ANDREWS

PRODUCTS, INC.

PERFORMANCE CAMS AND GEARS

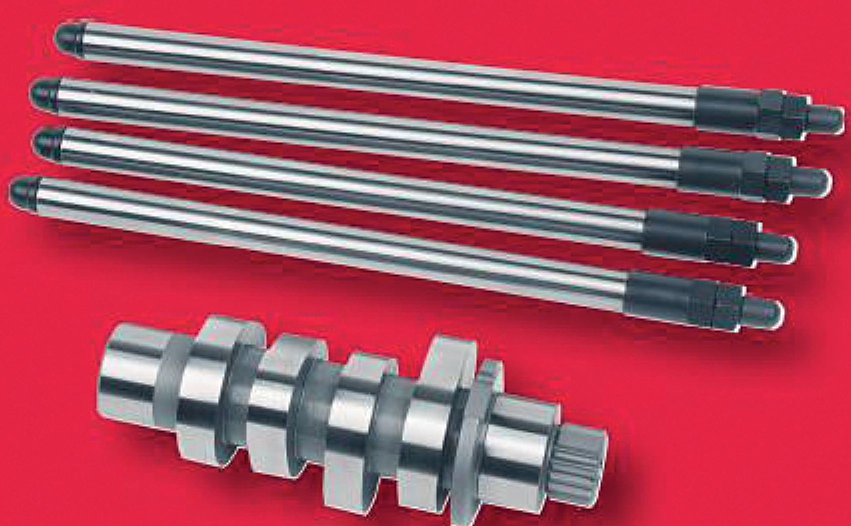


Table of Contents

Andrews Products

Andrews Products was founded in the spring of 1972 and for 45 years has specialized in making camshafts and transmission gears for the performance motorcycle market.

On behalf of the entire Andrews Products organization, we proudly present this catalog to all motorcycle enthusiasts and to the many designers and builders of performance motorcycle engines and transmissions.

Please review the pages of this catalog and see how Andrews Products can help you get the most out of the engine and transmission in your bike.

While we started by making motorcycle transmission gears and shafts, performance camshafts and related valve gear parts soon became additional, distinct product lines.

More gear sets with different ratios soon followed. The results were gears which out-performed anything else available. Their superior performance was quickly recognized by everyone who tried them. The novelty and uniqueness of both the cams and gears resulted in a wave of demand for new Andrews Products cams and gears.

Today, Andrews Products is recognized throughout the Motor Sports world as an industry leader. We utilize state-of-the-art engineering design and manufacturing technology for producing superior quality camshafts and transmission gears for both street and racing applications. As an industry leader, we understand what keeps us on top also keeps our customers on top. Over the years, Andrews Products has made significant investments in new computer controlled production machinery and inspection equipment.

Strategic purchases in the latest technologies keeps us and our customers right at the leading edge. With Andrews Products' unique, proprietary processing, innovative design, and strict quality control, we can consistently deliver the highest quality camshafts and transmission gears.

Many of our customers include the top NASCAR Cup, Xfinity and ARCA racing teams as well as other builders of racing engines for the automotive and motorcycle performance markets. This is a very demanding group of people for whom second best is not an option; they simply demand the best.

At Andrews Products, we share with our customers a passion for excellence and will not accept second place. Our customers rely on us to help them achieve top performance. This culture is well established throughout Andrews Products, its people and processes. and whether we are working with top race teams or making parts for street motorcycles, the same technology is used.

The entire Andrews Products Team looks forward to helping you achieve top performance and take the checkered flag as leaders.

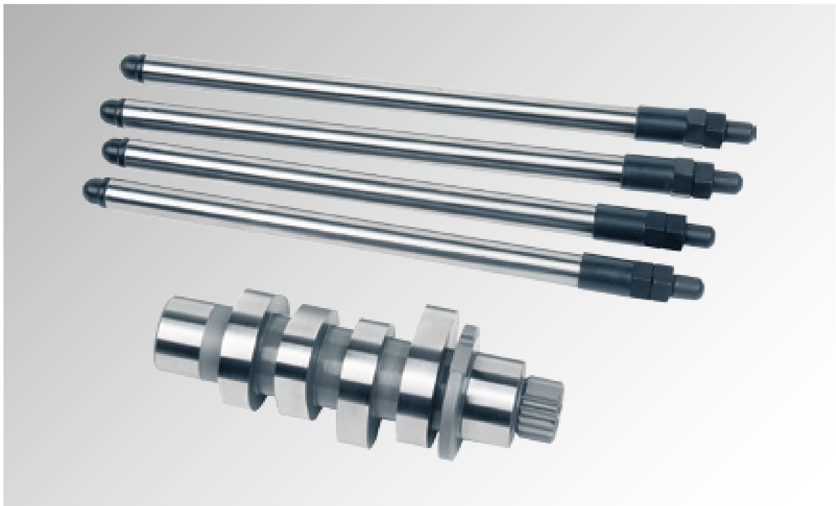
In November 2002, Andrews Products moved into a new 45,000 square foot facility in Mt. Prospect, Illinois. The photos on this page show our building. We operate out of a fully-equipped air-conditioned facility with everything in one place.

