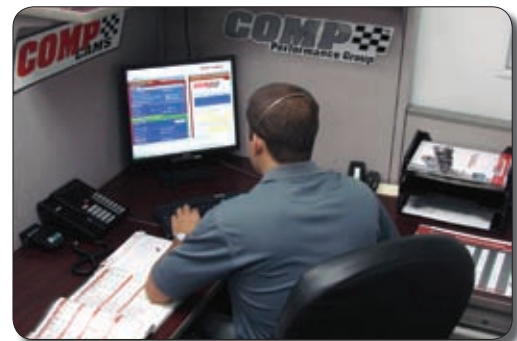
Performance

By selecting a COMP Cams® product you can have confidence in knowing that we spend thousands of hours and millions of dollars working with individuals, race teams and companies to ensure that our products provide superior performance and reliability. Whether we're working with a race team to generate race-winning power and reliability or putting thousands of grueling miles on one of our professional race or street/strip components, we test our products in real world environments to make certain they deliver what we advertise. No shortcuts, no compromised solutions will do. It is through our commitment to excellence that we know every COMP Cams® product will perform at the high standards we demand.



Service

Choosing the perfect valve train products for your application isn't a simple process. Every part of your valve train is a critical piece of a complex interlocking system that needs to match perfectly in order for your engine to generate peak performance. That's why we provide expert technical assistance to our customers – free of charge – through our toll free tech help lines or our online tech support system. Our staff of highly trained, expert technical advisors, backed by a vast inventory of precision-manufactured valve train components, makes sure that our customers have the proper parts for their specific applications the first time. Customer satisfaction is not only gauged by dyno performance numbers but by repeated customer loyalty built through years of personal, one-on-one contact.

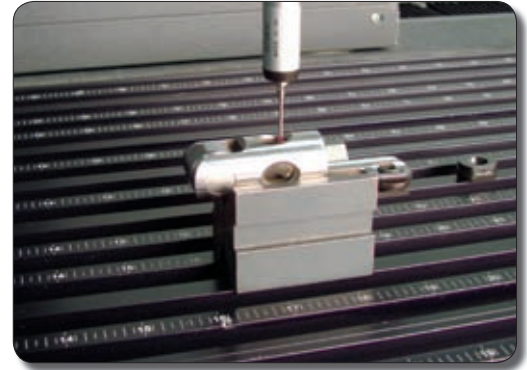


Services Available:

- Toll free technical assistance – six days a week
- Highly trained, professional sales and technical personnel
- Extensive online product information and tech resources
- On-site product support at race and enthusiast events
- Custom product design and manufacturing service
- Highest order fill rates and fastest shipping in the business

Technology & Engineering

The continued industry leadership by COMP Cams® is driven by advanced technology. We employ the industry's largest and most highly trained engineering staff and have the most sophisticated manufacturing processes and test equipment in the world. COMP Cams® seeks out the brightest engineering minds and joins them together with advanced testing and measuring equipment to create a powerful research and development facility that is unmatched in the industry. Because of the wide array of applications we service, the lessons learned through the creation of high performance parts for racing often find their way into our street-based products. This integration of research and engineering is what we call "System Technology", and it is infinitely beneficial. Our #1 goal is never forgotten: to achieve total performance success and pursue excellence to the benefit of our customers. It is this unwavering mission that defines COMP Cams® engineering.



Research & Testing

COMP Cams® has developed and engineered literally thousands of product innovations for the performance automotive aftermarket. The first step in creating these products is research and development, and for 34 years the world's elite motorsports teams have turned to COMP Cams® for advanced valve train design technology and product manufacture. When provided with the most sophisticated design resources, test equipment and manufacturing processes available, great things happen and what was once impossible becomes yesterday's limitations.



