Serious Parts for Serious Racers Since 1952

HOWARDS cams®

& RACING COMPONENTS

HRC HOWARDS RACING COMPONENTS

Howards CAMS

New: GM DuraMax 6.6L Ultimate X X-Beam Ultimate Duty Forged Billet Rods

New: Chev SB Pro Max™ 4340 Cracks with Big Block Snouts

New: Ford SB Pro Max™ 4340 Cranks

New: Chrysler SB Ultimate Duty Forged Billet Rods

New: Chrysler BB Ultimate Duty Forged Billet Rods

New: Chrysler 5.7L Hemi Ultimate Duty Forged Billet Rods

New: Ford BA Turbo Typhoon Ultimate Duty Forged Billet Rods

New: Mitsubishi Ultimate Duty Forged Billet Rods

New: Nissan Ultimate Duty Forged Billet Rods

New: Chev SB Lightweight Ultimate Duty Forged Billet Rods

New: GM LS1 Lightweight Ultimate Duty Forged Billet Rods

New: Chev SB & BB Nitrous Cams

New: Ultra Lite Direct Lube™ 73g Mechanical Lifters

New: Street Series Retro-Fit Hydraulic Roller Lifters

New: Pro Max™ High RPM Hydraulic Roller Lifters

New: Pro Max™ Direct Lube™ Mechanical Roller Lifters

New: Composite Distributor Gears

New: Ultra Lite Billet Composite Fuel Pump Pushrods

New: Max Z.P.M. Camshaft Break-In Lube

Some items are not legal for sale or use on any pollution controlled motor vehicle

HOWARDS cams™

INSIDE This Catalog

Cams & Valvetrain

Engine Components

Not responsible for typographical errors.

45,000 Sq. Ft. Manufacturing and Distribution Center

Expect the Best, If our Name is on it…

The name Howards™ has been synonymous with high performance camshafts since the 1950's. A great number of valve train innovations can be traced back to Howards™ Cams. From pioneers in drag racing and oval track cams to cutting edge marine development, Howards™ Cams is at the forefront of the camshaft industry.

From the humble beginnings of Howard to an industry leader today, Howards™ Cams has not forgotten the customer from the novice to the most sophisticated race teams. Our main objective is to produce the highest quality product at a reasonable price while also offering exceptional customer service. We at Howards™ Cams are also dedicated to providing our customers with unparalleled dealer support.

Our knowledgeable and courteous sales and technical support staffs are available for you from 8:00A.M. - 5:00P.M. C.S.T. Monday-Friday. All of us at Howards™ Cams want to thank you, our customers for the opportunity to serve you and look forward to many more successful years ahead.

Hydraulic Cam & Lifter Kits

Matched Hydraulic Flat tappet Cam & Lifter Kits

These performance cams and matched lifters are simply the best dollar value in the business! Great for street/strip applications, they produce optimum torque, horsepower and RPMs, while meeting tight budget requirements. Howards hydraulic profile cams & lifters are manufactured using the latest technology and software. The result? They provide increased power, improved mileage and better overall performance. For state-of-the-art, matched valvetrain components, Howards is the clear choice for running with the best!

Chev SB (Hydraulic)

.420/.420, 280/280, 208/208, 111LS
CL112011 ....Good Low & Mid-Range Torque, Good in PU, 4x4

.447/.447, 288/288, 214/214, 111LS
CL110931 .....Strong Low & Mid-Range Torque

.449/.449, 290/290, 224/224, 108LS
CL112431 .....Hot Street, 4bbl. & Headers Recommended

.470/.470, 288/288, 220/220, 108LS
CL110991 .....Street/Strip, Needs Headers, 4bbl. & Low Gears

.470/.470, 286/296, 220/230, 110LS
CL110951 .....Street/Strip, Needs Headers, 4bbl. & Low Gears

.480/.480, 288/288, 232/232, 108LS
CL112031 ....Broad Power Band, Works Well in Heavy Vehicles

.510/.510, 302/302, 246/246, 109LS
CL112041 .....E.T. Brackets, Strong Mid & Upper end Power

Chev BB (Hydraulic)

.478/.503, 282/292, 204/214, 112LS
CL120021 .....Exceptional Torque, Good in PU, 4x4, RV

.460/.460, 288/300, 204/208, 112LS
CL122501 .....Great Low End Torque, Good Fuel Economy

.502/.525, 290/300, 215/225, 112LS
CL120031 .....Great Low & Mid-Range, Heavy Vehicle OK

.500/.505, 310/322, 222/234, 115LS
CL122521.....Excellent in Performance & Marine

.525/.525, 310/310, 224/224, 111LS
CL120941 .....Strong Mid-Range, Needs Headers, 4bbl.

Chrysler BB 361-440 (Hydraulic)

.447/.447, 292/292, 214/214, 111LS
CL720931 .....Super Low End and Mid-range. Good Idle

Ford 221-302 (Hydraulic)

.450/.474, 280/288, 204/214, 112LS
CL210021 .....Good Low & Mid Range, Good in PU, 4x4, RV

.459/.459, 294/294, 214/214, 111LS
CL211031..Good Idle, Street, Off-Road, Towing, Fuel Economy

.474/.498, 288/298, 214/224, 112LS
CL210031 .....Broad Power Band, Hot Street / Marine

Ford 351W (Hydraulic)

.479/.479, 292/292, 214/214, 110LS
CL220931 .....Lopey Idle, Excellent Street Performance

Ford 429-460 (Hydraulic)

.495/.495, 298/298, 218/218, 110LS
CL242201.....Strong Bottom End, Great Daily Usage Cam

.514/.514, 292/292, 214/214, 114LS
CL240931 .....Hot Performance Street / Marine

Pontiac V8 (Hydraulic)

.472/.472, 296/296, 230/230, 108LS
CL410961 .....Hot Street/Strip Performance

Some items are not legal for sale or use on any pollution controlled motor vehicle

Retro-Fit Hydraulic Roller Cam & Lifter Kits

These street performance grinds are matched with Howards Street Series Retro-Fit hydraulic roller lifters. Perfect for the performance enthusiast wishing to upgrade to a hydraulic roller cam. These kits offer significant advantages of additional lift and more power compared to flat tappet designs. Saves money too. Ask your person for pushrod and valve spring recommendations.

Chev SB (Hydraulic Roller)

.450/.465, 262/272, 208/214, 112LS
CL110225 .....Great Daily Usage, Smooth Idle, Fuel Economy

.488/.495, 270/280, 214/218, 112LS
CL110235-12 .....Good Idle, Off-road and Street Performance

.501/.509, 280/292, 224/230, 112LS
CL110245 .....Mild Street Performance. Crisp Throttle

.510/.533, 288/294, 232/236, 112LS
CL110255 .....Fair Idle. Great Mid-range Torque and HP

.533/.548, 294/302, 234/242, 112LS
CL110265 .....Lopey Idle, Hot Street Performance, 10:1+ CR

Chev BB (Hydraulic Roller)

.510/.525, 262/272, 208/214, 112LS
CL120225 .....Great Daily Usage, Smooth Idle, Fuel Economy

.514/.537, 270/280, 214/222, 112LS
CL120235 .....Good Idle, Street Performance, 9.0:1+ CR

.568/.579, 280/292, 226/232, 112LS
CL120245 .....Mild Street Performance. Crisp Throttle

.585/.610, 288/294, 230/236, 112LS
CL120255 .....Fair Idle. Great Mid-range Torque and HP

.620/.620, 294/302, 236/242, 112LS
CL120265 .....Lopey Idle, Hot Street Performance, 10:1+ CR

.612/.612, 296/302, 236/242, 112LS
CL120405.....Rough Idle, Strong Mid-range Torque and HP

Ford 221-351W (Hydraulic Roller)

Note: 221-302 applications must change ignition firing order to 1-3-7-2-6-5-4-8.

.544/.544, 274/274, 220/220, 110LS
CL222725.....Mild Rough Idle, Good Torque & Power

.536/.536, 282/282, 226/226, 112LS
CL222745.....Best with 5-Speed or 2200-2500 stall.

.534/.547, 280/288, 224/232, 112LS
CL222755 .....Mild Street Performance. Crisp Throttle

.544/.560, 294/302, 234/242, 112LS
CL222735 .....Lopey Idle, Hot Street Performance, 10:1+ CR

Additional Heavy Duty Items

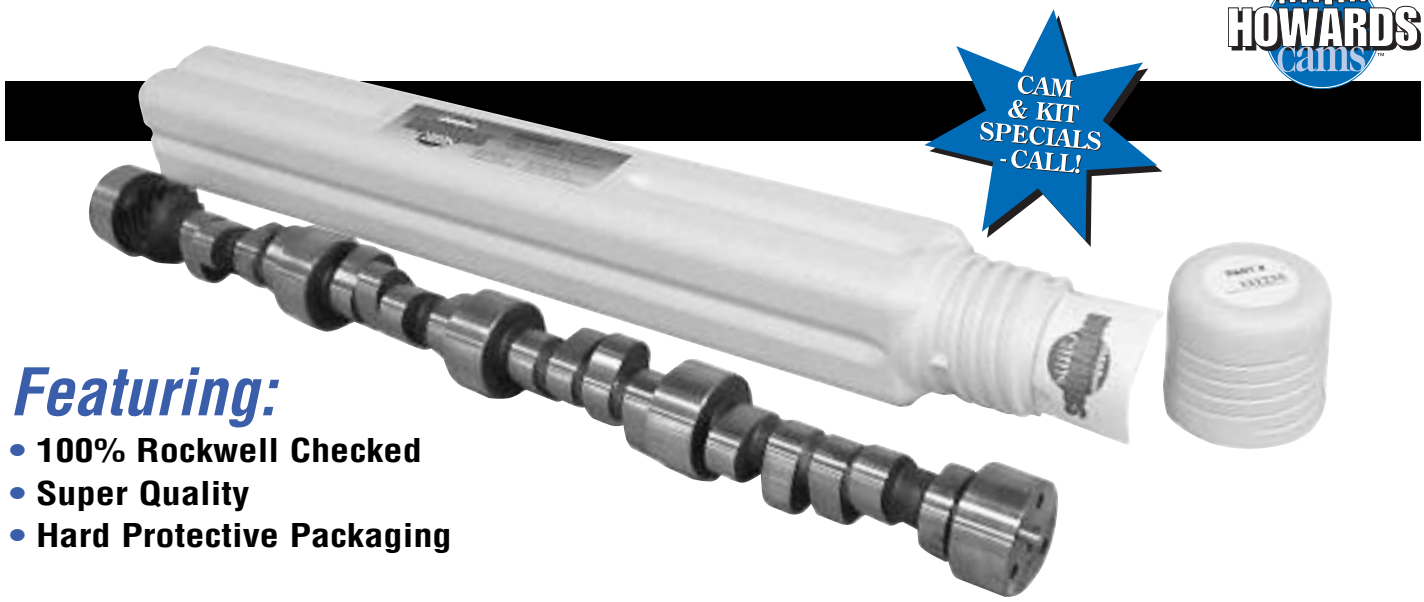
Please Call Our Tech. Department for specific applications.

94570 Chev SB Roller Cam Button (.800")
94575 Chev BB Roller Cam Button (.950")

See Page 47 for 1.250" Valve Springs
See Page 47 for 1.437" Valve Springs

See Page 50 for 7˚ & 10˚ Chrome Moly Retainers
See Page 50 for 7˚ & 10˚ Titanium Retainers

See Page 51 for 7˚ Valve Locks
See Page 51 for 10˚ Valve Locks



Featuring:

- **100% Rockwell Checked**
- **Super Quality**
- **Hard Protective Packaging**

All Howards™ Cams use the highest-grade race quality billets available. All hydraulic and mechanical flat tappet camshafts are 100% Rockwell checked and Parkerized to ensure the highest quality control standards available anywhere. Howards™ Cams are manufactured on dedicated high precision cam grinding machines. All Howards™ Cams are packaged and shipped in our unique, hard, high impact plastic reusable cases. This ensures that the high quality camshaft that went into the case comes out in the same condition, when delivered, as when it was packed.

A Cam For Every Application

- ***Max Factory Cams*** - OEM High performance cams to improve all around performance. Many OEM factory replacement grinds available. Good fuel economy.
- ***Max Efficiency Cams*** - Low-end torque and good mileage cams. Computer friendly high vacuum grinds. Smooth idle with superior drivability and economy.
- ***Max Torque Cams*** - High Performance Street & Strip, bracket racing and off road grinds. Delivers a good balance of power over a broad RPM range. Stump pulling power, yet not radical enough to be a pain for the gain.
- ***Max Marine Cams*** - Marine camshafts can vary greatly depending on a wide range of applications. Exhaust systems, drives, ratios, intake systems, hull weights, designs and usage all make cam selection very important. Howards™ Cams supplies camshafts for entry level MerCruisers® to 900 SCs, as well as jet boats, V-drives and blown hydros.
- ***Max Oval Cams*** - Howards™ Cams Max Oval camshafts were designed to provide explosive power out of the turns and make great horsepower down the straight-aways. Howards™ stocks or can custom grind a camshaft to suit most of our customer's applications, from vacuum and lift rules to all out competition.
- ***Max Effort™ Cams*** - Race only profiles. Computer designed, dyno and track proven to produce the highest horsepower and torque for a given engine combination. Howards™ Cams has numerous profiles available.
- ***Big Bottle™ Cams*** - Specifically designed for use with competition nitrous systems of 250HP or more. Custom designed lobes with extra attention to the exhaust lobes to scavenge the exhaust from the cylinders. Custom grinds are also available, just call to talk to our knowledgeable tech department.
- ***Custom Cams*** - If you do not see a cam that will work for you, give our tech department a call. We will be happy to design and grind a custom camshaft to specifically fit your needs. Custom camshafts are available in hydraulic flat tappet, mechanical flat tappet, hydraulic roller and mechanical roller profiles.

Some items are not legal for sale or use on any pollution controlled motor vehicle

American Motors • 66-91 290/401 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.6 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Efficiency *Hydraulic Flat Tappet*	**.450** *800-4800*	**.474**	**280**	**288**	**204**	**214**	**110**	**.000**	**.000**	**310011**	**98411**
Smooth idle, improved low end. High vacuum, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	**.479** *1200-5200*	**.479**	**290**	**290**	**214**	**214**	**111**	**.000**	**.000**	**312481**	**98411**
Good idle, Street, Off-Road, Towing. Good fuel efficiency.											
Max Torque *Hydraulic Flat Tappet*	**.477** *1500-5500*	**.477**	**292**	**292**	**222**	**222**	**114**	**.000**	**.000**	**310021**	**98411**
Strong low and mid-range torque and horsepower.											
Max Torque *Hydraulic Flat Tappet*	**.520** *2200-6200*	**.542**	**302**	**312**	**234**	**244**	**112**	**.000**	**.000**	**310031**	**98411**
Strong low and mid-range torque and horsepower. Manual or auto with stall.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91711 Hydraulic Lifters
99000 Max Z.P.M. Break-In Lube

See Page 40 for Hydraulic Lifters
See Page 47 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks

Cadillac • 68-84; 368-425-472-500 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.6 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Efficiency *Hydraulic Flat Tappet*	**.465** *1000-4200*	**.465**	**282**	**282**	**210**	**210**	**112**	**.000**	**.000**	**520021**	**98411**
Smooth idle, builds good low end torque and power.											
Max Torque *Hydraulic Flat Tappet*	**.486** *1200-4800*	**.486**	**286**	**286**	**218**	**218**	**112**	**.000**	**.000**	**520031**	**98411**
Good idle, strong low end torque and horsepower.											
Max Torque *Hydraulic Flat Tappet*	**.495** *1800-5000*	**.512**	**288**	**296**	**222**	**230**	**112**	**.000**	**.000**	**520051**	**98411**
Good low end torque and mid-range horsepower.											
Max Torque *Hydraulic Flat Tappet*	**.520** *2400-5600*	**.520**	**292**	**302**	**232**	**240**	**112**	**.000**	**.000**	**520071**	**98411**
Lopey idle, great mid-range torque and top end power. Needs stall.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91411 Hydraulic Lifters
99000 Max Z.P.M. Break-In Lube

See Page 40 for Hydraulic Lifters
See Page 47 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Factory *Hydraulic Flat Tappet*	.400 *600-4800*	.410	268	272	202	208	114	.000	.000	112001	98111
Smooth idle, strong low end. High vacuum, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	.426 *1100-5200*	.456	260	268	205	215	112	.000	.000	112561	98214
Smooth idle, Street, Towing, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	.426 *1000-5200*	.456	260	268	205	215	112	.000	.000	112561-S	98214
***Small Base Circle**, smooth idle, Street Performance, Towing, fuel economy.*											
Max Factory *Hydraulic Flat Tappet*	.420 *1200-5400*	.420	280	280	208	208	111	.000	.000	112011	98111
Good idle, Street, Off-Road, Towing. Good torque.											
Max Efficiency *Hydraulic Flat Tappet*	.430 *1000-5000*	.430	286	286	214	214	111	.000	.000	111021	98111
Good idle, Street, Off-Road, Towing. Good fuel efficiency.											
Max Efficiency *Hydraulic Flat Tappet*	.447 *1100-5200*	.447	288	288	214	214	111	.000	.000	110931	98111
Strong low and mid-range torque and horsepower.											
Max Efficiency *Hydraulic Flat Tappet*	.440 *1200-5500*	.455	268	270	215	225	112	.000	.000	112571	98214
Strong low and mid-range torque and horsepower.											
Max Efficiency *Hydraulic Flat Tappet*	.440 *1200-5500*	.455	268	270	215	225	112	.000	.000	112571-S	98214
***Small Base Circle**, strong low and mid-range torque and power.*											
Max Torque *Hydraulic Flat Tappet*	.446 *1500-5600*	.446	286	286	220	220	110	.000	.000	111221-10	98214
Nice idle, good low and mid range horsepower.											
Max Torque *Hydraulic Flat Tappet*	.470 *1700-5700*	.470	284	284	220	220	108	.000	.000	110991	98214
Good low and mid-range horsepower. Needs 4 barrel and headers.											
Max Torque *Hydraulic Flat Tappet*	.470 *2000-6000*	.470	286	296	220	230	110	.000	.000	110951	98214
Street and Strip. Needs 4 barrel, headers and lower gears.											
Max Torque *Hydraulic Flat Tappet*	.468 *1600-5800*	.480	288	302	220	230	110	.000	.000	112021	98214
High-lift, dual pattern. Needs 4 barrel, low gears and 2500+ stall											
Max Oval *Hydraulic Flat Tappet*	.410 *2500-6000*	.410	284	284	222	222	106	.000	.000	110071	98214
.420" Lift Rule cam, 1/4-3/8 mile, low to medium bank.											
Max Factory *Hydraulic Flat Tappet*	.447 *2000-5600*	.447	290	290	223	223	112	.000	.000	110031	98214
Nice idle, near duplicate of the Chev 325HP/327 cam (GM #3863151)											
Max Torque *Hydraulic Flat Tappet*	.449 *2500-6400*	.449	290	290	224	224	106	.000	.000	112431-06	98214
Lopey idle, good low end and mid-range horsepower and torque.											
Max Torque *Hydraulic Flat Tappet*	.449 *2400-6600*	.449	290	290	224	224	108	.000	.000	112431	98214
Hot Street cam. 4 barrel and headers recommended.											
Max Oval *Hydraulic Flat Tappet*	.450 *2600-6800*	.450	290	300	224	232	106	.000	.000	111241-06	98214
.450" Lift Rule cam, great on 3/8 mile tracks. Good low end response.											
Max Oval *Hydraulic Flat Tappet*	.450 *1600-6200*	.450	290	300	224	232	112	.000	.000	111241	98214
Vacuum Rule cam. Great on 1/4, 3/8 mile flat to medium bank tracks.											
Max Oval *Hydraulic Flat Tappet*	.450 *1600-6200*	.450	290	300	224	232	112	.000	.000	111241-S	98214
***Small Base Circle**, Vacuum Rule cam. Great on 1/4, 3/8 mile flat to medium bank tracks*											
Max Marine *Hydraulic Flat Tappet*	.465 *1800-6000*	.488	294	302	224	234	112	.000	.000	110041	98214
Fair idle, Hot Street and mild Bracket Racing.											
Max Torque *Hydraulic Flat Tappet*	.460 *1500-5600*	.460	310	310	225	225	111	.000	.000	110941	98214
Fair idle, strong mid-range performance.											
Max Torque *Hydraulic Flat Tappet*	.458 *1600-6000*	.472	310	314	225	235	112	.000	.000	112581-S	98214
***Small Base Circle**, Hot Street, 4-barrel and headers required.*											
Max Oval *Hydraulic Flat Tappet*	.390 *2800-6200*	.410	292	294	228	232	108	.000	.000	112811-08	98214
Stock Lift Rule. Best on 1/4 to 3/8 mile tracks with slight bank.											
Max Oval *Hydraulic Flat Tappet*	.390 *3000-6200*	.410	292	296	228	236	106	.000	.000	112701-06	98214
Stock Lift Rule. Best on 1/4 to 3/8 mile tracks. Strong lower mid-range power.											

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Hydraulic Flat Tappet Camshafts *(cont.)*

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Oval *Hydraulic Flat Tappet*	.390 *2800-6400*	.410	292	296	228	236	108	.000	.000	112701-08	98214
Stock Lift Rule. Best on 1/4 to 3/8 mile tracks. Good mid-range horsepower.											
Max Oval *Hydraulic Flat Tappet*	.390 *2600-6400*	.410	292	296	228	236	112	.000	.000	112701-12	98214
Stock Lift Rule and vacuum Rule. Broad power band.											
Max Oval *Hydraulic Flat Tappet*	.410 *2500-5600*	.410	288	288	230	230	106	.000	.000	110081	98214
Lift Rule cam. Good low and mid-range power. 1/4 to 3/8 mile banked tracks.											
Max Torque *Hydraulic Flat Tappet*	.470 *2400-6200*	.470	296	296	230	230	108	.000	.000	110961	98214
Hot Street/Brackets, broad power range, strong top end.											
Max Torque *Hydraulic Flat Tappet*	.480 *2500-6500*	.480	296	302	230	235	108	.000	.000	112141-08	98214
Lopey idle, broad power band, strong top end power.											
Max Torque *Hydraulic Flat Tappet*	.465 *1500-6000*	.472	280	292	230	240	108	.000	.000	112591-08S	98214
***Small Base Circle**, lopey idle, Hot Street/Brackets. 2500+ stall, 9.0:1+ CR.*											
Max Torque *Hydraulic Flat Tappet*	.465 *1500-6000*	.472	280	292	230	240	112	.000	.000	112591-S	98214
***Small Base Circle**, Hot Street and mild Bracket Racing.*											
Max Oval *Hydraulic Flat Tappet*	.450 *2500-6600*	.450	300	300	232	232	106	.000	.000	112691-06	98214
.450" Lift Rule cam. Strong low and mid-range power.											
Max Oval *Hydraulic Flat Tappet*	.450 *2400-6800*	.450	300	300	232	232	112	.000	.000	112691-12	98214
.450" Lift Rule cam. Strong mid-range horsepower.											
Max Torque *Hydraulic Flat Tappet*	.480 *3000-6500*	.480	288	288	232	232	108	.000	.000	112031	98214
Fair idle. Broad power band. Works well in heavy vehicles.											
Max Torque *Hydraulic Flat Tappet*	.488 *2000-6000*	.509	303	313	234	244	112	.000	.000	110051	98214
Lopey idle, Street/Strip or nostalgia. Likes headers and gears.											
Max Oval *Hydraulic Flat Tappet*	.480 *2800-6800*	.488	288	288	235	237	106	.000	.000	112681-06	98214
Lopey idle, strong low to mid-range torque and horsepower.											
Max Oval *Hydraulic Flat Tappet*	.480 *2800-6800*	.488	288	288	235	237	106	.000	.000	112681-06S	98214
***Small Base Circle**, choppy idle, strong low to mid-range torque and horsepower.*											
Max Torque *Hydraulic Flat Tappet*	.480 *2800-6800*	.488	288	288	235	237	112	.000	.000	112681-12	98214
Fair idle, strong mid to upper range performance.											
Max Torque *Hydraulic Flat Tappet*	.480 *2800-6800*	.488	288	288	235	237	112	.000	.000	112681-12S	98214
***Small Base Circle**, fair idle, strong mid to upper range performance.*											
Max Torque *Hydraulic Flat Tappet*	.485 *3000-6400*	.502	296	302	235	240	106	.000	.000	112601-06	98214
Bracket or 1/4 to 3/8 mile 4bbl. Limited Sportsman. Proven winner for .500" Lift Rule.											
Max Torque *Hydraulic Flat Tappet*	.485 *3000-6400*	.502	296	302	235	240	106	.000	.000	112601-06S	98214
***Small Base Circle**, Bracket or 1/4 to 3/8 mile 4bbl. Limited Sportsman.*											
Max Torque *Hydraulic Flat Tappet*	.485 *3000-6400*	.502	296	302	235	240	108	.000	.000	112601-08	98214
Lopey idle, good mid-range power. Needs 3200+ stall.											
Max Torque *Hydraulic Flat Tappet*	.485 *3000-6400*	.502	296	302	235	240	108	.000	.000	112601-08S	98214
***Small Base Circle**, lopey idle, good mid-range power. Needs 3200+ stall.*											
Max Torque *Hydraulic Flat Tappet*	.485 *3400-6800*	.502	296	302	235	240	112	.000	.000	112601	98214
Good mid-range to top end power. 100-150hp NOS OK. Needs stall.											
Max Torque *Hydraulic Flat Tappet*	.485 *3400-6800*	.502	296	302	235	240	112	.000	.000	112601-S	98214
***Small Base Circle**, Bracket Racing, strong mid and upper rpm.*											
Max Torque *Hydraulic Flat Tappet*	.470 *2500-6300*	.470	302	302	236	236	108	.000	.000	110971	98214
Lopey idle. Pro-Street and Bracket Racing profile.											
Max Oval *Hydraulic Flat Tappet*	.390 *3500-6800*	.410	296	302	236	242	106	.000	.000	112711-06	98214
3/8 and longer banked tracks. Good torque off corners. Strong mid-range.											
Max Oval *Hydraulic Flat Tappet*	.390 *3500-6200*	.410	296	302	236	242	108	.000	.000	112711-08	98214
Stock Lift Rule. 3/8 to 1/2 mile banked tracks. Good upper mid-range											

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Hydraulic Flat Tappet Camshafts (cont.)

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Oval *Hydraulic Flat Tappet*	.390 *3400-6300*	.410	296	302	236	242	112	.000	.000	112711-12	98214
Stock Lift Rule. 3/8 to 1/2 mile banked tracks. Good top-end power.											
Max Oval *Hydraulic Flat Tappet*	.390 *3200-6400*	.410	296	302	236	242	114	.000	.000	112711-14	98214
Stock Lift Rule and vacuum Rule. Banked 3/8 and longer tracks.											
Max Torque *Hydraulic Flat Tappet*	.470 *2800-6400*	.470	304	304	240	240	108	.000	.000	110981	98214
Rough idle, runs strong 4,000 rpm up, needs compression.											
Max Oval *Hydraulic Flat Tappet*	.410 *2500-6500*	.410	298	298	242	242	106	.000	.000	110091	98214
Lift Rule cam. 3/8 to 1/2 mile banked tracks. Good mid-range.											
Max Oval *Hydraulic Flat Tappet*	.434 *2800-6800*	.434	310	310	244	244	108	.000	.000	112621	98214
Lopey idle, needs low gears, headers and compression.											
Max Oval *Hydraulic Flat Tappet*	.450 *2600-6400*	.450	290	290	244	244	106	.000	.000	112721-06	98214
.450" Lift Rule cam. Good upper mid-range torque. High banked 3/8 to 1/2 mile.											
Max Effort *Hydraulic Flat Tappet*	.509 *2600-6600*	.533	310	324	244	254	112	.000	.000	110061	98214
Performance/Competition. Works well with small blower or NOS.											
Max Oval *Hydraulic Flat Tappet*	.450 *3600-6800*	.450	296	306	244	256	106	.000	.000	112751-06	98214
.450" Lift Rule, banked 3/8-1/2 mile tracks.											
Max Torque *Hydraulic Flat Tappet*	.510 *3400-6700*	.510	302	302	246	246	109	.000	.000	112041	98214
Hot Street/Brackets. Needs 10.0:1+ CR, good heads and exhaust. 3500+ stall.											
Max Torque *Hydraulic Flat Tappet*	.510 *3400-6700*	.510	302	302	246	246	109	.000	.000	112041-S	98214
***Small Base Circle**, E.T. Brackets. Strong mid and upper end power range.*											
Max Oval *Hydraulic Flat Tappet*	.400 *3000-6800*	.400	298	300	246	252	106	.000	.000	112731-06	98214
Stock Lift Rule, fast 3/8-1/2 mile tracks.											
Max Effort *Hydraulic Flat Tappet*	.520 *3200-6800*	.520	284	292	248	248	110	.000	.000	112401	98214
E.T. Brackets. Strong mid and upper end power range.											
Max Oval *Hydraulic Flat Tappet*	.420 *3400-6800*	.420	300	302	250	254	106	.000	.000	112741-06	98214
420" Lift Rule, high banked 1/2 mile tracks.											

MAX Z.P.M.™ Camshaft Break-In Lube

The most important product for proper flat tappet camshaft break-in available. This is true for both hydraulic and mechanical flat tappet camshafts. Virtually eliminates cam and lifter wear at initial break-in. Replaces the Zinc-Phosphates (ZDDP) removed from today's oils. The highest levels of Zinc-Phosphates (ZDDP) of all the popular brands tested, plus the addition of moly for extra protection. Compatible with all petroleum base and synthetic oils. Just add one 4 ounce bottle for up to 6 quarts of oil.

99000 MAX Z.P.M. Camshaft Break-In Lube, 4oz.

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Oval Track Lift Rule Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Oval *Hydraulic Flat Tappet*	.390	.410	292	296	228	236	106	.000	.000	112701-06	98214
3000-6200	*Stock Lift Rule, low banked 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.390	.410	292	294	228	232	108	.000	.000	112811-08	98214
2800-6200	*Stock Lift Rule, flat or loose 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.390	.410	296	302	236	242	106	.000	.000	112711-06	98214
3500-6200	*Stock Lift Rule, banked 3/8-1/2 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.400	.400	298	300	246	252	106	.000	.000	112731-06	98214
3000-6800	*Stock Lift Rule, fast 3/8-1/2 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.410	.410	284	284	222	222	106	.000	.000	110071	98214
2400-5400	*.420" Lift Rule, low bank 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.410	.410	288	288	230	230	106	.000	.000	110081-06	98214
2500-5600	*.420" Lift Rule, banked 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.410	.410	298	298	242	242	106	.000	.000	110091	98214
2600-6000	*.420" Lift Rule, banked 3/8-1/2 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.420	.420	300	302	250	254	106	.000	.000	112741-06	98214
3000-6800	*.420" Lift Rule, high banked 1/2 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.449	.449	290	290	224	224	106	.000	.000	112431-06	98214
2200-6500	*.450" Lift Rule, low bank 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.450	.450	290	300	224	232	106	.000	.000	111241-06	98214
2300-6600	*.450" Lift Rule, low bank 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.450	.450	300	300	232	232	106	.000	.000	112691-06	98214
2500-6600	*.450" Lift Rule, banked 1/4-3/8 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.450	.450	290	290	244	244	106	.000	.000	112721-06	98214
2700-7000	*.450"Lift Rule, high banked 3/8-1/2 mile tracks.*										
Max Oval *Hydraulic Flat Tappet*	.450	.450	296	306	244	256	106	.000	.000	112751-06	98214
3000-7000	*.450" Lift Rule, banked 3/8-1/2 mile tracks.*										

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

94580 Solid Cam Button
94570 Roller Cam Button
94505 Cam Degree Bushing Kit

91111 Hydraulic Lifters
91112 Anti-Pump up Hydraulic Lifters
94550 Cam Lock Plate & Bolt Kit

See Page 40 for Hydraulic Lifters
See Page 46 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 7° and 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Ultra Lite Billet Composite Fuel Pump Pushrods

Designed for NASCAR, a necessity for any serious racer using a mechanical fuel pump. Proprietary blended carbon reinforced bearing grade polymer. Ultra light weight, only 0.9 ounces (27 grams) to eliminate fuel pump cavitation. Gentle on the cam lobe. Can be used with cast or billet cams. Self lubricating. Super strong. Super long life.

94475 Chev V8, All Application (Cast or Billet), 27 Grams

Some items are not legal for sale or use on any pollution controlled motor vehicle

Camshafts

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Retro-Fit Hydraulic Roller Camshafts

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Factory *Hydraulic Roller Tappet*	.450 *800-4200*	.465	262	272	208	214	112	.000	.000	110225	98212
Great daily usage, smooth idle, great fuel economy.											
Max Efficiency *Hydraulic Roller Tappet*	.462 *1000-4400*	.470	265	272	210	215	110	.000	.000	110315-10	98212
Improved throttle response and low end torque.											
Max Efficiency *Hydraulic Roller Tappet*	.488 *1000-4800*	.495	270	280	214	218	110	.000	.000	110235-10	98212
Fair idle, good low and mid-range performance increase.											
Max Efficiency *Hydraulic Roller Tappet*	.488 *1000-5000*	.495	270	280	214	218	112	.000	.000	110235-12	98212
Good idle, Off-Road and Street Performance. 9.0:1 CR advised.											
Max Efficiency *Hydraulic Roller Tappet*	.488 *1000-5000*	.495	270	280	214	218	114	.000	.000	110235-14	98212
Good idle, broad power range with strong mid-range performance.											
Max Efficiency *Hydraulic Roller Tappet*	.501 *1600-5400*	.509	280	292	224	230	110	.000	.000	110245-10	98212
Fair idle, Street/Strip. Auto OK with 2500+ stall.											
Max Marine *Hydraulic Roller Tappet*	.501 *1800-5400*	.509	280	292	224	230	112	.000	.000	110245	98212
Fair idle, Street and mild Performance usage. Crisp throttle.											
Max Torque *Hydraulic Roller Tappet*	.525 *2000-5400*	.532	258	268	226	234	108	.000	.000	110325-08	98212
Choppy idle, Street performance usage. 2500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.525 *2200-5600*	.532	258	268	226	234	110	.000	.000	110325	98212
Rough idle, Street/Strip performance. Strong mid-range. 2500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.480 *2000-5500*	.480	306	306	230	230	108	.000	.000	110305-08	98212
Choppy idle, strong low and mid range performance. 2500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.510 *2200-5800*	.533	288	294	232	236	110	.000	.000	110255-10	98212
Rough idle, Street/Strip performance. Great low to mid-range torque and power.											
Max Torque *Hydraulic Roller Tappet*	.510 *2000-5600*	.533	288	294	232	236	112	.000	.000	110255	98212
Fair idle, performance usage. Great mid-range torque and horsepower.											
Max Torque *Hydraulic Roller Tappet*	.533 *2400-5800*	.548	294	302	234	242	110	.000	.000	110265-10	98212
Rough idle, Hot Street and Bracket Racing. 10.0:1-up CR advised. 2800+ stall											
Max Torque *Hydraulic Roller Tappet*	.533 *2400-6000*	.548	294	302	234	242	112	.000	.000	110265	98212
Lopey idle, Hot Street and Bracket Racing. 10.0:1-up CR advised.											
Max Torque *Hydraulic Roller Tappet*	.545 *2600-6400*	.562	298	306	242	248	110	.000	.000	110275-10	98212
Rough idle, Hot Street and Bracket Racing. 10.5:1-up CR advised.											
Max Torque *Hydraulic Roller Tappet*	.545 *2600-6500*	.562	298	306	242	248	112	.000	.000	110275-12	98432
Rough idle, Bracket Race with excellent mid and upper end horsepower.											
Max Torque *Hydraulic Roller Tappet*	.540 *2600-6400*	.540	314	318	248	252	110	.000	.000	110335-10	98212
Hot Street/Brackets. Requires aftermarket heads, 3500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.562 *2800-6600*	.578	298	305	248	254	110	.000	.000	110345-10	98212
Rough idle, needs good heads. Good upper mid-range. Needs 3500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.555 *2800-6700*	.555	298	308	252	258	110	.000	.000	110355-10	98212
Upper mid-range and top end power. Needs 11.0:1+ CR.											

Composite Distributor Gears

Make bronze distributor gear wear a thing of the past! NASCAR-proven technology yields precise timing and extended durability. Precision manufactured carbon ultra fiber material. 300% more durability versus bronze distributor gears when used with steel camshafts. Can be used with cast or billet cams.