Our main office and manufacturing plant is eleven miles north of the Chicago O'Hare International Airport. We are in one of the world's great manufacturing areas with easy access to transportation and shipping to anywhere in the U.S. and most foreign countries.

We are better equipped than ever to serve all of our customers with the first-class quality and support that all of you deserve.

Andrews Products is committed to the motorsports industry for the long haul.

Milwaukee 8 Engine Camshafts



Milwaukee 8 bikes are available in both 107 and 114 cubic inch engine sizes. With high efficiency four-valve heads, M8 engines show great potential for performance gains especially with new design Andrews M8 series camshafts.

Keep in mind, cam timing specs for four valve heads look very different from camshafts designed for two valve applications. Engines with four valve heads have much greater flow efficiency so listed cam timing durations are a lot shorter.

Pushrods (set of 4) . . . . Part# 292017

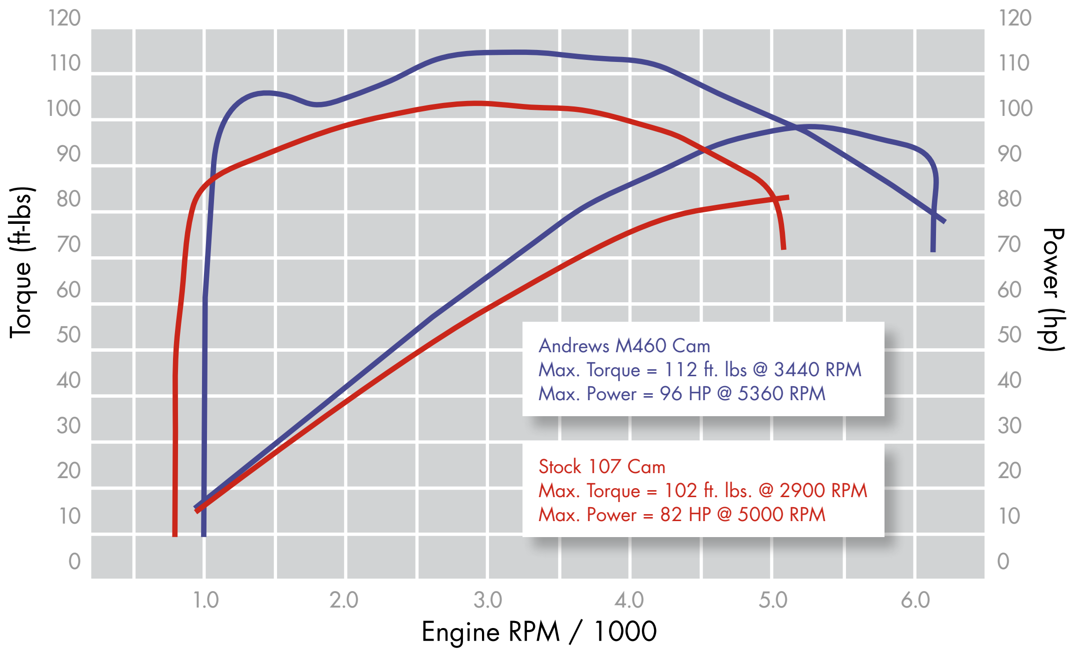
Part#	Grind	Timing(*)	CL**	Duration .050	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock 107	Int Exh	-07/01 33/-14	94 113.5	174 199	212 252	.350 .370	.055 .035	Stock	Stock 107 engine cam data listed for reference. (114 inch engine in 2017 had same camshaft).
217450	M450	00/14 34/00	97 107	194 214	226 251	.450 .450	.080 .076	Stock	Bolt in cam, 2017– up: more torque for riding with 107 engines, rapid torque rise (1000–5500 RPM).
217460	M460	00/20 38/02	100 108	200 220	233 258	.460 .460	.080 .086	Stock	Want more power from a stock engine? This is the cam for you! See curves below (1000–5800 RPM).
217462	M462	06/14 40/00	94 110	200 220	230 258	.460 .460	.106 .080	Stock	Bolt in cam, 2017–up: 107-114 inches. Big power (127 ft. lbs and 109 hp (from 1200 to 5500 RPM).
217464	M464	06/24 50/00	099 115	210 230	241 267	.464 .460	.106 .080	Stock	New M464 cam grind, great mid range torque and power, w/free flow exhaust pipes and injector tuning.
217504	M504	06/30 56/00	102 118	216 236	249 274	.504 .504	.105 .080	Hi-lift	More torque and power for bigger engines 114 inches and all around riding (1500–5700 RPM).
217520	M520	08/40 64/04	106 120	228 248	260 285	.520 .520	.115 .094	Hi-lift	Cam for bigger cubic inches. More torque and power for modified engines (1600–5500 RPM).