Research & Testing Equipment:

- 3 Engine Dynamometers/2 Chassis Dynamometers
- 2 Spintron® Cells w/ Proprietary Instrumentation
- 2 Adcole Model 911
- CMM (Coordinate Measuring Machine)
- High Speed Data Acquisition
- Laser Tracking
- Strain Gauging
- Load Cells
- Proximity Sensors
- Optron Vision Tracking System
- CFIA (Computerized Fuel Injector Analysis) Station
- SuperFlow 1020 Airflow Bench

Results

COMP Cams® has never forgotten that the criteria for achieving performance "success" is judged by results – both at the track and on the street. COMP Cams® has produced more champions than any other camshaft manufacturer by working directly with the best teams in circle track, drag racing, road racing and off-road racing. Whether you are looking for horsepower, reliability or gas mileage, COMP Cams® has the parts that will deliver.



UNDERSTANDING VALVE TIMING

You will often hear the camshaft dubbed the “heart” or “mind” of a performance engine. One of the main reasons for this is the dramatic effect the valve timing events have on a four stroke internal combustion engine. Our goal is to show you the effect of each valve event and how you can tailor these to the requirements of your engine.

Exhaust Opening

This occurs near the middle of the power stroke, after the spark plug has fired and the flame front expanded, pushing the piston downward (Fig. 1). Once the exhaust valve is open, the exhaust begins exiting the chamber and cylinder pressure drops rapidly. The combustion pressure is now used to force the burned mixture out of the exhaust – NOT force down the piston. During the exhaust stroke (Fig. 2), the remaining exhaust gasses will be pushed out by the piston, making room for the next charge of the air/gas mixture.

The later the exhaust opens, the more low rpm torque you gain by lengthening the power stroke. The earlier the exhaust opens, the more the power curve will carry past the point of peak horsepower, due to both reduced exhaust “pumping losses” and the exhaust having more time to free itself of the chamber.

Intake Opening

The next point on the graph is the intake opening where overlap begins, which is very critical to vacuum, throttle response, emissions and gas mileage. The exhaust stroke of the piston has pushed out nearly all of the burned mixture, and as the piston approaches the top, the intake valve opens, starting a siphon or “scavenge” effect through the chamber. This occurs at the end of the exhaust stroke.

The earlier the intake opens, the easier it is to maximize valve lift at peak piston velocity. For most rod-to-stroke ratios, peak piston velocity (and peak air demand) occurs at about 70° after Top Dead Center (TDC). The intake needs to be open as much as possible by that point, in order to not restrict airflow.

Overlap

During this period, both valves are open, allowing the intake and exhaust systems to affect one another. Here, the intake and exhaust systems communicate, resulting in a complex system where small changes on one side can greatly affect the other. The shape of the overlap is often just as important as its duration or the area. An engine’s overlap requirements are highly dependent on the design of the combustion chamber, air inlet and exhaust systems.

Once the piston passes through TDC and starts back down, the intake charge is pulled in quickly so the exhaust valve must close at exactly the right point, after TDC, to keep burned gas from re-entering while not allowing too much of the “good” inlet charge to escape with the exhaust.

Exhaust Closing

We have now passed through overlap. The exhaust valve closed just after the piston started down, and the intake valve is opening quickly. This is called the intake stroke (Fig. 3), where the engine “breathes in” and fills itself with another charge of the air/gas mixture.

Slower closing exhaust lobes may be preferred for various applications, due to the exhaust closing period having high airflow velocity at the exhaust valve seat. Like air flowing over the top of a wing, rapidly exiting exhaust will result in a low pressure signal to help draw in more air from the inlet.

Intake Closing

This is the most important valve event. The piston goes all the way to the bottom, and as it starts back up, the intake valve rushes to the seat. The closing point of the intake valve will determine where the cylinder begins to build pressure, as we are now into the compression stroke (Fig. 4).