94402 Chev V8, 90° V6 for .491 Shaft (std.)
94407 Chev V8, 90° V6 for .500 (MSD/etc.)
94427 Ford 221-302/351W, 5.0L for .500 Shaft

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 87-97 305/350 CI w/Stepped Nose

Hydraulic Roller Camshafts for OE Roller Applications

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Factory *Hydraulic Roller Tappet*	.450 *800-4200*	.465	262	272	208	214	112	.000	.000	180225	98212
Great daily usage, smooth idle, great fuel economy.											
Max Efficiency *Hydraulic Roller Tappet*	.462 *1000-4400*	.470	265	272	210	215	110	.000	.000	180315-10	98212
Improved throttle response and low end torque.											
Max Efficiency *Hydraulic Roller Tappet*	.488 *1000-4800*	.495	270	280	214	218	110	.000	.000	180235-10	98212
Fair idle, good low and mid-range performance increase.											
Max Efficiency *Hydraulic Roller Tappet*	.488 *1000-5000*	.495	270	280	214	218	112	.000	.000	180235-12	98212
Good idle, Off-Road and Street Performance. 9.0:1 CR advised.											
Max Efficiency *Hydraulic Roller Tappet*	.488 *1000-5000*	.495	270	280	214	218	114	.000	.000	180235-14	98212
Good idle, broad power range with strong mid-range performance.											
Max Efficiency *Hydraulic Roller Tappet*	.501 *1600-5400*	.509	280	292	224	230	110	.000	.000	180245-10	98212
Fair idle, Street/Strip. Auto OK with 2500+ stall.											
Max Marine *Hydraulic Roller Tappet*	.501 *1800-5400*	.509	280	292	224	230	112	.000	.000	180245	98212
Fair idle, Street and mild performance usage. Crisp throttle.											
Max Torque *Hydraulic Roller Tappet*	.525 *2000-5400*	.532	258	268	226	234	108	.000	.000	180325-08	98212
Choppy idle, Street performance usage. 2500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.525 *2200-5600*	.532	258	268	226	234	110	.000	.000	180325	98212
Rough idle, Street/Strip performance. Strong mid-range. 2500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.480 *2000-5500*	.480	306	306	230	230	108	.000	.000	180305-08	98212
Choppy idle, strong low and mid range performance. 2500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.510 *2200-5800*	.533	288	294	232	236	110	.000	.000	180255-10	98212
Rough idle, Street/Strip performance. Great low to mid-range torque and power.											
Max Torque *Hydraulic Roller Tappet*	.510 *2000-5600*	.533	288	294	232	236	112	.000	.000	180255	98212
Fair idle, performance usage. Great mid-range torque and horsepower.											
Max Torque *Hydraulic Roller Tappet*	.533 *2400-5800*	.548	294	302	234	242	110	.000	.000	180265-10	98212
Rough idle, Hot Street and Bracket Racing. 10.0:1-up CR advised. 2800+ stall											
Max Torque *Hydraulic Roller Tappet*	.533 *2400-6000*	.548	294	302	234	242	112	.000	.000	180265	98212
Lopey idle, Hot Street and Bracket Racing. 10.0:1-up CR advised.											
Max Torque *Hydraulic Roller Tappet*	.545 *2600-6400*	.562	298	306	242	248	110	.000	.000	180275-10	98212
Rough idle, Hot Street and Bracket Racing. 10.5:1-up CR advised.											
Max Torque *Hydraulic Roller Tappet*	.545 *2600-6500*	.562	298	306	242	248	112	.000	.000	180275-12	98432
Rough idle, Bracket Race with excellent mid and upper end horsepower.											
Max Torque *Hydraulic Roller Tappet*	.540 *2600-6400*	.540	314	318	248	252	110	.000	.000	180335-10	98212
Hot Street/Brackets. Requires aftermarket heads, 3500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.562 *2800-6600*	.578	298	305	248	254	110	.000	.000	180345-10	98212
Rough idle, needs good heads. Good upper mid-range. Needs 3500+ stall.											
Max Torque *Hydraulic Roller Tappet*	.555 *2800-6700*	.555	298	308	252	258	110	.000	.000	180355-10	98212
Upper mid-range and top end power. Needs 11.0:1+ CR.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

94570 Roller Cam Button
94505 Cam Degree Bushing Kit

91113 OE Style Hydraulic Roller Lifters
91164 Retro-Fit Hydraulic Roller Lifters

See Page 42 for Hydraulic Roller Lifters
See Page 48 for Valve Springs
See Page 50 for 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Mechanical Flat Tappet Camshafts

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Torque *Mechanical Flat Tappet*	**.505** *3000-6200*	**.520**	**278**	**282**	**240**	**246**	**106**	**.016**	**.018**	**110102**	**98212**
Hot Street/Brackets. Lopey idle. Needs higher CR and gears.											
Max Torque *Mechanical Flat Tappet*	**.505** *3000-6200*	**.520**	**278**	**282**	**240**	**246**	**108**	**.016**	**.018**	**110102-08**	**98212**
Hot Street/Bracket. Needs 10.0+ CR, 3200+ stall and gears.											
Max Oval *Mechanical Flat Tappet*	**.520** *3000-6400*	**.520**	**282**	**290**	**240**	**250**	**106**	**.024**	**.024**	**112061-06**	**98212**
Super throttle response. Stump pulling low and mid-range power.											
Max Oval *Mechanical Flat Tappet*	**.520** *3000-6400*	**.520**	**282**	**290**	**240**	**250**	**106**	**.024**	**.024**	**112061-06S**	**98212**
***Small Base Circle**, Super throttle response. Stump pulling. Low and mid-range power.*											
Max Torque *Mechanical Flat Tappet*	**.520** *2800-6200*	**.520**	**282**	**290**	**240**	**250**	**110**	**.024**	**.024**	**112061-10**	**98212**
Rough idle, Street/Strip. Broad mid-range power. Needs 10.0:1 CR, 3000+ stall.											
Max Torque *Mechanical Flat Tappet*	**.510** *2400-6200*	**.510**	**288**	**288**	**244**	**244**	**108**	**.022**	**.022**	**111001**	**98212**
Rough idle, super mid-range performance. Needs 11.0:1 CR-up.											
Max Torque *Mechanical Flat Tappet*	**.500** *2500-6200*	**.500**	**282**	**282**	**246**	**246**	**108**	**.030**	**.030**	**112071**	**98212**
Hot Street/Bracket, good mid-range performance.											
Max Oval *Mechanical Flat Tappet*	**.518** *2600-6500*	**.528**	**300**	**310**	**246**	**254**	**106**	**.024**	**.024**	**112651**	**98212**
Short Track profile, best on 1/4 to 3/8 mile tracks. 2 barrel OK.											
Max Torque *Mechanical Flat Tappet*	**.510** *3000-6200*	**.510**	**296**	**296**	**248**	**248**	**108**	**.022**	**.022**	**111011**	**98212**
Street/Strip, powerful through entire rpm range.											
Max Oval *Mechanical Flat Tappet*	**.514** *2800-6500*	**.514**	**296**	**296**	**249**	**249**	**106**	**.020**	**.020**	**112671**	**98212**
Best on 1/4 to 3/8 mile tight tracks. Big torque out of the corners. Needs headers.											
Max Oval *Mechanical Flat Tappet*	**.534** *2500-6500*	**.542**	**286**	**294**	**248**	**252**	**106**	**.014**	**.014**	**110812**	**98212**
Tight Lash Oval Track profile, great power coming off corners.											
Max Oval *Mechanical Flat Tappet*	**.534** *2500-6500*	**.542**	**286**	**294**	**248**	**252**	**106**	**.014**	**.014**	**110912-S**	**98212**
***Small Base Circle**, Tight Lash Oval Track profile, great power coming off corners.*											
Max Torque *Mechanical Flat Tappet*	**.525** *2600-6600*	**.540**	**286**	**292**	**250**	**256**	**108**	**.025**	**.025**	**112311**	**98212**
Hot Street/Strip, 10.0:1, 3000+ stall and single plane intake.											
Max Torque *Mechanical Flat Tappet*	**.525** *2600-6600*	**.540**	**286**	**292**	**250**	**256**	**110**	**.025**	**.025**	**112311-10S**	**98212**
***Small Base Circle**, Hot Street/Strip, 383+ cubic inch, 10.0:1, 2800+ stall.*											
Max Oval *Mechanical Flat Tappet*	**.510** *3000-6800*	**.510**	**286**	**296**	**250**	**258**	**106**	**.022**	**.022**	**112351**	**98212**
1/4 to 3/8 mile tracks. Great all-around short track cam.											
Max Torque *Mechanical Flat Tappet*	**.510** *2600-6800*	**.510**	**286**	**296**	**250**	**258**	**110**	**.022**	**.022**	**112351-10**	**98212**
383+ Street/Strip. Needs 10.0:1 CR, 2800+ stall.											
Max Oval *Mechanical Flat Tappet*	**.525** *3200-6800*	**.551**	**286**	**294**	**252**	**260**	**104**	**.024**	**.024**	**112452-04**	**98212**
Fast 1/4 to 3/8 mile tracks. Needs 11.0:1+ CR. Heavier car OK.											
Max Oval *Mechanical Flat Tappet*	**.525** *3000-6800*	**.525**	**286**	**292**	**252**	**260**	**106**	**.022**	**.022**	**111752**	**98213**
Best on 3/8 to 1/2 mile fast tracks. Super mid and upper RPM cam.											
Max Oval *Mechanical Flat Tappet*	**.543** *3000-7200*	**.563**	**292**	**298**	**252**	**260**	**106**	**.014**	**.014**	**110822**	**98212**
Great mid and top end Oval Track tight lash cam. Good on dirt or asphalt.											
Max Oval *Mechanical Flat Tappet*	**.543** *3000-7200*	**.563**	**292**	**298**	**252**	**260**	**106**	**.014**	**.014**	**110922-S**	**98212**
***Small Base Circle**, Great mid and top end Oval Track tight lash cam. Good on dirt or asphalt.*											
Max Factory *Mechanical Flat Tappet*	**.485** *3800-7000*	**.485**	**294**	**294**	**254**	**254**	**114**	**.030**	**.030**	**112192**	**98212**
Rough idle, near duplicate of the famous Duntov 30-30 cam (GM #3849346)											
Max Oval *Mechanical Flat Tappet*	**.540** *3000-7000*	**.555**	**288**	**296**	**255**	**263**	**106**	**.022**	**.022**	**112661**	**98212**
Best on fast 1/4 to 3/8 mile. Larger cubic inch 383+ recommended. 11.0:1+.											
Max Oval *Mechanical Flat Tappet*	**.504** *2800-7000*	**.504**	**286**	**296**	**255**	**266**	**105**	**.026**	**.026**	**112081**	**98212**
Great power, torque and throttle response. Great Sportsman cam.											
Max Oval *Mechanical Flat Tappet*	**.537** *3400-7500*	**.557**	**287**	**295**	**256**	**264**	**105**	**.026**	**.026**	**112292**	**98212**
Great mid-range and top end performer. Proven winner on fast 3/8 or 1/2 mile tracks.											
Max Torque *Mechanical Flat Tappet*	**.540** *3000-7400*	**.558**	**290**	**298**	**258**	**266**	**105**	**.026**	**.026**	**112091**	**98212**
Rough idle, works well in Pro-Street or heavy Bracket car.											

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

Mechanical Flat Tappet Camshafts (cont.)

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Oval *Mechanical Flat Tappet*	.555 *3200-7200*	.550	298	292	260	255	106	.022	.022	112542-06	98213
Rough idle, Oval Track. Banked 3/8 to 1/2 mile tracks. 11.5:1+ CR.											
Max Oval *Mechanical Flat Tappet*	.555 *3200-7200*	.550	298	292	260	255	106	.022	.022	112542-06S	98213
***Small Base Circle**, rough idle, Oval Track. Banked 3/8 to 1/2 mile tracks. 11.5:1+ CR.*											
Max Effort *Mechanical Flat Tappet*	.555 *3200-7200*	.555	298	300	260	264	106	.022	.022	112532-06	98213
Bracket Race or 3/8 to 1/2 mile Oval Track with fast corners. 350-383											
Max Effort *Mechanical Flat Tappet*	.555 *3200-7400*	.562	298	302	260	268	108	.024	.024	112321	98213
Bracket Race 350-383, or 3/8 to 1/2 mile 383-400. Needs 12.0:1+ CR											
Max Marine *Mechanical Flat Tappet*	.510 *3400-7400*	.534	308	318	262	274	112	.022	.024	112101	98212
Hot Pro-Street and Bracket Racing. Works well with NOS.											
Max Effort *Mechanical Flat Tappet*	.545 *3200-7200*	.532	308	314	268	274	106	.024	.024	112541	98212
Rough idle, Drag Race. Higher CR, stall speed and lower gears.											
Max Effort *Mechanical Flat Tappet*	.570 *3600-7400*	.575	302	310	268	278	108	.024	.024	112331	98213
Bracket Racer special. Super strong mid-range and top end.											
Max Effort *Mechanical Flat Tappet*	.580 *4000-7500*	.555	306	314	268	280	106	.025	.025	112262	98213
Serious Competition only. Needs the best of everything.											
Max Torque *Mechanical Flat Tappet*	.578 *3500-7500*	.578	320	320	276	276	110	.024	.024	112641	98213
Serious Competition 383-406, Requires 12.0:1+ CR, good single plane intake.											
Max Effort *Mechanical Flat Tappet*	.550 *4500-8000*	.570	302	310	278	286	106	.024	.024	112551	98213
Large 400+ Bracket/Class cam. Needs good heads and intake.											

Chevrolet Small Block • 57-86 262/400 C.I. • 87-95 305/350 C.I. w/Non-Hydraulic Roller Cam

4/7 Swap Mechanical Flat Tappet Camshafts (18736542 firing order)

Max Effort *Mechanical Flat Tappet*	.532 *3000-6800*	.525	278	282	248	252	106	.018	.018	114032	98212
Oval Track, 2bbl. 1/4 to 3/8 tight, with good intake and exhaust.											
Max Effort *Mechanical Flat Tappet*	.547 *3200-6800*	.532	280	290	252	260	106	.018	.018	114042	98212
Oval Track, 4bbl. 1/4 to 3/8 tight, with good intake, exhaust, 12.0:1+ CR.											
Max Effort *Mechanical Flat Tappet*	.543 *3200-6800*	.563	292	298	252	260	106	.014	.014	114822	98212
Oval Track, tight 1/4 to 3/8 mile. 12.0:1+ CR, single plane intake, headers.											
Max Effort *Mechanical Flat Tappet*	.532 *3800-7200*	.540	290	302	256	266	106	.026	.026	114012	98212
Drag Race with 4000+ stall, 11.0:1+ CR											
Max Effort *Mechanical Flat Tappet*	.560 *3400-7200*	.555	290	298	260	266	106	.018	.018	114052	98213
Oval Track, 360ci+, 1/4 to 3/8 tight, with good intake, exhaust, 12.0:1+ CR.											
Max Effort *Mechanical Flat Tappet*	.555 *4200-7400*	.585	296	304	266	274	106	.020	.022	114022	98213
Drag Race with 12.0:1+ CR, 4800+ stall											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91115 Mechanical Lifters
91118 Direct Lube Mechanical Lifters
94550 Cam Lock Plate & Bolt Kit

94580 Solid Cam Button
94570 Roller Cam Button
94505 Cam Degree Bushing Kit

See Page 41 for Mechanical Lifters
See Page 47 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 57-86 262/400 C.I.

Steel Billet Mechanical Roller Camshafts

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Torque *Mechanical Roller Tappet*	.555 *2000-6000*	.555	268	274	230	238	110	.018	.018	111213-10	98441
Noticeable idle, good for Weekend Street Cruiser. Should have 9.0:1 CR, 2000+ stall.											
Max Torque *Mechanical Roller Tappet*	.555 *2000-6000*	.555	268	274	230	238	110	.018	.018	111213-10S	98441
***Small Base Circle**, Noticeable idle, good for Weekend Street Cruiser. 9.0:1 CR, 2000+ stall.*											
Max Torque *Mechanical Roller Tappet*	.555 *2500-6500*	.555	280	280	238	238	110	.018	.018	111203-10	98441
Rough idle, Street Performance/mild Strip. Recommend 9.5:1 CR, 2500+ stall.											
Max Torque *Mechanical Roller Tappet*	.555 *2500-6500*	.555	280	280	238	238	110	.018	.018	111203-10S	98441
***Small Base Circle**, rough idle, Street Performance/mild Strip. Recommend 9.5:1, 2500+ stall.*											
Max Torque *Mechanical Roller Tappet*	.582 *2600-6400*	.582	286	286	246	246	106	.018	.018	111313-06	98441
Fair idle, Street performance mild Oval Track use.											
Max Torque *Mechanical Roller Tappet*	.582 *2600-6400*	.582	286	286	246	246	106	.018	.018	111313-06S	98441
***Small Base Circle**, fair idle, Street performance mild Oval Track use.*											
Max Torque *Mechanical Roller Tappet*	.582 *2500-6500*	.582	286	286	246	246	110	.018	.018	111313-10	98441
Fair idle, Pro-Street cam. Works well with small NOS system.											
Max Torque *Mechanical Roller Tappet*	.582 *2500-6500*	.582	286	286	246	246	110	.018	.018	111313-10S	98441
***Small Base Circle**, fair idle, Pro-Street cam. Works well with small NOS system.*											
Max Torque *Mechanical Roller Tappet*	.582 *2400-6700*	.582	286	286	246	246	112	.018	.018	111313-12	98441
Fair idle, Pro-Street cam. Works well with small NOS system.											
Max Torque *Mechanical Roller Tappet*	.582 *2400-6700*	.582	286	286	246	246	112	.018	.018	111313-12S	98441
***Small Base Circle**, fair idle, Pro-Street cam. Works well with small NOS system.*											
Max Torque *Mechanical Roller Tappet*	.582 *2500-6700*	.580	284	292	246	250	106	.018	.020	111153-06	98441
Lopey idle, great Oval Track and heavy Drag car.											
Max Torque *Mechanical Roller Tappet*	.582 *2500-6700*	.580	284	292	246	250	106	.018	.020	111153-06S	98441
***Small Base Circle**, lopey idle, great Oval Track and heavy Drag car.*											
Max Torque *Mechanical Roller Tappet*	.582 *2800-6700*	.580	284	292	246	250	108	.018	.020	111153-08	98441
Choppy idle, Should have 10.0:1+ CR, single plane intake, 2800+ stall.											
Max Torque *Mechanical Roller Tappet*	.582 *2800-6700*	.580	284	292	246	250	108	.018	.020	111153-08S	98441
***Small Base Circle**, choppy idle, Should have 10.0:1+ CR, single plane intake, 2800+ stall.*											
Max Torque *Mechanical Roller Tappet*	.630 *2600-6700*	.630	288	298	252	258	106	.024	.024	111013	98441
Strong mid-range horsepower, rough idle. Oval Track and Bracket cars.											
Max Torque *Mechanical Roller Tappet*	.630 *2600-6700*	.630	288	298	252	258	106	.024	.024	111013-S	98441
***Small Base Circle**, strong mid-range HP, rough idle. Oval Track and Bracket cars.*											
Max Oval *Mechanical Roller Tappet*	.600 *2800-6800*	.620	290	300	255	262	106	.022	.022	111163-06	98441
Good mid-range horsepower, rough idle. Needs 11.0:1 CR-up.											
Max Oval *Mechanical Roller Tappet*	.600 *2800-6800*	.620	290	300	255	262	106	.022	.022	111163-06S	98441
***Small Base Circle**, good mid-range horsepower, rough idle. Needs 11.0:1 CR-up.*											
Max Oval *Mechanical Roller Tappet*	.600 *2800-6800*	.620	290	300	255	262	108	.022	.022	111163-08	98441
Good mid-range power, rough idle. Needs 11.0:1 CR-up. Brackets.											
Max Oval *Mechanical Roller Tappet*	.600 *2800-6800*	.620	290	300	255	262	108	.022	.022	111163-08S	98441
***Small Base Circle**, good mid-range HP, rough idle. Needs 11.0:1 CR-up. Brackets.*											
Max Oval *Mechanical Roller Tappet*	.600 *3400-7000*	.600	300	310	258	268	106	.024	.024	111133-06	98441
Strong mid & upper rpm, banked Oval Track & Brackets w/auto trans.											
Max Oval *Mechanical Roller Tappet*	.600 *3400-7000*	.600	300	310	258	268	106	.024	.024	111133-06S	98441
***Small Base Circle**, strong mid and upper rpm, banked Oval Track & Brackets w/auto trans.*											
Max Effort *Mechanical Roller Tappet*	.600 *3400-7000*	.600	300	310	258	268	108	.024	.024	111133-08	98441
Mid and upper RPM torque, good in banked Oval Track and Bracket.											
Max Effort *Mechanical Roller Tappet*	.600 *3400-7000*	.600	300	310	258	268	108	.024	.024	111133-08S	98441
***Small Base Circle**, mid and upper RPM torque, good in banked Oval Track and Bracket.*											

Chevrolet Small Block • 57-86 262/400 C.I.

Steel Billet Mechanical Roller Camshafts (cont.)

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Effort *Mechanical Roller Tappet*	**.600** *3200-7000*	**.600**	**300**	**310**	**258**	**268**	**110**	**.024**	**.024**	**111133-10**	**98441**
			Mid and upper RPM torque, OK w/NOS.								
Max Effort *Mechanical Roller Tappet*	**.600** *3200-7000*	**.600**	**300**	**310**	**258**	**268**	**110**	**.024**	**.024**	**111133-10S**	**98441**
			***Small Base Circle**, mid and upper RPM torque, OK w/NOS up to 250HP.*								
Max Effort *Mechanical Roller Tappet*	**.600** *3200-7000*	**.600**	**300**	**310**	**258**	**268**	**112**	**.024**	**.024**	**111133-12**	**98441**
			Mid and upper RPM torque. Heavier car OK. Great w/NOS.								
Max Effort *Mechanical Roller Tappet*	**.600** *3200-7000*	**.600**	**300**	**310**	**258**	**268**	**112**	**.024**	**.024**	**111133-12S**	**98441**
			***Small Base Circle**, mid and upper RPM torque. Heavier car OK. Great w/NOS.*								
Max Effort *Mechanical Roller Tappet*	**.635** *3400-7400*	**.645**	**300**	**310**	**264**	**274**	**106**	**.024**	**.024**	**111113-06**	**98441**
			Strong mid and upper end torque and power. Needs 12.5:1 CR-up.								
Max Effort *Mechanical Roller Tappet*	**.635** *3400-7400*	**.645**	**300**	**310**	**264**	**274**	**106**	**.024**	**.024**	**111113-06S**	**98441**
			***Small Base Circle**, strong mid and upper end torque and HP. Needs 12.5:1 CR-up.*								
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7400*	**.645**	**300**	**310**	**264**	**274**	**108**	**.024**	**.024**	**111113-08**	**98441**
			Great mid and upper end torque and horsepower. Needs 12.5:1 CR-up.								
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7400*	**.645**	**300**	**310**	**264**	**274**	**108**	**.024**	**.024**	**111113-08S**	**98441**
			***Small Base Circle**, great mid and upper end torque and HP. Needs 12.5:1 CR-up.*								
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7500*	**.645**	**300**	**310**	**264**	**274**	**110**	**.024**	**.024**	**111113-10**	**98441**
			Great mid and upper end torque and horsepower. Needs 12.5:1 CR-up.								
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7500*	**.645**	**300**	**310**	**264**	**274**	**110**	**.024**	**.024**	**111113-10S**	**98441**
			***Small Base Circle**, great mid and upper end torque and HP. Needs 12.5:1 CR-up.*								
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7500*	**.645**	**300**	**310**	**264**	**274**	**112**	**.024**	**.024**	**111113-12**	**98441**
			Good all around mid-range power. Needs 11.0:1+ CR, 4000+ stall. Good with NOS.								
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7500*	**.645**	**300**	**310**	**264**	**274**	**112**	**.024**	**.024**	**111113-12S**	**98441**
			***Small Base Circle**, good all around mid-range power. Needs 11.0:1+ CR, 4000+ stall.*								
Max Effort *Mechanical Roller Tappet*	**.638** *3800-7500*	**.623**	**302**	**314**	**264**	**276**	**106**	**.024**	**.024**	**111103-06**	**98441**
			Strong mid and upper end torque and horsepower. Needs 12.5:1 CR-up.								
Max Effort *Mechanical Roller Tappet*	**.638** *3800-7500*	**.623**	**302**	**314**	**264**	**276**	**106**	**.024**	**.024**	**111103-06S**	**98441**
			***Small Base Circle**, strong mid and upper end torque and HP. Needs 12.5:1 CR-up.*								
Max Effort *Mechanical Roller Tappet*	**.638** *3800-7600*	**.623**	**302**	**314**	**264**	**276**	**108**	**.024**	**.024**	**111103-08**	**98441**
			Strong mid and upper end torque and horsepower. Needs 12.5:1 CR-up.								
Max Effort *Mechanical Roller Tappet*	**.638** *3800-7600*	**.623**	**302**	**314**	**264**	**276**	**108**	**.024**	**.024**	**111103-08S**	**98441**
			***Small Base Circle**, strong mid and upper end torque and HP. Needs 12.5:1 CR-up.*								
Max Oval *Mechanical Roller Tappet*	**.675** *4500-8200*	**.624**	**296**	**306**	**264**	**272**	**106**	**.024**	**.024**	**111223-06**	**98541**
			Great in large cubic inch small block Oval Track late models.								
Max Oval *Mechanical Roller Tappet*	**.675** *4500-8200*	**.624**	**296**	**306**	**264**	**272**	**106**	**.024**	**.024**	**111223-06S**	**98541**
			***Small Base Circle**, great in large cubic inch small block Oval Track late models.*								
Max Oval *Mechanical Roller Tappet*	**.645** *3800-7200*	**.645**	**308**	**316**	**268**	**276**	**106**	**.024**	**.024**	**111123-06**	**98441**
			Competition use, good mid and upper HP, medium to high bank Oval Track.								
Max Oval *Mechanical Roller Tappet*	**.645** *3800-7200*	**.645**	**308**	**316**	**268**	**276**	**106**	**.024**	**.024**	**111123-06S**	**98441**
			***Small Base Circle**, Competition use, good mid and upper HP, medium to high bank Oval Track.*								
Max Effort *Mechanical Roller Tappet*	**.645** *3800-7200*	**.645**	**308**	**316**	**268**	**276**	**108**	**.024**	**.024**	**111123-08**	**98441**
			Competition use, good mid and upper power, medium to high bank Oval Track.								
Max Effort *Mechanical Roller Tappet*	**.645** *3800-7200*	**.645**	**308**	**316**	**268**	**276**	**108**	**.024**	**.024**	**111123-08S**	**98441**
			***Small Base Circle**, Competition use, good mid and upper HP, medium to high bank Oval Track.*								
Max Effort *Mechanical Roller Tappet*	**.645** *3600-7200*	**.645**	**308**	**316**	**268**	**276**	**110**	**.024**	**.024**	**111123-10**	**98441**
			Competition use, good mid and upper power, bracket, OK w/NOS.								
Max Effort *Mechanical Roller Tappet*	**.645** *3600-7200*	**.645**	**308**	**316**	**268**	**276**	**110**	**.024**	**.024**	**111123-10S**	**98441**
			***Small Base Circle**, Competition use, good mid and upper power, bracket, OK w/NOS.*								

Chevrolet Small Block • 57-86 262/400 C.I.

Steel Billet Mechanical Roller Camshafts (cont.)

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Oval *Mechanical Roller Tappet*	**.630** *4200-7800*	**.628**	**320**	**330**	**276**	**286**	**106**	**.024**	**.024**	**111083-06**	**98441**
Competition profile, good top end power. Needs good parts.											
Max Oval *Mechanical Roller Tappet*	**.630** *4200-7800*	**.628**	**320**	**330**	**276**	**286**	**106**	**.024**	**.024**	**111083-06S**	**98441**
***Small Base Circle**, Competition profile, good top end power. Needs good parts.*											
Max Effort *Mechanical Roller Tappet*	**.630** *4200-7800*	**.628**	**320**	**330**	**276**	**286**	**108**	**.024**	**.024**	**111083-08**	**98441**
Competition profile, good top end power. Needs good parts.											
Max Effort *Mechanical Roller Tappet*	**.630** *4200-7800*	**.628**	**320**	**330**	**276**	**286**	**108**	**.024**	**.024**	**111083-08S**	**98441**
***Small Base Circle**, Competition profile, good top end power. Needs good parts.*											
Max Effort *Mechanical Roller Tappet*	**.630** *4000-7800*	**.628**	**320**	**330**	**276**	**286**	**110**	**.024**	**.024**	**111083-10**	**98441**
Competition profile, good top end power. Works good w/NOS.											
Max Effort *Mechanical Roller Tappet*	**.630** *4000-7800*	**.628**	**320**	**330**	**276**	**286**	**110**	**.024**	**.024**	**111083-10S**	**98441**
***Small Base Circle**, Competition profile, good top end power. Works good w/NOS.*											
Max Effort *Mechanical Roller Tappet*	**.630** *4000-7800*	**.628**	**320**	**330**	**276**	**286**	**114**	**.024**	**.024**	**111083-14**	**98441**
Competition profile, good top end power. Works good w/NOS.											
Max Effort *Mechanical Roller Tappet*	**.630** *4000-7800*	**.628**	**320**	**330**	**276**	**286**	**114**	**.024**	**.024**	**111083-14S**	**98441**
***Small Base Circle**, Competition profile, good top end power. Works good w/NOS.*											
Max Effort *Mechanical Roller Tappet*	**.675** *4500-8200*	**.638**	**316**	**326**	**278**	**286**	**106**	**.022**	**.024**	**111233-06**	**98441**
All out Competition big cylinder head & compression.											
Max Effort *Mechanical Roller Tappet*	**.675** *4500-8200*	**.638**	**316**	**326**	**278**	**286**	**106**	**.022**	**.024**	**111233-06S**	**98441**
***Small Base Circle**, all out Competition big cylinder head & compression.*											
Max Effort *Mechanical Roller Tappet*	**.675** *4400-8200*	**.638**	**316**	**326**	**278**	**286**	**110**	**.022**	**.024**	**111233-10**	**98441**
Works great in big cubic inch small blocks. OK with NOS.											
Max Effort *Mechanical Roller Tappet*	**.675** *4400-8200*	**.638**	**316**	**326**	**278**	**286**	**110**	**.022**	**.024**	**111233-10S**	**98441**
***Small Base Circle**, works great in big cubic inch small blocks. OK with NOS.*											
Max Effort *Mechanical Roller Tappet*	**.675** *5000-8500*	**.630**	**320**	**334**	**282**	**292**	**106**	**.025**	**.025**	**111093**	**98541**
All out Competition only. Best of everything.											
Max Effort *Mechanical Roller Tappet*	**.675** *5000-8500*	**.630**	**320**	**334**	**282**	**292**	**106**	**.025**	**.025**	**111093-06S**	**98541**
***Small Base Circle**, all out Competition only. Best of everything.*											
Max Effort *Mechanical Roller Tappet*	**.728** *5000-7800*	**.712**	**320**	**336**	**282**	**296**	**114**	**.028**	**.028**	**111073-14**	**98541**
All out Competition only. Needs good valvetrain. Big top end power. Works good w/NOS.											
Max Effort *Mechanical Roller Tappet*	**.728** *5000-7800*	**.712**	**320**	**336**	**282**	**296**	**114**	**.028**	**.028**	**111073-14S**	**98541**
***Small Base Circle**, all out Competition only. Needs good valvetrain. Works good w/NOS.*											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

94570 Roller Cam Button
94505 Cam Degree Bushing Kit

91117 Mechanical Roller Lifters
91188 Pro-Max Direct Lube Mechanical Roller Lifters

See Page 44 for Mechanical Roller Lifters
See Page 48 for Valve Springs
See Page 50 for 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Chevrolet Small Block • 57-86 262/400 C.I.

4/7 Swap Steel Billet Mechanical Roller Camshafts (18736542 firing order)

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Effort	.630	.630	288	298	252	258	106	.024	.024	114013	98441
Mechanical Roller Tappet	*2600-6700*		*1/4 mile tight track. Heavy car.*								
Max Effort	.630	.630	288	298	252	258	106	.024	.024	114013-S	98441
Mechanical Roller Tappet	*2600-6700*		***Small Base Circle**, 1/4 mile tight track. Heavy car.*								
Max Effort	.645	.645	296	300	258	264	106	.024	.024	114173-06	98441
Mechanical Roller Tappet	*3200-7000*		*1/4 mile Drag or Dirt Modifieds and Sprints.*								
Max Effort	.645	.645	296	300	258	264	106	.024	.024	114173-06S	98441
Mechanical Roller Tappet	*3200-7000*		***Small Base Circle**, 1/4 mile Drag or Dirt Modifieds and Sprints.*								
Max Effort	.600	.600	296	304	258	268	108	.024	.024	114143-08	98441
Mechanical Roller Tappet	*3800-7200*		*Mid and upper RPM torque, good in banked Oval Track and Bracket.*								
Max Effort	.600	.600	296	304	258	268	108	.024	.024	114143-08S	98441
Mechanical Roller Tappet	*3800-7200*		***Small Base Circle**, mid and upper RPM torque, good in banked Oval Track and Bracket.*								
Max Effort	.645	.630	302	306	260	264	106	.024	.024	114053	98441
Mechanical Roller Tappet	*3200-7000*		*Strong Modified or Limited Sprint winner.*								
Max Effort	.645	.630	302	306	260	264	106	.024	.024	114053-S	98441
Mechanical Roller Tappet	*3200-7000*		***Small Base Circle**, Strong Modified or Limited Sprint winner.*								
Max Effort	.645	.615	300	304	264	270	106	.025	.025	114023	98441
Mechanical Roller Tappet	*3500-7200*		*1/4-3/8, Good heads. Dirt Late Model.*								
Max Effort	.645	.615	300	304	264	270	106	.025	.025	114023-S	98441
Mechanical Roller Tappet	*3500-7200*		***Small Base Circle**, 1/4-3/8, Good heads. Dirt Late Model.*								
Max Effort	.645	.623	318	328	274	284	106	.025	.025	114033	98441
Mechanical Roller Tappet	*4200-7800*		*377-400 O.D. 3/8-1/2. Good heads.*								
Max Effort	.645	.623	318	328	274	284	106	.025	.025	114033-S	98441
Mechanical Roller Tappet	*4200-7800*		***Small Base Circle**, 377-400 O.D. 3/8-1/2. Good heads.*								
Max Effort	.675	.639	316	322	278	284	108	.025	.025	114043	98441
Mechanical Roller Tappet	*4400-8000*		*377+, lighter car. Fast track, Drag w/auto*								
Max Effort	.675	.639	316	322	278	284	108	.025	.025	114043-S	98441
Mechanical Roller Tappet	*4400-8000*		***Small Base Circle**, 377+, lighter car. Fast track, Drag w/auto*								
Max Effort	.728	.712	320	336	282	296	114	.028	.028	114073-14	98541
Mechanical Roller Tappet	*5000-7800*		*All out Competition only. Needs good valvetrain. Big top end power. Works good w/NOS.*								
Max Effort	.728	.712	320	336	282	296	114	.028	.028	114073-14S	98541
Mechanical Roller Tappet	*5000-7800*		***Small Base Circle**, all out Competition only. Needs good valvetrain. Works good w/NOS.*								

Forged Steel 10° Valve Locks

The ULTIMATE 10° Valve Locks!

Forged in Milwaukee from Charter Wire™ material. These forgings are stronger, more precise than machined steel locks. They offer longer life, even under high pressure race environment. Because of being a true forged lock, install heights are accurate! Stronger ... More Consistent ... Longer Life... Why buy any other?

American Made!

93017 11/32" Valve Stems, Single Groove, +.035" Height

93018 3/8" Valve Stems, Single Groove, Std. Height

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Small Block • 57-86 262/400 C.I.

Big Bottle Cams™ - Nitrous Oxide Mechanical Roller Camshafts

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Big Bottle Cams *Mechanical Roller Tappet*	**.600** *3200-7000*	**.600**	**300**	**310**	**258**	**268**	**112**	**.024**	**.024**	**111133-12**	**98441**
Mid and upper RPM torque, 250+ plate systems.											
Big Bottle Cams *Mechanical Roller Tappet*	**.600** *3200-7000*	**.600**	**300**	**310**	**258**	**268**	**112**	**.024**	**.024**	**111133-12S**	**98441**
***Small Base Circle**, mid and upper RPM torque, 250+ plate systems.*											
Big Bottle Cams *Mechanical Roller Tappet*	**.635** *3500-7500*	**.645**	**300**	**310**	**264**	**274**	**112**	**.024**	**.024**	**111113-12**	**98441**
Mid and upper end torque and horsepower. Needs 12.5:1 CR-up.											
Big Bottle Cams *Mechanical Roller Tappet*	**.635** *3500-7500*	**.645**	**300**	**310**	**264**	**274**	**112**	**.024**	**.024**	**111113-12S**	**98441**
***Small Base Circle**, mid and upper end torque and power. Needs 12.5:1 CR-up.*											
Big Bottle Cams *Mechanical Roller Tappet*	**.630** *4000-7800*	**.628**	**320**	**330**	**276**	**286**	**114**	**.024**	**.024**	**111083-14**	**98441**
Competition profile, good top end power. Plate or plumbed.											
Big Bottle Cams *Mechanical Roller Tappet*	**.630** *4000-7800*	**.628**	**320**	**330**	**276**	**286**	**114**	**.024**	**.024**	**111083-14S**	**98441**
***Small Base Circle**, Competition profile, good top end power. Plate or plumbed.*											
Big Bottle Cams *Mechanical Roller Tappet*	**.728** *5000-7800*	**.712**	**320**	**338**	**282**	**296**	**114**	**.024**	**.024**	**111073-14**	**98541**
All out competition, Multi-stage nitrous systems.											
Big Bottle Cams *Mechanical Roller Tappet*	**.728** *5000-7800*	**.712**	**320**	**338**	**282**	**296**	**114**	**.024**	**.024**	**111073-14S**	**98541**
***Small Base Circle**, all out Competition, Multi-stage nitrous systems.*											
4/7 Swap Firing Order											
Big Bottle Cams *Mechanical Roller Tappet*	**.728** *5000-7800*	**.712**	**320**	**338**	**282**	**296**	**114**	**.024**	**.024**	**114073-14**	**98541**
All out Competition, Multi-stage nitrous systems.											
Big Bottle Cams *Mechanical Roller Tappet*	**.728** *5000-7800*	**.712**	**320**	**338**	**282**	**296**	**114**	**.024**	**.024**	**114073-14S**	**98541**
***Small Base Circle**, all out Competition, Multi-stage nitrous systems.*											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91117 Mechanical Roller Lifters

91188 Pro-Max Direct Lube Mechanical Roller Lifters

94570 Roller Cam Button

94505 Cam Degree Bushing Kit

See Page 43 for Mechanical Roller Lifters
See Page 48 for Valve Springs
See Page 50 for 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Gen III • LS-Series

Hydraulic Roller Camshafts

	Valve Lift w/1.7 Rockers		Duration in Degrees Advertised		Duration in Degrees @ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Torque *Hydraulic Roller Tappet*	**.595** *1000-5800*	**.598**	**262**	**266**	**210**	**214**	**114**	**.000**	**.000**	**190315**	**98116**
High lift short duration design, Great throttle response.											
Max Torque *Hydraulic Roller Tappet*	**.550** *1500-6400*	**.550**	**269**	**273**	**216**	**224**	**114**	**.000**	**.000**	**190235**	**98116**
Aggressive Street/Strip, upper torque and horsepower.											
Max Torque *Hydraulic Roller Tappet*	**.561** *1800-6800*	**.578**	**275**	**277**	**222**	**225**	**112**	**.000**	**.000**	**190245**	**98116**
Street/Strip applications, mid-range torque and horsepower.											
Max Effort *Hydraulic Roller Tappet*	**.578** *2200-7200*	**.586**	**281**	**283**	**226**	**232**	**115**	**.000**	**.000**	**190325**	**98116**
Aggressive Street/Strip, upper torque and horsepower.											
Max Effort *Hydraulic Roller Tappet*	**.612** *2800-7200*	**.612**	**287**	**289**	**236**	**242**	**113**	**.000**	**.000**	**190265**	**98116**
Large cubic inch, Race only applications.											