(*) Timing and duration listed for .050 cam lift. (**) Lobe Centerline angle

Dyno Curves show **big** power boost for 107 inch engine with M460 cam(blue) compared to stock cam in (red).

M462 cam tested 127 ft. lbs. and 109 HP in 107 engine.

Engine was stock compression with injector tuning and relieved exhaust pipes!



ANDREWS

Twin Cam (Camshafts 2007-up) and 2006 Dyna

Crankshaft Sprockets: change cam timing + or -4 degrees, or stock timing high performance sprockets

Camshafts on all 2007 and later Twin Cam engines and '06 Dynas use roller chain cam drives. Camshafts made for '99–'06 engines will not fit the 2007–up (or '06 Dyna engines). Engines built from 1999–'06 use older type cam drive chains. Cams listed below are designed for use with stock H/D hydraulic lifters. Install kit includes gasket and inner bearings.

Installation Kit: Gasket & Bearings . . . . Part# 216902

Matching EZ-Install pushrods kits are also available from Andrews Products. EZ-Install pushrods do not require removal of gas tanks or rocker boxes to install bolt-in camshafts, see page 9.

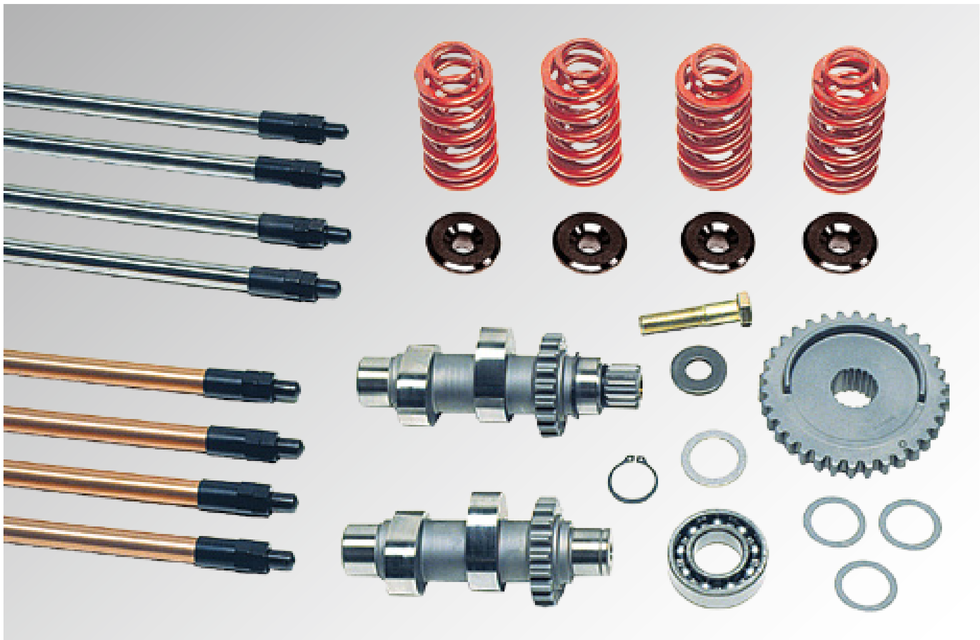
Crankshaft Sprocket: +4 or -4 deg. cam timing change for all '07 and later Twin Cam engines and '06 Dynas. Install at +4 degrees for more torque or -4 degrees for less compression pressure.