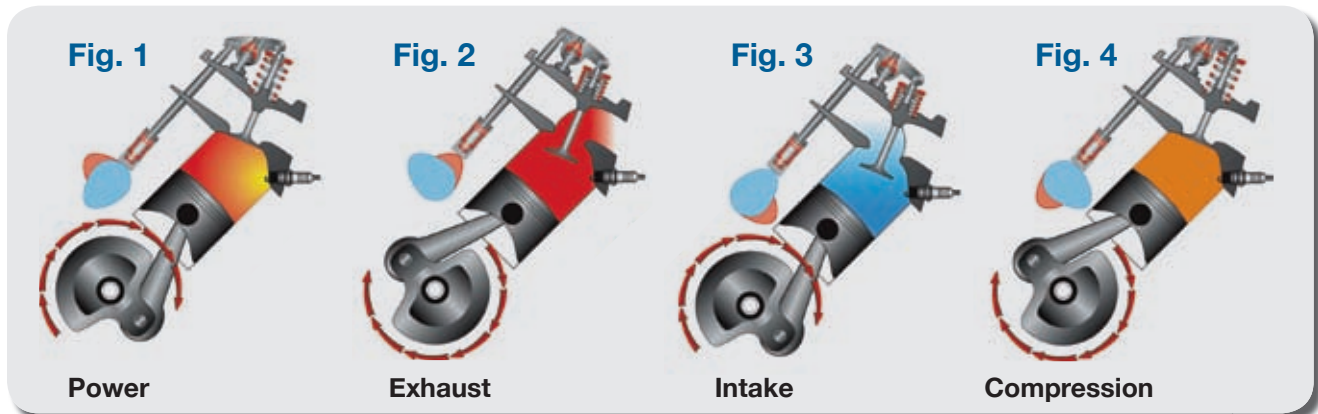
Earlier intake closings will trap more air in the chamber at low speeds, making better low rpm torque; later intake closings give the air more time to enter the chamber at higher rpm. Lift at Bottom Dead Center is important because there is still a substantial amount of airflow during this time. For a given rpm, you want to close the intake valve as soon as the rapidly increasing cylinder pressure overcomes the momentum of the inlet charge and air begins to rush back out of the chamber and into the intake manifold.

Duration & Lift

A cam’s duration is the number of degrees of crankshaft rotation a cam maintains beyond a given tappet lift. Although 0.050” lift is the most common, duration can be measured at many points. Lift is simply the rise of the tappet from its position on the base circle. The engine actually responds to the duration and lift at the valve, not the tappet.

$$\text{Valve Lift} = (\text{Tappet Lift} \times \text{Actual Rocker Ratio}) - \text{Lash} - \text{Deflection}$$

In our example, a .365” intake/.367” exhaust tappet lift and a 1.7:1 rocker ratio result in .621” intake/.624” exhaust valve lift, assuming no lash or deflection. When describing or analyzing a cam, .050” lift duration is the most common because it’s easy to measure and indicates the resulting combination’s “power band.” The advertised lift duration (.020”