Street Series Retro-Fit Hydraulic Roller Lifters

Designed to replace OE style lifters and all installation hardware. These tie-bar lifters are capable of higher lifts than the OE hardware will allow. Can be used with all OE and performance high lift hydraulic roller grinds. Cold form technology shapes the body for durability. Carbonitride and tempered for hardness. The roller wheel is hardened and tempered steel alloy. Heat-treated stainless steel cross bars. High alloy steel tie bar buttons. ***Note:*** Specifically designed for street applications to 6500 rpm. Made in the USA!

91166 GM Gen III (LS-Series)

Mechanical Roller Lifters for GM Gen III (LS-Series)

These "Link-Bar" style lifters are specifically designed to work with standard and high lift mechanical roller cam Gen III applications. Allows removal of stock GM lifter tray. Steel alloy bodies with a special enhanced finish. Heat-treated stainless steel link bars. Case hardened 8620 rollers fitted with the best bearings and pins. Fully rebuildable.

91177 GM Gen III (LS-Series)

See page 38 for Mechanical Roller Custom Ground Gen III Cams

Some items are not legal for sale or use on any pollution controlled motor vehicle

Camshafts

Chevrolet Big Block • 396-502 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.7 Rockers		Duration in Degrees Advertised		Duration in Degrees @ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Factory *Hydraulic Flat Tappet*	**.440** *600-4000*	**.465**	**262**	**272**	**190**	**202**	**110**	**.000**	**.000**	**122491**	**98515**
Smooth idle, strong low end. High vacuum, good fuel economy.											
Max Marine *Hydraulic Flat Tappet*	**.460** *800-4000*	**.460**	**290**	**300**	**204**	**208**	**112**	**.000**	**.000**	**122501**	**98515**
Great low end torque replacement cam, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	**.478** *800-4000*	**.503**	**282**	**292**	**204**	**214**	**112**	**.000**	**.000**	**120021**	**98515**
Exceptional low end torque. Good in PUs, 4x4s and RVs.											
Max Factory *Hydraulic Flat Tappet*	**.478** *800-4200*	**.478**	**284**	**284**	**208**	**208**	**111**	**.000**	**.000**	**122511**	**98515**
Low end performer, smooth idle. Good fuel efficiency.											
Max Efficiency *Hydraulic Flat Tappet*	**.506** *1500-5000*	**.506**	**292**	**292**	**214**	**214**	**112**	**.000**	**.000**	**120931**	**98515**
Good idle, Street, Off-Road, Towing. Good fuel efficiency.											
Max Marine *Hydraulic Flat Tappet*	**.502** *1600-5200*	**.525**	**290**	**300**	**215**	**225**	**112**	**.000**	**.000**	**120031**	**98515**
Great low and mid-range torque. OK in heavy vehicle.											
Max Marine *Hydraulic Flat Tappet*	**.500** *1800-5400*	**.505**	**310**	**322**	**222**	**234**	**115**	**.000**	**.000**	**122521**	**98515**
Fair idle. Excellent in Performance and Marine applications.											
Max Marine *Hydraulic Flat Tappet*	**.525** *2000-5500*	**.550**	**302**	**308**	**224**	**234**	**114**	**.000**	**.000**	**122121**	**98515**
Hot Marine, Performance MerCruisers. Fair idle.											
Max Torque *Hydraulic Flat Tappet*	**.525** *1800-5400*	**.525**	**310**	**310**	**224**	**224**	**111**	**.000**	**.000**	**120941**	**98515**
Fair idle. Strong mid-range. Needs 4 barrel and headers.											
Max Torque *Hydraulic Flat Tappet*	**.514** *2200-5600*	**.514**	**306**	**306**	**230**	**230**	**110**	**.000**	**.000**	**120051**	**98515**
Noticeable idle, great with oval port heads.											
Max Torque *Hydraulic Flat Tappet*	**.535** *2400-5600*	**.535**	**296**	**296**	**230**	**230**	**111**	**.000**	**.000**	**120961**	**98515**
Street/Strip, lots of torque. Auto OK with 3.55+ gears.											
Max Marine *Hydraulic Flat Tappet*	**.545** *3000-6400*	**.536**	**304**	**314**	**236**	**240**	**112**	**.000**	**.000**	**122441**	**98515**
Lopey idle. Moderate Performance and Bracket Racing.											
Max Effort *Hydraulic Flat Tappet*	**.575** *3800-7000*	**.600**	**316**	**328**	**244**	**254**	**110**	**.000**	**.000**	**122531**	**98611**
Super mid-range and top end horsepower. Minimum 11.0:1 CR.											
Max Effort *Hydraulic Flat Tappet*	**.575** *3500-6800*	**.575**	**302**	**302**	**246**	**246**	**110**	**.000**	**.000**	**120061**	**98611**
Hot Pro-Street and Bracket Racing. Works well with NOS.											

MAX Z.P.M.™ Camshaft Break-In Lube

The most important product for proper flat tappet camshaft break-in available. This is true for both hydraulic and mechanical flat tappet camshafts. Virtually eliminates cam and lifter wear at initial break-in. Replaces the Zinc-Phosphates (ZDDP) removed from today's oils. The highest levels of Zinc-Phosphates (ZDDP) of all the popular brands tested, plus the addition of moly for extra protection. Compatible with all petroleum base and synthetic oils. Just add one 4 ounce bottle for up to 6 quarts of oil.

99000 MAX Z.P.M. Camshaft Break-In Lube, 4oz.

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

94585 Solid Cam Button
94575 Roller Cam Button
94505 Cam Degree Bushing Kit

91111 Hydraulic Lifters
91112 Anti-Pump up Hydraulic Lifters
94550 Cam Lock Plate & Bolt Kit

See Page 40 for Hydraulic Lifters
See Page 46 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Big Block • 396-502 C.I.

Retrofit Hydraulic Roller Camshafts

	Valve Lift w/1.7 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Efficiency *Hydraulic Roller Tappet*	.510 *1200-4400*	.525	262	272	210	214	112	.000	.000	120225	98636
Great daily usage, smooth idle, great fuel economy.											
Max Torque *Hydraulic Roller Tappet*	.514 *1400-4600*	.537	270	280	214	222	112	.000	.000	120235	98636
Good idle, Off-Road and Street Performance. 9.0:1 CR advised.											
Max Torque *Hydraulic Roller Tappet*	.568 *2000-5600*	.576	280	292	224	232	110	.000	.000	120245-10	98636
Noticeable idle, Street Performance. Should have 2000+ stall, 9.5:1 CR.											
Max Marine *Hydraulic Roller Tappet*	.568 *2000-5600*	.576	280	292	224	232	112	.000	.000	120245	98636
Fair idle, Street and mild Performance usage. Crisp throttle.											
Max Torque *Hydraulic Roller Tappet*	.595 *2400-5800*	.602	262	272	228	236	108	.000	.000	120325-08	98636
Street/Strip, 10.0:1+ CR, aftermarket dual plane intake recommended.											
Max Torque *Hydraulic Roller Tappet*	.595 *2400-6000*	.602	262	272	228	236	110	.000	.000	120325-10	98636
Fair idle, Performance usage. Mid-range torque and horsepower.											
Max Torque *Hydraulic Roller Tappet*	.585 *3000-6000*	.610	288	294	230	236	112	.000	.000	120255	98636
Fair idle, Performance usage. Great mid-range torque and power.											
Max Marine *Hydraulic Roller Tappet*	.612 *2500-6000*	.612	296	302	236	242	112	.000	.000	120405	98636
Rough idle, strong mid-range torque and horsepower.											
Max Torque *Hydraulic Roller Tappet*	.620 *2400-6000*	.620	294	302	236	242	110	.000	.000	120265-10	98636
Decent idle, Performance Street. Needs 10.0:1+.											
Max Torque *Hydraulic Roller Tappet*	.620 *2800-6200*	.620	294	302	236	242	112	.000	.000	120265	98636
Lopey idle, Hot Street and Bracket Racing. 10.0:1-up CR advised.											
Max Effort *Hydraulic Roller Tappet*	.620 *3000-6500*	.620	302	302	242	242	110	.000	.000	120275	98636
Rough idle, Bracket Race with excellent mid and upper end horsepower.											
Max Effort *Hydraulic Roller Tappet*	.612 *3200-6200*	.612	314	318	250	254	110	.000	.000	120335-10	98636
Lopey idle, Pro-Street/Bracket. Single plane intake, 10.5:1+ CR advised.											
Max Effort *Hydraulic Roller Tappet*	.636 *3200-6400*	.655	298	306	250	256	110	.000	.000	120345-10	98636
Lopey idle, Pro-Street/Bracket. 10.5:1+ CR advised. OK with NOS.											
Max Effort *Hydraulic Roller Tappet*	.629 *3400-6400*	.629	298	308	252	258	110	.000	.000	120355-10	98636
Lopey idle, Hot Street/Bracket. Single plane intake, 10.5:1+ CR advised.											
Max Effort *Hydraulic Roller Tappet*	.627 *3600-6800*	.636	310	318	252	256	112	.000	.000	120285	98636
Lopey idle, Hot Street/Bracket. Single plane intake, 10.5:1+ CR advised. OK with NOS.											

Chevrolet Big Block • 396-502 C.I.

Mechanical Flat Tappet Camshafts

Max Torque *Mechanical Flat Tappet*	.579 *2500-6400*	.579	296	306	248	248	110	.025	.025	121051	98611
Rough idle, Street/Strip, best with 10.0+ CR, 3000+ stall											
Max Marine *Mechanical Flat Tappet*	.575 *2600-6800*	.636	300	304	250	260	112	.022	.026	122141	98611
Rough idle, excellent Bracket cam. Increased CR required.											
Max Torque *Mechanical Flat Tappet*	.595 *3200-7000*	.604	286	292	250	256	110	.025	.025	122311	98611
Increased mid-range torque and horsepower. Can be used with NOS.											
Max Torque *Mechanical Flat Tappet*	.629 *3400-7000*	.624	298	302	260	268	108	.026	.026	122321	98636
Rough idle, good mid-range torque and power. Needs good heads and intake.											
Max Torque *Mechanical Flat Tappet*	.560 *3600-6800*	.580	318	322	264	270	112	.022	.026	122131	98611
Increased mid-range torque and horsepower. Can be used with NOS.											
Max Effort *Mechanical Flat Tappet*	.629 *4000-7400*	.646	302	310	268	278	108	.026	.026	122331	98636
Moderate competition, excellent mid and upper RPM power. 12.0-1 CR.											
Max Effort *Mechanical Flat Tappet*	.650 *3600-7800*	.670	320	324	268	276	112	.022	.026	122151	98636
Competition use, great mid and upper RPM horsepower. 12.5-1-up needed.											

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Big Block • 396-502 C.I.

Steel Billet Mechanical Roller Camshafts

	Valve Lift w/1.7 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Torque *Mechanical Roller Tappet*	**.570** *2000-6000*	**.570**	**282**	**282**	**226**	**226**	**110**	**.014**	**.016**	**121323-10**	**98631**
Fair idle, Street and mild Performance usage. 9.0:1 CR-up.											
Max Torque *Mechanical Roller Tappet*	**.629** *2000-6200*	**.629**	**268**	**274**	**230**	**238**	**108**	**.020**	**.020**	**121213-08**	**98631**
Lopey idle, great for Power Touring. Easy on parts. Needs 2000+ stall.											
Max Torque *Mechanical Roller Tappet*	**.629** *1800-6200*	**.629**	**268**	**274**	**230**	**238**	**110**	**.020**	**.020**	**121213-10**	**98631**
Noticeable idle, broad power range, very reliable power. Needs 2000+ stall.											
Max Torque *Mechanical Roller Tappet*	**.660** *2500-6500*	**.660**	**285**	**285**	**248**	**248**	**110**	**.016**	**.018**	**121313-10**	**98631**
Lopey idle, Pro-Street cam. Works well with small NOS system.											
Max Torque *Mechanical Roller Tappet*	**.660** *2500-6600*	**.660**	**285**	**285**	**248**	**248**	**112**	**.016**	**.018**	**121313-12**	**98631**
Hot street, Marine. Good low end performance.											
Max Torque *Mechanical Roller Tappet*	**.660** *2500-6700*	**.675**	**285**	**290**	**248**	**255**	**110**	**.020**	**.020**	**121153-10**	**98631**
Good mid-range horsepower, rough idle. Needs 11.0:1 CR-up.											
Max Torque *Mechanical Roller Tappet*	**.671** *3400-6800*	**.655**	**298**	**306**	**260**	**266**	**108**	**.026**	**.026**	**121163-08**	**98631**
Good Bracket cam. Good mid range torque.											
Max Effort *Mechanical Roller Tappet*	**.680** *3400-7000*	**.680**	**300**	**310**	**260**	**270**	**108**	**.025**	**.025**	**121133-08**	**98631**
Nice Bracket cam, lopey idle, needs higher stall and lower gear.											
Max Effort *Mechanical Roller Tappet*	**.680** *3200-7000*	**.680**	**300**	**310**	**260**	**270**	**110**	**.025**	**.025**	**121133-10**	**98631**
Nice Bracket cam, lopey idle, needs higher stall and lower gear.											
Max Torque *Mechanical Roller Tappet*	**.680** *3000-7000*	**.680**	**300**	**310**	**260**	**270**	**112**	**.025**	**.025**	**121133-12**	**98631**
Nice Bracket cam, lopey idle, needs higher stall. NOS OK.											
Max Torque *Mechanical Roller Tappet*	**.680** *3200-7200*	**.680**	**300**	**310**	**260**	**270**	**114**	**.025**	**.025**	**121133-14**	**98631**
Pro-Street, great blower cam. Multiple carb suggested.											
Max Torque *Mechanical Roller Tappet*	**.706** *4000-7000*	**.706**	**300**	**308**	**262**	**272**	**108**	**.025**	**.025**	**121173-08**	**98631**
Good mid-range torque and horsepower. 12.0:1 minimum.											
Max Torque *Mechanical Roller Tappet*	**.706** *4200-7000*	**.706**	**300**	**308**	**262**	**272**	**110**	**.025**	**.025**	**121173-10**	**98631**
Good mid-range torque and horsepower. 12.0:1 minimum.											
Max Torque *Mechanical Roller Tappet*	**.730** *4000-7200*	**.714**	**300**	**310**	**266**	**276**	**108**	**.026**	**.026**	**121053-08**	**98631**
Good mid to upper rpm torque and horsepower. Minimum 4500-stall.											
Max Torque *Mechanical Roller Tappet*	**.680** *3800-7000*	**.680**	**300**	**308**	**266**	**278**	**108**	**.028**	**.028**	**121663-08**	**98631**
Rough idle. Good upper rpm horsepower. Auto w/4000 stall. 11.0:1+.											
Max Torque *Mechanical Roller Tappet*	**.680** *4000-7000*	**.680**	**300**	**308**	**266**	**278**	**110**	**.028**	**.028**	**121663-10**	**98631**
Rough idle. Good upper rpm horsepower. Auto w/4000 stall. 11.0:1+.											
Max Torque *Mechanical Roller Tappet*	**.680** *4000-7000*	**.680**	**300**	**308**	**266**	**278**	**112**	**.028**	**.028**	**121663-12**	**98631**
Rough idle. Good upper rpm horsepower. Auto w/4000 stall. 11.0:1+. OK with NOS.											
Max Effort *Mechanical Roller Tappet*	**.765** *4000-7200*	**.714**	**302**	**310**	**268**	**276**	**108**	**.025**	**.025**	**121253-08**	**98731***
Good mid-range to upper rpm torque and power. Heavy cars OK.											
Max Effort *Mechanical Roller Tappet*	**.685** *4000-6800*	**.685**	**296**	**308**	**270**	**278**	**108**	**.025**	**.025**	**121143-08**	**98631**
Moderate Competition. Super mid and upper rpm torque and power.											
Max Effort *Mechanical Roller Tappet*	**.702** *3800-7000*	**.702**	**308**	**314**	**270**	**278**	**108**	**.025**	**.025**	**121123-08**	**98631**
Competition use, good mid and upper horsepower, bracket cars.											
Max Effort *Mechanical Roller Tappet*	**.702** *3500-7200*	**.702**	**308**	**314**	**270**	**278**	**110**	**.025**	**.025**	**121123-10**	**98631**
Competition, good mid & upper horsepower, bracket cars, OK w/NOS.											
Max Effort *Mechanical Roller Tappet*	**.702** *3500-7200*	**.702**	**308**	**314**	**270**	**278**	**114**	**.025**	**.025**	**121123-14**	**98631**
Competition use, good mid and upper horsepower, Multi-Stage NOS.											
Max Effort *Mechanical Roller Tappet*	**.731** *4800-7000*	**.731**	**310**	**314**	**274**	**278**	**108**	**.026**	**.026**	**121673-08**	**98631**
Competition use. 13.0:1 minimum. Good mid and upper range power.											
Max Effort *Mechanical Roller Tappet*	**.714** *4800-7400*	**.714**	**312**	**324**	**274**	**284**	**108**	**.025**	**.025**	**121283-08**	**98631**
Competition use, good mid and upper horsepower.											

*1.625 or Larger Diameter. Requires Machining of Cylinder Head.

Chevrolet Big Block • 396-502 C.I.

Steel Billet Mechanical Roller Camshafts (cont.)

	Valve Lift w/1.7 Rockers		Duration in Degrees Advertised		Duration in Degrees @ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Effort *Mechanical Roller Tappet*	**.765** *4800-7200*	**.714**	**310**	**314**	**276**	**284**	**108**	**.025**	**.025**	**121023-08**	**98731***
Competition use, good mid and upper horsepower.											
Max Effort *Mechanical Roller Tappet*	**.765** *4800-7400*	**.714**	**310**	**314**	**276**	**284**	**110**	**.025**	**.025**	**121023-10**	**98731***
Competition use, good mid and upper horsepower.											
Max Effort *Mechanical Roller Tappet*	**.730** *4500-7500*	**.710**	**310**	**314**	**277**	**282**	**108**	**.025**	**.025**	**121693-08**	**98631**
Bracket/ Super Gas, heavier car. Needs race converter.											
Max Effort *Mechanical Roller Tappet*	**.712** *4000-7800*	**.712**	**320**	**330**	**278**	**286**	**108**	**.025**	**.025**	**121083-08**	**98631**
Great Super-Comp. cam. 468+CID with 12.5:1 CR-up.											
Max Effort *Mechanical Roller Tappet*	**.712** *4200-7800*	**.712**	**320**	**330**	**278**	**286**	**110**	**.025**	**.025**	**121083-10**	**98631**
Great Super-Comp. cam. 468+ with 12.5:1 CR-up, OK with NOS.											
Max Effort *Mechanical Roller Tappet*	**.712** *4000-7800*	**.712**	**320**	**330**	**278**	**286**	**114**	**.025**	**.025**	**121083-14**	**98631**
Great Super-Comp. cam. 468+ with 12.5:1 CR-up, OK with NOS.											
Max Effort *Mechanical Roller Tappet*	**.740** *4400-8000*	**.732**	**314**	**324**	**278**	**288**	**108**	**.025**	**.025**	**121233-08**	**98731***
Good upper RPM cam in big cubic inch engine with 13.0:1+ CR.											
Max Effort *Mechanical Roller Tappet*	**.740** *4200-7800*	**.732**	**314**	**324**	**278**	**288**	**110**	**.025**	**.025**	**121233-10**	**98731***
Works great in 496+CID with high stall. Will work with NOS.											
Max Effort *Mechanical Roller Tappet*	**.740** *4000-7600*	**.732**	**314**	**324**	**278**	**288**	**112**	**.025**	**.025**	**121233-12**	**98731***
Great Super Class cam, easy on valvetrain.											
Max Effort *Mechanical Roller Tappet*	**.802** *4400-7800*	**.802**	**310**	**314**	**278**	**292**	**112**	**.025**	**.025**	**121043-12**	**98731***
509-540 ci with good heads. Works good with plate style NOS systems.											
Max Effort *Mechanical Roller Tappet*	**.802** *4200-8000*	**.802**	**310**	**314**	**278**	**292**	**114**	**.025**	**.025**	**121043-14**	**98731***
509-540 ci with good heads. Works good 250+ HP NOS.											
Max Effort *Mechanical Roller Tappet*	**.765** *4500-7300*	**.730**	**314**	**322**	**280**	**288**	**110**	**.028**	**.028**	**121683-10**	**98731***
Works great in 496+CID with high stall. Will work with NOS.											
Max Effort *Mechanical Roller Tappet*	**.765** *4500-7400*	**.720**	**316**	**314**	**282**	**288**	**110**	**.025**	**.025**	**121703-10**	**98731***
Works great in 496+CID with high stall.											
Max Effort *Mechanical Roller Tappet*	**.765** *4600-8200*	**.730**	**318**	**322**	**284**	**288**	**108**	**.026**	**.026**	**121623-08**	**98731***
Competition only, needs cubic inch, high CR, stall and gears.											
Max Effort *Mechanical Roller Tappet*	**.765** *4500-8200*	**.730**	**318**	**322**	**284**	**288**	**110**	**.026**	**.026**	**121623-10**	**98731***
Competition only in 500+CID, needs high CR, stall and gears.											
Max Effort *Mechanical Roller Tappet*	**.765** *4400-8200*	**.730**	**318**	**322**	**284**	**288**	**112**	**.025**	**.025**	**121623-12**	**98731***
Competition only in 500+CID, needs high CR, stall and gears.											
Max Effort *Mechanical Roller Tappet*	**.765** *5000-8000*	**.730**	**318**	**322**	**284**	**288**	**114**	**.025**	**.025**	**121623-14**	**98731***
Competition only in 500+CID, needs high CR, stall and gears. Good with NOS.											
Max Effort *Mechanical Roller Tappet*	**.765** *5000-8200*	**.720**	**318**	**332**	**284**	**295**	**106**	**.026**	**.026**	**121093-06**	**98731***
Great Bracket cam for 509-540 ci. Needs high CR, stall and gears.											
Max Effort *Mechanical Roller Tappet*	**.765** *5000-8500*	**.720**	**318**	**332**	**284**	**295**	**108**	**.026**	**.026**	**121093-08**	**98731***
540+ ci Bracket. Needs good heads, 13.0:1+ CR and high stall.											
Max Effort *Mechanical Roller Tappet*	**.765** *4800-8400*	**.720**	**318**	**332**	**284**	**295**	**110**	**.026**	**.026**	**121093-10**	**98731***
All out Competition in big inch engine. Needs the best parts.											
Max Effort *Mechanical Roller Tappet*	**.765** *4800-8500*	**.720**	**318**	**332**	**284**	**295**	**114**	**.026**	**.026**	**121093-14**	**98731***
All out Competition in big inch engine. Needs the best parts.											
Max Effort *Mechanical Roller Tappet*	**.800** *5200-8200*	**.748**	**320**	**334**	**286**	**296**	**112**	**.025**	**.025**	**121033-12**	**98731***
550+ ci Competition with big heads and intake.											
Max Effort *Mechanical Roller Tappet*	**.860** *5000-8400*	**.805**	**324**	**352**	**284**	**312**	**116**	**.030**	**.030**	**121803-16**	**98731***
550+ ci with Big Chief style heads. Great with big NOS systems.											

*1.625 or Larger Diameter. Requires Machining of Cylinder Head.

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chevrolet Big Block • 396-502 C.I.

4/7 Swap Steel Billet Roller Camshafts (18736542 firing order)

	Valve Lift w/1.7 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Effort	.706	.714	298	306	260	266	108	.026	.026	124193-08	98631
Mechanical Roller Tappet	*3800-7000*		*Good mid-range torque and horsepower. Great for brackets.*								
Max Effort	.731	.731	302	310	268	274	108	.026	.026	124203-08	98631
Mechanical Roller Tappet	*4800-7400*		*Good mid-range torque and horsepower. 11.0:1+ compression.*								
Max Effort	.685	.685	296	308	270	278	108	.025	.025	124143-08	98631
Mechanical Roller Tappet	*4000-6800*		*Good Bracket Race cam. 11.0:1+ compression.*								
Max Effort	.685	.685	296	308	270	278	110	.025	.025	124143-10	98631
Mechanical Roller Tappet	*4000-6800*		*Good Bracket Race cam. 11.0:1+ compression.*								
Max Effort	.774	.740	308	314	270	278	108	.026	.026	124213-08	98631
Mechanical Roller Tappet	*3800-7000*		*Good Bracket Race cam. 11.0:1+ compression.*								
Max Effort	.765	.731	310	314	274	278	108	.026	.026	124233-08	98631
Mechanical Roller Tappet	*4800-7000*		*Competition use. 12.0:1 minimum.*								
Max Effort	.765	.714	310	314	276	284	108	.025	.025	124023-08	98731*
Mechanical Roller Tappet	*4800-7200*		*11.0:1+ CR, 4500+ Stall. Good in 427-496.*								
Max Effort	.765	.714	310	314	276	284	110	.025	.025	124023	98731*
Mechanical Roller Tappet	*4500-7500*		*11.0:1+ CR, 4500+ Stall. Good in super gas.*								
Max Effort	.710	.714	310	314	278	282	110	.025	.025	124013	98631
Mechanical Roller Tappet	*4500-7500*		*468+ CID. 12.0:1+ Strong mid-range.*								
Max Effort	.808	.765	310	312	278	284	110	.025	.025	124243-10	98631
Mechanical Roller Tappet	*4500-7800*		*13.0:1+ CR, Good heads. Strong mid and top end.*								
Max Effort	.712	.712	320	330	278	286	108	.025	.025	124183-08	98631
Mechanical Roller Tappet	*4500-7800*		*Good upper rpm torque and horsepower. 12.5:1+ CR. 5000+ stall.*								
Max Effort	.765	.731	308	314	280	286	108	.025	.025	124583-08	98631
Mechanical Roller Tappet	*4500-7800*		*540 Bracket special. 13.0:1 CR, 5000+ stall.*								
Max Effort	.802	.802	310	314	278	292	112	.025	.025	124043-12	98731*
Mechanical Roller Tappet	*4600-7800*		*Good in Super Gas. Up to 14.5:1 compression. 5000+ stall.*								
Max Effort	.802	.802	310	314	278	292	114	.025	.025	124043	98731*
Mechanical Roller Tappet	*4200-8000*		*Quick 16. Needs good heads.*								
Max Effort	.808	.774	310	312	280	288	110	.025	.025	124263-10	98631
Mechanical Roller Tappet	*4400-8000*		*540+, Strong torque. Also good tractor pull.*								
Max Effort	.839	.800	316	334	281	300	115	.025	.025	124073	98738-A*
Mechanical Roller Tappet	*4800-8800*		*Large cubic inch w/multi-stage nitrous.*								
Max Effort	.873	.808	318	334	282	296	114	.025	.025	124053	98048*
Mechanical Roller Tappet	*4800-8600*		*540+ cubic inch. 12.5:1 minimum. Race convertor and NOS.*								
Max Effort	.765	.730	318	322	284	288	110	.026	.026	124623-10	98731*
Mechanical Roller Tappet	*4600-8200*		*Quick 16. Needs good heads.*								
Max Effort	.740	.722	312	320	286	294	108	.025	.025	124303-08	98631
Mechanical Roller Tappet	*4800-7600*		*Super Gas/Super Comp. Needs good heads.*								
Max Effort	.800	.748	320	334	286	296	112	.025	.025	124033	98731*
Mechanical Roller Tappet	*4800-8000*		*480+. Good heads 13.0:1+ CR. Some nitrous OK.*								
Max Effort	.765	.731	318	330	288	296	110	.026	.026	124313-10	98631
Mechanical Roller Tappet	*4600-7800*		*Big cubic inch Super-Bracket.*								
Max Effort	.873	.802	320	334	285	300	114	.025	.025	124063	98048*
Mechanical Roller Tappet	*4500-7500*		*540+. Comp. and Quick 16.*								
Max Effort	.850	.825	320	336	286	312	116	.025	.025	124083	98048*
Mechanical Roller Tappet	*5200-9000*		*Large cubic inch with nitrous.*								
Max Effort	.878	.867	328	338	292	320	116	.025	.025	124093-16	98048*
Mechanical Roller Tappet	*4800-8500*		*Big cubic inch only. Requires huge heads.*								
Max Effort	.878	.867	328	338	292	320	118	.025	.025	124093	98048*
Mechanical Roller Tappet	*4800-8500*		*Very large cubic inch with multi-stage nitrous.*								

Some items are not legal for sale or use on any pollution controlled motor vehicle

*1.625 or Larger Diameter. Requires Machining of Cylinder Head.

Chevrolet Big Block • 396-502 C.I.

Big Bottle Cams™ - Nitrous Oxide Mechanical Roller Camshafts

	Valve Lift w/1.7 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Big Bottle Cams	.680	.680	300	308	266	278	112	.028	.028	121663-12	98631
Mechanical Roller Tappet	*4000-7000*		*Rough idle. Good upper rpm horsepower. Auto w/4000 stall. 11.0:1+.*								
Big Bottle Cams	.802	.802	310	314	278	292	112	.025	.025	121043-12	98731*
Mechanical Roller Tappet	*4600-7800*		*13.0:1+ compression. Good Heads, 5000+ stall.*								
Big Bottle Cams	.802	.802	310	314	278	292	114	.025	.025	121043-14	98731*
Mechanical Roller Tappet	*4200-8000*		*13.0:1+ compression. Good Heads, 5000+ stall.*								
Big Bottle Cams	.765	.720	318	332	284	295	114	.026	.026	121093-14	98731*
Mechanical Roller Tappet	*4800-8500*		*Fast bracket, 13.0:1 compression, good heads.*								
4/7 Swap Firing Order											
Big Bottle Cams	.802	.802	310	314	278	292	114	.025	.025	124043	98731*
Mechanical Roller Tappet	*4200-8000*		*Quick 16. Needs good heads. Multi-stage systems.*								
Big Bottle Cams	.839	.800	316	334	281	300	115	.025	.025	124073	98738-A*
Mechanical Roller Tappet	*4800-8800*		*Large cubic inch w/multi-stage nitrous.*								
Big Bottle Cams	.850	.825	320	336	286	312	116	.025	.025	124083	98048*
Mechanical Roller Tappet	*5200-9000*		*500+ cubic inch, high compression. Multi stage systems.*								
Big Bottle Cams	.878	.867	328	338	292	320	118	.025	.025	124093	98048*
Mechanical Roller Tappet	*4800-8500*		*Very large cubic inch with big multi-stage nitrous.*								

*1.625 or Larger Diameter. Requires Machining of Cylinder Head.

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91127 Mechanical Roller Lifters

91198 Pro-Max Direct Lube Mechanical Roller Lifters

94575 Roller Cam Button

94505 Cam Degree Bushing Kit

See Page 43 for Mechanical Roller Lifters
See Page 47 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Fuel Pump Push Rods
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Camshafts

Chrysler Small Block • 1964-1992 273, 340, 360 C.I. • 1967-1991 318 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.5 Rockers		Duration in Degrees Advertised		Duration in Degrees @ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Efficiency *Hydraulic Flat Tappet*	**.422** *1200-4600*	**.444**	**278**	**288**	**204**	**214**	**112**	**000**	**000**	**710011**	**98411**
Smooth idle. Great for Street Performance and towing.											
Max Factory *Hydraulic Flat Tappet*	**.420** *1400-4400*	**.420**	**280**	**280**	**208**	**208**	**111**	**000**	**000**	**710021**	**98411**
Good low speed torque. Street, PUs or 4WDs.											
Max Efficiency *Hydraulic Flat Tappet*	**.447** *1500-5200*	**.447**	**292**	**292**	**214**	**214**	**112**	**000**	**000**	**710931**	**98411**
Great cam for use in Performance Street cars and PUs.											
Max Efficiency *Hydraulic Flat Tappet*	**.444** *1500-5000*	**.467**	**288**	**298**	**214**	**224**	**112**	**000**	**000**	**710031**	**98411**
Increased low and mid-range torque. Needs 4 barrel and headers.											
Max Efficiency *Hydraulic Flat Tappet*	**.442** *1500-4800*	**.442**	**286**	**286**	**214**	**214**	**110**	**000**	**000**	**711021**	**98411**
Strong mid-range torque. Needs 4 barrel and good flowing exhaust. 1800+ stall.											
Max Torque *Hydraulic Flat Tappet*	**.453** *2200-5500*	**.453**	**296**	**296**	**226**	**226**	**108**	**000**	**000**	**712221**	**98411**
Mid-range and top end horsepower and torque. Needs 4bbl., gears, headers.											
Max Torque *Hydraulic Flat Tappet*	**.480** *2500-6000*	**.480**	**286**	**286**	**231**	**231**	**109**	**000**	**000**	**712231**	**98411**
Runs strong 3,500 and up. 9.5+ comp., auto OK with gears.											

Chrysler Small Block • 1964-1992 273, 340, 360 C.I. • 1967-1991 318 C.I.

Mechanical Flat Tappet Camshafts

Max Torque *Mechanical Flat Tappet*	**.517** *2800-6200*	**.525**	**288**	**292**	**246**	**250**	**108**	**.024**	**.024**	**712381**	**98432**
Street/Strip, good Oval Track cam for limited induction systems.											
Max Torque *Mechanical Flat Tappet*	**.533** *3200-6600*	**.537**	**290**	**298**	**250**	**256**	**106**	**.020**	**.020**	**712391**	**98432**
Rough idle, Street/Strip, Oval Track. Needs 9.5: or higher CR.											
Max Torque *Mechanical Flat Tappet*	**.540** *3400-7000*	**.555**	**294**	**302**	**254**	**260**	**108**	**.026**	**.026**	**712361**	**98432**
Lopey idle. Oval Track, Street/Strip with 10.0:1+ CR. Auto needs 3500+ stall.											
Max Effort *Mechanical Flat Tappet*	**.555** *3600-7200*	**.562**	**296**	**304**	**260**	**270**	**108**	**.026**	**.026**	**712321**	**98432**
Hot Street/Bracket. Must have 11.0:+ CR and 4000+ stall.											

Chrysler Small Block • 1964-1992 273, 340, 360 C.I. • 1967-1991 318 C.I.

Steel Billet Mechanical Roller Camshafts

Max Torque *Mechanical Roller Tappet*	**.582** *2500-6700*	**.580**	**284**	**292**	**246**	**250**	**106**	**.020**	**.020**	**711153-06**	**98441**
Lopey idle, great oval track and heavy drag car.											
Max Torque *Mechanical Roller Tappet*	**.585** *2800-6800*	**.600**	**286**	**292**	**246**	**254**	**108**	**.024**	**.024**	**712113-08**	**98441**
340-360 ci. Hot Street and mild Bracket.											
Max Torque *Mechanical Roller Tappet*	**.630** *2600-6700*	**.630**	**288**	**298**	**252**	**258**	**106**	**.024**	**.024**	**711013-06**	**98441**
Good mid and upper horsepower, Great for Brackets.											
Max Effort *Mechanical Roller Tappet*	**.605** *3400-7000*	**.605**	**300**	**310**	**258**	**268**	**108**	**.025**	**.025**	**711133-08**	**98441**
Strong mid-range and upper end horsepower, 12.0:1+ CR											
Max Torque *Mechanical Roller Tappet*	**.645** *4200-7400*	**.645**	**296**	**303**	**260**	**268**	**106**	**.024**	**.024**	**712123-06**	**98441**
11.5:1+ Comp. Good heads. Strong mid and upper horsepower.											
Max Effort *Mechanical Roller Tappet*	**.635** *3600-7400*	**.645**	**300**	**310**	**264**	**274**	**108**	**.025**	**.025**	**711113-08**	**98441**
12.5:1+ Comp. Good heads. Strong mid to top end.											

Some items are not legal for sale or use on any pollution controlled motor vehicle

Chrysler Big Block • 361, 383, 400, 413, 426W, 440 C.I.

Hydraulic Flat Tappet Camshafts (Single Bolt)

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Factory *Hydraulic Flat Tappet*	.420 *800-4800*	.420	280	280	208	210	111	.000	.000	720021	98515
Smooth idle, strong low end. High vacuum, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	.445 *1000-5200*	.465	288	298	214	224	112	.000	.000	720031	98515
Good idle and throttle response. Needs 4 barrel and good exhaust.											
Max Efficiency *Hydraulic Flat Tappet*	.450 *1000-5400*	.450	292	292	214	214	111	.000	.000	720931	98515
Super low and mid-range performance. Good idle.											
Max Torque *Hydraulic Flat Tappet*	.480 *2000-6200*	.480	302	302	236	236	108	.000	.000	722241	98515
Runs strong 3,500 and up. 9.5+ comp., auto OK with gears.											
Max Effort *Hydraulic Flat Tappet*	.520 *2800-6700*	.550	310	320	242	252	109	.000	.000	722251	98515
Hot Pro-Street/Bracket. Strong mid-range, needs 11.0-1 CR-up.											

Chrysler Big Block • 361, 383, 400, 413, 426W, 440 C.I.

Mechanical Flat Tappet Camshafts (3 Bolt)

Max Torque *Mechanical Flat Tappet*	.517 *2500-6200*	.533	282	290	246	252	110	.020	.020	722401	98636
Good Street Machine cam. Best with 3000+ stall.											
Max Torque *Mechanical Flat Tappet*	.540 *3000-6500*	.555	294	302	254	260	108	.026	.026	722361	98636
Rough idle, Street/Strip. Should have 10.5:1+ CR and 3500+ stall.											
Max Torque *Mechanical Flat Tappet*	.555 *3500-7000*	.562	296	304	260	270	108	.026	.026	722321	98636
Hot Street/Bracket. Needs 10.5:1+ CR, good heads and intake.											
Max Effort *Mechanical Flat Tappet*	.585 *3600-7200*	.615	304	310	264	272	108	.026	.026	722422	98636
Pro-Street/Bracket. Needs 11.0:1+ CR, 4000+ stall.											
Max Effort *Mechanical Flat Tappet*	.615 *3800-7600*	.615	308	308	272	272	108	.028	.028	722411	98636
Lopey idle, 440+ ci Bracket cam. 4200+ stall advised.											

Chrysler Big Block • 361, 383, 400, 413, 426W, 440 C.I.

Steel Billet Mechanical Roller Camshafts (3 Bolt)

Max Torque *Mechanical Roller Tappet*	.605 *3000-6700*	.605	300	310	258	268	108	.025	.025	722133-08	98637
Good Bracket cam. Good mid range torque.											
Max Effort *Mechanical Roller Tappet*	.638 *3200-7000*	.623	300	314	264	276	108	.025	.025	722103-08	98637
Strong mid-range increase. Brackets.											
Max Effort *Mechanical Roller Tappet*	.645 *4000-7000*	.645	308	308	274	274	106	.024	.024	722773	98637
440 CID. Bracket special. Strong mid-range.											
Max Effort *Mechanical Roller Tappet*	.645 *4000-7000*	.645	308	308	274	274	108	.024	.024	722773-08	98637
440 CID. Bracket special. Strong mid-range.											
Max Effort *Mechanical Roller Tappet*	.642 *4200-7200*	.642	318	318	283	283	106	.025	.025	722793	98637
11:1+ upper mid-range and top end power. 440+CID.											
Max Effort *Mechanical Roller Tappet*	.673 *4500-7500*	.673	320	320	285	285	108	.025	.025	722783	98637
11:1+ upper mid-range and top end power. 440+CID.											