Sprocket (+4 or -4 deg. timing change) . . . . .Part# 216323
Performance Sprocket (stock timing) . . . . .Part# 216324

Part#	Grind	Timing(*)	CL**	Duration .053	Duration .020	Lift	Valve TDC	Lift @ Springs	Application
Stock '06-Dyna	Intake Exhaust	02/34 42/-03	106 112.5	216 219	256 259	.473 .474	.087 .110	Stock	Stock '06 Dynaglide cam data listed for reference: All 2006 Dynaglides are fuel injection only; no carburetors.
Stock Intake	Intake Exhaust	-09/25 42/-03	107 112.5	196 219	234 259	.473 .474	.087 .110	Stock	Stock '07–'12 specs listed for reference. Short intake duration is stock on all '07–'12 engines.
216321	21H	10/30 40/08	100 106	220 228	255 264	.498 .498	.134 .121	Stock	Bolt-in cam: '07–'13: More torque for all around riding, heavy bikes, stock compression ratios and pistons. Similar to #23 cam for EV80. (1700–4800 RPM)
216326	26H	11/35 41/09	102 106	226 230	262 266	.490 .490	.138 .120	Stock	Bolt-in cam 96–103 inches and stock compression ratio. Great for two-up touring, this cam will add torque and HP at lower and middle RPM ranges. (1800–5200 RPM)
216331	31H	10/46 52/08	108 112	236 240	272 276	.510 .510	.131 .120	Stock	Great cam for motors with 96 inches and 9.8 to 10.2 CR. Lower TDC lift for easy installation. Similar to TW37 with timing setup for higher compression. (2400–5600 RPM).
216332	32H	10/46 52/08	108 112	236 240	272 276	.570 .570	.131 .120	Hi-lift	High lift version of 31H. Much more power thru RPM range with 10:1+ Compression pistons. (2800–5600 RPM)
216337	37H	18/38 46/14	100 106	236 240	272 276	.510 .510	.174 .148	Stock	Hot street cams for 96-103 inches. 90+ rear wheel HP possible with well tuned 96, more with 103+ inches. Smooth idle, broad torque (2200–5600 RPM) 9.0 to 9.5 CR.
216348	48H	13/29 43/15	98 104	222 238	257 273	.548 .548	.153 .163	Stock	Broad tip cams for baggers with stock motors. max. torque at low and mid RPM, (2500-5500).
216354	54H	16/42 43/15	103 104	238 238	273 273	.555 .555	.165 .158	Stock	Specially designed for 96–103 engines with compression ratios up to 10:1 (2200–5600 RPM range).
216355	55H	22/46 52/20	102 106	248 252	283 292	.550 .550	.197 .181	Stock	Great cam for 96–103 inch engines with 9.8 to 10.2 CR Max. HP/torque at mid and upper RPMs. (2600–6200)
216357	57H	18/38 46/14	100 106	236 240	270 274	.560 .560	.184 .153	Stock	Bolt-in, broad tip cams: 96, 103 Limited and CVO 110 engines. Max. torque: 2200–5600 RPM.
216360	60H	24/56 58/22	106 108	260 260	296 296	.560 .560	.205 .192	Stock	For well-prepped 95–103 inchers with 10.0 to 10.5 CR, 100+ HP is within reach. (2700–6500+ RPM)
216367	67H	24/48 58/22	102 108	252 260	287 297	.570 .570	.209 .187	Hi-lift	Performance cams for 96–110+ inches, 10.0 to 10.8 CR with high flow head setup. (2600–6400+ RPM)

*Timing and duration for .053 cam lift **Lobe Centerline angle

Twin 88 Chain Drive Cams
('99–'06) except '06 Dyna)



Want more power from your Twin Cam engine? Andrews Products has 10 proven grinds to get you there. More HP and torque for stock or modified engines is within easy reach. All cams listed are designed to run with stock H/D hydraulic lifters. Matching pushrods, heat treated steel sprockets, and collars are shown on this page and also on page 9.

For any bolt-in cam grind on this page, EZ-Install pushrods do not require removal of gas tanks or rocker boxes for installation. Please refer to explanations regarding compression pressure and how to pick the right cam on pages 16 and 17 in this catalog.