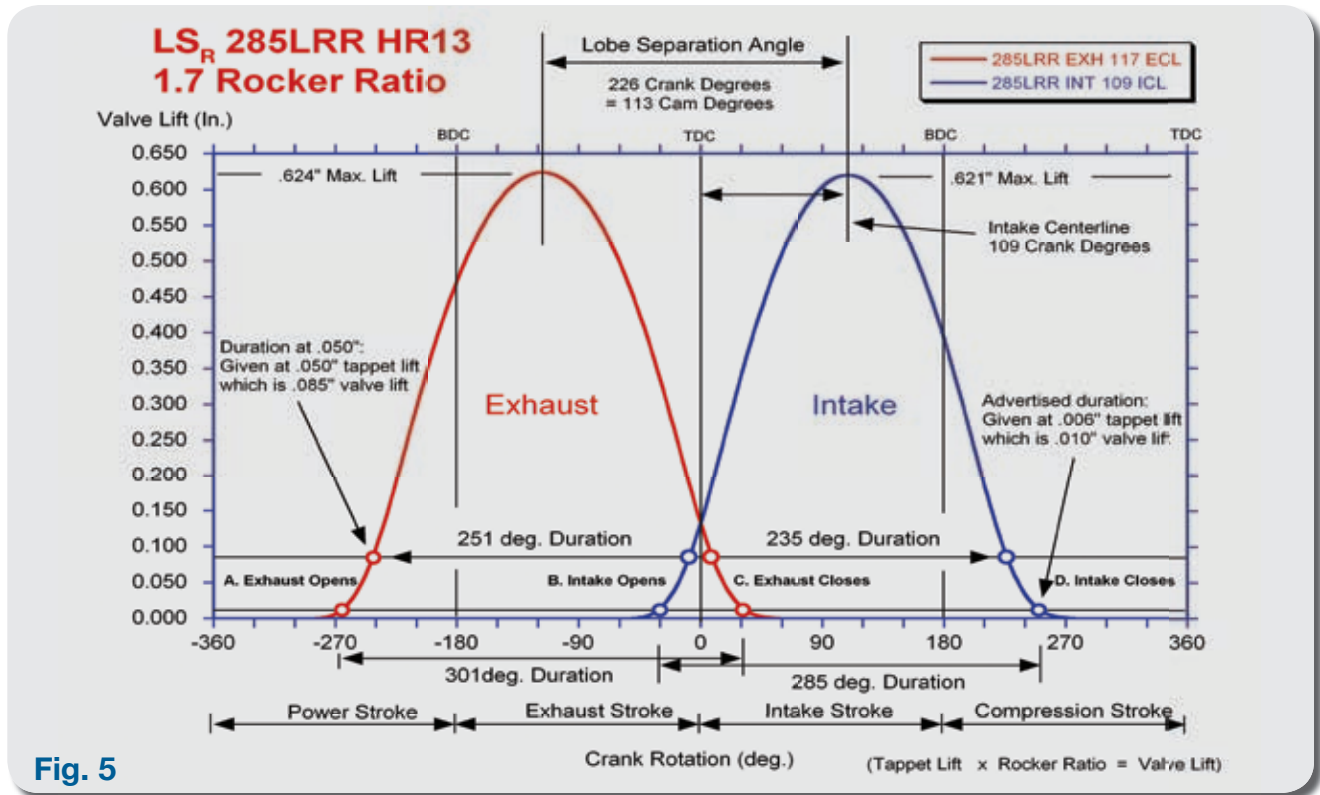


Fig. 5

solid/.006" hydraulic) provides better "seat-to-seat" numbers. The duration at .200" lift gives the best measurement of area under the curve and maximum power potential. Comparing advertised .050" and .200" durations gives engine builders an idea of the profile's "aggressiveness." Tappet durations do not take into account rocker ratio and valve lash effects.

Valve durations will typically be larger than tappet durations and will increase with the rocker arm ratio. In the example, the rated duration is .006" tappet lift: $.006" \times 1.7 = .010"$. We now use .010" valve lift. Some cam manufacturers rate their cams at .050" lift. Multiply this by the 1.7 rocker ratio and you get .085". For the given diagram, the duration at .085" lift shows around 235° and 251° standard for a 285 cam.

Lobe Separation & Centerlines

Lobe separation and intake centerline are often confused, although they are very different measurements that control different events in the engine. The lobe separation angle is equal to 1/2 the angle in crankshaft degrees of rotation between the maximum exhaust valve lift and maximum intake lift. It cannot be changed after the initial cam grind.

The intake centerline is the angle in crank

degrees between a cylinder's piston coming to TDC and the event of maximum intake lift. Exhaust centerline is the angle in crank degrees between the event of maximum exhaust lift and that cylinder's piston coming to TDC. Advance measures the angle of rotation in crankshaft degrees between the point where both centerlines would be the same and the actual intake centerline. These can be changed when degreeding the camshaft. Fig.5 shows an LS[™] 285 Cam with a lobe separation of 113°. We show it installed in the engine 4° advanced, at 109° intake centerline.