Camshafts

Ford Small Block • 221-302 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.6 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Efficiency *Hydraulic Flat Tappet*	.450 *1000-4500*	.474	280	288	204	214	112	.000	.000	210021	98412
Great low and mid-range. Smooth idle. Good in PUs and RVs.											
Max Factory *Hydraulic Flat Tappet*	.448 *800-4400*	.448	282	282	208	208	111	.000	.000	212161	98412
Smooth idle, strong low end. High vacuum, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	.459 *1200-4700*	.459	280	288	214	214	111	.000	.000	211031	98412
Good idle, Street, Off-Road, Towing. Good fuel efficiency.											
Max Torque *Hydraulic Flat Tappet*	.477 *1500-5200*	.477	292	292	214	214	110	.000	.000	210931	98412
Strong low and mid-range, fuel efficiency and driveability.											
Max Marine *Hydraulic Flat Tappet*	.474 *1500-5400*	.498	288	298	214	224	112	.000	.000	210031	98412
Broad power band. Excellent in Hot Street and Marine.											
Max Torque *Hydraulic Flat Tappet*	.498 *2500-6200*	.520	298	304	224	232	112	.000	.000	210041	98412
Strong mid-range. Great E.T. Bracket cam. OK w/NOS.											
Max Torque *Hydraulic Flat Tappet*	.474 *2400-5700*	.474	308	308	226	226	110	.000	.000	210941	98412
Needs good intake, 4bbl. and headers. Best with 9.5+ CR.											
Max Torque *Hydraulic Flat Tappet*	.504 *2800-6300*	.504	296	296	230	230	108	.000	.000	210961	98412
Broad power range, extra performance in smaller engine.											
Max Torque *Hydraulic Flat Tappet*	.512 *3000-6600*	.512	288	288	231	231	110	.000	.000	210051	98412
Strong power range from 3,500 up. Needs 4bbl., header and stall.											

Ford Small Block • 221-302 C.I.

Mechanical Flat Tappet Camshafts

Max Torque *Mechanical Flat Tappet*	.514 *2000-6000*	.514	276	276	230	230	110	.020	.020	212341	98432
Good Street cam, broad power range. 2200+ stall recommended.											
Max Torque *Mechanical Flat Tappet*	.534 *2800-6800*	.542	282	292	246	252	106	.025	.025	212351	98432
Fair idle, Street/Strip in light car. 10.0:1 CR, 4.10 or lower gears.											
Max Torque *Mechanical Flat Tappet*	.528 *3400-6500*	.528	296	300	250	252	107	.024	.024	212271	98432
Street/Strip, 4-speed or auto w/3000+ stall, best with good intake.											
Max Torque *Mechanical Flat Tappet*	.568 *3400-7000*	.584	286	294	250	256	108	.026	.028	212371	98432
Rough idle, needs good induction system. Good Oval Track cam.											
Max Effort *Mechanical Flat Tappet*	.582 *3400-7400*	.582	288	296	254	260	108	.026	.028	212361	98432
Rough idle, Bracket cam. Best with 11.0:1+ CR and 4000+ stall.											
Max Effort *Mechanical Flat Tappet*	.592 *3500-7500*	.588	296	304	260	268	108	.026	.028	212321	98432
Rough idle, Bracket favorite. Needs 11.0:1 CR and 4000+ stall.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91211 Hydraulic Lifters
91212 Anti-Pump up Hydraulic Lifters
99000 Max Z.P.M. Cam Break-in Lube

See Page 40 for Hydraulic Lifters
See Page 46 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Distributor Gears

Ford Small Block • 221-302 C.I.

Retrofit Hydraulic Roller Camshafts (for use w/O.E. 5.0L Style Hyd. Roller Lifters & Spider)

	Valve Lift w/1.6 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Torque *Hydraulic Roller Tappet*	.516 *1200-5600*	.531	270	278	217	226	112	.000	.000	221275-S*	98432
	Mild rough idle. Good torque and power. 1800+ stall.										
Max Factory *Hydraulic Roller Tappet*	.500 *2500-6000*	.500	308	308	218	218	113	.000	.000	222765-S*	98432
	Good idle, strong low end and mid-range performance. Needs 2800+ stall.										
Max Torque *Hydraulic Roller Tappet*	.544 *2000-6000*	.544	274	274	220	220	110	.000	.000	222725-S*	98432
	Fair idle, strong Street Performance. Requires 9.0+ CR, 5-speed or 2800+ stall.										
Max Effort *Hydraulic Roller Tappet*	.534 *2200-6500*	.547	278	306	224	232	112	.000	.000	222755-S*	98432
	Fair idle, Street and Mild Performance usage. Crisp throttle.										
Max Torque *Hydraulic Roller Tappet*	.536 *2500-6500*	.536	278	278	226	226	112	.000	.000	222745-S*	98432
	Best with 5-speed or 2200-2500 stall.										
Max Effort *Hydraulic Roller Tappet*	.544 *2600-6500*	.560	282	285	234	242	112	.000	.000	222735-S*	98432
	Lopey idle, Hot Street and Bracket Racing. 10.0:1-up CR advised.										

***Use 302 HO/351W Firing Order**

***Note:** 221-302ci (non O.E. roller) can also use 302 HO/5.0L or 351W hydraulic roller cams with 91168 tie bar style retro-fit hydraulic roller lifters (not for use with spider)*

Ford Small Block • 221-302 C.I.

Steel Billet Mechanical Roller Camshafts - Use 351W w/Windsor Firing Order

Ford • 302 HO & 5.0 L

Hydraulic Roller Camshafts for OE Roller Applications

Max Torque *Hydraulic Roller Tappet*	.516 *1200-5600*	.531	270	278	217	226	112	.000	.000	221275	98432
	Mild rough idle. Good torque and power. 1800+ stall.										
Max Factory *Hydraulic Roller Tappet*	.500 *2500-6000*	.500	308	308	218	218	113	.000	.000	222765	98432
	Good idle, strong low end and mid-range performance. Needs 2800+ stall.										
Max Torque *Hydraulic Roller Tappet*	.544 *2000-6000*	.544	274	274	220	220	110	.000	.000	222725	98432
	Fair idle, strong Street Performance. Requires 9.0+ CR, 5-speed or 2800+ stall.										
Max Effort *Hydraulic Roller Tappet*	.534 *2200-6500*	.547	278	306	224	232	112	.000	.000	222755	98432
	Fair idle, Street and mild Performance usage. Crisp throttle.										
Max Torque *Hydraulic Roller Tappet*	.536 *2500-6500*	.536	278	278	226	226	112	.000	.000	222745	98432
	Best with 5 speed or 2200-2500 stall.										
Max Effort *Hydraulic Roller Tappet*	.576 *2600-6500*	.568	282	286	234	242	112	.000	.000	222735	98432
	Lopey idle, Hot Street and Bracket Racing. 10.0:1-up CR advised.										

Camshafts

Ford • 351 W

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.6 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Factory *Hydraulic Flat Tappet*	**.417** *800-4500*	**.445**	**280**	**292**	**200**	**210**	**114**	**.000**	**.000**	**220011**	**98412**
Smooth idle, strong low end. High vacuum, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	**.450** *1000-5000*	**.474**	**280**	**288**	**204**	**214**	**112**	**.000**	**.000**	**220021**	**98412**
Great low and mid-range. Smooth idle. Good in PUs and RVs.											
Max Efficiency *Hydraulic Flat Tappet*	**.479** *1400-5200*	**.479**	**292**	**292**	**214**	**214**	**110**	**.000**	**.000**	**220931**	**98412**
Lopey idle. Excellent Street Performance cam.											
Max Efficiency *Hydraulic Flat Tappet*	**.467** *1200-5400*	**.467**	**302**	**302**	**220**	**220**	**112**	**.000**	**.000**	**220041**	**98412**
Good idle and throttle response. Ok with small blower.											
Max Torque *Hydraulic Flat Tappet*	**.498** *2600-6200*	**.520**	**282**	**282**	**224**	**234**	**112**	**.000**	**.000**	**220051**	**98412**
Rough idle, good mid and upper RPM and horsepower. OK with NOS.											
Max Torque *Hydraulic Flat Tappet*	**.512** *2000-6000*	**.512**	**280**	**280**	**230**	**230**	**110**	**.000**	**.000**	**220001**	**98412**
Rough idle, great mid-rangs torque and horsepower.											

Ford • 351 W

Mechanical Flat Tappet Camshafts

Max Torque *Mechanical Flat Tappet*	**.528** *2500-6000*	**.528**	**276**	**276**	**230**	**230**	**110**	**.020**	**.020**	**222341**	**98432**
Lopey idle, Good Street/Strip cam. Small NOS OK. 2800+ stall recommended.											
Max Oval *Mechanical Flat Tappet*	**.552** *3000-6500*	**.560**	**282**	**292**	**246**	**252**	**106**	**.025**	**.025**	**222351**	**98432**
Oval Track Late Model, 3/8-1/2 mile, good power and torque.											
Max Torque *Mechanical Flat Tappet*	**.560** *3000-7000*	**.584**	**286**	**294**	**252**	**264**	**110**	**.026**	**.028**	**222371**	**98432**
Rough idle, excellent mid-range. Needs 11.0:1+ CR, 2500+ stall and good heads.											
Max Effort *Mechanical Flat Tappet*	**.585** *3200-7200*	**.592**	**288**	**296**	**254**	**260**	**108**	**.026**	**.028**	**222361**	**98432**
Strong torque with good power. Needs good intake, headers.											
Max Effort *Mechanical Flat Tappet*	**.592** *3500-7500*	**.588**	**296**	**304**	**260**	**268**	**108**	**.026**	**.028**	**222321**	**98432**
Bracket Race or 3/8 to 1/2 mile Oval Track. Needs 12.0:1+ CR											
Max Effort *Mechanical Flat Tappet*	**.592** *3700-7500*	**.608**	**300**	**314**	**268**	**278**	**110**	**.024**	**.024**	**222331**	**98432**
Bracket Racer special. Super strong mid-range and top end. Great in big cubic inch.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91211 Hydraulic Lifters
91212 Anti-Pump up Hydraulic Lifters
91215 Mechanical Lifters
91218 Direct Lube Mechanical Lifters
99000 Max Z.P.M. Cam Break-in Lube

See Page 40 for Hydraulic Lifters
See Page 41 for Mechanical Lifters
See Page 46 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Steel Billet Mechanical Roller Camshafts

	Valve Lift w/1.6 Rockers		Duration in Degrees Advertised		Duration in Degrees @ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Torque *Mechanical Roller Tappet*	**.620** *2200-5800*	**.620**	**286**	**286**	**246**	**246**	**110**	**.016**	**.018**	**221313-10**	**98441**
Nice idle. Strong low and mid-range.											
Max Torque *Mechanical Roller Tappet*	**.616** *2400-6500*	**.632**	**286**	**298**	**246**	**254**	**108**	**.024**	**.024**	**221113-08**	**98441**
Lopey idle. Strong mid-range. 10.0:1+ CR.											
Max Torque *Mechanical Roller Tappet*	**.624** *3000-6600*	**.624**	**294**	**304**	**254**	**260**	**108**	**.025**	**.025**	**221013-08**	**98441**
Lopey idle. Strong mid-range with top end increase.											
Max Effort *Mechanical Roller Tappet*	**.640** *3400-7000*	**.640**	**300**	**310**	**256**	**268**	**108**	**.025**	**.025**	**221133**	**98441**
Mid to upper range horsepower and torque. 11.0:1+ Good heads.											
Max Effort *Mechanical Roller Tappet*	**.672** *3800-7200*	**.680**	**296**	**312**	**264**	**268**	**106**	**.025**	**.025**	**221173-06**	**98441**
Strong mid and upper range horsepower. 11.0:1+ Good heads.											
Max Effort *Mechanical Roller Tappet*	**.720** *3600-6800*	**.688**	**304**	**312**	**268**	**274**	**108**	**.025**	**.025**	**221223-08**	**98441**
Competition use, good mid and upper power.											
Max Effort *Mechanical Roller Tappet*	**.672** *3800-7200*	**.656**	**300**	**314**	**268**	**276**	**108**	**.025**	**.025**	**221123**	**98441**
Strong upper horsepower. 11.5:1+ Good heads.											
Max Effort *Mechanical Roller Tappet*	**.688** *4200-7800*	**.672**	**320**	**330**	**276**	**284**	**108**	**.025**	**.025**	**221083**	**98441**
Strong upper horsepower. 11.5:1+ Good heads.											
Max Effort *Mechanical Roller Tappet*	**.768** *5400-8000*	**.752**	**324**	**334**	**282**	**302**	**112**	**.026**	**.026**	**221093-12**	**98441**
Large cubic inch, all out Competition. Best of everything. Works good w/NOS.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91217 Mechanical Roller Lifters

See Page 43 for Mechanical Roller Lifters
See Page 47 for Valve Springs
See Page 50 for 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Camshafts

Ford • 351C-351M-400 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.73 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Factory *Hydraulic Flat Tappet*	**.486** *1200-4600*	**.512**	**282**	**292**	**204**	**214**	**112**	**.000**	**.000**	**230011**	**98515**
Exceptional low end torque. Good in PUs, 4x4s and RV											
Max Factory *Hydraulic Flat Tappet*	**.484** *1000-4000*	**.484**	**282**	**282**	**208**	**208**	**111**	**.000**	**.000**	**232171**	**98515**
Smooth idle, good fuel economy. Great RV and Towing cam.											
Max Efficiency *Hydraulic Flat Tappet*	**.495** *1600-5000*	**.495**	**286**	**286**	**214**	**214**	**110**	**.000**	**.000**	**231031**	**98515**
Fair idle, good low and mid-range torque. Needs 4 bbl. and headers.											
Max Torque *Hydraulic Flat Tappet*	**.515** *1800-5200*	**.515**	**292**	**292**	**214**	**214**	**110**	**.000**	**.000**	**230931**	**98515**
Strong low and mid-range, fuel efficiency and driveability.											
Max Efficiency *Hydraulic Flat Tappet*	**.512** *1600-5400*	**.538**	**292**	**302**	**214**	**224**	**112**	**.000**	**.000**	**230021**	**98515**
Hot Street and mild Bracket Race. Works well with NOS.											
Max Torque *Hydraulic Flat Tappet*	**.538** *2400-6400*	**.562**	**302**	**308**	**224**	**234**	**112**	**.000**	**.000**	**230041**	**98515**
Lopey idle, moderate performance. Higher CR is recommended.											
Max Torque *Hydraulic Flat Tappet*	**.544** *3300-6600*	**.544**	**296**	**296**	**228**	**228**	**108**	**.000**	**.000**	**230961**	**98515**
Strong mid-range, works best w/aftermarket dual plane.											

Ford • 351C-351M-400 C.I.

Mechanical Flat Tappet Camshafts

Max Torque *Mechanical Flat Tappet*	**.569** *2800-6800*	**.590**	**292**	**300**	**244**	**254**	**106**	**.024**	**.024**	**232181**	**98636**
Rough idle, super mid-range performance. Needs 10.5:1+ CR.											
Max Torque *Mechanical Flat Tappet*	**.614** *3200-7200*	**.631**	**286**	**296**	**250**	**256**	**110**	**.026**	**.026**	**232371**	**98636**
Pro Street/Bracket cam. Requires 3500+ stall, 10.5:1+ CR.											
Max Torque *Mechanical Flat Tappet*	**.630** *3200-7200*	**.644**	**296**	**306**	**252**	**260**	**108**	**.026**	**.028**	**232361**	**98636**
Rough idle, strong mid-range power											
Max Effort *Mechanical Flat Tappet*	**.640** *3500-7600*	**.640**	**304**	**304**	**260**	**260**	**108**	**.026**	**.028**	**232191**	**98636**
Pro Street/Bracket, strong top end, 3500+ stall, 11.0:1+ CR.											
Max Effort *Mechanical Flat Tappet*	**.640** *3800-7800*	**.650**	**298**	**310**	**260**	**268**	**108**	**.026**	**.028**	**232321**	**98636**
Lopey idle, Pro Street/Bracket, 4000+ stall, 11.0:1+ CR.											

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91211 Hydraulic Lifters
91212 Anti-Pump up Hydraulic Lifters
91215 Mechanical Lifters
91218 Direct Lube Mechanical Lifters
99000 Max Z.P.M. Cam Break-in Lube

See Page 40 for Hydraulic Lifters
See Page 41 for Mechanical Lifters
See Page 46 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Distributor Gears

Ford FE • 352-428 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.75 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Separation	Valve Lash			Recommended Valve
	IN	EX	IN	EX	IN	EX	Angle	IN	EX	Part #	Springs
Max Efficiency *Hydraulic Flat Tappet*	.486 *1000-4400*	.512	282	292	204	214	112	.000	.000	250011	98515
Smooth idle, strong low end. High vacuum, good fuel economy.											
Max Efficiency *Hydraulic Flat Tappet*	.484 *1000-4400*	.484	282	282	210	210	111	.000	.000	250021	98515
Smooth idle, increased low end torque. Great in PUs.											
Max Efficiency *Hydraulic Flat Tappet*	.502 *1400-4600*	.502	286	286	214	214	111	.000	.000	251021	98515
Fair idle, good all-around performance. Good torque.											
Max Torque *Hydraulic Flat Tappet*	.525 *1600-5400*	.525	292	292	214	214	110	.000	.000	250931	98515
Good idle, increased torque. Great all around performance.											
Max Torque *Hydraulic Flat Tappet*	.510 *1400-5200*	.510	292	302	214	224	112	.000	.000	250031	98515
Good idle. Excellent Street Performance dual pattern cam.											
Max Torque *Hydraulic Flat Tappet*	.519 *1800-5600*	.546	292	302	214	224	112	.000	.000	252461	98515
Noticeable idle, Street/Strip. Best with 9.0:1+ CR and 2200+ stall.											
Max Torque *Hydraulic Flat Tappet*	.554 *2400-6000*	.554	290	290	230	230	110	.000	.000	250051	98515
Rough idle, Hot Street/Bracket. Big mid-range torque. Needs 2500+ stall.											

Ford Big Block • 429-460 C.I.

Hydraulic Flat Tappet Camshafts

Application See Page 6 for explanation	RPM Range	Lift With 1.73 Rockers		Duration in Degrees Advertised		@ .050"		Lobe Sep. Angle	Valve Lash		Part #	Valve Springs
		IN	EX	IN	EX	IN	EX		IN	EX		
Max Efficiency *Hydraulic Flat Tappet*	.484 *1000-4200*	.484		282	282	208	208	111	000	000	240021	98515
Smooth idle, increased torque. Good for economy, Towing.												
Max Efficiency *Hydraulic Flat Tappet*	.495 *1000-4400*	.495		288	288	214	214	111	000	000	241021	98515
Smooth idle. Great for Off-Road and Towing. Good fuel economy.												
Max Torque *Hydraulic Flat Tappet*	.514 *1600-5000*	.514		292	292	214	214	114	000	000	240931	98515
Good idle and throttle response with 4bbl and good exhaust.												
Max Torque *Hydraulic Flat Tappet*	.512 *1500-4800*	.538		292	302	214	224	112	000	000	240031	98515
Fair idle, Hot Performance Street and Marine.												
Max Efficiency *Hydraulic Flat Tappet*	.495 *1500-5400*	.495		298	298	218	218	110	000	000	242201	98515
Good idle, strong bottom end. Great daily usage cam.												
Max Marine *Hydraulic Flat Tappet*	.538 *1800-5600*	.562		302	308	224	234	112	000	000	240041	98515
Strong mid-range. Needs 4bbl., headers and medium stall.												

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91211 Hydraulic Lifters
91212 Anti-Pump up Hydraulic Lifters
91215 Mechanical Lifters
91218 Direct Lube Mechanical Lifters
99000 Max Z.P.M. Cam Break-in Lube

See Page 40 for Hydraulic Lifters
See Page 46 for Valve Springs
See Page 50 for 7° and 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° Valve Locks
See Page 51 for 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Distributor Gears

Some items are not legal for sale or use on any pollution controlled motor vehicle

Ford Big Block • 429-460 C.I.

Mechanical Flat Tappet Camshafts

	Valve Lift w/1.73 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Torque *Mechanical Flat Tappet*	.588 2400-6200	.605	294	304	244	254	112	.026	.026	242211	98636
Rough idle, excellent Bracket cam. Increased CR required.											
Max Torque *Mechanical Flat Tappet*	.614 2800-6600	.631	286	296	250	256	110	.026	.026	242371	98636
Rough idle, Street/Strip. Best with 10.0:1+ CR, 3000+ stall.											
Max Torque *Mechanical Flat Tappet*	.615 3000-6600	.640	296	306	254	260	108	.026	.026	242361	98636
Rough idle, Hot Street/Bracket. Needs 10.5:1+ CR and 3200+ stall.											
Max Effort *Mechanical Flat Tappet*	.640 3400-7400	.650	298	310	260	268	108	.026	.026	242321	98636
Pro-Street/Strip, radical idle. Needs good aftermarket heads and intake.											

Ford Big Block • 429-460 C.I.

Steel Billet Mechanical Roller Cams

Max Torque *Mechanical Roller Tappet*	.692 3400-6600	.692	296	306	258	268	108	.024	.024	241133	98631
Moderate idle. Good in strong Street or Bracket car.											
Max Torque *Mechanical Roller Tappet*	.692 3600-6600	.692	296	306	258	268	110	.024	.024	241133-10	98631
Good in strong Street or Bracket car. OK w/NOS.											
Max Effort *Mechanical Roller Tappet*	.711 3800-6800	.720	304	308	269	272	110	.025	.025	241123-10	98631
460+CID. 11.0:1 Comp. Strong mid range horsepower.											
Max Effort *Mechanical Roller Tappet*	.718 4000-7000	.726	306	314	270	278	108	.025	.025	241713-08	98631
460+CID. 12.0:1 Comp. Strong mid to upper horsepower.											
Max Effort *Mechanical Roller Tappet*	.744 4800-7600	.744	310	320	274	280	108	.025	.025	241693-08	98737*
460+ ci, Great mid-range and upper end. Needs 5000+ stall, 12.5:1 CR.											
Max Effort *Mechanical Roller Tappet*	.744 4600-7600	.744	310	320	274	280	110	.025	.025	241693-10	98737*
460+ ci, Great mid-range and top end. Needs 5000+ stall.											
Max Effort *Mechanical Roller Tappet*	.718 4800-7400	.727	314	328	278	286	110	.025	.025	241083-10	98631
460+ ci. 12.0:1 Comp. Strong mid-upper horsepower.											
Max Effort *Mechanical Roller Tappet*	.796 4600-7200	.727	316	324	280	284	110	.026	.026	241723-10	98738-A*
12.0:1 min. Modified heads. Strong upper rpm.											
Max Effort *Mechanical Roller Tappet*	.778 5200-7500	.727	314	332	284	292	110	.026	.026	241363	98738-A*
Big cubic inch 500+ motors. Best with 13.5:1+. Needs true race converter.											

* *1.625 Diameter Requires Machining of Cylinder Head.

Additional Heavy Duty Items

Please Call Our Tech. Department for specific applications.

91247 Mechanical Roller Lifters

See Page 41 for Mechanical Flat Tappet Lifters
See Page 43 for Mechanical Roller Lifters
See Page 47 for Flat Tappet Valve Springs
See Page 48 for Roller Valve Springs
See Page 50 for 7° or 10° Chrome Moly Retainers
See Page 50 for 10° Titanium Retainers
See Page 51 for 7° or 10° Valve Locks
See Page 52 for Valve Seals
See Page 57 for Distributor Gears

Oldsmobile • 260-455 C.I./39° Lifter Bore Angle

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.6 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Efficiency *Hydraulic Flat Tappet*	.450 *800-4800*	.474	280	288	204	216	112	.000	.000	510011	98411
OE and Performance replacement. Increased low end torque.											
Max Efficiency *Hydraulic Flat Tappet*	.480 *1200-5500*	.480	292	292	214	214	111	.000	.000	510931	98411
Good low end and mid-range. Will work well in jet boats.											
Max Torque *Hydraulic Flat Tappet*	.474 *1200-5800*	.498	288	298	214	224	112	.000	.000	510021	98411
Street Performer/Hot Jet Boats. 4 barrel and good exhaust a must.											
Max Marine *Hydraulic Flat Tappet*	.520 *2400-6400*	.542	304	314	234	244	112	.000	.000	510041	98411
Fair idle, strong mid-range. Best with 9.5:1+. Also good in jet boat.											

Pontiac • 265-455 C.I.

Hydraulic Flat Tappet Camshafts

	Valve Lift w/1.5 Rockers IN	EX	Duration in Degrees Advertised IN	EX	@ .050" IN	EX	Lobe Separation Angle	Valve Lash IN	EX	Part #	Recommended Valve Springs
Max Factory *Hydraulic Flat Tappet*	.422 *800-4800*	.444	278	288	204	214	112	.000	.000	410011	98341
Smooth idle, Great upgrade from stock cam.											
Max Efficiency *Hydraulic Flat Tappet*	.450 *1500-5500*	.450	292	292	214	214	111	.000	.000	410931	98341
Good idle, Strong low and mid-range torque.											
Max Efficiency *Hydraulic Flat Tappet*	.444 *1200-5400*	.467	288	298	214	224	112	.000	.000	410021	98341
Super low and mid-range torque. Excellent driveability.											
Max Torque *Hydraulic Flat Tappet*	.462 *1800-5800*	.462	284	284	224	224	110	.000	.000	410991	98341
Nice single pattern cam for Hot Street/Strip performance.											
Max Torque *Hydraulic Flat Tappet*	.472 *2200-6200*	.472	296	296	230	230	108	.000	.000	410961	98341
Hot Street, improved mid-range. Best with 9.5:1+ comp., 4-barrel.											
Max Torque *Hydraulic Flat Tappet*	.480 *2500-6500*	.480	286	286	231	231	110	.000	.000	410041	98341
Exceptional mid-range and top end with 389 or larger.											
Max Torque *Hydraulic Flat Tappet*	.470 *2400-6400*	.470	304	314	231	240	114	.000	.000	410051	98341
Excellent RAM Air IV replacement. Will work well with NOS.											

Pontiac • 265-455 C.I.

Mechanical Roller Camshafts

Max Effort *Mechanical Roller Tappet*	.600 *3500-6500*	.600	290	298	260	268	108	.024	.024	411123-08	98637
400-455. Hot street and bracket race.											
Max Effort *Mechanical Roller Tappet*	.615 *4000-6600*	.622	302	310	276	286	108	.024	.024	411133-08	98637
450+CID. 12:1. Good heads. Best with 1.65 rockers.											

Some items are not legal for sale or use on any pollution controlled motor vehicle

Camshafts

Custom Order • Special Grind Camshafts

AMC	Camshaft Type	Part #
V8 290-401, '66-'93	Hydraulic Flat Tappet	319991
V8 290-401, '66-'93	Mechanical Flat Tappet	319992
V8 290-401, '66-'93	Mechanical Roller	319993
BUICK/OLDS		
Buick/Olds 215, 300, 340, '61-'67	Hydraulic Flat Tappet	539991
BUICK		
350, '68-'80	Hydraulic Flat Tappet	549991
400, 430, 455, '67-'67	Hydraulic Flat Tappet	559991
CADILLAC		
366, 425, 472, 500, '68-'84	Hydraulic Flat Tappet	529991
366, 425, 472, 500, '68-'84	Mechanical Flat Tappet	529992
CHEVROLET L6		
194, 230, 250, '62-'84	Hydraulic Flat Tappet	169991
194, 230, 250, '62-'84	Mechanical Flat Tappet	169992
216, 235, 261, '57-'63	Hydraulic Flat Tappet	179991
216, 235, 261, '57-'63	Mechanical Flat Tappet	179992
292 '63-'90	Mechanical Flat Tappet	159992
CHEVROLET V6		
4.3L, '85-'86 (non-OE hyd. roller)	Hydraulic Flat Tappet	149991
4.3L, '85-'86 (non-OE hyd. roller)	Mechanical Flat Tappet	149992
4.3L, '87-'91 (OE hyd. roller)	Hydraulic Roller	149995
CHEVROLET SB		
262-400, '57-'96 (non-OE hyd. roller)	Hydraulic Flat Tappet	119991
262-400, '57-'96 (non-OE hyd. roller)	Hydraulic Flat Tappet Small Base	119991-S
262-400, '57-'96 (non-OE hyd. roller)	Hydraulic Flat Tappet Special Core	119991-P55
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Flat Tappet	119992
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Flat Tappet	119992-S
262-400, '57-'96 (non-OE hyd. roller)	Mech. Flat Tappet Special Core	119992-P55
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Flat Tappet 4/7 Swap	119996
262-400, '57-'96 (non-OE hyd. roller)	Mech. Flat Tappet 4/7 Swap Sm. Base	119996-S

CHEVROLET SB	Camshaft Type	Part #
262-400, '57-'96 (non-OE hyd. roller)	Hydraulic Roller	119995
262-400, '57-'96 (non-OE hyd. roller)	Hyd./Mech. Roller w/Cast Dist. Gear	119999
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Roller	119993
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Roller Small Base	119993-S
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Roller w/Rear Drive	119993-RD
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Roller 4/7 Swap	119994
262-400, '57-'96 (non-OE hyd. roller)	Mech. Roller 4/7 Swap Sm. Base	119994-S
262-400, '57-'96 (non-OE hyd. roller)	Mechanical Roller w/50-55mm Bearing	119997
305-350, '87-'99 (OE hyd. roller)	Hydraulic Roller	189995
305-350, '87-'99 (OE hyd. roller)	Hydraulic Roller Small Base	189995-S
CHEVROLET GEN III (LS-Series)		
350, '97-'00 (Also Vortec 4800, 5300, 6000)	Hydraulic Roller	119998
CHEVROLET BB		
396-502, '67-'95 (non-OE hyd. roller)	Hydraulic Flat Tappet	129991
396-502, '67-'95 (non-OE hyd. roller)	Mechanical Flat Tappet	129992
396-502, '67-'95 (non-OE hyd. roller)	Hydraulic Roller	129995
396-502, '67-'95 (non-OE hyd. roller)	Hyd./Mech. Roller w/Cast Dist. Gear	129999
396-502, '67-'95 (non-OE hyd. roller)	Mechanical Roller	129993
396-502, '67-'95 (non-OE hyd. roller)	Mechanical Roller 4/7 Swap	129994
396-502, '67-'95 (non-OE hyd. roller)	Mechanical Flat Tappet 4/7 Swap	129997
CHEVROLET BB GEN 6		
454-502, '96-'00 (OE hyd. roller)	Hydraulic Roller	129996
CHEVROLET 348/409		
348/409, '58-'65	Hydraulic Flat Tappet	139991
348/409, '58-'65	Mechanical Flat Tappet	139992
348/409, '58-'65	Mechanical Roller	139993

Choosing a Custom Grind Camshaft

All of the following variables have to be considered when picking a particular grind. It all boils down to picking a cam that will develop peak power within the rpm range where the engine needs to make it.

- ***Cam/Lifter Type***
- ***Usage*** ***(Street/Oval Track/Drag/?)***
- ***Engine Displacement***
- ***Bore and Stroke***
- ***Rod Length***
- ***Compression Ratio***
- ***Engine RPM Range***
- ***Firing Order***
- ***Cylinder Heads*** ***(Ported?)***
- ***Rocker Arm Ratio***
- ***Induction System*** ***(Manifold/Carb)***
- ***Supercharged?*** ***(Boost)***
- ***Transmission*** ***(Manual/Auto)***
- ***Rear End Gear Ratio***
- ***Exhaust***

Note: Your Custom Cam will only be as good as the information you supply! Please don't guess or "exaggerate" figures.

Some items are not legal for sale or use on any pollution controlled motor vehicle

Custom Order • Special Grind Camshafts

CHRYSLER SLANT 6	Camshaft Type	Part #
170, 198, 225, '60-'80	Hydraulic Flat Tappet	759991

CHRYSLER SB		
273-360, '65-'95 (318 - '67-'95)	Hydraulic Flat Tappet	719991
273-360, '65-'95 (318 - '67-'95)	Mechanical Flat Tappet	719992
273-360, '65-'95 (318 - '67-'95)	Hydraulic Roller	719995
273-360, '65-'95 (318 - '67-'95)	Mechanical Roller	719993
"R" Block	Mechanical Roller	719994

CHRYSLER BB/RB		
361-440, '58-'79	Hydraulic Flat Tappet	729991
361-440, '58-'79	Mechanical Flat Tappet	729992
361-440, '58-'79	Mechanical Roller	729993

CHRYSLER HEMI		
392 Hemi, '57-'58	Hydraulic Flat Tappet	739991
426 Hemi, '66-'71	Hydraulic Flat Tappet	749991
426 Hemi, '66-'71	Mechanical Roller	749993

CHRYSLER AFTERMARKET HEMI		
(2.125 Journal 9310)	Mechanical Roller	729999

FORD 4.6L/5.4L MODULAR V8		
4.6L/5.4L SOHC 2 Valve '91-Present	Hydraulic Roller (2 Cams)	279993
4.6L/5.4L SOHC 3 Valve '04-Present	Hydraulic Roller (4 Cams)	279994

FORD SB		
221-302/5.0L (except H.O.) '62-'95	Hydraulic Flat Tappet	219991
221-302/5.0L (except H.O.) '62-'95	Mechanical Flat Tappet	219992
221-302/5.0L (except H.O.) '62-'95	Retrofit Hyd. Roller w/351W Firing Order	229995
221-302/5.0L (except H.O.) '62-'95	Mechanical Roller w/351W Firing Order	229993
351W/5.0L H.O. '69-'95	Hydraulic Flat Tappet	229991
351W/5.0L H.O. '69-'95	Mechanical Flat Tappet	229992
351W, '69-'93	Retrofit Hydraulic Roller	229994
351W, '94-'95/5.0L H.O. '85-'95	Hydraulic Roller	229995
351W/5.0L H.O. '69-'95	Mechanal Roller	229993

FORD 351C, 351M, 400	Camshaft Type	Part #
351C, 351M, 400, '75-'82	Hydraulic Flat Tappet	239991
351C, 351M, 400, '75-'82	Mechanical Flat Tappet	239992
351C, 351M, 400, '72-'82	Hydraulic Roller	239995
351C, 351M, 400, '72-'82	Mechanical Roller	239993

FORD FE		
352-428, '63-'76	Hydraulic Flat Tappet	259991
352-428, '63-'76	Mechanical Flat Tappet	259992
352-428, '63-'76	Mechanical Roller	259993

FORD 429-460		
429-460 '68-'97	Hydraulic Flat Tappet	249991
429-460 '68-'97	Mechanical Flat Tappet	249992
429-460 '68-'97	Hydraulic Roller	249995
429-460 '68-'97	Mechanical Roller	249993

FORD FLAT HEAD		
'49-'53	Mechanical Flat Tappet	269992

FORD Y-BLOCK		
272, 292, 312, '55-'62	Mechanical Flat Tappet	299992

OLDSMOBILE V8 39°		
307-455, '66-'84	Hydraulic Flat Tappet	519991
307-455, '66-'84	Mechanical Flat Tappet	519992
307-455, '66-'84	Mechanical Roller	519993

PONTIAC 151 IRON DUKE		
'79-'84	Hydraulic Flat Tappet	429991
'79-'84	Mechanical Flat Tappet	429992

PONTIAC V8		
326-455, '55-'81	Hydraulic Flat Tappet	419991
326-455, '55-'81	Mechanical Flat Tappet	419992
326-455, '55-'81	Mechanical Roller	419993

Notes:

Some items are not legal for sale or use on any pollution controlled motor vehicle

Hydraulic Flat Tappet

Performance Hydraulic Lifters

Howards™ Cams hydraulic lifters are 100% Rockwell tested. They are designed for maximum performance, offering precision oil control. Use as OE replacements as well as in high performance racing applications.

91711	American Motors V-8 304-401	91211	Ford V-8 221-302, 351W
91411	Cadillac 368, 425, 472, 500	91211	Ford V-8 351C–400M
91111	Chevrolet V-8 265-454	91211	Ford V-8 429-460
91711	Chrysler A 273-340-360, 67-up 318	91251	Ford "FE" 332-428
91711	Chrysler B 383-440	91411	Oldsmobile V-8 260-455
		91411	Pontiac V-8 265-455

Max Effort Hydraulic Lifters

The Max Effort high output lifters were designed specifically for higher revving applications. Perfect for race applications which require a hydraulic lifter or high performance street applications that need an extra edge. These lifters can show a noticeable increase of power from 5,000 rpm and up. ***Important:*** pre-load must be set at .002"-.004" (warm) to achieve performance levels.

91112	Chevrolet V-8 265-454	91212	Ford V-8 221-302, 351W
91712	Chrysler A 273-340-360, 67-up 318	91212	Ford V-8 351C–400M
91712	Chrysler B 383-440	91212	Ford V-8 429-460

Variable Duration Hydraulic Lifters

Maximum low end torque without sacrifice of mid or top end power. More vacuum (up to 3 in.) and better fuel economy. Effectively lowers cam duration by approximately 10 degrees, up to 3000 rpm. ***Note:*** These lifter produce a mild ticking sound (similar to mech. lifters).

91001	Chevrolet V-8 265-454

TECH TIP

Hydraulic lifters should never be pumped up with oil before installation. This will cause the valve lifter plunger to "top out" rather than it's normal operating height, giving you incorrect valve adjustment. This incorrect pre-load will cause excessive valve train noise, rough idle and can cause severe engine damage.

Some items are not legal for sale or use on any pollution controlled motor vehicle

Performance Mechanical Lifters

Designed and manufactured to the closest tolerances in the performance industry. The precision ground crown face insures long life for both cam and lifter in the harsh competition environment. 100% rockwell tested. Made in the USA!

91715	American Motors V-8 304-401	91215	Ford V-8 221-302, 351W
91115	Chevrolet V-8 265-454	91215	Ford V-8 351C–400M
91715	Chrysler A 273-340-360, 67-up 318	91215	Ford V-8 429-460
91715	Chrysler B 383-440	91415	Oldsmobile V-8 260-455
		91415	Pontiac V-8 265-455

"The Original" Direct Lube™ Extreme Duty Mechanical Lifters

Today's cams have more aggressive lobes. Increasing oil supply to these lobes is critical. A precision "E.D.M." laser burns a .021" hole in the center of the face of the lifter. This allows a constant oil supply to the cam lobe, allowing higher valve spring pressures, more aggressive profiles and reduced lobe wear.