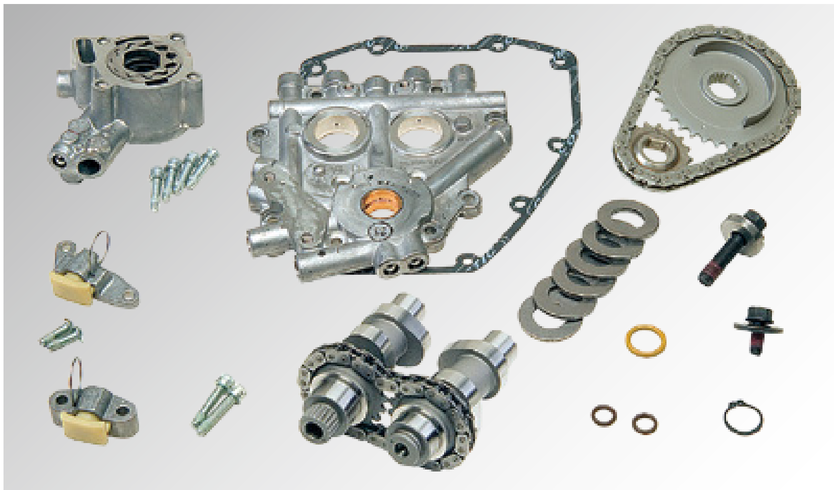
Camshafts listed on this page will also fit Screaming Eagle chain drive conversion kits (part # 25284-11)

Touring and Performance Cams

Part#	Grind	Timing(*)	Duration .053	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock 88 Carburetors	(A)	-02/38 42/-03	216 219	255 259	.473 .474	.072 .110	Stock	Carbureted engine: stock cam data listed for reference. (Stock 88 engine output is approximately 62 HP)
Stock 88 Injectors	(B)	02/34 42/-03	216 219	255 259	.473 .474	.087 .110	Stock	Fuel injected engine: stock cam data listed for reference. (Stock engine output is approximately 62 HP)
288121	TW21	10/30 40/08	220 228	255 264	.498 .498	.134 .121	Stock	Bolt-in cam: More torque for all around riding with heavy bikes, stock compression ratios, and stock pistons. Similar to #23 cam for EV80. (1700–4800 RPM)
288126	TW26a	11/35 41/09	226 230	262 266	.490 .490	.138 .112	Stock	Bolt-in cam 88–95 inches and stock compression ratio. Great for two-up touring, this cam will add torque and HP at lower and middle RPM ranges. (1800–5200 RPM)
288131	TW31s	10/46 52/08	236 240	272 276	.510 .510	.131 .120	Stock	Great cam for motors with 95 inches and 9.8 to 10.2 CR. Lower TDC lift for easy installation. Similar to TW37 with different timing. (2400–5600 RPM)
288137	TW37b	18/38 46/14	236 240	272 276	.510 .510	.174 .148	Stock	Hot street cams for 88 or 95 inches. 80+ rear wheel HP possible with well tuned 88 incher, more with 95. Smooth idle, broad torque (2200–5600 RPM) 9.0 to 9.5 CR.
288148	TW48	13/29 43/15	222 238	257 273	.548 .548	.153 .163	Hi-lift	Broad-tip cams for baggers with stock engines. Max. torque at low and mid RPM, (2500-5500).
288154	TW54	16/42 43/15	238 238	273 273	.555 .555	.165 .158	Hi-lift	Specially designed for 95 inch+ engines with CR to 10:1 RPM range from 2200 to 5600.
288150	TW50	20/48 54/18	248 252	283 287	.510 .510	.184 .168	Stock	Designed for easy installation in 95-inch motors with stock heads and 9.5 to 9.8 CR. (2400–6000 RPM)
288155	TW55	22/46 52/20	248 252	283 292	.550 .550	.197 .181	Hi-lift	Great cams for 95 inch engines with 9.8 to 10.2 CR. Max. HP and torque at mid and upper RPMs (2600–6200 RPMs)
288160	TW60a	24/56 58/22	260 260	296 296	.560 .560	.205 .192	Hi-lift	For well-prepped 95–103 inchers with 10.2 to 10.5 CR and head work, 100+ HP is within reach. (2700–6500+ RPM)
288167	TW67	24/48 58/22	252 260	287 297	.570 .570	.209 .187	Hi-lift	Performance cams for 95–107+ inches 10.0-10.8 CR with high flow head setup. (2600–6400+ RPM)

*Timing and duration listed for .053 cam lift.