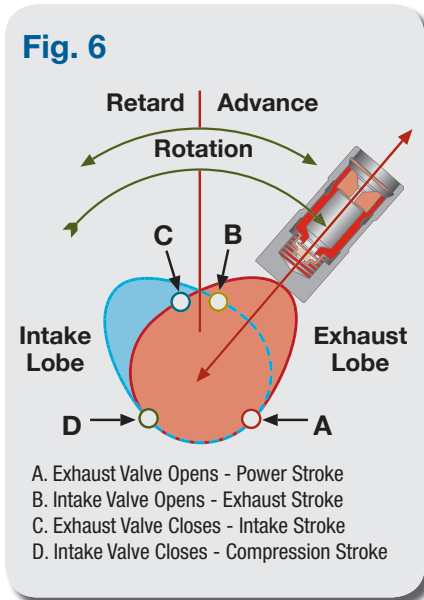


Fig. 6

Fig. 6 shows the end of the same cam with all opening and closing points marked. All points are in the same order as in Fig. 5. This figure shows how a cam must be laid out to give the timing points we aim to achieve. It's important to note that as we design a camshaft, what we are actually designing is the valve motion and valve events required for optimal engine performance. Therefore, Fig. 6 shows the result of the design - NOT the design itself.

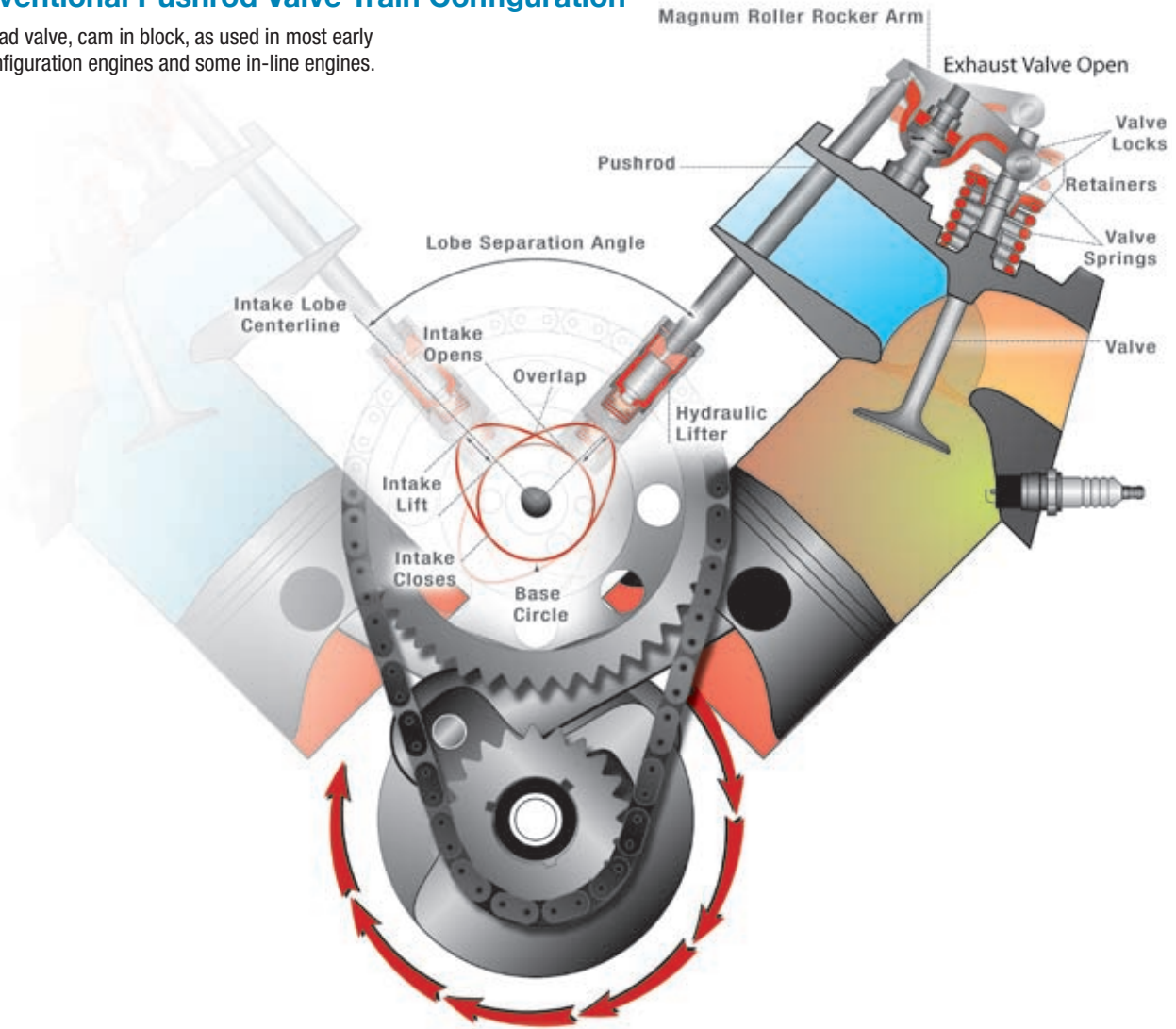
Finishing Touches

As far as the mechanics of degreeding, the COMP Cams® DVD "The Proper Procedure to Install and Degree a Camshaft" (#190DVD) takes you step-by-step through the process. The previous pages discuss theory; the video shows you how to get the job done.