91718	American Motors V-8 304-401	91218	Ford V-8 221-302, 351W
91118	Chevrolet V-8 265-454	91218	Ford V-8 351C–400M
91718	Chrysler A 273-340-360, 67-up 318	91218	Ford V-8 429-460
91718	Chrysler B 383-440		

Ultra-Lite Direct Lube™ Mechanical Lifters

Only 73 grams

All the features of Howards Cams famous Direct Lube™ lifters in a new lite weight version. Only 73 grams total weight. Approximately 20 grams lighter per lifter than the original version (91118). ***Note:*** No chamfer to ensure maximum effective diameter.

91110 Chevrolet V-8 265-454

MAX Z.P.M.™ Camshaft Break-In Lube

The most important product for proper flat tappet camshaft break-in available. This is true for both hydraulic and mechanical flat tappet camshafts. Virtually eliminates cam and lifter wear at initial break-in. Replaces the Zinc-Phosphates (ZDDP) removed from today's oils. The highest levels of Zinc-Phosphates (ZDDP) of all the popular brands tested, plus the addition of moly for extra protection. Compatible with all petroleum base and synthetic oils. Just add one 4 ounce bottle for up to 6 quarts of oil.

99000 MAX Z.P.M. Camshaft Break-In Lube, 4oz.

Some items are not legal for sale or use on any pollution controlled motor vehicle

Lifters

Hydraulic Roller

O.E. Style Performance Hydraulic Roller Lifters

Performance stock replacement for use in OE hydraulic roller blocks. The best combination for the street. Reduce friction, increase torque and horsepower.

91113	Chevrolet SB 305-350	91123	Chevrolet BB 454-502 (Gen 5/6)
91113	GM Gen III (LS-Series)	91213	Ford 5.0L

Street Series Retro-Fit Hydraulic Roller Lifters

Designed for street performance enthusiast who want to upgrade to a hydraulic roller camshaft. Manufactured to fit early or late model blocks, including blocks with tall lifter bosses. Cold form technology shapes the body for durability. Carbonitride and tempered for hardness. The roller wheel is hardened and tempered steel alloy. Heat-treated stainless steel cross bars. High alloy steel tie bar buttons. ***Note:*** Specifically designed for street applications to 6500 rpm. Made in the USA!

91164	Chevrolet SB 265-400	91168	Ford V-8 221-302, 351W
91166	GM Gen III (LS-Series)	91168	Ford V-8 351C–400M
91167	Chevrolet BB (Mark IV, Gen 5/6)		
91165	Chevrolet BB (Gen 5/6 & Aftermarket)		

Maximum Effort Retro-Fit Hydraulic Roller Lifters

A true high performance street lifter designed primarily for ease of maintenance and reliability. Our number one selling hydraulic roller lifter. CNC machined and then fitted with a precision check ball internal valving to prevent lifter "pump up". These features combine to provide a broader power band and increased RPM potential while still offering the low maintenance of a hydraulic cam.

91160	Chevrolet SB 265-400	91161	Chevrolet BB 396-454 (Mark IV/Gen 5)

Race Series Vertical Bar Hydraulic Roller Lifters

All new proprietary hydraulic valving specifically designed for continuous operation to 6600 rpm. With ideal seat pressures between 150-160 lbs. The lifter body is fully machined from alloy steel bar stock and completely micro polished. The nose wheel is machined from 8620 material and case hardened for durability. Fully Rebuildable.

91163	Chevrolet SB 265-400	91162	Chevrolet BB (Mark IV/Gen 5/6)

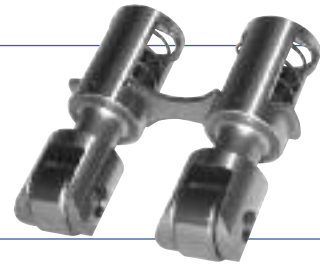
Pro Max™ High RPM Hydraulic Roller Lifters

Designed to operate at rpm ranges over 7000 rpm. All new internal valving for increased rpm, torque and horsepower. The lifter body is fully machined from alloy steel bar stock. The nose wheel is machined from 8620 material and case hardened for durability. ***Note:*** spring pressure requirements for these lifters are 200-225 lbs. seat pressure, 500-575 lbs. open pressure. specific lash adjustments are also required. Fully Rebuildable.

91170	Chevrolet SB 265-400	91171	Chevrolet BB (Mark IV, Gen 5/6)

Some items are not legal for sale or use on any pollution controlled motor vehicle

Horizontal Bar Roller Lifters



All new tooling. Features CNC machined alloy bar stock bodies with case hardened 8620 rollers. Spring loaded, self lifting design for easy cam changes is what make these lifters so popular. Fully rebuildable.

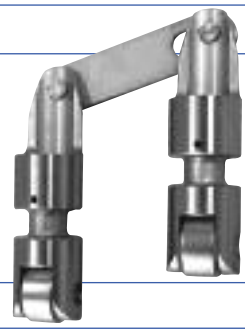
91119	Chevrolet SB 265-350	91129	Chevrolet BB (Mark IV, Gen 5)

Vertical Bar Mechanical Roller Lifters

These lifters feature 8620 heat-treated steel bodies. Yes, the same 8620 material some manufacturers are using in their "new high strength designs", is what these lifters have been manufactured from since their original design. Other features include 9310 steel rollers and superior high strength bearings. Carefully assembled by hand and checked for fit prior to packaging.

91117	Chevrolet SB 265-400	91128	Chevrolet BB 396-502 (+.300" Tall)	91217	Ford SB 221-302, 351W
91122	Chevrolet SB 265-400 (+.300" Tall)	91717	Chrysler SB 318-360	91247	Ford BB 429-460
91127	Chevrolet BB 396-454	91727	Chrysler BB 383-440, 426 Hemi	91417	Oldsmobile/Pontiac V8

Mechanical Roller Lifters for GM Gen III (LS-Series)



These "Link-Bar" style lifters are specifically designed to work with standard and high lift mechanical roller cam Gen III applications. Allows removal of stock GM lifter tray. Steel alloy bodies with a special enhanced finish. Heat-treated stainless steel link bars. Case hardened 8620 rollers fitted with the best bearings and pins. Fully rebuildable.

91177	GM Gen III (LS-Series)

Pro Lite Direct Lube™ Mechanical Roller Lifters w/High Pressure Pin Oilers

Up to 20 grams a pair lighter (only 198g Chev SB) than competitor's lightweight lifters. ***PLUS Direct Lube™ High Pressure Pin Oilers at No Extra Charge.*** The lightened bodies are still ultra strong because they are made from 8620 steel. They are fitted with 9310 steel rollers on precision sorted needle bearings for reliability. Stainless steel cross bars. 100% machined and hand assembled in the USA!

91137	Chevrolet SB 265-400	91138	Chevrolet BB 396-454
91132	Chevrolet SB 265-400 (+.300" Tall)	91133	Chevrolet BB 396-502 (+.300" Tall)

Pro Max™ Direct Lube™ Mechanical Roller Lifters w/High Pressure Pin Oilers

What we believe to be the best link bar mechanical roller lifter available. Features "Full Time" (most other oiling type lifters are timed based) high pressure oiling to the roller bearing shafts. This continuous oiling offers higher rpm and high spring pressure capability. The Pro Max™ features lightened, steel alloy bodies with a special enhanced finish. Heat treated stainless steel link bars. Case hardened 8620 rollers fitted with the best alloy bearings and pins. These are the same materials and designs used on most Top Fuel lifters. .300" taller body allows lifter to fit early, late model and after market blocks. Fully Rebuildable.

91188	Chevrolet SB 265-400 (+.300" Tall)	91199	Chevrolet BB 396-502 (+.300" Tall/.180" Offset)
91189	Chevrolet SB 265-400 (+.300" Tall/.180" Offset)	91288	Ford SB 221-302, 351W
91198	Chevrolet BB 396-454 (+.300" Tall)	91298	Ford BB 429-460

Some items are not legal for sale or use on any pollution controlled motor vehicle

Rev Kits & Stud Girdles

Rev Kits

Rev Kits

Our Rev Kits are designed for roller cam applications to increase valve train stability throughout the RPM range. In addition to increasing RPM capability, rev kits will also keep the lifter in the lifter bore in the event of valve train failure. The locator bars and lifter buttons are made of the highest quality aluminum and then anodized for protection. Each kit is complete with locator bars, springs, and lifter buttons.

90130 Chevrolet SB 265-400 Mechanical Roller (Flat Top Lifters)

90131 Chevrolet SB 265-400 Retrofit Hydraulic Roller

90140 Chevrolet BB 396-454 Mechanical Roller

90135 Chevrolet SB 265-400 Mechanical Roller (Cutaway style lifter) (5/16" pushrods only)

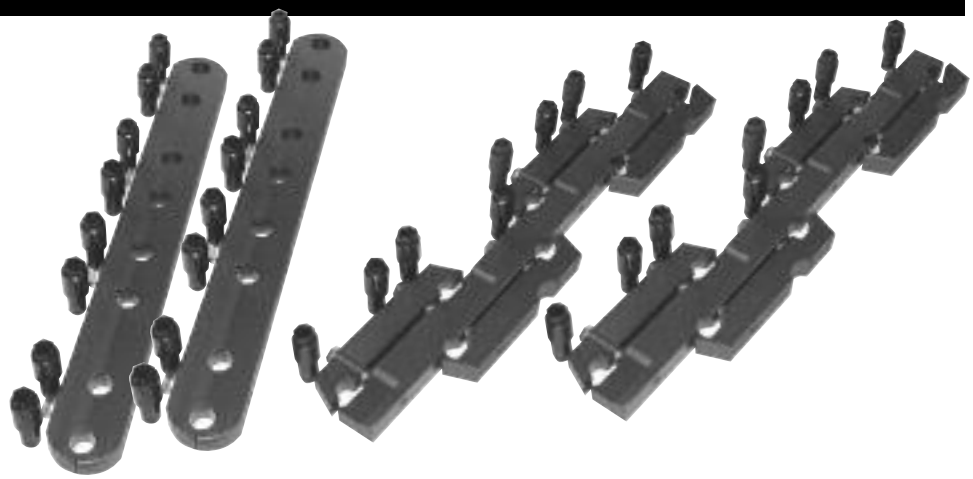
90141 Chevrolet BB Tall Deck Mechanical Roller

Note: Will not work on some Pro-Topline or RHS Chev small block cylinder heads.

Stud Girdles

Aluminum Stud Girdle Kits

Designed to increase the strength and rigidity of the rocker arm studs by eliminating flex and thereby assuring true rocker arm ratios. Howards™ stud girdles are made from the highest quality aluminum. They are spring-loaded for easy removal and include locking hex head adjusters. A must for all competition engines not using shaft rockers.



90100 Small Block Chevrolet 3/8" stud Standard Offset

90101 Small Block Chevrolet 7/16" stud Standard Offset

90120 Big Block Chevrolet 7/16" stud Standard Offset

90110 Small Block Chevrolet 3/8" stud Canfield Heads

90111 Small Block Chevrolet 7/16" stud Canfield Heads

90121 Big Block Chevrolet Dart & Brodix

Double Roller Billet Steel Timing Sets

Double Roller Billet Steel Timing Sets

These pro billet timing sets are designed for accuracy and long life. Lightweight by design these sets feature a billet steel cam sprocket with lightening holes, a heat-treated crank sprocket with 9-key-ways (except 94320) and a black oxide coating. The chain is a large .250" diameter seamless roller. Most sets include a press fit roller thrust bearing. ***Note:*** No machining required.

94300*	Chevrolet SB 265-400
94300-5*	Chevrolet SB .005" Undersize
94300-10*	Chevrolet SB .010" Undersize
94301*	Chevrolet SB w/Factory Roller Caw
94303*	Chevrolet SB w/BB Crank Snout
94302*	Chevrolet SB Dart/Rocket Block
94305*	Chevrolet BB 396-454
94305-5*	Chevrolet BB .005" Undersize
94305-10*	Chevrolet BB .10' Undersize
94330	Chrysler SB 56-88, 273-360
94335	Chrysler BB 56-77, 383-440, Single bolt
94340*	Chrysler BB 56-77, 383-440, Three bolt
94310*	Ford 289-302/351W (65-72)
94312*	Ford 302/351W (72-02)
94312-5*	Ford 302/351W .005" Undersize
94320*	Ford 351C/M & 400 (3-Keyway)
94315*	Ford BB 429-460
94325*	Ford FE 352-428
94345**	Pontiac V-8 55-81, 326-455

**** Features roller thrust bearing***
***** Features bronze thrust bearing***

Cam Correct

Cam Correct "Feel The Rush"

"Feel the Rush!"

MADE IN U.S.A.

Proudly Made in America!
Since 1992

Cam Correct's Real Benefits

Cam Correct gives a choice of zero variation of cam ignition timing or a controlled variable valve timing advancing and retarding the cam up to 7 degrees. Cam Correct uses a spring loaded self-adjusting movable shoe on the chain drive side. The long wearing shoe assumes the position of a pendulum ensuring exact cam timing by maintaining perfect chain pitch. Cam Correct gives increased torque at first throttle response and offers all the benefits of a timing chain, (higher horsepower, elimination of destructive harmonics) all at lower cost over gear or belt drive systems. (timing set not included)

CCK8271	SB Chev. Kit
CCK8272	BB Chev. Kit

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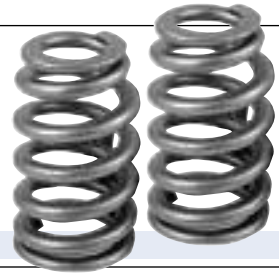
Valve Springs

Stock Diameter

LS1/2/6 Ovate Inverted Conical Valve Springs



Specifically designed for GM Gen III LS1, LS2 and LS6 applications. Performance drop-in replacement. Precision winding, heat treat and finishing processes. Designed for stock style retainers. .560" max lift.

	O.D.	I.D.	Style	Open Pressure	Closed Pressure	Rate	Coil Bind
98115	1.055/1.280	.670/.875	Inv. Conical Ovate	72 @1.800	214 @1.200	236	1.150

LS1/2/6 Dual Valve Springs

Specifically designed for GM Gen III LS1, LS2 and LS6 performance applications. Hi-tech winding, heat treat and finishing processes make these the ultimate late model performance spring. Use chrome moly steel retainers #97162. .640" max lift.

	O.D.	I.D.	Style	Open Pressure	Closed Pressure	Rate	Coil Bind
98116	1.290	.830	Dual	135 @1.800	355 @1.150	340	1.100

Stock Diameter Performance Valve Springs

Delivers increased valve train stability and performance over OEM springs. Made from premium chrome silicone, coiled and heat-treated in the finest facilities available. Designed for most performance hydraulic and mild mechanical flat tappet applications. ***Note:*** Some have taller installed heights and may require either longer valves or retainers design for greater installed height.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer*	Application
AMC V8										
98636	1.530	.700	D. w/Damp	130#@1.875	330#@1.300	348	1.150	.670	97118•97128•97216	
Chevrolet SB										
98212	1.265	.875	S. w/Damp	115#@1.780	340#@1.250	425	1.150	.570	97112•97132•97214	1,3
GM Gen III LS1/2/6 (Single Inverted Conical Ovate)										
98115	1.055/1.280	.670/.875	I. Conical Ovate	72#@1.800	214#@1.200	236	1.150	.600	LS OE	2
Chevrolet BB										
98636	1.530	.700	D. w/Damp	130#@1.875	330#@1.300	348	1.150	.670	97118•97128•97216	
Chrysler SB										
98412	1.445	1.040	S. w/Damp	120#@1.680	295#@1.175	347	1.125	.500	97118	1,2,3
98432	1.437	.760	D. w/Damp	135#@1.750	285#@1.250	300	1.062	.625	97118•97128	2,3
Chrysler BB										
98515	1.510	1.110	S. w/Damp	100#@1.880	275#@1.380	350	1.300	.520	97110•97128•97216	1,3
98611	1.550	1.130	S. w/Damp	135#@1.880	350#@1.250	341	1.150	.670	97110•97128•97220	2,3
98636	1.530	.700	D. w/Damp	130#@1.875	330#@1.300	348	1.150	.670	97118•97128•97216	
Ford SB										
98412	1.445	1.040	S. w/Damp	120#@1.680	295#@1.175	347	1.125	.500	97118	1,2,3
98432	1.437	.760	D. w/Damp	135#@1.750	285#@1.250	300	1.062	.625	97118•97128	2,3
Ford 351W/C/M/400										
98515	1.510	1.110	S. w/Damp	100#@1.880	275#@1.380	350	1.300	.520	97110•97128•97216	1,3
98636	1.530	.700	D. w/Damp	130#@1.875	330#@1.300	348	1.150	.670	97118•97128•97216	
Ford FE & 429-460										
98636	1.530	.700	D. w/Damp	130#@1.875	330#@1.300	348	1.150	.670	97118•97128•97216	
Pontiac/Oldsmobile V8										
98341	13.84	.800	Dual	105#@1.625	230#@1.150	263	.910	.655	97118	1
98432	1.437	.760	D. w/Damp	135#@1.750	285#@1.250	300	1.062	.625	97118•97128	2,3

* Before ordering retainers, please check for proper valve stem diameters

1 = Hyd. Flat Tappet 2 = Hyd. Roller 3 = Mech. Flat tappet

Some items are not legal for sale or use on any pollution controlled motor vehicle

Performance Street/Strip Valve Springs

Performance Street/Strip Valve Springs

Coiled and heat-treated in the finest facilities available. Howards research and development teams are constantly updating materials and manufacturing techniques, to provide the best possible valve springs. Howards Cams pioneered many valve spring developments since the 1950's, and are still working with the best engineers and race teams to be on the cutting edge of valve spring technology.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer*
Hydraulic Flat Tappet Valve Springs									
98111	1.240	.860	Single w/Damp	90 @ 1.700	240 @ 1.250	335	1.125	.520	
98214	1.250	.870	Single w/Damp	115 @ 1.700	300 @ 1.250	411	1.160	.500	
98212	1.265	.875	Single w/Damp	115 @ 1.750	340 @ 1.250	425	1.150	.550	97112•97132•97214
98341	1.385	.800	Dual	105 @ 1.625	230 @ 1.150	263	.910	.655	
98411	1.437	.960	Single w/Damp	110 @ 1.750	270 @ 1.100	246	1.050	.640	
98412	1.445	1.040	Single w/Damp	120 @ 1.680	295 @ 1.175	347	1.125	.500	97118
98444	1.440	.750	Dual	125 @ 1.800	250 @ 1.200	208	1.050	.690	
98511	1.485	1.060	Single w/Damp	105 @ 1.800	300 @ 1.250	355	1.150	.590	
98515	1.510	1.110	Single w/Damp	100 @ 1.880	275 @ 1.380	350	1.300	.520	97110•97128•97216
Hydraulic Roller Valve Springs									
98213	1.265	.875	Single w/Damp	120 @ 1.800	350 @ 1.200	380	1.100	.640	97112•97132•97214
98412	1.445	1.040	Single w/Damp	120 @ 1.680	295 @ 1.175	347	1.125	.500	97118
98432	1.437	.760	Dual w/Damp	135 @ 1.750	285 @ 1.250	300	1.062	.625	97118•97128
98442	1.437	.750	Dual	145 @ 1.750	315 @ 1.150	283	1.025	.665	
98443	1.440	.800	Dual	145 @ 1.880	325 @ 1.250	286	1.150	.670	
98445	1.470	.800	Dual	120 @ 1.875	425 @ 1.110	399	1.080	.735	
98542	1.480	.800	Dual	110 @ 1.880	345 @ 1.320	420	1.270	.550	
98611	1.550	1.130	Single w/Damp	135 @ 1.880	350 @ 1.250	341	1.150	.670	97110•97128•97220
98632	1.540	.745	Dual w/Damp	140 @ 1.940	425 @ 1.250	413	1.150	.730	
Mechanical Flat Tappet Valve Springs									
98213	1.265	.875	Single w/Damp	120 @ 1.800	350 @ 1.200	380	1.100	.640	97112•97132•97214
98214	1.250	.870	Single w/Damp	115 @ 1.700	300 @ 1.250	411	1.160	.500	
98212	1.265	.875	Single w/Damp	115 @ 1.750	340 @ 1.250	425	1.150	.550	97112•97132•97214
98412	1.445	1.040	Single w/Damp	120 @ 1.680	295 @ 1.175	347	1.125	.500	97118
98444	1.440	.750	Dual	125 @ 1.800	250 @ 1.200	208	1.050	.690	
98432	1.437	.760	Dual w/Damp	135 @ 1.750	285 @ 1.250	300	1.062	.625	97118•97128
98442	1.437	.750	Dual	145 @ 1.750	315 @ 1.150	283	1.025	.665	
98443	1.440	.800	Dual	145 @ 1.880	325 @ 1.250	286	1.150	.670	
98445	1.470	.800	Dual	120 @ 1.875	425 @ 1.110	399	1.080	.735	
98511	1.485	1.060	Single w/Damp	105 @ 1.800	300 @ 1.250	355	1.150	.590	
98542	1.480	.800	Dual	110 @ 1.880	345 @ 1.320	420	1.270	.550	
98515	1.510	1.110	Single w/Damp	100 @ 1.880	275 @ 1.380	350	1.300	.520	97110•97128•97216
98611	1.550	1.130	Single w/Damp	135 @ 1.880	350 @ 1.250	341	1.150	.670	97110•97128•97220
98632	1.540	.745	Dual w/Damp	140 @ 1.940	425 @ 1.250	413	1.150	.730	

* Before ordering retainers, please check for proper valve stem diameters

Electro Polished Performance Springs

Manufactured of aircraft chrome silicone, with advanced heat-treating. Outers are then electro polished and stress relieved. Designed for racing hydraulic and mechanical flat tappet as well as performance hydraulic roller camshafts.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift
98215	1.265	.875	Single w/Damp	120 @ 1.800	350 @ 1.200	380	1.100	.640
98432E	1.437	.760	Dual w/Damp	135 @ 1.750	285 @ 1.250	300	1.062	.625

Some items are not legal for sale or use on any pollution controlled motor vehicle

Mechanical Roller Valve Springs

Max Effort™ Mechanical Roller Valve Springs

Howards™ Cams competition racing valve springs are CNC coiled and heat-treated in the finest facilities available. Using only the highest quality valve spring wire, all Howards™ valve springs are stress relieved, ground and shot-peened to offer our customers some of the very best valve springs on the market. Whether you're running a flat tappet or roller cam in your drag race, circle track, road course, performance marine or other extreme race application, Howards™ offers the perfect valve spring to suit your needs.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer
98441	1.437	.800	Dual	175 @ 1.750	400 @ 1.150	375	1.050	.625	97128•97220
98431	1.437	.800	Dual w/Damp	200 @ 1.750	390 @ 1.250	380	1.250	.580	97128•97220
98541	1.500	.800	Dual	150 @ 1.850	435 @ 1.250	475	1.040	.750	97118•97128•97220
98634	1.540	.750	Dual w/Damp	175 @ 1.950	440 @ 1.250	380	1.150	.740	97220
98633	1.540	.730	Dual w/Damp	200 @ 1.950	540 @ 1.250	486	1.150	.740	97220
98631	1.540	.730	Dual w/Damp	200 @ 1.950	600 @ 1.200	533	1.150	.740	97220
98635	1.540	.750	Dual w/Damp	225 @ 1.950	555 @ 1.250	471	1.150	.740	97220
98732	1.625	.765	Dual w/Damp	180 @ 1.940	690 @ 1.200	689	1.100	.780	97222
98731	1.625	.770	Dual w/Damp	235 @ 2.000	680 @ 1.250	594	1.150	.790	97222

Pro-Alloy Mechanical Roller Valve Springs

Howards Cams Pro-Alloy material is specially developed low stress, high endurance material. Howards Cams research and development staff spent many years of development, experience and testing to create a spring you can count on. Low fatigue rate compared to most roller springs on the market. Exceeds H-11 Vasco-Jet specifications. Cycle tested to 12 million cycles with no breakage.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer
98643	1.550	.815	Dual	230 @ 1.880	550 @ 1.250	508	1.080	.750	97220
98737	1.625	.770	Dual w/Damp	240 @ 2.000	685 @ 1.250	593	1.150	.800	97222
98738-A	1.625	.860	Dual w/Damp	250 @ 2.000	800 @ 1.150	645	1.070	.870	97220
98841	1.650	.840	Dual	300 @ 2.100	705 @ 1.350	540	1.250	.800	97222
98851	1.650	.638	Dual w/Damp	325 @ 2.100	800 @ 1.350	630	1.250	.800	97225
98048	1.660	.635	Triple	350 @ 2.100	1020 @ 1.200	745	1.145	.895	97224
98049	1.660	.635	Triple	350 @ 2.200	1075 @ 1.200	725	1.145	.995	97224

Electro Polished Pro-Alloy Mechanical Roller Valve Springs

When only the best will do! Howards Cams™ took their state-of-the-art Pro-Alloy roller valve springs one step further. Each of these springs are electro polished, which enhances the material even further. By reducing localized stress areas, these springs offer even greater life expectancy. Unconditionally Guaranteed against breakage for one year! Just return the broken spring and we'll replace it, no questions asked.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer
98644	1.550	.815	Dual	230 @ 1.880	550 @ 1.250	508	1.080	.750	97220
98637	1.550	.730	Dual w/Damp	225 @ 1.950	600 @ 1.230	521	1.190	.700	97220
98638	1.550	.735	Dual w/Damp	230 @ 2.100	620 @ 1.380	542	1.350	.720	97220
98745	1.625	.770	Dual w/Damp	240 @ 2.000	685 @ 1.250	593	1.150	.800	97222
98853	1.750	.649	Triple	370 @ 2.250	1110 @ 1.200	705	1.150	1.000	

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Mechanical Roller Valve Springs

Pro-Endurance Mechanical Roller Valve Springs

Consistent run after run, lap after lap. Specifically designed to last under the toughest racing environments, including Drag Race, Oval Track and Endurance applications. Special materials, winding process and heat treatment are what makes these true high endurance masterpieces. Fully tested to rev higher, live longer and run harder.

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer
98885	1.560	.740	Dual	245 @ 2.000	600 @ 1.300	507	1.200	.740	97213
98895	1.570	.740	Dual w/Damp	245 @ 2.030	620 @ 1.300	514	1.200	.770	97216

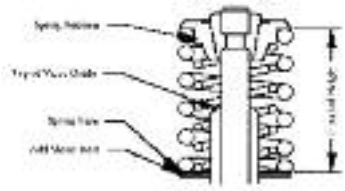
Pro-Series H-11 Tool Steel Valve Springs

PRO springs for the serious racer. Manufactured with laser technology. Inspected and batched to zero tolerance. This is the next generation tool steel spring!

	O.D.	I.D.	Description	Seat Pressure	Open Pressure	Rate	Coil Bind	Max Lift	Retainer
98645	1.550	.710	Dual	225 @ 1.850	675 @ 1.150	644	1.090	.700	97216
98751	1.625	.670	Triple	250 @ 2.000	680 @ 1.250	570	1.100	.850	97225
98852	1.650	.650	Triple	340 @ 2.200	1040 @ 1.200	700	1.130	.980	97224

Valve Spring Tech Info

Installation Chart



To avoid coil binding of valve spring, measure your installed height (see chart). Subtract the valve lift. Subtract an additional .060" safety factor. This is measurement A. Install a retainer on your spring. Slowly compress spring until it coil binds. Measure the distance from under outer lip of retainer to bottom of valve spring. This is measurement B. Measurement A must not be less than measurement B.

Note: Valve spring life is greatly affected by many factors. Most problems are heat or coil bind related. If you use oil restrictors your spring life can be decreased by approximately 40%.

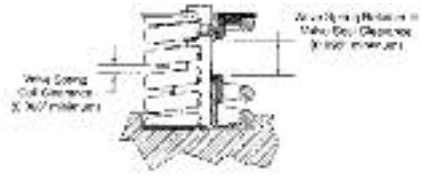
Coil bind is a critical factor. Break in new springs by running at low RPM's until warm and then letting them cool back down before hard running. Any questions, call our tech line.

Valve Spring Run-In

Each set of Howards™ valve springs are hand-selected to keep load variations below +/- 10% of the next. However, it is important to "run-in" your new valve springs at low RPM using the following procedure:

1. Start the engine and run the engine between 1500 and 2000 RPM until the engine reaches operating temperature.
2. Shut off the engine and allow the springs to cool.
3. After initial run-in, most springs will lose a slight amount of pressure. Re-check and shim up the valve springs if necessary. After the springs are "run-in", spring pressure should remain constant until the point of replacement.

Valve Spring Coil Clearance



Coil clearance is the distance between the valve spring coils when the valve is at maximum lift (fully open). A minimum of 0.060" must exist between the coils at maximum lift. Coil bind is when the valve spring is compressed fully-to the point that all the coils are "stacked up" on top of each other. .100 is recommended for high RPM applications. Coil bind is a catastrophic condition that will result in valve train failure. Disassemble each spring (if multiple springs are employed at each valve). Check all the springs (both inner and outer springs). If there is not 0.060"-0.100" minimum clearance between the coils, the solutions are: the valve retainer, the valve locks, the valve, or the spring must be changed; the spring pocket must be machined. Keep in mind that these modifications will change the valve spring installed height.

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Valve Spring Retainers

LS1/2/6 Chrome Moly Steel Retainers

Specifically designed for LS1/LS6 applications using dual performance springs, such as Howards part number 98116. Ideal for performance street to competition. Made from heat-treated 4140 chrome moly material. Black oxide finish. Designed for use with LS1 OE style valve locks.

	Lock Angle	Valve Stem	Valve Spring	Dia. A	Dia. B	Dia. C
97162	7°	5/16", 8mm	1.290" Dual	1.155"	.950"	.675"

7° Chrome Moly Steel Retainers

Premium retainers are manufactured from 4140 chrome moly bar stock steel. Heat-treated for strength and long life. Ideal for all applications ranging from street to competition. Black oxide finish to prevent corrosion.

	Lock Angle	Valve Stem	Valve Spring	Dia. A	Dia. B	Dia. C
97112	7°	11/32"	1.250" Single	1.125"	.850"	.645"
97118	7°	11/32"	1.437-1.450" Single/Dual	1.440"	1.050"	.700"
97120	7°	3/8"	1.437-1.450" Single/Dual	1.440"	1.050"	.700"

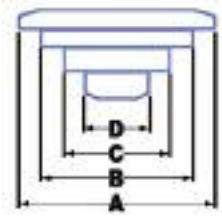
10° Chrome Moly Steel Retainers

Specifically designed for superior strength and durability. 10° design to eliminate lock pull through. A must for high spring pressure applications. Machined from premium 4140 chrome moly bar stock. Heat-treated and black oxide finish. Strong, lightweight.

	Lock Angle	Valve Stem	Valve Spring	Dia. A	Dia. B	Dia. C
97132	10°	All	1.250" Single	1.125"	.875"	.740"
97128	10°	All	1.437-1.450" Single/Dual	1.435"	1.070"	.700"
97126	10°	All	1.437-1.450" -.050" Install Hgt.	1.435"	1.070"	.700"
97130	10°	All	1.450-1.550" Single/Dual	1.435"	1.140"	.705"
97131	10°	All	1.500-1.550" +.100" Install Hgt.	1.500"	1.125"	.710"

American Made Titanium Retainers

The ultimate in lightweight and strength. When you upgrade from steel to titanium valve spring retainers you gain speed and power, because titanium retainers are lighter and stronger than steel. Manufactured to precise tolerances of special 6AL 4V titanium for maximum strength and durability. Up to 50% lighter than steel retainers. Lighter means less chance of valve float.



	Lock Angle	Valve Stem	Valve Spring	Dia. A	Dia. B	Dia. C	Dia. D
97214	7°	11/32"	1.250" Single	1.225"	.870"	.650"	
97216	10°	All	1.437-1.450" Single/Dual	1.440"	1.050"	.700"	
97220	10°	All	1.500-1.550" Single/Dual	1.500"	1.105"	.710"	
97222	10°	All	1.500-1.650" Dual	1.500"	1.175"	.765"	
97224	10°	All	1.500-1.650" Triple	1.500"	1.185"	.860"	.620"
97225	10°	All	1.500-1.650" Triple	1.500"	1.350"	.840"	.635"
97226	10°	All	1.500-1.650" Triple	1.500"	1.185"	.768"	.640"
97227	10°	All	1.500-1.650" +.50" Install Hgt.	1.500"	1.185"	.768"	.640"

Some items are not legal for sale or use on any pollution controlled motor vehicle

7° Heat-Treated Valve Locks

Stamped from alloy steel and heat-treated for superior wear resistance. Out performs O.E. style keepers.

93020 5/16" Valve Stems, Single Groove
93040 11/32" Valve Stems, Single Groove, Black Oxided
93045 3/8" Valve Stems, Single Groove, Black Oxided
93065 3/8" Valve Stems, Chrysler 2 & 4 Groove
93060 11/32" Valve Stems, Ford 4 Groove

10° Machined Steel Valve Locks

Precision machined. Wider angle (10°) to better distribute valve spring loads over the retainer than typical 7° locks.

93070 5/16" Valve Stems, Single Groove
93075 11/32" Valve Stems, Single Groove, w/Lash Cap Recess
93085 11/32" Valve Stems, Single Groove, No Recess, +.050" Hght.
93080 3/8" Valve Stems, Single Groove, w/Lash Cap Recess
93090 3/8" Valve Stems, Single Groove, No Recess, +.050" Hght.

Forged Steel 7° Valve Locks

THE FACTS! The strongest 7° valve lock on the market! Cold forged alloy steel, stronger and more accurate than machined steel locks. The only "true" +.050" 7 degree lock on the market today. At almost 1/2 the cost they obsolete machined locks. ***American Made!***

93005 11/32" Valve Stems, Single Groove, Std. Height
93010 11/32" Valve Stems, Single Groove, +.050 Hght.
93015 3/8" Valve Stems, Single Groove, +.050 Hght.

Forged Steel 10° Valve Locks

The ULTIMATE 10° Valve Locks!

Forged in Milwaukee from Charter Wire™ material. These forgings are stronger, more precise than machined steel locks. They offer longer life, even under high pressure race environment. Because of being a true forged lock, install heights are accurate! Stronger ... More Consistent ... Longer Life... Why buy any other?

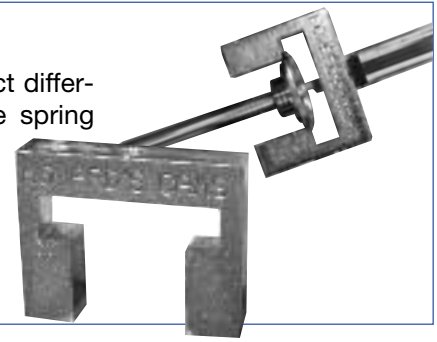
American Made!

93017 11/32" Valve Stems, Single Groove, +.035" Height
93018 3/8" Valve Stems, Single Groove, Std. Height

Retainer Height Tools

Measures exact differences in retainers and locks for your combinations. Detect differences in same part numbers or different combinations, for your exact valve spring installed height. Simple to use with most calipers (not included).

92010 Height Tool, fits 1.250-1.360" Retainers
92020 Height Tool, fits 1.400-1.760" Retainers



Some items are not legal for sale or use on any pollution controlled motor vehicle

Valve Seals/Lash Caps

Ultimate Duty™ Valve Seals

Due to valve guide cutter and manufacturing inconsistencies, Hylomar sealant (included) should always be used.

The Best Seal Made, Period! Howards™ Premium PC type seals are made of a space age material which is tolerant to pump gas, alcohol, and nitromethane. Temperature tolerant to 350˚. They are self-lubricating and offer controlled radial tension during changes in operating temperatures. Color Coded. Controls oil while lubricating the valve guide.

- Space age DuPont® fluoropolymer material
- Alcohol, Nitromethane tolerant
- Controlled radial tension during changing temperatures
- Self lubricated material to 350˚
- Design allows very small amount of oil for guide/stem lubrication
- Color coded • Installs with fingers
- Lifetime replacement warranty

Exact Seal Dimensions

93310 (red) Seal		93315 (orange) Seal		93320 (blue) Seal	
ID Guide	.494”	ID Guide	.524”	ID Guide	.524”
ID Valve	.337”	ID Valve	.337”	ID Valve	.369”
Outer Diameter	.630”	Outer Diameter	.630”	Outer Diameter	.630”
Overall Height	.460”	Overall Height	.460”	Overall Height	.460”
Inside Height	.340”	Inside Height	.340”	Inside Height	.340”
Guide Contact	.120”	Guide Contact	.120”	Guide Contact	.120”

93310 11/32” Stem x .500” Guide 93315 11/32” Stem x .531” Guide 93310 3/8” Stem x .531” Guide

Small O.D. Valve Seals

These high quality valve seals offer a small outside diameter for greater spring clearance. A must for triple springs. Fluoro elastomer hi-temp material. Rigid chimney, metal-clad.

93370 11/32” x .500 (.550” O.D.) 93375 11/32” x .531 (.575” O.D.)

Lash Caps

Today’s race engine technology and extreme cam profiles subject the tip of the valve stem to a tremendous amount of pounding. Designed to protect the valve stem under the most harsh conditions. Manufactured from premium quality chrome moly steel. Precision machined and ground perfectly flat to maintain accuracy. Provides a better wear surface for increased valve stem life. Lengthens valve .080” to correct rocker geometry. A must for high rpm engines.

93200 5/16” x .250” Tip 93205 11/32” x .250” Tip 93210 3/8” x .250” Tip

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Extreme Application Valves

These one-piece stainless steel valves were developed for applications requiring excellent reliability in a race environment. Ideal for both oval track and drag racing with big lifts and high spring pressures. Fully machined 21-4N material. Hardened tips and hard chrome stems. Undercut stems.

Chev SB

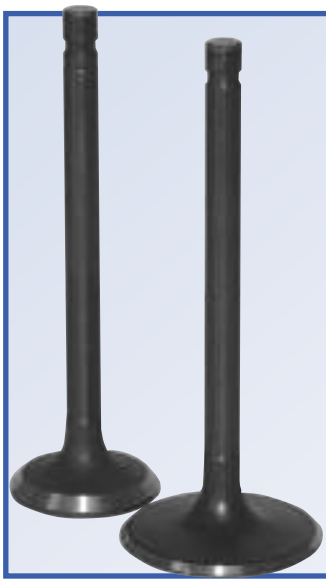
Intake	Size	Stem	Length
19401	1.940 (int)	11/32”	stock
19411	1.940 (int)	11/32”	+.100”
20201	2.020 (int)	11/32”	stock
20211	2.020 (int)	11/32”	+.100”
20501	2.055 (int)	11/32”	stock
20511	2.055 (int)	11/32”	+.100”
20801	2.080 (int)	11/32”	stock
20811	2.080 (int)	11/32”	+.100”
21001	2.100 (int)	11/32”	stock
21011	2.100 (int)	11/32”	+.100”

Exhaust	Size	Stem	Length
15001	1.500 (exh)	11/32”	stock
15011	1.500 (exh)	11/32”	+.100”
16001	1.600 (exh)	11/32”	stock
16011	1.600 (exh)	11/32”	+.100”
16201	1.625 (exh)	11/32”	stock
16211	1.625 (exh)	11/32”	+.100”

Chev BB

Intake	Size	Stem	Length
20603	2.065 (int)	3/8”	stock
21911	2.190 (int)	11/32”	+.100”
21903	2.190 (int)	3/8”	stock
21913	2.190 (int)	3/8”	+.100”
22511	2.250 (int)	11/32”	+.100”
22513	2.250 (int)	3/8”	+.100”
23011	2.300 (int)	11/32”	+.100”
23012	2.300 (int)	11/32”	+.250”
23003	2.300 (int)	3/8”	stock
23013	2.300 (int)	3/8”	+.100”

Exhaust	Size	Stem	Length
17203	1.720 (exh)	3/8”	stock
18811	1.880 (exh)	11/32”	+.100”
18803	1.880 (exh)	3/8”	stock
18813	1.880 (exh)	3/8”	+.100”
19011	1.900 (exh)	11/32”	stock



“Extreme Black™” Severe Application Valves

Engineered for high rpm and high horsepower applications. Extreme Black™ feature a gloss black nitride and are perfect for high temperatures (they run cooler which improves valve life), nitrous, turbo and supercharger applications. For naturally aspirated motors these valves will give you a much greater cylinder flow for good horsepower gains. They start as a one piece forged, high temperature, high nickel, stainless steel alloy. CNC finished to strict tolerances making these valves the choice for the most demanding race classes. The black nitride micro-hardness is higher than the stainless steel base material. No process can match it for surface hardness. Surface finish is smoother than with chromed stems, having less friction between stem and guide. The black nitride reduces power loss due to less valve-guide friction. Nitriding is not a coating, it is a process where it actually becomes part of the steel.

Intake	Size	Stem	Length
20501N	2.055 (int)	11/32”	stock
20511N	2.055 (int)	11/32”	+.100”
20811N	2.080 (int)	11/32”	+.100”

Exhaust	Size	Stem	Length
16001N	1.600 (exh)	11/32”	stock
16011N	1.600 (exh)	11/32”	+.100”
16211N	1.625 (exh)	11/32”	+.100”

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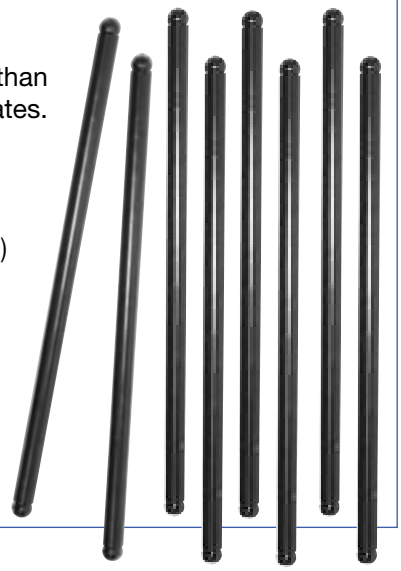
Performance Series C1010 Pushrods

Manufactured from .060" wall C1010 material. Over 20% more column strength than OE. Advanced design eliminates ball breakage. Heat treated for use with guide plates. Designed for spring pressures up to 500 lbs. Sets of 16.



5/16" C1010 Pushrods (sets of 16)

95200 7.144" (Chev SB HRC Retro-Fit)
95201 7.205" (OE Hyd. Roller)
95203 7.700"
95204 7.750"
95205 7.800" (Chev SB, std. length)
95206 7.850"
95207 7.900" (Chev SB, +.100" length)
95208 7.950"
95209 8.000"
95210 8.050"

3/8" C1010 Pushrods (sets of 16)

95220 7.640/8.595" (Chev BB HRC Retro-Fit)
95222 8.280/9.250" (Chev BB, std. length int.)

.080" Wall Swedged End Pushrods

Howards™ Single Piece pushrods are engineered for maximum strength and durability. Produced from seamless 4130 chromemoly aircraft tubing. Each tube is through hardened to a depth of .010" to .015". Pushrods are mirror polished to eliminate the possibility of stress fractures, and finished in black oxide. Strong, but light, well suited for roller applications. Packed in a unique protective storage case.

5/16" Swedged End Pushrods (sets of 16)

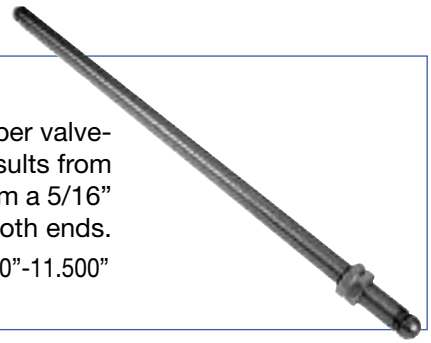
95007 5/16", 6.800" (Ford SB, std. length)
95020 5/16", 7.100"
95021 5/16", 7.150" (Chev SB HRC Retro-Fit)
95022 5/16", 7.200" (OE Hyd. Roller)
95018 5/16", 7.400" (LS1, std. length)
95008 5/16", 7.700"
95009 5/16", 7.750"
95010 5/16", 7.800" (Chev SB, std. length)
95011 5/16", 7.850"
95012 5/16", 7.900" (Chev SB, +.100" length)
95013 5/16", 7.950"
95014 5/16", 8.000"
95015 5/16", 8.150" (Ford 351W, std. length)
95016 5/16", 8.400" (Ford 351C, std. length)
95017 5/16", 8.550" (Ford 429-460, std. lgth)

3/8" Swedged End Pushrods (sets of 8)

95107 3/8", 7.550"
95108 3/8", 7.600" (Chev BB, HRC Retro-Fit exh.)
95109 3/8", 7.650"
95113 3/8", 7.900" (Chev SB, +.100" length)
95110 3/8", 8.280" (Chev BB, std. length int.)
95111 3/8", 8.380" (Chev BB, +.100" lgth int.)
95118 3/8", 8.500"
95119 3/8", 8.550" (Ford 429-460, std. length)
95121 3/8", 8.600" (Chev BB, HRC Retro-Fit int.)
95112 3/8", 8.680" (Chev BB, +.400" lgth int.)
95115 3/8", 9.250" (Chev BB, std. length exh.)
95116 3/8", 9.350" (Chev BB, +.100" lgth exh.)
95117 3/8", 9.650" (Chev BB, +.400" lgth exh.)

Pushrod Length Checkers

Easy and economical tool to layout and determine proper pushrod length for proper valvetrain geometry. Proper valvetrain geometry is necessary to obtain the desired results from the cam and to ensure damage is not done to the rest of the valvetrain. Made from a 5/16" pushrod that is cut and threaded with over one inch of travel. 5/16" ball tip on both ends.



92129 6.500"-7.500"
92130 7.500"-8.700"
92131 8.500"-9.800"
92132 9.700"-11.000"
92133 10.200"-11.500"

Some items are not legal for sale or use on any pollution controlled motor vehicle

Long Slot Rocker Arms

Howards™ Cams Long Slot Rocker Arms are excellent for stock engines or street performance. They are manufactured from the highest quality steel alloy, and then heat-treated. Rocker sets include anti-gall rocker balls, and locking nuts. 3/8" and 7/16" stud.

90005 Chev 265-400, V6 200-262, 3/8" stud, 1.5 Ratio
90006 Chev 265-400, V6 200-262, 3/8" stud, 1.6 Ratio
90007 Chev 265-400, V6 200-262, 7/16" stud, 1.5 Ratio
90008 Chev 265-400, V6 200-262, 7/16" stud, 1.6 Ratio

Long Slot Roller Tip Rocker Arms

These rockers are manufactured from die formed premium steel, thru-hardened and use a precision ground tool steel roller tip. Combine this with anti-gall rocker balls and self-locking nuts; you've got a strong performance and a super accurate rocker arm package.

90009 Chev 265-400, V6 200-262, 3/8" stud, 1.5 Ratio
90010 Chev 265-400, V6 200-262, 3/8" stud, 1.6 Ratio
90011 Chev 265-400, V6 200-262, 7/16" stud, 1.5 Ratio
90012 Chev 265-400, V6 200-262, 7/16" stud, 1.6 Ratio

Howards™ Billet Aluminum Rockers
"The Purple Rocker"

Unique full body design offers less flex and will withstand 800+ lbs. of spring pressure at over .800" lift. 100% CNC machined. Designed for more retainer and spring clearance than most other manufacturers. They feature needle bearing fulcrums and roller tips, centerless ground trunnions, centerless ground pins and rollers and include thick walled adjusting nuts. Unconditionally guaranteed to the original purchaser (with proof of purchase) for life!

Chev SB 3/8" Stud
90068 Chev. SB, 3/8" 1.30 (break-in)
90070 Chev. SB, 3/8" 1.50
90071 Chev. SB, 3/8" 1.60
90074 Chev. SB, 3/8" 1.60/1.50

Chev SB 3/8" Self-Aligning
90084 Chev. SB (Self-Aligning), 3/8" 1.50
90085 Chev. SB (Self-Aligning), 3/8" 1.60

Chev SB 7/16" Stud
90069 Chev. SB, 7/16" 1.30 (break-in)
90072 Chev. SB, 7/16" 1.50
90077 Chev. SB, 7/16" 1.55
90073 Chev. SB 7/16" 1.60
90087 Chev. SB, 7/16" 1.65
90076 Chev. SB 7/16" 1.60/1.50
90088 Chev. SB 7/16" 1.65/1.50
90078 Chev. SB 7/16" 1.65/1.55

Chev BB 7/16" Stud
90075 Chev. BB 7/16 1.70
90079 Chev. BB 7/16" 1.80
90086 Chev. BB 7/16" 1.80/1.70

Ford SB 3/8" Stud
90080 Ford SB, 3/8 1.60

Ford SB 7/16" Stud
90081 Ford SB 7/16" 1.60
90082 Ford SB 7/16" 1.70

Ford 351C, 429-460 7/16" Stud
90083 Ford 351C/429-460, 7/16" 1.73

Pontiac/Holden 7/16" Stud
90090 Pontiac/Holden 7/16" 1.65

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MAX Z.P.M.™ Camshaft Break-In Lube

The most important product for proper flat tappet camshaft break-in available. This is true for both hydraulic and mechanical flat tappet camshafts. Virtually eliminates cam and lifter wear at initial break-in. Replaces the Zinc-Phosphates (ZDDP) removed from today's oils. The highest levels of Zinc-Phosphates (ZDDP) of all the popular brands tested, plus the addition of moly for extra protection. Compatible with all petroleum base and synthetic oils. Just add one 4 ounce bottle for up to 6 quarts of oil.

99000 MAX Z.P.M.™ Camshaft Break-In Lube, 4oz.

Advance and Retard Cam Bushings

An easy way to advance or retard your cam timing. These offset bushings come in packs of 5 (4 offset & 1 0°). Precision manufactured to offer precise timing of your cam. Requires drilling a 13/32" hole in camshaft timing gear.

94505 Set of 5, Even (0°, 2°, 4°, 6°, 8°)

94505:4505-0 Each, 0°
94510:4510-1 Each, 1°
94505:4505-2 Each, 2°
94510:4510-3 Each, 3°
94505:4505-4 Each, 4°

94510 Set of 5, Odd (0°, 1°, 3°, 5°, 7°)

94510:4510-5 Each, 5°
94505:4505-6 Each, 6°
94510:4510-7 Each, 7°
94505:4505-8 Each, 8°

Camshaft Locking Plate and Bolt Kit

Howards™ cam bolt lock plate is cheap insurance when changing camshafts or timing sets. The combination of super strength bolts and locking plate with bendable tabs eliminates the possibility of the cam bolts coming loose and possibility of serious engine damage.

94550 Includes Locking Plate and (3) Super Strength Bolts

Aluminum Cam Thrust Buttons

Designed to control cam end play. Excessive cam play can cause inaccurate ignition timing and premature timing chain wear. Simply pushes into front of cam gear.

94582 Chev SB, .600" Long
94580 Chev SB, .800" Long
94585 Chev BB, .950" Long

Roller Cam Thrust Buttons

Full needle bearing design. Maintains proper cam end play that can cause inaccurate timing and premature timing chain stretch. A must for roller cam applications.

94570 Chev SB, .800" Long
94575 Chev BB, .950" Long

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Bronze Distributor Gears

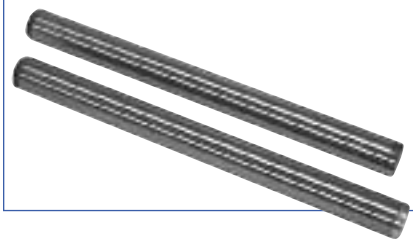
Our distributor gears are manufactured in The United States from a premium bronze alloy material machined to exacting tolerances. These gears feature a high-strength tooth design that resists wear even when used with high pressure oil pumps. A must with billet roller cams.

94400	Chev V8, 90° V6 for .491 Shaft (std./Mallory)	94435	Ford 351C/M/400 for .500 Shaft
94405	Chev V8, 90° V6 for .500 (MSD/etc.)	94440	Ford 351C/M/400 for .531 Shaft
94415	Chrysler SB 273-360, 5.2/5.9L for .484 Shaft	94450	Ford FE 332-428 for .467 Shaft
94420	Chrysler BB 350-440 for .484 Shaft	94435	Ford FE 332-428 for .500 Shaft
94420	Chrysler 426 Hemi/KB for .484 Shaft	94435	Ford 429-460 for .500 Shaft
94430	Ford 221-302/351W, 5.0L for .467 Shaft	94440	Ford 429-460 for .531 Shaft
94425	Ford 221-302/351W, 5.0L for .500 Shaft	94455	Oldsmobile V8 for .491 Shaft
94445	Ford 221-302/351W, 5.0L for .500 Shaft	94460	Pontiac V8 for .489 Shaft

Composite Distributor Gears

Make bronze distributor gear wear a thing of the past! NASCAR-proven technology yields precise timing and extended durability. Precision manufactured carbon ultra fiber material. 300% more durability versus bronze distributor gears when used with steel camshafts. Can be used with cast or billet cams.

94402	Chev V8, 90° V6 for .491 Shaft (std.)	94427	Ford 221-302/351W, 5.0L for .500 Shaft
94407	Chev V8, 90° V6 for .500 (MSD/etc.)		



Fuel Pump Pushrods

Premium grade aerospace chrome moly material. Centerless ground after heat-treating. Hollow for light weight and fast response. Rated 170,000 psi tensile strength. Chev SB and BB .500" dia. x 5.750" overall length.

92150	Steel Tip for Cast Cams	92151	Bronze Tip for Billet Roller Cams

Ultra Lite Billet Composite Fuel Pump Pushrods

Designed for NASCAR, a necessity for any serious racer using a mechanical fuel pump. Proprietary blended carbon reinforced bearing grade polymer. Ultra light weight, only 0.9 ounces (27 grams) to eliminate fuel pump cavitation. Gentle on the cam lobe. Can be used with cast or billet cams. Self lubricating. Super strong. Super long life.

94475 Chev V8, All Application (Cast or Billet), 27 Grams

"The Cam Tube"

- The most protective cam package available
- Great for storage and shipping
- Greatly improves cam survival if dropped
- High impact injected molded plastic

CAM TUBE Cam Tube, Molded High Impact Plastic, Yellow or Grey

Some items are not legal for sale or use on any pollution controlled motor vehicle

Valve Spring Cups and Locators

Howards™ valve spring cups are made from specially hardened chromemoly steel and finished in a rich black oxide for maximum durability. Spring cups will prevent unwanted valve spring movement and galling of the cylinder heads. Machining may be required.

Valve Spring Cups

96005	1.437" (1.550" OD x .680" ID)
96010	1.550" (1.687" OD x .640" ID)
96015	1.550" (1.680" OD x .577" ID)
96020	1.625" (1.750" OD x .635" ID)

Valve Spring Locators

96025	1.550" (1.550" OD x .635" ID)
96030	1.550" (1.550" OD x .570" ID)
96035	1.625" (1.625" OD x .635" ID)
96040	1.625" (1.625" OD x .570" ID)

Exhaust Rotator Eliminators

These .300" thick spacers are used to make up the difference when doing away with factory big block Chevy exhaust rotators. No more having to stack shims to take up the difference. These exhaust rotator eliminators also provide a step for the valve spring so it cannot walk around on the cylinder head.

96045 Rotator Eliminator, Exhaust, Big Block Chevrolet

Valve Spring Shims

Critical when setting up proper valve spring height and pressures. High quality heat-treated valve spring shims are designed to handle the immense pressures of todays racing valve springs. Must specify thickness. Available in .015", .030" and .060".

96205	1.250" X .812"
96210	1.250" X .875"
96215	1.437" X .645"
96220	1.437" X .765"
96225	1.480" X .703"
96235	1.480" X .765", .015" Only
96230	1.500" X 1.031"
96240	1.640" X .635"

Spring Height Micrometer

The easiest way to measure valve spring installed height is with a height micrometer. This tool is used between the cylinder head spring seat and valve spring retainer. The tool is adjusted until all components are fully seated. The tool is read just like a micrometer and will provide accurate measurements every time it is used.

92155 Measures from 1.400"- 1.900"

92156 Measures from 1.600"- 2.100"

E-Z Wrench

No more wishing that you had three hands to adjust your valves. Howards™ E-Z Wrench makes it a breeze to adjust roller rocker arms and steel rocker arms with poly locks.

92100 9/16" E-Z Wrench

92105 5/8" E-Z Wrench

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Spring Seat and Seal Cutters

These tools from Howards™ will allow the engine builder to modify the cylinder heads to fit the desired valve springs and valve stem seals to suit their application.

Seal Cutters

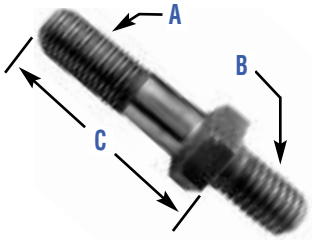
92050	5/16” X .531”
92035	11/32” X .500”
92040	11/32” X .531”
92045	3/8” X .531”

Valve Spring Seat Cutters

92065	1.440” Dia.
92070	1.550” Dia.
92075	1.680” Dia.
92080	1.740” Dia.

Arbors

92085	5/16”
92090	11/32”
92095	3/8”



Rocker Arm Studs

Manufactured from tough 8740 steel, featuring a large ground radius fillet to provide increased support to the stud shank, effectively eliminating bending and subsequent breakage. All studs are precision machined with rolled threads and heat treated for tensile strength of 180,000 PSI then finished in black oxide. Each kit contains 16 studs.

		“A”	“B”	“C”
94650	Chev SB and other standard 3/8” applications	3/8”-24	7/16”-14	1.750”
94652	Chev SB 3/8” with Roller Rockers	3/8”-24	7/16”-14	1.895”
94651	Chev SB standard 7/16” applications	7/16”-20	7/16”-14	1.770”
94656	Chev SB 7/16” w/Roller Rockers & Girdles	7/16”-20	7/16”-14	1.900”
94657	Chev BB Mark IV	7/16”-20	7/16”-14	1.750”
94655	Chev BB 7/16” w/Roller Rockers & Girdles	7/16”-20	7/16”-14	1.900”
94658	Chev BB Gen 5/6, 496ci (8100 series)	7/16”-20	10M x 1.50	1.750”
94650	Ford SB standard 3/8” applications	3/8”-24	7/16”-14	1.750”
94656	Chev SB standard 7/16” applications	7/16”-20	7/16”-14	1.900”

Guide Plates

Pushrod guide plates reduce the unwanted sideways motion of the pushrod under load. This keeps the rocker arm stabilized, making the valve operation much smoother and more efficient. Made from heat-treated chrome moly steel to reduce wear.

94600	Chev SB, 5/16” Flat	94610	Chev SB, 3/8”	94620	Ford SB, 5/16” Flat
94601	Chev SB, 5/16” Raised	94611	Chev SB, 7/16”	94625	Ford 429-460, 5/16”
94602	Chev SB, 3/8” Raised				

Lifter Valley Breather Tubes

Allows crankcase pressure to rise unobstructed, allowing more speedy oil drain back to the oil pan.

92145 Chev V8

Some items are not legal for sale or use on any pollution controlled motor vehicle

HRC HOWARDS RACING COMPONENTS™

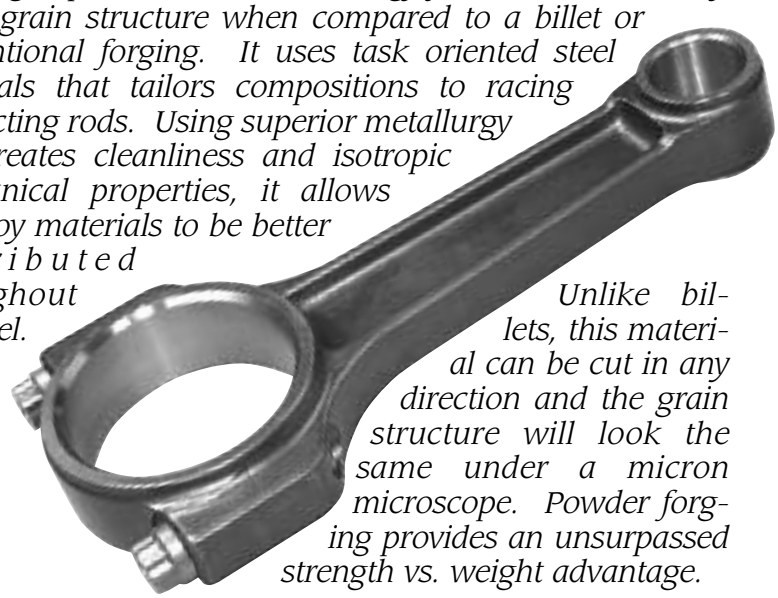
"The Best For Less!"
Buy American!

- **Our #1 Selling Rod!**
- **800 Horsepower Range** *(w/Upgraded L-19 Fasteners)*
- **585 Grams** *(approx.)*
- **All Rods ± 2 Grams**
- **ASTM 4260 Super Steel (Rivals 300M)**
- **Proprietary Fracture Cap Technology**
- **ARP 2000 3/8" Capscrew Fasteners** *(for applications to 650HP)*
- **All Rods 100% Magnafluxed**

GKN

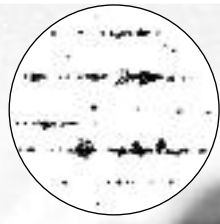
PRECISION DENSE
FORGED CONNECTING RODS
"THE NEXT GENERATION OF RACING RODS"

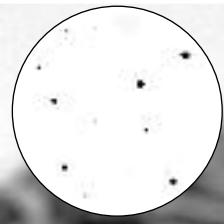
Howards and the king of powder forged technology, GKN, have teamed up to design and manufacture the most technically advanced and reliable performance rods on the planet! Forged powder metal technology features an extremely dense grain structure when compared to a billet or conventional forging. It uses task oriented steel materials that tailors compositions to racing connecting rods. Using superior metallurgy that creates cleanliness and isotropic mechanical properties, it allows the alloy materials to be better distributed throughout the steel.



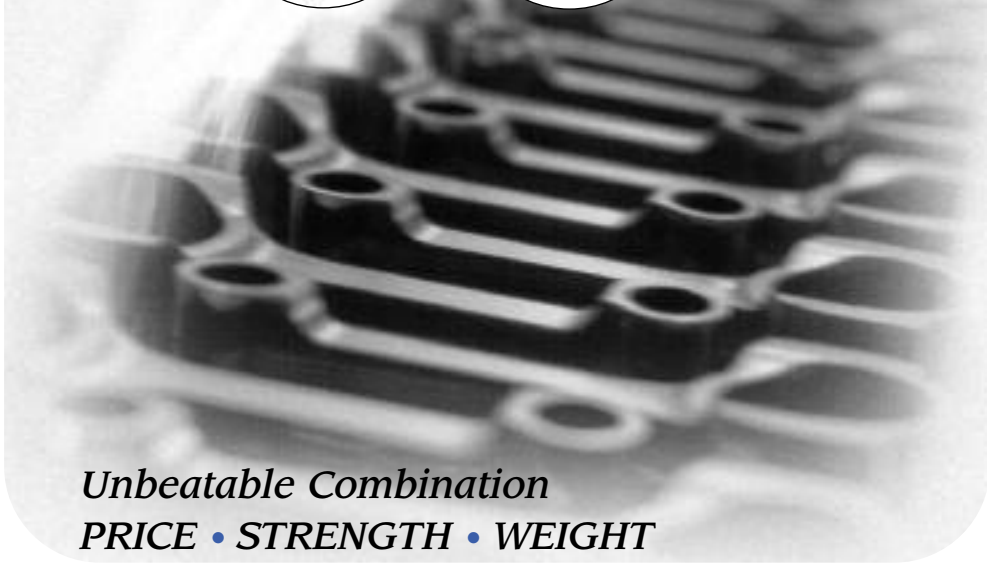
Unlike billets, this material can be cut in any direction and the grain structure will look the same under a micron microscope. Powder forging provides an unsurpassed strength vs. weight advantage.

Typical AISI 4340 Micron Microscope Enlargement for forged and billet rods





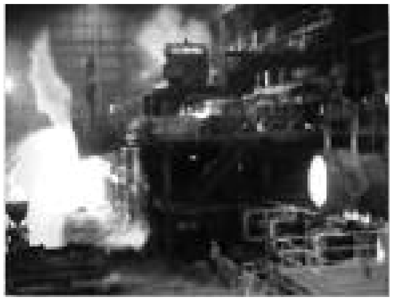
GKN P/F 4260 Micron Microscope Enlargement



Unbeatable Combination
PRICE • STRENGTH • WEIGHT

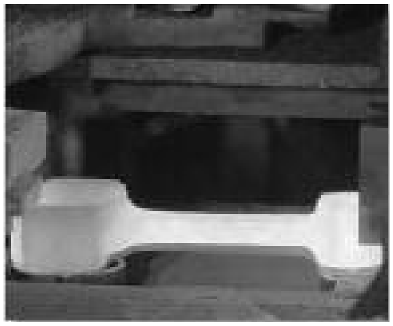
Some items are not legal for sale or use on any pollution controlled motor vehicle

The Manufacturing Process



First, superior high-tech base powder is blended with selected alloying elements in a lab style environment. Melting, atomizing and annealing are controlled to exacting standards to then create super fine powders without impurities!

Next, the base powder, lubricants, additives and graphite elements are compacted under tremendous pressure. Sintering or heating to over 1500° alters and refines the structure of the metal. Hot forging with a 750-ton press finalizes the structure of the metal.



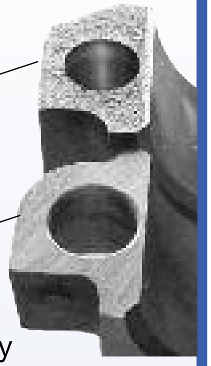
Connecting Rod Material Performance Comparison				
	AISI 1141	GKN P/F 11C60	AISI 4340	GKN ASTM 4260
Ultimate Tensile Strength	680	900	1470	1620
Yeild Strength	570	620	1325	1450
Elongation	15%	10%	10%	7%
Hardness (HRC)	20	28	42	42
Fatigue Endurance Limit	240	340	>600	>600

We use superior ASTM 4260 blend (see chart). We used CAD solids modeling for proof of concept and machined models from billet. We use Finite Element Analysis, a computer program that accurately simulates stress and reaction to stress, which allows redesigns for better strength and weight reduction in the correct places. This greatly reduces the design cycle time and accurately predicts strength and fatigue resistance before the rod is manufactured and sold to you.

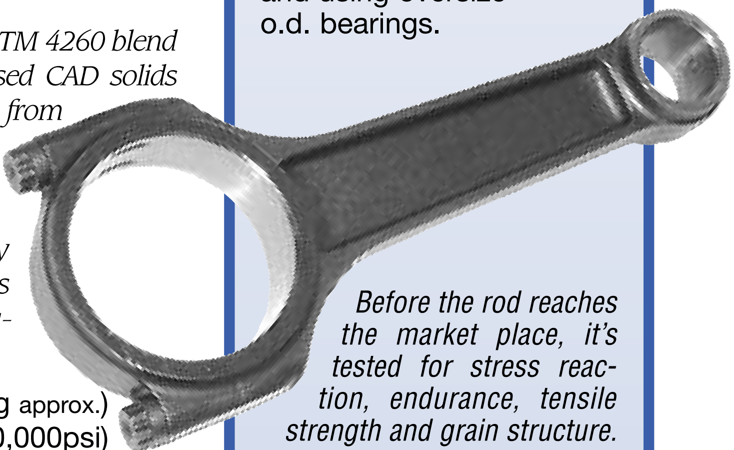
PPF6000............Chev. SB 6.0 Large Journal (585g approx.)
PPF6000-L19 ....Chev. SB 6.0 w/ARP L19 (260,000psi)

Precision Dense Forge Lite *(for applications to 500HP)*
Designed for Circle Track 2-Barrel applications up to 500HP. Utilizes special 245,000 psi fasteners.
PFL6000............Chev. SB 6.0 Large Journal (500g approx.)

Fractured Cap Technology



One of the secondary operations incorporates fractured cap technology. This procedure eliminates fretting which is undesirable cap movement and makes alignment sleeves unnecessary. A fractured cap also provides superior alignment of the cap to the body each and every time. This provides a much better crank bore roundness versus machine caps after assembly. We then use Ampco bushings and 3/8" ARP 2000 capscrews. The results are rods that are easily resizable by simply honing out the crank bore and using oversize o.d. bearings.



Before the rod reaches the market place, it's tested for stress reaction, endurance, tensile strength and grain structure. The final product is lighter, stronger and more reliable than anything on the market!

4340 Forged Sport Rods

Super Quality • American Made!

All Howards Sport Rods use 4340 aircraft quality steel forgings, Ampco bronze bushings, ARP 2000 capscrews and rod cap alignment sleeves. All are stroker clearanced. Special shot peening and multi-phase heat-treating processes are used.

SPORT ROD Features

- ***Certified 4340 Aircraft Quality Steel***
- ***Fully Stroker Clearanced***
- ***Critical Heat-Treating and Shot Peening Processes***
- ***Ampco Bronze Bushings***
- ***Precision Bearing Cap Alignment***
- ***ARP 2000 Capscrews***

750 HP RANGE

Our experience on the race track, combined with our racing customers, has allowed us to keep the lead in manufacturing the best rods in America. Our promise to you is a commitment to continue in that tradition.

H.R.C. Sport Rods

• Bronze Bushed • Stroker Clearanced
• ARP 2000 7/16" capscrew bolts • Special heat-treating
• Shot peened • Rod cap alignment dowels • 750 HP Range

SP5700 .....Chev. SB 5.7" Large Journal (638g approx.)
SP5700S .....Chev. SB 5.7" Small Journal (659g approx.)
SP6000 .....Chev. SB 6.0" Large Journal (651g approx.)

550 HP RANGE

With all the features of sport rods, HRC Sport Lite Rods are even lighter and ideal for applications up to 550 HP. The beam area is also fully CNC profiled.

H.R.C. Sport Lite Rods

• Lightweight • Bronze Bushed • Stroker Clearanced
• ARP 2000 3/8" capscrew bolts • Special heat-treating
• Shot peened • Rod cap alignment dowels • 550 HP Range

SL5700 .....Chev. SB 5.7" Large Journal (535g approx.)
SL5700S.....Chev. SB 5.7" Small Journal (557g approx.)
SL6000 .....Chev. SB 6.0" Large Journal (569g approx.)
SL6000S .....Chev. SB 6.0" Small Journal (608g approx.)

4340 Forged
Ultra Lite & Xtreme Lite Rods

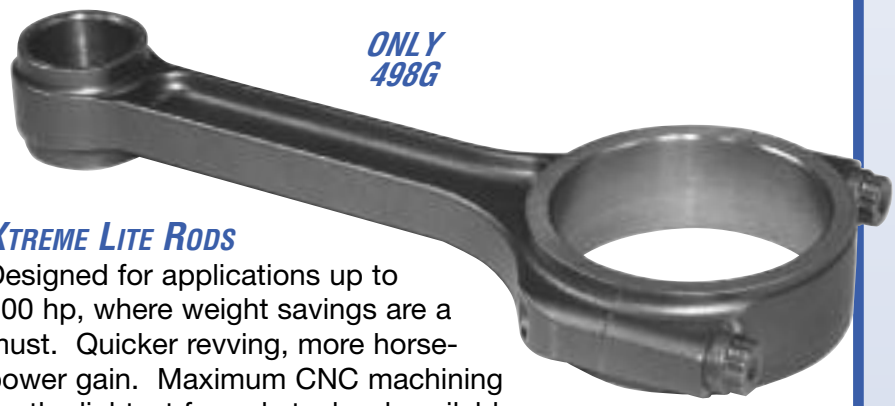
When even the smallest weight reduction is critical in the rods you need, Howards Racing delivers. We also go the extra mile in adding strength and reliability through our exclusive heat-treating process.

These rods are fully CNC machined for the ultimate in weight savings.

Ultra Lite Rods

American made aircraft quality 4340 certified material. They are shot peened and feature special heat-treating. Other features include stroker clearance, rod cap alignment sleeves, bronze bushings and 3/8" ARP 2000 capscrews. Up to 500 hp.

UL5700 .....Chev. SB 5.7" Large Journal (522g approx.)
UL6000 .....Chev. SB 6.0" Large Journal (514g approx.)
UL6000S .....Chev. SB 6.0" Small Journal (553g approx.)



ONLY 498G

Xtreme Lite Rods

Designed for applications up to 500 hp, where weight savings are a must. Quicker revving, more horse-power gain. Maximum CNC machining for the lightest forged steel rod available. Special heat-treating for strength and reliability. Bronze bushed, rod cap alignment sleeves. Features state-of-the-art MSA aerospace 5/16" capscrews, which have better strength than 220,000 psi 3/8" capscrews. ***American Made!***

XL6000 .....Chev. SB 6.0" Large Journal (498g approx.)

"The Best For Less!"
Buy American!

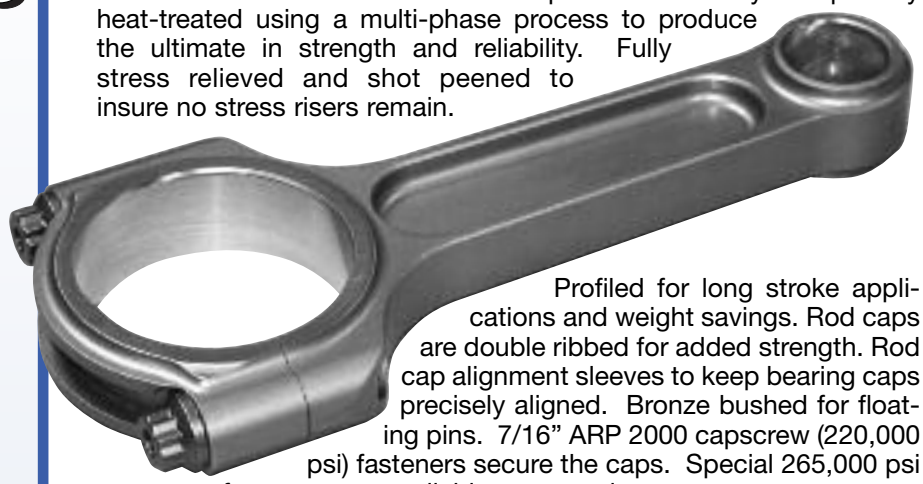
FORGED LITE Features

- ***Fully CNC Machined***
- ***American Made***
- ***Stroker Clearanced***
- ***4340 Certified Steel***
- ***Ampco Bronze Bushings***
- ***Rod Cap Alignment Sleeves***
- ***Special Heat-Treating Process for Additional Strength***

Some items are not legal for sale or use on any pollution controlled motor vehicle

Ultimate Duty™ Forged Billet Rods

A true American forged billet rod at prices as low as imported billets! These rods start with certified high nickel 4340 aircraft quality steel and are fully CNC machined on the newest generation of equipment to insure the removal of all surface imperfections. They are specially heat-treated using a multi-phase process to produce the ultimate in strength and reliability. Fully stress relieved and shot peened to insure no stress risers remain.



Profiled for long stroke applications and weight savings. Rod caps are double ribbed for added strength. Rod cap alignment sleeves to keep bearing caps precisely aligned. Bronze bushed for floating pins. 7/16" ARP 2000 capscrew (220,000 psi) fasteners secure the caps. Special 265,000 psi fasteners are available as an option.

Chev SB

BR5700 .....Chev SB (LJ), 5.700" (650g approx.)
BR5850 .....Chev SB (LJ), 5.850" (664g approx.)
BR5850S .....Chev SB (SJ), 5.850" (702g approx.)
BR6000 .....Chev SB (LJ), 6.000" (673g approx.)
BR6125 .....Chev SB (LJ), 6.125" (674g approx.)
BR6200 .....Chev SB (LJ), 6.200" (680g approx.)
BR6250 .....Chev SB (LJ), 6.250" (680g approx.)
BR6300 .....Chev SB (LJ), 6.300" (670g approx.)
BR6400 .....Chev SB (LJ), 6.400" (678g approx.)
BR6500 .....Chev SB (LJ), 6.500" (687g approx.)

GM Gen III LS-1

BR6125-LS1 .....GM Gen III LS-1, 6.125" (673g approx.)

Chev BB

BR6135.....Chev BB, 6.135" (747g approx.)
BR6385.....Chev BB, 6.385" (749g approx.)
BR6385-2100 .....w/Chev SB LJ Crank (2.100"), 6.385" (790g approx.)
BR6535.....Chev BB, 6.535" (762g approx.)
BR6635.....Chev BB, 6.635" (764g approx.)
BR6700.....Chev BB, 6.700" (780g approx.)
BR6800.....Chev BB, 6.800" (782g approx.)

Chrysler SB

BR6123 .....Chrysler SB, 6.123" (672g approx.)
BR6251-HEMI.....Chrysler 5.7L Hemi, 6.250" (661g approx.)
BR6251-HEMI-927.....5.7L Hemi w/.927" Pin, 6.250" (662g approx.)