At COMP Cams®, we put a lot of pride and effort into designing and engineering our camshafts. Camshaft design is not just some "black art" but rather a series of decisions and compromises based on the engine application. Only years of experience can say whether a certain combination of lobes will work. Take a look at the decals of the top race teams – it's obvious they trust the experts at COMP Cams®.

Conventional Pushrod Valve Train Configuration

Overhead valve, cam in block, as used in most early "V" configuration engines and some in-line engines.



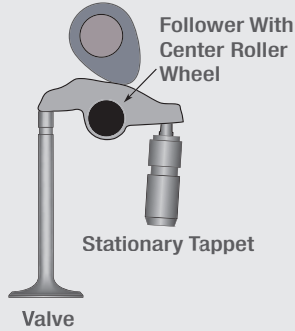
Conventional Over Head Cam Configuration

Cam Profile



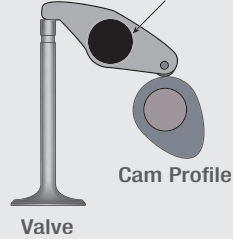
Bucket Style Follower OHC, as used in:
Ford Ztec
Olds Quad 4

Cam Profile

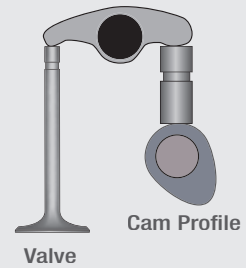


Finger Type Follower OHC, as used in:
Ford Modular, Pinto and Ranger 4 Cyl.
Mitsubishi 4G63, GM Ecotec
Chrysler 2.2L

Center Pivot Roller Follower



Center Pivot OHC, as used in:
Honda B18
Porsche



Center Pivot with Lifter OHC, as used in:
Ford Escort CVH

Camshaft Selection Process

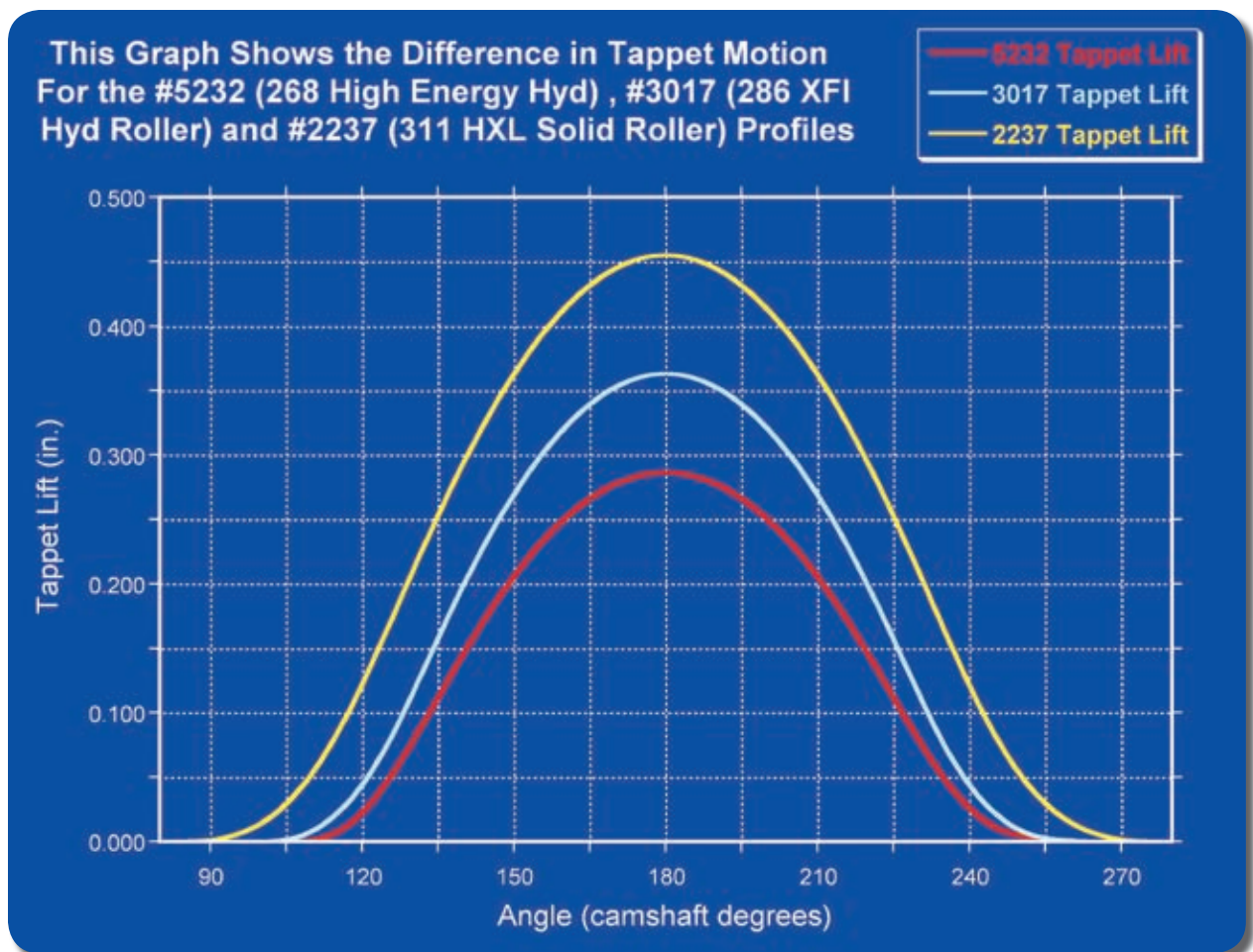
When selecting a cam there are a number of important points to consider, but one outshines the rest – being realistic and honest about what you expect your engine to do. Even if you love the lope of a monster cam, requiring that characteristic from a daily street driver may be unrealistic. By selecting the right cam for your engine, you can generate tons of torque, extend your engine's rpm limit, retain reliability, and in some cases, even pick up a few extra miles per gallon.

Part of the cam selection process has nothing to do with power generation. In a street driven vehicle with various engine accessories, it is important to select a camshaft that generates the proper amount of engine vacuum. Next, honestly determine the rpm range in which you require your engine to operate. This will also help you choose the matching valve train components required to build the most power, torque and reliability.

At the core of the cam selection process is determining the lifter style that fits your needs. If you are looking for an inexpensive and uncomplicated lifter, then hydraulic flat tappet lifters are a good choice. Solid flat tappet lifters offer a great nostalgic sound and great performance but must be adjusted on a periodic basis. Today's alternative is the long lasting and low maintenance hydraulic roller lifter, a favorite of many performance engine builders. But remember, when in doubt, our CAM HELP® experts are here to make sure you find the right cam for your engine, regardless of your application, so call us toll free at 1-800-999-0853 or visit www.camhelp.com.