Chrysler BB

BR6760 .....Chrysler BB, 6.760" (766g approx.)
BR6760-990 .....Chrysler BB w/.990" Pin, 6.760" (767g approx.)

Ford SB

BR5400F* .....Ford SB, 5.400" w/.927" Piston Pin (630g approx.)
BR5400C*.....Ford SB, 5.400" (636g approx.)

Chev. SB (LJ) Crank (2.100") & Piston pin (.927"), Ford big end width

265,000 PSI Bolt Upgrade is available as an option.

Custom Ultimate Duty™ Rods Available - Call for Information

ULTIMATE DUTY™ FORGED BILLET ROD Features

- ***Certified High Nickel 4340 Aircraft Quality Steel***
- ***1000+ Horsepower Rating***
- ***Multi-Phase Heat-Treating and Shot Peening Processes***
- ***Ampco Bronze Bushings***
- ***Precision Bearing Cap Alignment***
- ***ARP 2000 Capscrews***

Some items are not legal for sale or use on any pollution controlled motor vehicle

Ultimate Duty™ Forged Billet Rods
for Import Applications

Same high quality and features except designed and manufactured for specific import applications. High nickel 4340 aircraft quality steel for the ultimate in strength and reliability.

Ford BA Turbo Typhoon (Aussie)

BR6060BA .....Ford BA Turbo, 6.060" (640g approx.)

Mitsubishi

BR5900MIT.....Mitsubishi 4G63 4cyl (early/6 Bolt), 5.900" (653g approx.)

BR5900MITEVO* .....Mitsubishi 4G63 4cyl (late), 5.900" (652g approx.)

*7 Bolt EVO Crank applications

Nissan

BR6001RB30 .....Nissan RB30 6cyl, 6.000" (610g approx.)

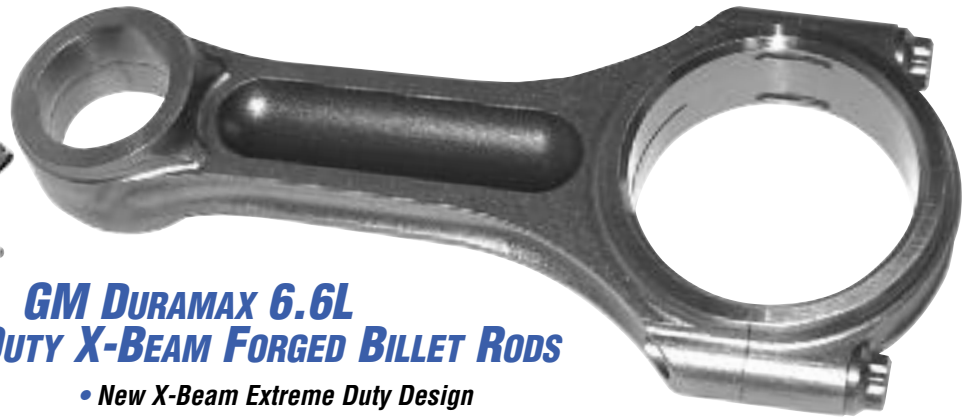
Custom Ultimate Duty™ Rods Available - Call for Information

Ultimate Duty™ Forged Billet Lite
Lightweight 4340 Forged Billet Rods

New lighter design (approx. 50 grams less). Great for faster revving oval track and drag race applications requiring up to a 800 horsepower rating. These rods start with the same certified 4340 aircraft quality high nickel steel as Howards Ultimate Duty™ Forged Billet Rods. They are fully CNC machined with new profiles to lighten all non-critical areas. They are specially heat-treated using a multi-phase process to insure the ultimate in strength and reliability. Fully stress relieved and shot peened to insure no stress risers remain. Profiled for long stroke applications. Double ribbed rod caps for added strength. Bronze bushed for floating pins. 7/16" ARP 2000 (220,000 psi) capscrew fasteners.

BL6000 .....Chev SB (LJ), 6.000" (620g approx.)

BL6125-LS1.....GM Gen III LS-1, 6.125" (625g approx.)



GM Duramax 6.6L
Extreme Duty X-Beam Forged Billet Rods

• New X-Beam Extreme Duty Design

• American 4340 Certified Aircraft Quality Steel • American Multi-Phase Heat-Treating

All new X-beam design for the ultimate in strength and durability. These rods start with certified 4340 aircraft quality steel and are fully CNC machined on the newest generation of equipment to insure the removal of all surface imperfections. A precision "EDM" laser burns a hole from the top of the rod bearing journal to wrist pin bushing for an extra supply of oil to the piston pin. Fully stress relieved and shot peened to insure no stress risers remain. The beam is profiled for weight savings. The cap has been lightened for easier balancing. They are specially heat-treated using a multi-phase process to insure the ultimate in strength and reliability. Rod caps are double ribbed for added strength. Rod cap alignment dowels to keep bearing caps precisely aligned. Bronze bushed for floating pins. 7/16" ARP 2000 capscrew (220,000 psi) fasteners secure the caps. The Ultimate Duramax Rod!

BX6420.....GM Duramax 6.6L

99805 .....Drilled Rod Bearing Set (required for wrist pin oiling)

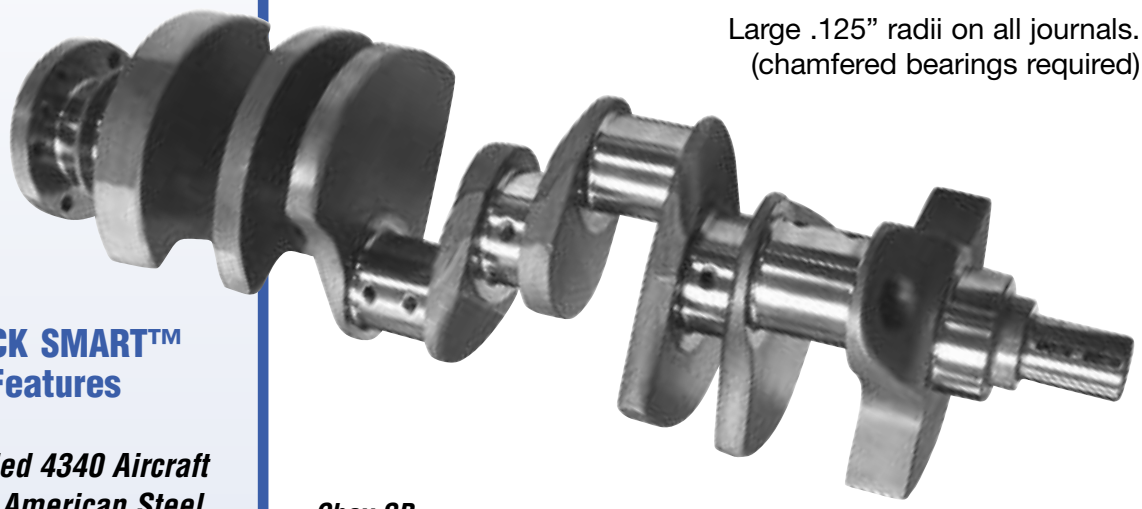
Note: Standard rod bearings may be used but will not feed the wrist pin with oil unless drilled.

Some items are not legal for sale or use on any pollution controlled motor vehicle

Track Smart™ 4340 American Crankshafts

No inferior imports here! Only the finest quality premium grade 4340 aerospace chromemoly material American forgings are used. After close inspection, they are machined on the most advanced CNC machines in the industry. They are then nitrided and all surface journals are micro-polished to five microns or better. Number 1 and 4 rod throws have lightening holes.

Large .125" radii on all journals.
(chamfered bearings required)



TRACK SMART™ Features

- ***Certified 4340 Aircraft Quality American Steel***
- ***Non-Twist Forging***
- ***CNC Machined***
- ***Fully Nitrided***
- ***1 & 4 Rod Throws Have Lightening Holes***
- ***Micro-Polished Journals***
- ***100% Made in America***

Chev SB

353457TS2 .....350 Main, 3.480" Stroke, 5.700" Rod
353457TSP**.....350 Main, 3.480" Stroke, 5.700" Rod
353460TS2 .....350 Main, 3.480" Stroke, 6.000" Rod
353460TSP**.....350 Main, 3.480" Stroke, 6.000" Rod
353557TS2 .....350 Main, 3.500" Stroke, 5.700" Rod
353560TS2 .....350 Main, 3.500" Stroke, 6.000" Rod
353757TS2 .....350 Main, 3.750" Stroke, 5.700" Rod
353760TS2 .....350 Main, 3.750" Stroke, 6.000" Rod
353760TSF*.....350 Main, 3.750" Stroke, 6.000" Rod
353860TSF*.....350 Main, 3.875" Stroke, 6.000" Rod
403757TS2 .....400 Main, 3.750" Stroke, 5.700" Rod
403757TSP**.....400 Main, 3.750" Stroke, 5.700" Rod
403760TS2 .....400 Main, 3.750" Stroke, 6.000" Rod
403760TSP**.....400 Main, 3.750" Stroke, 6.000" Rod

****1 pc. Rear Main **Profiled w/4 lightening holes.***

Chev BB

454061TS4***.....454 Main, 4.000" Stroke, 6.135" Rod
454063TS4***.....454 Main, 4.000" Stroke, 6.385" Rod
454363TS .....454 Main, 4.375" Stroke, 6.385" Rod
454365TS2 .....454 Main, 4.375" Stroke, 6.535" Rod

******4 lightening holes.***

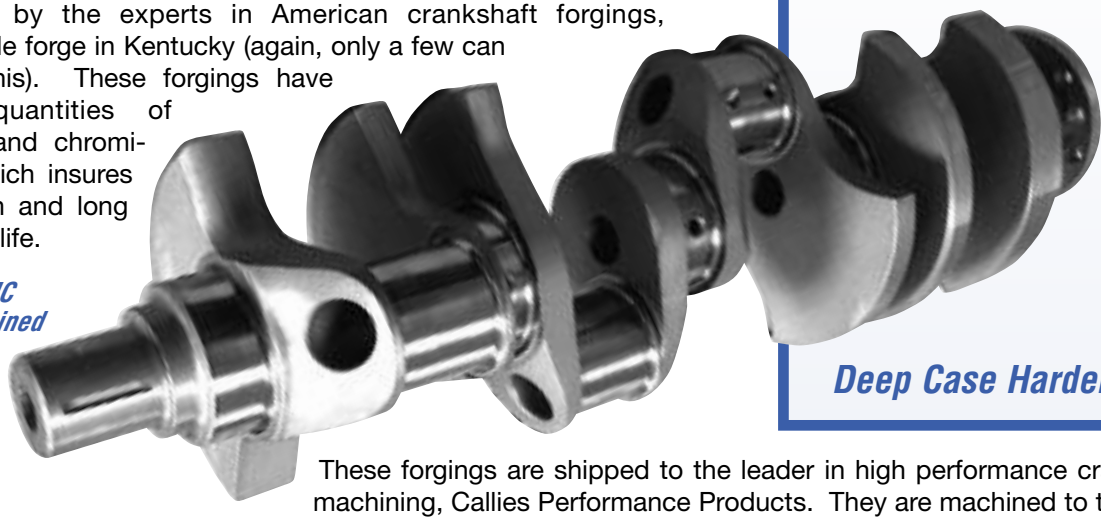
Profiling and Lightening is available for Track Smart™ Cranks!

Some items are not legal for sale or use on any pollution controlled motor vehicle

Pro Max™ 4340 Crankshafts

100% American Made! Starting with the finest high purity 4340 aircraft quality high nickel alloy. Many manufacturers state they use 4340, but very few use the same quality. There is a difference! Forged by the experts in American crankshaft forgings, Louisville forge in Kentucky (again, only a few can state this). These forgings have high quantities of nickel and chromium, which insures strength and long service life.

"The Best For Less!"
Buy American!



CNC Machined

Deep Case Hardened

These forgings are shipped to the leader in high performance crankshaft machining, Callies Performance Products. They are machined to the highest specifications, with roundness within 60 millionths and taper being held to within .0003" on all rod and main diameters. All journals have .125" Tru-Form fillet radii. 1" Angalite lightening holes in all rod throws. Callies "Deep Case" hardening produces a wear layer that remains intact even if reground .010" under (other cranks have a hardness depth as little as .003"). Journals are micro-finished to 5 microns or better. The ***best*** forgings, the ***best*** machining, and ***best*** hardening. Which crank will you run? Requires chamfered bearings.

Chev SB 350 Main

353257 .....350 Main, 3.250" Stroke, 5.700" Rod
353457 .....350 Main, 3.480" Stroke, 5.700" Rod
353557 .....350 Main, 3.500" Stroke, 5.700" Rod
353660 .....350 Main, 3.625" Stroke, 6.000" Rod
353757 .....350 Main, 3.750" Stroke, 5.700" Rod
353760 .....350 Main, 3.750" Stroke, 6.000" Rod
353860 .....350 Main, 3.875" Stroke, 6.000" Rod
354060 .....350 Main, 4.000" Stroke, 6.000" Rod

Chev SB 350 Main w/BB Snout (Double Keyways)

353557-4.....350 Main, 3.500" Stroke, 5.700" Rod
353760-4.....350 Main, 3.750" Stroke, 6.000" Rod
353860-4.....350 Main, 3.875" Stroke, 6.000" Rod
354060-4.....350 Main, 4.000" Stroke, 6.000" Rod

Chev SB 400 Main

403457 .....400 Main, 3.480" Stroke, 5.700" Rod
403660 .....400 Main, 3.625" Stroke, 6.000" Rod
403757 .....400 Main, 3.750" Stroke, 5.700" Rod
403760 .....400 Main, 3.750" Stroke, 6.000" Rod
403860 .....400 Main, 3.875" Stroke, 6.000" Rod
404060 .....400 Main, 4.000" Stroke, 6.000" Rod
404260 .....400 Main, 4.250" Stroke, 6.000" Rod

Chev SB 400 Main w/BB Snout (Double Keyways)

403760-4.....400 Main, 3.750" Stroke, 6.000" Rod
403860-4.....400 Main, 3.875" Stroke, 6.000" Rod
404060-4.....400 Main, 4.000" Stroke, 6.000" Rod
404260-4.....400 Main, 4.250" Stroke, 6.000" Rod

Chev SB 400 Main Gun Drilled w/BB Snout (Double Keyways)

403760-6.....400 Main, 3.750" Stroke, 6.000" Rod
403860-6.....400 Main, 3.875" Stroke, 6.000" Rod
404060-6.....400 Main, 4.000" Stroke, 6.000" Rod

Chev BB (Added Feature: Double Keyways)

454061 .....454 Main, 4.000" Stroke, 6.135" Rod
454263 .....454 Main, 4.250" Stroke, 6.385" Rod
454363 .....454 Main, 4.375" Stroke, 6.385" Rod
454365 .....454 Main, 4.375" Stroke, 6.535" Rod
454565 .....454 Main, 4.500" Stroke, 6.535" Rod
454767 .....454 Main, 4.750" Stroke, 6.700" Rod

Ford SB (Cleveland/SVO Mains) Gun Drilled

313760 .....351C Main, 3.750" Stroke, 6.000" Rod
314062 .....351C Main, 4.000" Stroke, 6.200" Rod
314162 .....351C Main, 4.100" Stroke, 6.200" Rod
314262 .....351C Main, 4.250" Stroke, 6.200" Rod

Profiling and Lightening is available for Pro Max™ Cranks!

Some items are not legal for sale or use on any pollution controlled motor vehicle

HRC HOWARDS RACING COMPONENTS™

MAXIMUM EFFORT™ RACE PISTONS Features

- *2618-T61 Aluminum Forgings*
- *Forced Pin Oilers*
- *CNC Turned Skirts*
- *Double Spirolox*
- *1/16, 1/16, 3/16 Ring Grooves Except Where Noted*
- *Heat Treated Aircraft Quality Wrist Pins*

MAXIMUM EFFORT™ RACE PISTONS

All HRC pistons are machined on the most modern CNC equipment in the industry. They are forged from 2618-T61 aluminum for ultimate strength and fatigue resistance. The design of the CNC turned skirts allows these pistons to work properly under intense heat and severe side loads without scuffing or splitting the cylinder walls. Skirt to wall clearance on most HRC pistons is designed to operate at .004" clearance. Dome pistons are designed with radiused domes, eliminating sharp edges and "hot spots". The valve pockets are built to handle large cam profiles and oversized valves. Pocket angles are designed to work with most angle-milled heads. Forced pin oilers are standard, as are the aircraft quality pins that are heat-treated and end ground to work in floated or press fit applications. Double spiro lox are included. Replacements are available as needed. Rings are available for all stocking pistons.

	Bore Size	Stroke	Rod Length	Dome Volume	Comp. Ratio w/64cc	Comp. Distance	Avg. Wght.
Chev SB Flat Top							
HRC4557	4.000	3.480/3.500	6.000	-4.0cc	10.7	1.268	389
HRC4559	4.000	3.480/3.500	6.125	-4.0cc	10.4	1.133	371
HRC4558	4.000	3.562	6.000	-4.0cc	10.6	1.227	395
HRC4559	4.000	3.750	6.000	-4.0cc	11.1	1.133	371
HRC4560	4.030	3.480/3.500	5.700	-4.0cc	10.8	1.568	439
HRC4567	4.030	3.480/3.500	6.000	-4.0cc	10.8	1.268	406
HRC4579	4.030	3.480/3.500	6.125	-4.0cc	10.6	1.133	382
HRC4583	4.030	3.562	6.000	-4.0cc	10.8	1.227	409
HRC4579	4.030	3.750	6.000	-4.0cc	11.3	1.133	382
HRC4573	4.040	3.480/3.500	6.000	-4.0cc	10.9	1.268	410
HRC4589	4.040	3.480/3.500	6.125	-4.0cc	11.3	1.133	386
HRC4588	4.040	3.562	6.000	-4.0cc	10.8	1.227	414
HRC4589	4.040	3.750	6.000	-4.0cc	11.3	1.133	386
HRC4555	4.040	3.875	6.000	-4.0cc	11.4	1.063	378
HRC4569	4.155	3.480/3.500	6.250	-6.0cc	10.6	1.000	371
HRC4566 (1)	4.155	3.750	6.000	-4.0cc	11.8	1.133	402
HRC4575	4.155	3.750	6.000	-4.0cc	11.8	1.133	400
HRC4569	4.155	3.750	6.125	-6.0cc	11.3	1.000	371
HRC4568	4.155	3.875	6.000	-4.0cc	11.9	1.063	379
HRC4569	4.155	4.000	6.000	-6.0cc	12.0	1.000	371
HRC4576 (1)	4.165	3.750	6.000	-4.0cc	11.9	1.133	414
HRC4554	4.165	3.750	6.000	-4.0cc	11.9	1.133	406

(1) *1/16, 1/16, 1/8 Ring Grooves.*

Some items are not legal for sale or use on any pollution controlled motor vehicle

	Bore Size	Stroke	Rod Length	Dome Volume	Comp. Ratio	Comp. Distance	Avg. Wght.
Chev SB Dome					w/64cc		
HRC4556	4.000	3.480/3.500	6.125	7.8cc	11.9	1.125	406
HRC4556	4.000	3.750	6.000	7.8cc	12.7	1.125	406
HRC4572	4.030	3.480/3.500	6.000	12.7cc	13.6	1.268	455
HRC4570	4.030	3.480/3.500	6.125	7.8cc	12.0	1.125	418
HRC4570	4.030	3.750	6.000	7.8cc	12.8	1.125	418
HRC4584 (1)	4.030	3.750	6.000	7.8cc	13.1	1.133	485
HRC4585	4.040	3.480/3.500	6.000	12.4cc	13.6	1.268	466
HRC4590	4.040	3.480/3.500	6.125	7.8cc	12.1	1.125	421
HRC4590	4.040	3.750	6.000	7.8cc	12.9	1.125	421
HRC4577	4.155	3.480/3.500	6.000	6.7cc	12.4	1.125	500
HRC4582 (1)	4.155	3.750	6.000	6.7cc	13.1	1.120	433
HRC4561 (1)	4.155	3.750	6.000	6.7cc	13.6	1.133	433
HRC4581	4.155	3.875	6.000	1cc	13.0	1.071	406
HRC4580	4.155	4.000	6.000	1cc	13.4	1.008	395
HRC4562	4.155	4.000	6.000	5.6cc	13.9	1.000	411
Chev BB Flat Top					w/118cc		
HRC4578	4.500	4.250	6.385	-3cc	9.3	1.273	588
Chev BB Dome					w/118cc		
HRC4591	4.310	4.250	6.385	51cc	14.1	1.273	578
HRC4592 (2)	4.350	4.500	6.535	43cc	13.8	1.398	636
HRC4586	4.500	4.250	6.385	42cc	13.6	1.273	562
HRC4587	4.600	4.250	6.535	45cc	14.5	1.120	586
Ford 302 Flat Top					64cc/58cc		
HRC6342 (3)	4.030	3.400	5.400	-5cc	10.0/10.7	1.100	390
HRC6343 (3)	4.040	3.400	5.400	-5cc	10.0/10.8	1.100	392
Ford 351W Inverted Dome (Dish)					64cc/58cc		
HRC6432 (3)	4.030	4.000	6.250	-28cc	9.2/9.7	1.230	438
HRC6432 (3)	4.030	4.100	6.200	-28cc	9.4/9.9	1.230	438
HRC6433 (3)	4.040	4.000	6.250	-28cc	9.2/9.7	1.230	442
HRC6433 (3)	4.040	4.100	6.200	-28cc	9.4/10.0	1.230	442
HRC6435 (3)	4.125	4.000	6.250	-28cc	9.5/10.1	1.230	446
HRC6435 (3)	4.125	4.100	6.200	-28cc	9.8/10.3	1.230	446
Ford 351W Mini Dome					64cc/58cc		
HRC6456 (3)	4.030	4.000	6.250	1cc	12.4/13.4	1.230	413
HRC6456 (3)	4.030	4.100	6.200	1cc	12.7/13.8	1.230	413
HRC6457 (3)	4.040	4.000	6.250	1cc	12.5/13.5	1.230	417
HRC6457 (3)	4.040	4.100	6.200	1cc	12.8/13.8	1.230	417
HRC6458 (3)	4.125	4.000	6.250	1cc	12.9/14.0	1.230	461
HRC6458 (3)	4.125	4.100	6.200	1cc	13.2/14.3	1.230	461

(1) 1/16, 1/16, 1/8 Ring Grooves.
(2) Designed for 10.200" Deck Blocks Only.
(3) Features .927" Piston Pins.

"The Best For Less!"
Buy American!

- ***Radius Valve Reliefs***
- ***Accumulator Grooves***
- ***Oversized Valve Pockets***
- ***Lock Removal Indents***
- ***Machined Oil Drain Back Holes***
- ***Honed Pin Bores***

Some items are not legal for sale or use on any pollution controlled motor vehicle

HRC HOWARDS RACING COMPONENTS™

TOOL STEEL WRIST PINS Features

- ***Machined From Solid H11 Bar Stock***
- ***Heat Treated & Triple Tempered***
- ***Centerless Ground to 0.0001" Total Tolerance***
- ***Best Strength To Weight Ratio***
- ***Inner Diameters Honed to Precise Size***

Tool Steel Wrist Pins

The most over looked upgrade to a competition engine. Precision machined from solid H-11 bar stock, heat treated and triple tempered, and centerless ground to 0.0001" total tolerance. Inner diameters are honed on Sunnen equipment to precise size and finish requirements, while the outside diameter features a slight O.D. edge break to maintain maximum bearing area. These pins will give you the best strength to weight ratio available. Sets of 8

Ford SB .912" x 2.500"

HRC91250 ..... .912"x 2.500", .090" Wall, 75g
HRC91252 ..... .912"x 2.500", .120" Wall, 96g

Chev SB .927" x 2.500"

HRC92250 ..... .927"x 2.500", .090" Wall, 76g
HRC92252 ..... .927"x 2.500", .120" Wall, 98g
HRC92254 ..... .927"x 2.500", .140" Wall, 111g
HRC92258* ..... .927"x 2.500", .115-.145" Wall, 118g

Chev SB .927" x 2.750"

HRC92272 ..... .927"x 2.750", .120" Wall, 106g

Chev SB .927" x 2.950"

HRC92292 ..... .927"x 2.950", .120" Wall, 115g
HRC92298* ..... .927"x 2.950", .125-180" Wall, 143g

Chev BB .990" x 2.930"

HRC99292 ..... .990"x 2.930", .120" Wall, 123g
HRC99293 ..... .990"x 2.930", .130" Wall, 130g
HRC99295 ..... .990"x 2.930", .150" Wall, 147g

**** Taper Wall.***

Spiral Locks

High quality replacements for most popular performance pistons. Sold in sets of 32. Note: Spiral Locks are not designed to be reusable. You should always use a new set each time you remove and reassemble the piston and rods. 4 required per piston.

927-042 for .896"-.945" Pins 990-042 for .946"-1.005" Pins

True Seal™ Plasma Moly Ring Sets

Race winning technology at an affordable price. Superior combustion control in today's extreme engines. Starting with a plasma moly ring that is barrel lapped for quick seating and long life. Second rings are cast iron reverse torsional twist. The oil ring features a stainless steel expander with chrome plated carbon steel rails. Manufacturered in the most popular bore sizes. A true seal for more horsepower and longer life. All applications are file fit.

1/16", 1/16", 3/16" Standard Tension

HRC4860-4000-5 .....4.000" Bore +.005" (File Fit)
HRC4860-4020-5 .....4.020" Bore +.005" (File Fit)
HRC4860-4030-5 .....4.030" Bore +.005" (File Fit)
HRC4860-4040-5 .....4.040" Bore +.005" (File Fit)
HRC4860-4060-5 .....4.060" Bore +.005" (File Fit)
HRC4860-4125-5 .....4.125" Bore +.005" (File Fit)
HRC4860-4145-5 .....4.145" Bore +.005" (File Fit)
HRC4860-4155-5 .....4.155" Bore +.005" (File Fit)
HRC4860-4165-5 .....4.165" Bore +.005" (File Fit)
HRC4860-4250-5 .....4.250" Bore +.005" (File Fit)
HRC4860-4280-5 .....4.280" Bore +.005" (File Fit)
HRC4860-4310-5 .....4.310" Bore +.005" (File Fit)
HRC4860-4350-5 .....4.350" Bore +.005" (File Fit)
HRC4860-4500-5 .....4.500" Bore +.005" (File Fit)
HRC4860-4530-5 .....4.530" Bore +.005" (File Fit)
HRC4860-4560-5 .....4.560" Bore +.005" (File Fit)
HRC4860-4600-5 .....4.600" Bore +.005" (File Fit)
HRC4862-4600-5 .....4.600" Bore +.005" (File Fit)

1/16", 1/16", 3/16" Low Tension

HRC4862-4030-5 .....4.030" Bore +.005" (File Fit)
HRC4862-4040-5 .....4.040" Bore +.005" (File Fit)
HRC4862-4125-5 .....4.125" Bore +.005" (File Fit)
HRC4862-4165-5 .....4.165" Bore +.005" (File Fit)
HRC4862-4500-5 .....4.500" Bore +.005" (File Fit)

1/16", 1/16", 1/8" Standard Tension

HRC4870-4030-5 .....4.030" Bore +.005" (File Fit)
HRC4870-4040-5 .....4.040" Bore +.005" (File Fit)
HRC4870-4155-5 .....4.155" Bore +.005" (File Fit)

TRUE SEAL™ PLASMA MOLY RINGS Features

- *Plasma Moly Top Ring*
- *Cast Iron Reverse Torsional Twist Seconds*
- *Barrel Lapped*
- *Quick Seating*
- *Long Life*

Piston Ring Filer

To get the most performance and horsepower, you need to set proper ring gap. Files piston rings quickly and accurately. Simple hand crank design. A must for every engine builder.

92165 Manual Ring Filer

Some items are not legal for sale or use on any pollution controlled motor vehicle

SUGGESTED MAIN CAP FASTENERS

Using Howards Billet Main caps will strengthen your block extremely. However, good quality fasteners must be used for full effect. We highly recommend the use of high quality bolt or stud kits with a rating of 180,000psi or higher. ARP's Pro Series fasteners (200,000psi) are a good match with our main cap kits. The following recommended part numbers are for use as a guide only. Certain applications may require different lengths, check with the manufacturer if you are not certain.

H350R or H350C Main Caps

Bolt Kits

134-5202 .....Hex Head (180,000)
234-5201 ..12 pt. Pro Series (200,000)

Stud Kits (200,000psi)

134-5601 Hex Head w/o windage tray
234-5601 ..Hex Head w/windage tray

H350S Main Caps

Stud Kits (200,000psi)

234-5602 ..Hex Head w/splayed bolts

H400 Main Caps

Stud Kits (200,000psi)

234-5605 ..Hex Head w/windage tray

Main Cap Support Straps

(w/HRC billet or OE center 3 straps)

Bolt Kits

234-5203 ..12 pt. Pro Series (200,000)

Stud Kits (200,000psi)

234-5603 Hex Head w/straight bolt caps
234-5604 ..Hex Head w/splayed caps

HRC Extreme Billet Main Caps

Precision CNC machined from superior quality low carbon 1020 billet material. Available as stock replacement (straight bolt) or with splayed outer bolt holes. The splayed caps feature 10 degree angled outer holes to positively reinforce and tie the block together. Main cap set consists of the center 3 caps. Front and rear caps are also available. Use together for ultimate in bottom end stress and flex management. Drill bushings included with caps requiring them. Side notches for easy removal. Proudly 100% manufactured in the U.S.A. Line boring required after installation.

Chev 350 Main (2.450" Journal)

H350R.....4-Bolt Replacement, 3 pcs.
H350C.....Converts 2-Bolt to 4-Bolt, 3 pcs.
H350S.....Converts 2-Bolt to 4-Bolt, Splayed Outer Bolts, 3 pcs.
H350F.....Front Cap (2-Bolt), 1 pc.
H350RDS.....Rear Cap, Dry-Sump (2-Bolt), 1 pc.
H350RWS.....Rear Cap, Wet-Sump (2-Bolt), 1 pc.

Chev 400 Main (2.650" Journal)

H400.....Converts 2-Bolt to 4-Bolt, Splayed Outer Bolts, 3 pcs.
H400F.....Front Cap (2-Bolt), 1 pc.
H400RWS.....Rear Cap, Wet-Sump (2-Bolt), 1 pc.

Chev 454 Main (2.750" Journal)

H454.....Converts 2-Bolt to 4-Bolt, 3 pcs.
H454RWS.....Rear Cap, Wet-Sump (4-Bolt), 1 pc.

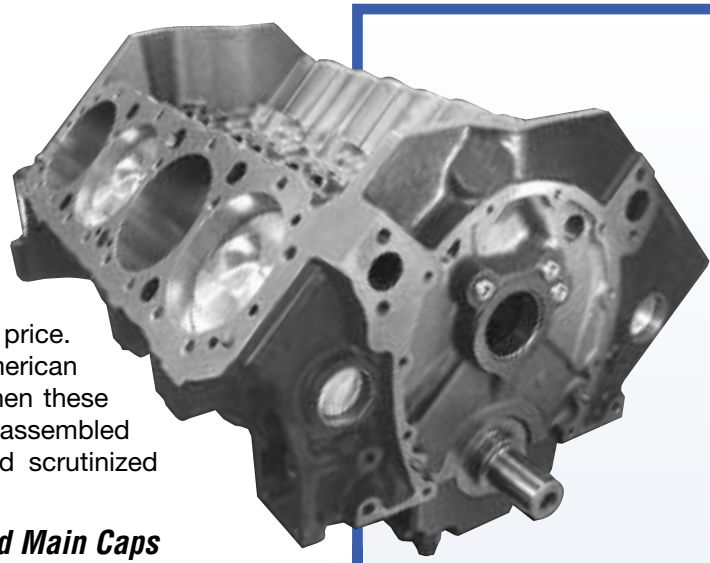
Main Cap Support Straps

Designed to support the front and rear OE style main caps for higher horsepower applications. The best thing to use next to billet replacement caps (see above). Milling top of the caps is necessary, but line bore is usually not affected.

H350FS .....Front main cap strap, Chev. 350
H400FS .....Front main cap strap, Chev. 400
H350RSDS .....Rear main cap strap, dry sump, Chev. 350
H350RSWS .....Rear main cap strap, wet sump, Chev 350

Maximum Effort™ Racing Short Blocks

Assembled with 100% American Race Quality Parts from Howards Racing Components!



The question is do you? Do you really want inferior "low nickel" imported parts in your American machine? Imported parts have become popular because of price. But what if you can have "true" 100% American race quality at a price you can afford? Then these are the short blocks for you. Professionally assembled by dedicated experts. Each part is hand scrutinized before balancing and final assembly.

- ***GM 4-Bolt Block w/HRC Billet Splayed Main Caps***
  Hand selected 2-piece rear seal blocks (except 395ci). They are parallel decked, align bored, bored and honed with deck plates, oil galleries are tapped, stroker clearanced, race cam bearings and brass freeze plugs. ARP fasteners.
- ***HRC Track Smart™ 4340 Forged Steel Crank***
  Aerospace high nickel 4340 non-twist American forging. Precision machined and nitrided.
- ***HRC Maximum Effort™ Pistons***
  2618 extruded forgings. CNC machined by Ross Pistons. Forced pin oilers. Includes AQ quality pins.
- ***HRC Precision Dense Forged Connecting Rods***
  State-of-the-art ASTM 4260 super strength material. Fracture cap technology. 245,000 psi capscrews.
- ***HRC True Seal™ Plasma Moly File Fit Rings***
- ***Clevite H-Series Bearings***
- ***Precision Internal Race Balanced***

Chev SB

SBTP352F* .....(352ci) 4.000" x 3.500" Flat Top (10.3:1 w/64cc)
SBTP355F .....(355ci) 4.030" x 3.480" Flat Top (10.4:1 w/64cc)
SBTP355D .....(355ci) 4.030" x 3.480" Dome (13.0:1 w/64cc)
SBTP356F .....(356ci) 4.040" x 3.480" Flat Top (10.5:1 w/64cc)
SBTP356D .....(356ci) 4.040" x 3.480" Dome (13.0:1 w/64cc)
SBTP357F .....(357ci) 4.030" x 3.500" Flat Top (10.3:1 w/64cc)
SBTP357D .....(357ci) 4.030" x 3.500" Dome (13.0:1 w/64cc)
SBTP359F .....(359ci) 4.040" x 3.500" Flat Top (10.5:1 w/64cc)
SBTP359D .....(359ci) 4.040" x 3.500" Dome (13.0:1 w/64cc)
SBTP376F* .....(376ci) 4.000" x 3.750" Flat Top (11.0:1 w/64cc)
SBTP376D* .....(376ci) 4.000" x 3.750" Dome (12.4:1 w/64cc)
SBTP383F .....(383ci) 4.030" x 3.750" Flat Top (11.1:1 w/64cc)
SBTP383D .....(383ci) 4.030" x 3.750" Dome (12.6:1 w/64cc)
SBTP385F .....(385ci) 4.040" x 3.750" Flat Top (11.2:1 w/64cc)
SBTP385D .....(385ci) 4.040" x 3.750" Dome (12.7:1 w/64cc)

****Features "New" GM 4-bolt main block (cast cap).***

Chev SB w/1-pc Rear Seal

SBTP397F .....(397ci) 4.040" x 3.875" Flat Top (11.5:1 w/64cc)

Do You Really Want Import Steel In Your American Muscle?

MAXIMUM EFFORT™ RACING SHORT BLOCKS Features

- ***GM 4-Bolt Block w/HRC Billet Splayed Caps***
- ***American Non-Twist 4340 Steel Crank***
- ***American 2618 Forged Pistons***
- ***American Precision Dense Forged Rods***
- ***Professionally Balanced & Assembled***

Some items are not legal for sale or use on any pollution controlled motor vehicle

HRC HOWARDS RACING COMPONENTS™

100% American

MAXIMUM EFFORT™ BALANCED RACE ASSEMBLIES Features

- ***Precision Race Balanced***
- ***American High Nickel 4340 Forged Steel Crank***
- ***American ASTM 4260 Precision Dense Forged Rods***
- ***American 2618-T61 Maximum Effort Forged Pistons***
- ***Plasma Moly File Fit Rings***
- ***Pro Series Rod & Main Bearings***

HRC Maximum Effort™ Balanced Race Assemblies

These "American" kits feature Howards HRC state-of-the-art Precision Dense Forged Racing Rods w/ARP 2000 capscrew fasteners, HRC Track Smart 4340 forged crank, HRC forged 2618 pistons and a set of HRC True Seal™ plasma moly rings. Howards finishes these kits with a set of race rod and main bearings. Internally race balanced.

- ***HRC Track Smart 4340 forged steel crankshaft***
- ***HRC forged 2618 pistons***
- ***HRC Precision Dense Forged connecting rods***
- ***Pro-Series rod & main bearings***
- ***HRC True Seal™ Plasma Moly file fit rings.***
- ***Precision Race Balanced.***

Chev SB w/Flat Top Pistons (10.4-11.7:1 w/64cc)

RATP355F .....(355) 350 Main, 4.030 Bore, 3.480" Stroke
RATP356F .....(356) 350 Main, 4.040 Bore, 3.480" Stroke
RATP357F .....(357) 350 Main, 4.030 Bore, 3.500" Stroke
RATP359F .....(359) 350 Main, 4.040 Bore, 3.500" Stroke
RATP383F .....(383) 350 Main, 4.030 Bore, 3.750" Stroke
RATP385F .....(385) 350 Main, 4.040 Bore, 3.750" Stroke
RATP397F* .....(397) 350 Main, 4.040 Bore, 3.875" Stroke
RATP406F .....(406) 400 Main, 4.155 Bore, 3.750" Stroke

****1pc rear main.***

Chev SB w/Dome Pistons (12.6-13.2:1 w/64cc)

RATP355D.....(355) 350 Main, 4.030 Bore, 3.480" Stroke
RATP356D.....(356) 350 Main, 4.040 Bore, 3.480" Stroke
RATP357D.....(357) 350 Main, 4.030 Bore, 3.500" Stroke
RATP359D.....(359) 350 Main, 4.040 Bore, 3.500" Stroke
RATP383D.....(383) 350 Main, 4.030 Bore, 3.750" Stroke
RATP385D.....(385) 350 Main, 4.040 Bore, 3.750" Stroke
RATP406D.....(406) 400 Main, 4.155 Bore, 3.750" Stroke

Options: Rod bolt upgrade (recommended for over 650HP)
Clevite Bearings (H-Series)

Some items are not legal for sale or use on any pollution controlled motor vehicle

HRC Track Smart Race Assemblies

Our most popular race kits! These kits feature premium American made parts you can rely on. American 4340 steel contains much higher percentages of Nickel and Chromium. These materials are crucial to strength and durability. We start with a Howards Track Smart 4340 forged steel crankshaft, matched with a set of Howards forged 4340 rods and a set of Howards or SRP by JE pistons. We finish these kits with Clevite "H" series rod and main bearings, and a set of HRC Plasma Moly file fit rings.