The Proper Camshaft For Your Application

The chart below represents three different lobe designs and points out the differences between a mechanical roller (yellow), a hydraulic roller (blue) and a hydraulic flat tappet (red). The mechanical roller has a higher lift and a greater valve opening than the others, putting it at the top of the list of extreme racing applications. The hydraulic roller in the middle has a greater opening than the hydraulic flat tappet and is better suited in high performance street applications where power is the main concern. At the bottom of the chart is a lobe from a hydraulic flat tappet camshaft. This is a street cam with good vacuum and a mild idle. This camshaft was designed with low-end torque and mid-range power and is excellent for daily driven street machines.



HYDRAULIC FLAT TAPPET CAMS

Common Usage: Mild street performance to mild race

Key Benefits: Minimal maintenance, little or no valve train noise and economical cost

Limitations: Long-term wear, limited rpm range, lobe profile limitations

A popular street camshaft used with pre 1985s original overhead valve OEM engines, the hydraulic flat tappet cam is commonly used up to mildly aggressive performance profiles. The flat tappet lifter has a flat appearing base (this surface is actually slightly crowned) that rides on the cam lobe face, rotating slowly within the lifter bore to promote proper oiling. Internally, the lifter features a cavity that fills with oil and a piston that is depressed by the pushrod (and valve spring). This "hydraulic chamber" provides a cushion of fluid to soften the impact on the valve train, creating room for expansion as the engine reaches operating temperature. Hydraulic flat tappet camshafts deliver quiet operation at street to mild racing engine speeds. The biggest advantage to hydraulic flat tappet lifters is that they do not require constant maintenance to ensure proper valve lash. Hydraulic flat tappet camshafts/lifters are pre-loaded at initial start-up and require little, if any, maintenance from that point forward. Flat tappet lifters can only be used once per camshaft and must be replaced due to wear patterns created by the direct contact of the cam with the lifter base.

SOLID/MECHANICAL FLAT TAPPET CAMSHAFTS

Common Usage: Moderate street performance to serious race

Key Benefits: Increased engine rpm and profile aggressiveness vs. economical cost of hydraulic flat tappet

Limitations: Long-term wear, periodic valve adjustment required

The original race engine lifter, solid (also referred to as mechanical) flat tappet camshafts feature more aggressive street performance or racing profiles and are capable of higher engine rpm than hydraulic flat tappet camshafts. As with the hydraulic flat tappet camshaft, the flat appearing lifter bottom follows the contours of the camshaft to operate the valve train components at the appropriate time, rotating within the lifter bore in a similar fashion to the hydraulic flat tappet lifter. The solid lifter does not have the internal cavity and piston found with the hydraulic lifter and does not expand or contract with engine temperature. Because of this feature, the solid lifter requires an initial cold valve lash setting and then adjustment after the engine has reached operating temperature (hot lash setting) to deliver the engine's top performance potential. Solid flat tappet lifters also feature a signature performance "ticking" sound, particularly when cold, that many performance fans like.

The lash setting is adjusted by using a set of feeler gauges to set the proper distance between the rocker arm tip and top of the valve stem when the lifter is on the base circle of the camshaft. Solid lifter camshafts require a certain level of valve lash maintenance at regular intervals. Flat tappet lifters can only be used once per camshaft and must be replaced due to wear patterns created by the direct contact of the camshaft with the lifter base.

Special Note: Flat tappet camshafts require a special break-in process to allow the lifters and camshaft to properly mate. These steps include (but are not limited to) using a suitable engine oil with a high Zinc (ZDDP) content (see page 272 for part numbers) and reducing valve spring pressure during break-in. For a complete, step-by-step break-in procedure, please call us toll free at 1-800-999-0853.