- ***HRC Track Smart™ 4340 forged steel crankshaft***
- ***HRC or SRP/JE forged pistons***
- ***HRC 4340 connecting rods***
- ***Clevite H-Series rod & main bearings***
- ***HRC True Seal™ Plasma Moly file fit rings.***

***Chev SB** w/HRC Sport Lite Rods & Flat Top Pistons*

RATL355F .....(355) 350 Main, 4.030 Bore, 3.480" Stroke
RATL357F .....(357) 350 Main, 4.030 Bore, 3.500" Stroke
RATL383F .....(383) 350 Main, 4.030 Bore, 3.750" Stroke
RATL406F .....(406) 400 Main, 4.155 Bore, 3.750" Stroke

***Chev SB** w/HRC Sport Rods & Dome Pistons*

RATS355D.....(355) 350 Main, 4.030 Bore, 3.480" Stroke
RATS357D.....(357) 350 Main, 4.030 Bore, 3.500" Stroke
RATS383D.....(383) 350 Main, 4.030 Bore, 3.750" Stroke
RATS406D.....(406) 400 Main, 4.155 Bore, 3.750" Stroke

***Chev LS1** w/HRC Ultimate Duty™ Rods, Mahle Inv. Dome Pistons/Rings & Comp Star Crank*

RATB383Li.....(383) LS1 Main, 3.905 Bore, 4.000" Stroke

***Chev BB** w/HRC Ultimate Duty™ Rods & Dome Pistons*

RATB468D.....(468) 454 Main, 4.310 Bore, 4.000" Stroke
RATB496D *(A)*.....(496) 454 Main, 4.310 Bore, 4.250" Stroke
RATB509D.....(509) 454 Main, 4.500 Bore, 4.000" Stroke
RATB540D *(A)*.....(540) 454 Main, 4.500 Bore, 4.250" Stroke
RATB565D *(A)*.....(565) 454 Main, 4.600 Bore, 4.250" Stroke

***(A)* Features Callies Dragonslayer Crankshaft.**

***Chrysler SB (340) (360 Main add $290.00)** w/HRC Ultimate Duty™ Rods*

RADB40CF *(B)*.....(408) 340 Main, 4.030 Bore, 3.790" Stroke
RADB41CF *(B)*.....(416) 340 Main, 4.070 Bore, 4.000" Stroke

***(B)* Features Callies Dragonslayer Crankshaft & JE Pistons.**

Options: Balancing (plus heavy metal if necessary)
Tool Steel Pins

"The Best For Less!"
Buy American!

Do You Really Want Import Steel In Your American Muscle?

HRC TRACK SMART RACE ASSEMBLIES Features

- ***American Non-Twist High Nickel 4340 Steel Crank***
- ***American 2618-T61 Forged Pistons***
- ***American High Nickel Forged 4340 Steel Connecting Rods***
- ***HRC True Seal™ File Fit Rings***
- ***Clevite H-Series Rod & Main Bearings***

100% American

Some items are not legal for sale or use on any pollution controlled motor vehicle

100% American

HRC HOWARDS RACING COMPONENTS™

HRC PRO SERIES™ RACE ASSEMBLIES Features

- ***Pro Max™ American High Nickel 4340 Steel Crank***
- ***American High Nickel Ultimate Duty™ Forged Billet 4340 Steel Rods***
- ***American 2618-T61 Forged Pistons***
- ***HRC True Seal™ File Fit Rings***
- ***Clevite H-Series Rod & Main Bearings***
- ***New Ford Applications***

HRC PRO SERIES™ RACE ASSEMBLIES

The ultimate kits for your high horsepower needs. These kits feature the top of the line ***100% American*** forged parts. Each kit includes a Howards Pro Max™ deep case hardened 4340 crank, a set of Howards Ultimate Duty™ Forged Billet rods and a set of Howards forged dome pistons. These kits also include Clevite "H" series rod and main bearings, and a set of HRC True Seal™ Plasma Moly file fit rings.

Chev SB Dome (12.6-15.1:1 w/64cc)

RAPB355D.....(355) 350 Main, 4.030 Bore, 3.480" Stroke
RAPB357D.....(357) 350 Main, 4.030 Bore, 3.500" Stroke
RAPB377D.....(377) 400 Main, 4.155 Bore, 3.480" Stroke
RAPB383D.....(383) 350 Main, 4.030 Bore, 3.750" Stroke
RAPB393D.....(393) 400 Main, 4.155 Bore, 3.625" Stroke
RAPB406D.....(406) 400 Main, 4.155 Bore, 3.750" Stroke
RAPB421D***(C)*** .....(421) 350 Main, 4.155 Bore, 3.875" Stroke
RAFR421D .....(421) 400 Main, 4.155 Bore, 3.875" Stroke
RAPB434D***(C)*** .....(434) 350 Main, 4.155 Bore, 4.000" Stroke
RAFR434D .....(434) 400 Main, 4.155 Bore, 4.000" Stroke
RAPB461D***(D)*** .....(461) 400 Main, 4.155 Bore, 4.250" Stroke

(C) Designed for use with after market blocks, such as Dart, World, Bowtie, etc.
(D) Designed for use with 9.325" or 9.500" deck after market blocks, such as Dart, Brodix, Rocket, etc (specify deck height). Features HRC flat top pistons (14.25:1 approx.)

Chev BB (Features double keywayed snout) Dome (12.9-13.9:1 w/119cc)

RAFR468D .....(468) 454 Main, 4.310 Bore, 4.000" Stroke
RAFR496D .....(496) 454 Main, 4.310 Bore, 4.250" Stroke
RAFR540D***(F)***.....(540) 454 Main, 4.500 Bore, 4.250" Stroke
RAFR557D***(G)***.....(557) 454 Main, 4.500 Bore, 4.375" Stroke
RAFR565D .....(565) 454 Main, 4.600 Bore, 4.250" Stroke
RAFR572D***(H)***.....(572) 454 Main, 4.500 Bore, 4.500" Stroke
RAFR582D***(G)***.....(582) 454 Main, 4.600 Bore, 4.375" Stroke
RAFR598D***(G/H)***.....(598) 454 Main, 4.600 Bore, 4.500" Stroke
RAFR632D***(G/H)***.....(632) 454 Main, 4.600 Bore, 4.750" Stroke

(F) Also available w/Flat Top (RAFR540F 9.3:1) or Mini Dome (RAFR540MD 10.4:1).
(G) Features Custom Pistons (any CR). (H) Designed 10.200" deck height.

Ford SB (SVO Mains w/9.500" Deck) Inverted Dome (9.7-10.0:1 w/58cc)

RAPB408FiD .....(408) 351C Main, 4.030 Bore, 4.000" Stroke
RAPB418FiD .....(418) 351C Main, 4.030 Bore, 4.100" Stroke
RAPB427FiD .....(427) 351C Main, 4.125 Bore, 4.000" Stroke
RAPB438FiD .....(438) 351C Main, 4.125 Bore, 4.100" Stroke

Ford SB (SVO Mains w/9.500" Deck) Dome (13.4-14.2:1 w/58cc)

RAPB408FD .....(408) 351C Main, 4.030 Bore, 4.000" Stroke
RAPB418FD .....(418) 351C Main, 4.030 Bore, 4.100" Stroke
RAPB427FD .....(427) 351C Main, 4.125 Bore, 4.000" Stroke
RAPB438FD .....(438) 351C Main, 4.125 Bore, 4.100" Stroke

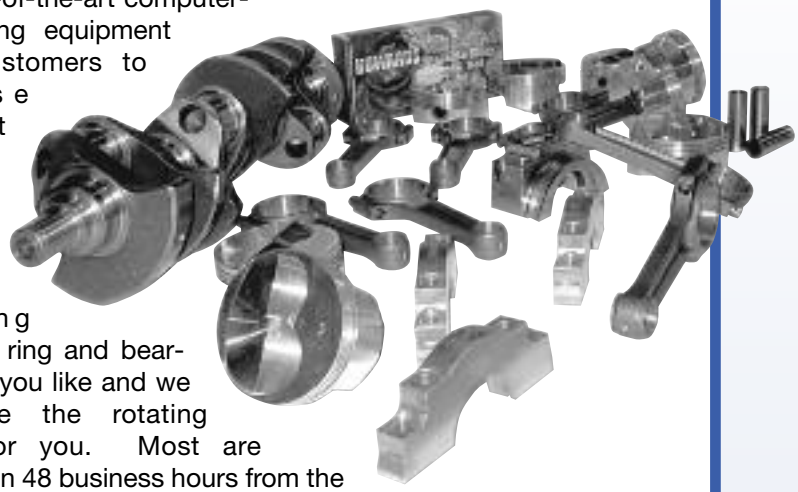
Options:

Balancing (plus heavy metal if necessary)
Tool Steel Pins
Chev SB Crank w/Big Block Snout

Some items are not legal for sale or use on any pollution controlled motor vehicle

Smart Select Rotating Assemblies

HRC "Smart Select" rotating assemblies allow customers to hand pick from over 40 manufacturers of race quality components. HRC utilizes state-of-the-art computerized balancing equipment to allow customers to purchase exactly what they want from one source. Choose the crankshaft, connecting rods, piston, ring and bearing package you like and we will balance the rotating assembly for you. Most are shipped within 48 business hours from the time your order is placed. Choose your components from a huge inventory of quality parts from the following respected manufacturers: ACL, Arias, BME, Callies, Clevite, Comp Star, Crower, Diamond, Dyer's, Elgin, Engine Tech, Federal Mogul, Grant, GRP, Hastings, Howards HRC, Howards Aluminum Rods, JE, Keith Black, King, Mahle, Manley, Oliver, Probe, Ross, SRP, Scat, Silv-O-Lite, Speed Pro, Total Seal, and more! Add a block (Dart, World, Brodix)



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Name _____

Address _____ City _____ State _____ Zip _____

Make _____ Bore _____ Stroke _____ Main _____

Crankshaft Manufacturer _____ Part Number (if known) _____

Pistons Manufacturer _____ Part Number (if known) _____

Rods Manufacturer _____ Part Number (if known) _____

Rings Manufacturer _____ Part Number (if known) _____

Rod Bearing Manufacturer _____ Part Number (if known) _____

Main Bearing Manufacturer _____ Part Number (if known) _____

Balancing: ❑ Internal ❑ External ❑ None

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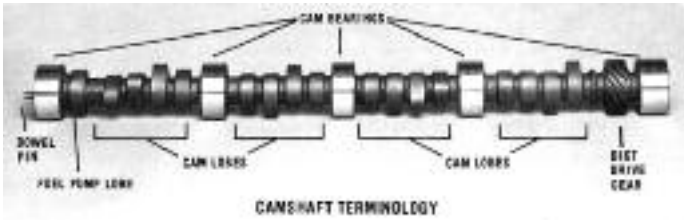
How to Install a Performance Camshaft



CAMSHAFT TERMINOLOGY

How to Install a Performance Camshaft

Installing a new cam is a relatively easy and straightforward operation that can be performed by anyone who is handy with tools, has a basic understanding of what's inside an engine, and who has the necessary tools and shop manual (Chilton, Motor's, etc.). The cam may be replaced with the engine in the car (by removing the radiator, grill, some braces, etc.), but the job is far easier if you obtain a hoist and remove the engine. Either way, take your time. You can probably do the job in a weekend without a hassle, but the more time and care you take, the better the result.

Following instructions in your shop manual, remove the carburetor/intake manifold, valve covers, radiator, water pump and other engine accessories that interfere (air conditioning, smog pump, etc.). You'll need a special puller to remove the crankshaft harmonic damper (available from most tool rental places). Then remove the timing chain cover. ***HINT:*** As you unbolt each piece, use a box or plastic bag to store the bolts and other hardware items, adding a note to identify where the pieces go to and anything tricky you'll want to remember during engine reassembly.

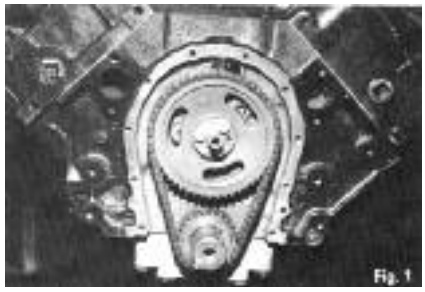


Fig. 1

With the timing chain and camshaft sprocket and crankshaft sprockets exposed, locate the timing marks on the sprockets. Rotate the engine until these marks are aligned (Fig. 1), at which point the number one piston should be at top dead center (TDC). When installing the new cam, these marks must be aligned or serious engine damage may result.

With the timing marks aligned, remove the distributor cap and make a mark on the distributor body to indicate the position of the rotor; then make a mark on the distributor body and the engine to locate the position of the distributor in the engine. Then remove the distributor.

Remove the timing chain. Unless the engine has a very low mileage (under 10,000 miles) discard the chain as a stretched chain affects cam and ignition timing.

Remove the rocker arms, pushrods and valve lifters. Discard the lifters. New lifters must be installed with a new camshaft. For a complete job and best performance, the cylinder heads can be removed and disassembled by removing the valve springs and valves (valves and valve seat surfaces may need refacing by a competent machine shop).

In order to obtain maximum potential performance from any camshaft, matching valve springs and special valve stem oil seals should be installed with your new cam.

Replacing The Cam

Remove the camshaft very slowly by pulling on the cam sprocket, being careful not to drag the cam lobes on the bearings inside the block. With the cam out inspect the bearing surfaces for any indication of wear. Corresponding cam bearings should then be replaced. Remove the sprocket from the cam and inspect it closely for worn or broken teeth and inspect the crank sprocket as well. Replace all worn parts as necessary.

Before beginning assembly, compare the part numbers of cam, springs, lifters and other newly purchased products with the listings in this catalog to be certain you have the proper parts. The cam and all components, except hydraulic lifters, should be washed in solvent and dried thoroughly. Coat the cam lobes and distributor drive gear with Camshaft and Engine Assembly Lube or similar moly-disulfide assembly lube. Also coat the bearing surfaces on the cam and in the block with top grade engine oil. Bolt the cam sprocket to the cam, including any thrust plate. Check the thrust plate for proper end clearance.

Gently insert the cam into the engine, taking care not to damage the bearings and rotating the cam slowly as you slide it in. With the cam in place, check that the thrust surface of the sprocket touches the block. If the engine has a thrust plate, bolt the plate to the block. Rotate the cam by hand, it should spin freely without any binding. If there is resistance, cam bearings may need to be replaced.

With the cam in place, coat a new set of lifters with our moly-disulfide Assembly Lube on the cam face surface, then trial-fit each lifter for smooth fit in its bore. Remove the lifters one at a time, coat each lifter bore with top-grade engine oil and reinsert each lifter. With all lifters in place, apply pressure against the cam sprocket making sure the thrust faces are in contact. Rotate the cam to make sure there is no resistance with all lifters in place. If there are hard spots or other rotation interference, check for proper alignment of cam lobes and lifters (Fig. 2).

Carefully remove the cam sprocket and reinstall with the timing chain. Be sure to use Loc-tite or equivalent on each sprocket bolt. Be sure timing marks on cam and crank sprockets are aligned. Proper torque on sprocket bolts is critical; use a torque wrench and obtain tightening specs from your shop manual. After installation, again check for proper cam lobe/lifter alignment. On three-bolt cam sprockets, we suggest using a safety wire or camshaft lock plate. If the sprocket should come loose, cam lobe and lifter damage will result.

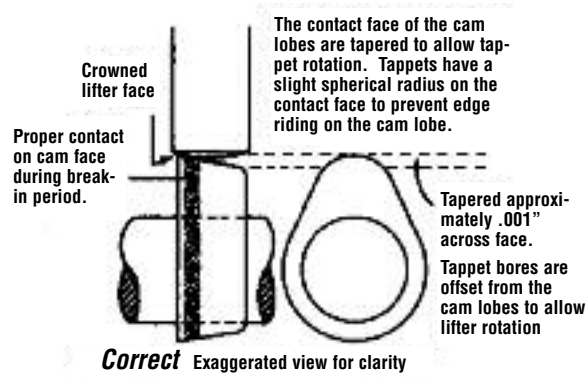
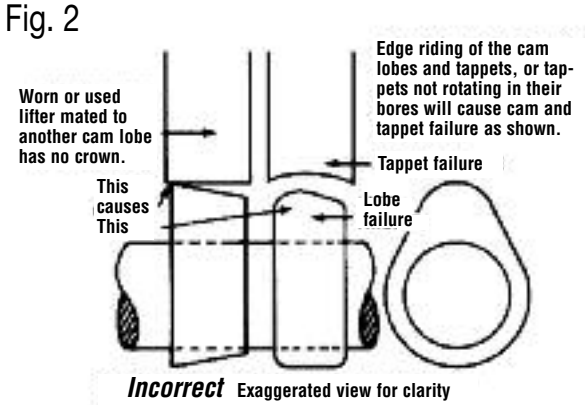
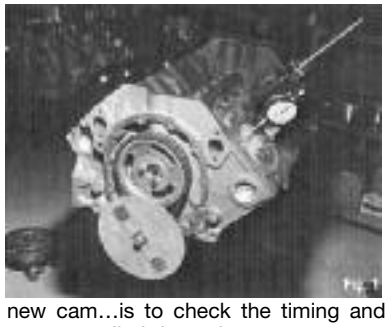


Fig. 2





Degreeing a Camshaft

Variables in the engine, including timing chain stretch, crankshaft sprocket keyway location, cam sprocket key or dowel location and other factors can affect timing. The manufacturing tolerances in these parts can accumulate or be self-canceling. The only way to know for certain…and to get maximum performance from your new cam…is to check the timing and phasing of the cam through a process called degreeing.

Equipment Needed

To degree your cam, you'll need three items: a degree wheel calibrated in one-degree increments and at least 6" in diameter, a pointer to be attached to the block aimed at the degree wheel, and a dial indicator with a minimum of 0.500" travel. You'll also need a method of attaching the dial indicator.

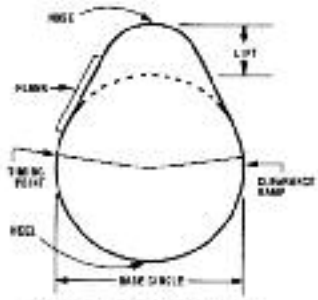
The engine must be sufficiently torn down to allow removal of pushrods and lifters and the cylinder head covering number one cylinder must be removed.

First, attach a degree wheel to the crankshaft. Next, install the pointer. This must be securely bolted to the engine block and must be rigid to assure accuracy of readings. The pointer's free end should almost touch the degree wheel (Fig. 2). A wire pointer is commonly used, but one fashioned from sheet stock (aluminum will do) is best because it is more rigid.

Rotate the crankshaft until number one cylinder's piston is as close to top dead center as possible. (Top dead center is the highest point the piston reaches in number one cylinder). Adjust the degree wheel so the pointer is aimed at the TDC mark.

Finding TDC

A dial indicator is used to determine top dead center. The key to accuracy is in the firmness of the mounting of the dial indicator over cylinder number one. The indicator must securely and positively mount to the head surface of the block.



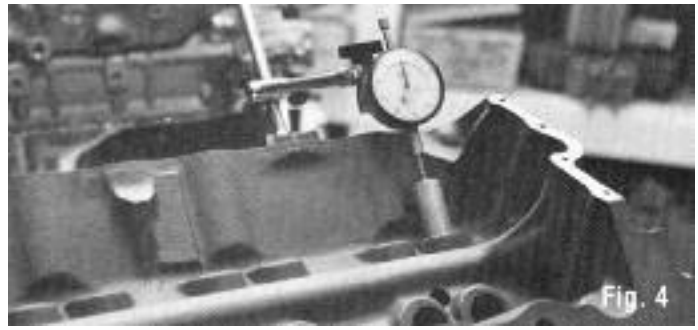
Cam Lobe Terminology

Place the dial indicator over the cylinder and set the zero mark at roughly the piston's highest point. Rotate the engine counterclockwise to 0.100 inch down and then rotate the crank clockwise to where the piston is 0.050 inch down in the bore. Record the degree-wheel reading. Then continue to rotate the piston clockwise through TDC to 0.050 inch down on the dial indicator to the opposite side of TDC and read the degree wheel. Top dead center will be halfway between these two temporary marks.

For example, if your first mark was at 35˚ and the second mark was at 41° (on the other side of the degree wheel's indicated 0˚ or TDC), add the two figures together (35 plus 41 equal 76), and then divide by two to find true TDC. In this case, 76 divided by 2 equals 38. This true TDC will be obtained by rotating the crankshaft until the pointer is aligned with 38˚ on the degree wheel.

Without moving the crankshaft, loosen the degree wheel and rotate it until the pointer indicates the figure (in this case 38˚). Rotate the crank slowly in the opposite direction from the last time until the noted dial indicator reading. The pointer should indicate the same reading (38˚ in our example), but on the other side of the 0˚ or TDC mark.

To check your accuracy, repeat the rotation and counter-rotation process outlined above. This time, the pointer should give the exact same reading each time, except on the opposite sides of the TDC/0˚ mark.



Finding The Cam Centerline

Depending on the mount you use and the length of the indicator's stem, you may need an extension to link the lifter and the indicator. Use the same type lifter for checking that will be used in the completed engine. You can not use a roller tappet on a flat-tappet cam nor can you use a flat-tappet lifter on a roller cam. Using a cam checking toll such as Proform 66838 with the correct tip is also suggested.

Rotate the crankshaft until the intake lifter for cylinder number one is riding on the base circle. Mount the dial indicator on this lifter. Do not place the tip of the dial indicator in the pushrod cup of the lifter to read lift. The lifter cup radius offers no flat area for repeatability. Instead, use the edge of the lifter or build a dedicated lifter with a flat that will accurately locate the dial-indicator plunger. Make sure the dial indicator travels roughly the same angle as the lifter. If the heads are bolted on the engine, you can use a pushrod to move the dial indicator. ***Note:*** All other lifters and all pushrods should be removed. The indicator should be located so that the stem is depressed 0.020" to 0.030" into the operating range, then set the dial to zero.

Rotate the engine slowly in the normal direction of rotation to several revolutions and make certain that the indicator always returns to zero when the lifter contacts the base circle of the lobe. If it doesn't, the lifter is sticking and must be freed prior to any checks being made. Watch any flexing in the indicator mount.

Begin by rotating the engine clockwise until the dial indicator reads max lift. Zero the dial indicator and rotate the engine counterclockwise until the dial indicator reads roughly 0.100 inch down from max lift. Slowly rotate the engine clockwise until the dial indicator reads 0.050 inch from max lift and record the number shown on the degree wheel. Next, continue to rotate the crankshaft clockwise until the dial indicator reads 0.050 inch on the closing side of the intake lobe from max lift and record the number shown on the degree wheel.

Back the engine up to 0.100 inch on the dial indicator before taking the reading at 0.050 on the opening side of the lobe because traveling past the data point and then turning the engine clockwise to approach the 0.050-inch data point removes any slack that may be present in the timing chain that resulted from turning the engine backward. This is why you don't turn the engine counterclockwise to 0.050, but rather go past it and then turn clockwise up to the first checking point. It's a small point, but accuracy is our goal.

Adding these two numbers together and dividing by two will give you the intake centerline. For example, if your first mark was at 65° and the second mark was at 152°, then 65 + 152 equals 217 divided by 2 equals 108.5 degrees ATDC.

Compare this number (in this case 108.5) with the lobe centerline listed on the timing card. Taking the lobe centerline from your timing card and subtracting the centerline you got from your measurements will give you the cam advance. For example, if the cams cam card reads 110° lobe center and your measurements give you 108.5°, then 110° - 108.5° = 1.5°. This is the advance at the crank. Remember for every time your cam rotates once your crankshaft rotates twice. So the advance at the cam gear is half (in this case .75°). This can be corrected with multiple keyway crank gears, offset crank keys or offset cam bushings.

Camshaft Tuning

There are two reasons for altering the phase relationship between the

This Data to be used for Degreeing Purposes only.

GROSS LIFT AT CAM
Intake _____
Exhaust _____
DEGREE OF DURATION @ .050
Intake _____
Exhaust _____

RUNNING CLEARANCE
Intake _____
Exhaust _____
VALVE LIFT
Intake _____
Exhaust _____
DEGREES OF DURATION
Intake _____
Exhaust _____

RECOMMENDED VALVE SPRING INFORMATION
SPRING PART #_____
INSTALLED HT._____ INS. =_____ LBS._____
OPEN HT._____ INS. =_____ LBS._____

LOBE CENTER_____
PROFILE NUMBER_____
PART NUMBER_____

Camshaft Tuning ***(cont.)***

camshaft and the crankshaft. By advancing or retarding the cam in relation to the crankshaft you can:

1) Correct a valve timing error (as above). Minor variations from the cam's specs can be caused by a build-up of tolerances in the engine, which cannot be controlled by the camshaft manufacturer. Included are wear of gears, position of keyways.

2) Alter performance. Effective valve timing is a compromise between efficient performance at low and high engine speeds. One cam cannot give both with maximum efficiency. You know where you want your engine to give maximum performance and advancing or retarding the cam allows you to dial it in to suit your needs and your engine.

Advancing & Retarding

By advancing the cam in relations to the crank, the valves open and close earlier. Duration and overlap remain unchanged. Advancing raises the cylinder pressure (due to earlier valve closing) and improves low- and mid-range torque at the expense of some top-end power. The result is similar to using a shorter-duration cam since the intake valve closing point is more critical than its opening point.

Retarding the cam so valves open and close later has the opposite effect. This should increase top-end power at the expenses of low-and mid-range torque. Thus:

Advance Cam: More low-and mid-range torque.

Retard Cam: More top-end power.

Advancing and retarding are easily accomplished with offset bushings or keys for the cam or crankshaft, depending on the engine. Remember that one crankshaft degree equals to camshaft degrees.

How Much is Enough?

Considerable trial and error is involved in advancing and retarding a cam to alter performance. However, two degrees isn't enough to feel and eight degrees may begin hurting overall performance. Four degrees will usually achieve the desired results and six is probably the maximum you'll need.

Our experience indicates that a cam advance of 2 to 6 should give the best overall performance. These settings have even helped top-end power in many engines.

Retarding the cam is usually restricted to all-out competition engines where low rpm use is not a consideration.

Before attempting to advance a retard or cam, you must know the actual valve timing, not the manufacturer's specifications. See the procedures covered earlier in "Degreeing a Camshaft".

Important notes: Advancing and retarding a cam will move one valve closer to the piston. Valve-to-piston clearance must be checked after advance or retard alterations to prevent possible engine damage. Also, changing the cam timing will also change ignition timing, which must then be reset.

Changing the Valve Lash

Altering valve lash with mechanical lifter cams is a trick used successfully by many racing mechanics. Because the cam lobe does not start to lift the valve until it rotates far enough to take up all valve lash, the greater the lash, the later the valve opens and the earlier it closes. That shortens duration (as does advancing the cam). Smaller lash opens the valves earlier and closes them later for longer duration.

Greater Lash: Increases low- and mid-range torque at the expense of top-end power.

Smaller Lash: Increase top-end power at the expense of low- and mid range torque. Increased rpm may also result.

A change of 0.001" in valve lash equates to approximately 3˚ in duration. Increasing lash above manufacturer's specifications should be approached with caution, particularly in high-rpm engines. In such cases, the valve might hit its seat upon closing, without being cushioned by lobe clearance ramp, causing high shock loads in the valve train. Lash should not be increased more than 0.004" above the specified lash. If greater lash produces much better performance you should consider advancing the cam. Decreasing valve lash below engine manufacturer's specs isn't as critical from the standpoint of mechanical problems. The only concern here would be valves running hot because they aren't on the seats long enough to transfer sufficient heat to the cylinder head. This isn't important on drag racing engines, but is on some endurance engines that operate for longer periods of time. Finally, be sure to change intake lash and exhaust lash by the same amount so wider settings can be used on the exhaust. You need extra clearance to allow for heat expansion on the exhaust side.

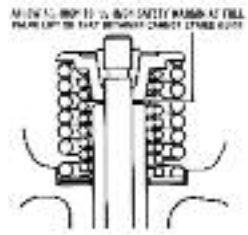
Valve Train Interference

It is critically important to check four main areas for possible valve train component interference, which can quickly damage a cam, lifters, pistons and other parts. You need to check valve to piston, coil bind, retainer to seal and/or guide, and retainer to rocker arm. When in doubt, check with an experienced mechanic.

Valve to Piston

The high lift and long duration of a performance cam can cause interference between valves and pistons, quickly leading to bent valves and/or cracked pistons. Clearance between the two should be checked after the cam timing has been set and also after advancing or retarding a cam.

To check for adequate clearance, place a 1/4" thick strip of modeling clay on any piston, covering the valve pocket area. Cover the clay and valve face with engine oil to prevent sticking. Install the head gasket and head, using standard torque specifications for the bolts surrounding the one cylinder where the check is being made.



Valve Spring Coil Clearance (Coil Bind)

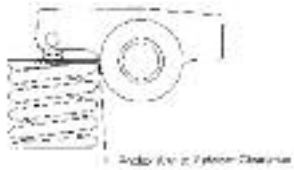
Coil clearance is the distance between the valve spring coils when the valve is at maximum lift (fully open). A minimum of 0.060" must exist between the coils at maximum lift. Coil bind is when the valve spring is compressed fully-to the point that all the coils are "stacked up" on top of each other. .100" is recommended for high RPM applications. Coil bind is a catastrophic condition that will result in valve train failure. Disassemble each spring (if multiple springs are employed at each valve). Check all the springs (both inner and outer springs). If there is not 0.060"-0.100" minimum clearance between the coils, the solutions are: the valve retainer, the valve locks, the valve, or the spring must be changed; the spring pocket must be machined. Keep in mind that these modifications will change the valve spring installed height.

Spring Retainer to Valve Seal or Guide Clearance

The distance between the bottom of the valve spring retainer and the top of the valve guide/seal must be 0.090" larger than the valve lift of the camshaft. If not, you must machine the top of the guide for correct clearance.

Retainer to Rocker Arm Clearance

When installing the rocker arms, check to see that the bottom of the rocker arms clear the spring retainers. Many rocker arms have a cut to accommodate large valve spring retainers.



Pushrod Too Long:
The mark is toward the exhaust side of the valve tip.

Pushrod Too Short:
The mark is toward the intake side of the valve tip.

Pushrod Length Correct:
The mark is in the center of the valve tip.

How to Check for Correct Rocker Geometry

After you have estimated the required pushrod length using a Pushrod Length Checker, use this guide to check for proper alignment.

1) The first step is to install a solid lifter and an adjustable pushrod. Mark the tip of the valve with a machinist dye or ink.

2) Install your rocker arm and set it up with zero lash.

3) Rotate the crankshaft clockwise several times. Take off the rocker arm. The pattern of the rocker tip will be where the ink has been wiped away from the valve tip. The pattern should be centered on the valve tip. If not, adjust the pushrod length to center the pattern.

Camshaft Break-in

The first few minutes of engine operation after installing a new cam are critical. It takes time for the engine's oiling system to reach efficiency and while you're waiting for that to happen, metal-to metal contact can occur. If it does, something is going to fail then or later. Especially critical is the lifter/cam lobe area. If metal touches metal here without benefit of solid lubrication, galling will occur and something (the lifter, the lobe or both) is going to fail.

To prevent these and similar problems not covered by any warranty, please follow the steps outlined here:

1) New lifters must be installed with any new cam installation. The surface of a new lifter, which rides on the cam lobe, has a spherical shape with a 0.002" crown, which is almost impossible to detect. Used lifters won't have that crown and will quickly destroy cam lobes (see Fig. 2. "How to Install a Performance Camshaft"). ***Note:*** that if you later take your engine apart, lifters must be reinstalled in the bore from which they were removed. Each lifter wears in a way that mates it to a given cam lobe; switching lifters is the same as using old lifters with a new cam.

2) Install the valve train components (lifters, valves, springs, etc.) recommended by the cam manufacturer. These items have been tested and proven for compatibility with the cam.

3) Coat the cam lobes, distributor drive gear, lifter cam faces and other critical components with a moly-disulfide lube like our Camshaft and Engine Assembly Lube for protection against metal-to-metal contact during initial break-in.

4) Check the entire valve train for interference and adequate clearance during assembly. The four areas of major concern are covered in "How to Install a Performance Camshaft."

5) Fill the oil pan with top-quality MS-DG engine oil meeting the SAE or API specifications set by the engine manufacturer.

A Pennsylvania-based detergent oil is preferred. Use a straight viscosity of 20W or 30W for break-in; do not switch to a multi-viscosity oil until after the break-in period. For flat tappet applications, a zinc-phosphorous additive needs be added, such as MAX Z.P.M. (99000), to the engine oil during break-in.

6) Before starting the engine be sure:

- The valves are correctly adjusted. Set solid lifters 0.003" to 0.005" tighter than specified.
- To prime the oil system by turning the oil pump manually until pressure is indicated on the oil gauge. Be sure crankcase is filled to proper (normal) level.
- To put gas in the carburetor float bowls, prime the accelerator pump and have gas in the tank.
- There's water in the radiator.
- The battery is charged.
- Nothing will get caught in the fan, fan belts, and alternator/generator belt or by the crankshaft. Check the entire engine compartment for loose tools or parts.
- Ignition timing is set accurately.

To avoid galling, the engine should start right away. Avoid a long grind on the starter and over cranking the engine before firing. Low oil pressure could damage camshaft and other components.

7) When the engine fires, immediately rev it to 2500-3000 rpm. Do not idle the engine for the first 20 minutes. Much of the oil for lubrication and cooling the camshaft comes from crankshaft splash. Below 2500 rpm, turbulence is probably not enough to lubricate the cam fully. The engine may be run on the road or in the shop, but the shop is best. If adjustments are required during the first 20 minutes, shut the engine off.

8) Vary rpm frequently during this initial break-in period to change oiling within the engine.

9) After completing the break-in period, change the engine oil and filter. Regularly change engine oil and filter and maintain proper valve lash adjustment on solid lifter engines.

Following these steps will extend the trouble-free life of your cam and assure you of an engine that delivers the maximum possible performance.

Rod Bolt Stretch/Torque

THE IMPORTANCE OF PROPER ROD BOLT STRETCH/TORQUE...

Whether measured by stretch or by torque, properly preloading a rod bolt is essential for trouble-free performance. If a bolt is installed without sufficient preload (or pre-stretch), every revolution of the crankshaft will cause a separation between the connecting rod and rod cap. This imposes additional stretch in the bolt. The stretch disappears when the load is removed on each revolution, or cycle. Over time, this cycle stretching and relaxing can cause the bolt to fail due to fatigue, just like a paper clip is bent back and forth by hand. To prevent this condition, the bolt's pre-load must be greater than the load caused by engine operation.

A properly installed bolt remains stretched by its preload and isn't exercised by the cyclic loads imposed on the connecting rod. A quality bolt will stay stretched this way for years without failing. The important thing is to prevent the bolt from failing due to fatigue by tightening it to a load greater than the demand of the engine. Protect your bolts and tighten them as recommended.

You can easily monitor the condition of the rod bolts through use of a stretch gauge. Prior to installing the rod, measure the length of the bolt in a "relaxed" (untorqued) state. Write this down. When you tear the engine down for maintenance, again measure the length of each rod bolt - being careful to keep everything in the proper order. If any of the rod bolts have taken a permanent set and have stretched by .001" or longer you should replace the fastener ***IMMEDIATELY!*** This stretching is a sure indicator that the bolt has been compromised and taken past its yield point.

In other types of bolted joints, this careful attention to tightening is not as important.

A rod bolt stretch gauge is one of the most important tools a serious engine builder can own. It's valuable in properly setting up a rod for resizing, obtaining the proper torque load when installed in the engine, and monitoring the condition of the bolt while in use.

Rod Bolt Stretch Gauge

For example, flywheel bolts need only be tightened enough to prevent them from working loose. Flywheel loads are carried either by shear pins or by side loads in the bolts; they don't cause cyclic tension loads in the bolts. Connecting rod bolts, on the other hand, support the primary tension loads caused by engine operation and must be protected from cyclic stretching. That's why proper tightening of connecting rod bolts is so important.

Friction is an extremely challenging problem because it is so variable and difficult to control. The best way to avoid the pitfalls of friction is by using the stretch method. This way preload is controlled and independent of friction. Each time the bolt is torqued and loosened, the friction factor gets smaller. Eventually, the friction levels out and becomes constant for all following repetitions. Therefore, when installing a new bolt where the stretch method cannot be used, the bolt should be tightened and loosened several times before final torque. The number of cycles depends on the lubricant. With moly, five loosening and tightening cycles are sufficient.

TORQUE SPECIFICATIONS

Part # (Size)	Stretch +/- .0002"	Torque w/Moly Lube
MSAMSP05005 (5/16" x 1.500" 235,000)	.0078"	36 ft lbs
ARP4AJ1.500-2SU (3/8" x 1.500" 215,000)	.0057"	45 ft lbs
ARP4AJ1.500-6SU (3/8" x 1.500" 260,000) L-19	.0057"	50 ft lbs
ARP4AP1.550-2LU (7/16" x 1.550" 220,000)	.0058"	70 ft lbs
ARP4AP1.600-2LU (7/16" x 1.600" 220,000)	.0062"	70 ft lbs
MSAMSP07004 (7/16" x 1.600" 230,000)	.0088"	78 ft lbs

Apparel

M1117	Howards Cams "Rattler" 1/24 Scale Diecast
HRCHAT	Hat Beige/Black
SHIRTB-S	T-Shirt Black, Small
SHIRTB-M	T-Shirt Black, Medium
SHIRTB-L	T-Shirt Black, Large
SHIRTB-XL	T-Shirt Black, X-Large
SHIRTB-XXL	T-Shirt Black, 2X-Large
SHIRTB-XXXL	T-Shirt Black, 3X-Large
SHIRT-S	T-Shirt White, Small
SHIRT-M	T-Shirt White, Medium
SHIRT-L	T-Shirt White, Large
SHIRT-XL	T-Shirt White, X-Large
SHIRT-2XL	T-Shirt White, 2X-Large
SHIRT-3XL	T-Shirt White, 3X-Large
SHIRT-4XL	T-Shirt White, 3X-Large

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