Camshafts For Converting '99–'06 Engines To 2007-Style Roller Chain Cam Drives. A Recommended Upgrade For All 1999–2006 Engines.



Complete kit is shown for information. Andrews Products supplies camshafts and sprockets only.

Camshafts on all 1999–2006 H/D 88 engines (except 2006 Dyna) can be updated to new style roller chain drives. Cam grinds listed below are designed for stock H/D hydraulic lifters. The '07 type cams and chain drives are much more durable and efficient than old-style chain tensioners. Installation requires Andrews "N" series camshafts as listed below.

EZ-Install pushrods are available from Andrews Products. EZ-Install pushrods do not require removal of gas tanks or rocker boxes when installing bolt-in camshafts. EZ-install pushrod part number. 292088

Please see page 9 for all EZ-Install pushrod descriptions and part #s.

Eliminate old style chain adjusters! Conversion camshaft kits fit all '99–2006* Twin Cam engines. (New '07 chain adjusters operate with engine oil pressure to maintain proper cam chain tension). Andrews Products conversion cam kits will fit any 1999–2006 Twin Cam engine! Stock H/D camshafts can't be used for 2007 roller chain conversions!

Andrews "N" cams cannot be installed with Screaming Eagle cam support plates: H/D part numbers: 25284-08 or 25284-11.

Following parts must be purchased from a local H/D dealer to complete a conversion camshaft installation:

Oil Pump 26037-06
Cam Support Plate 25355-06
Retaining Ring (Front Cam) 4741A
Inner Chain 25683-06
Chain Tensioner 39968-06
Tensioner Mounting Screws 4740A
Outer Chain 25675-06
Chain Tensioner 389969-06
Outer Chain Mounting Screws 942
Pinion Sprocket (17 teeth) 25673-06
Outer Cover Gasket 25244-99A
Rear Cam Sprocket (34 teeth: '02–'06)* 25728-06
*H/D part number
Rear Cam Sprocket (34 teeth: '99–'01)** 216015
**Andrews part number

Part#	Grind	Timing(*)	CL**	Duration .053	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock 88 Carburetors	(A)	-02/38 42/-03	110 112.5	216 219	255 259	.473 .474	.072 .110	Stock	Stock cam data listed for '99–'06 carbureted engines. (Stock 88 engine output is approximately 62 HP).
Stock 88 Injectors	(B)	02/34 42/-03	106 112.5	216 219	255 259	.473 .474	.087 .110	Stock	Stock cam data listed for '99–'06 fuel injected engines. (Stock engine output is approximately 62 HP).
216821	21N	10/30 40/08	100 106	220 228	255 264	.498 .498	.134 .121	Stock	Bolt-in cam: More torque for all around riding with heavy bikes, stock compression ratios, and stock pistons. Similar to #23 cam for EV80 (1700–4800 RPM).
216826	26N	11/35 41/09	102 106	226 230	262 266	.490 .490	.138 .120	Stock	Bolt-in cam 88–95 inches and stock compression ratio. Great for two-up touring, this cam will add torque and HP at lower and middle RPM ranges (1800–5200 RPM).
216837	37N	18/38 46/14	100 106	236 240	272 276	.510 .510	.174 .148	Stock	Hot street cams for 88 or 95 inches. 80+ rear wheel HP possible with well-tuned 88 incher, more with 95. Smooth idle, broad torque (2200–5600 RPM) 9.0 to 9.5 CR.
216848	48N	13/29 43/15	98 104	222 238	257 273	.548 .548	.153 .163	Hi-lift	Broad tip cams for baggers with stock engines. max. torque at low and mid RPM, (2500-5500).
216854	54N	16/42 43/15	103 104	238 238	273 273	.555 .555	.165 .158	Hi-lift	Great cam for 95 inches with 10:1 CR. RPM range; 2200-5600. Grind added due to popular demand.
216855	55N	22/46 52/20	102 106	248 252	283 292	.550 .550	.197 .181	Hi-lift	Great cam for 95 inchers with 9.8 to 10.2 CR. Max HP & torque at mid and upper RPMs (2600 to 6200).
216867	67N	24/48 58/22	102 108	252 260	287 297	.570 .570	.209 .187	Hi-lift	Performance cams for 95–107+ inches, 10.0 to 10.8 CR. with high-flow head setup (2600–6400+ RPM).

(*) Timing and duration listed for .053 cam lift. (**) Lobe Centerline angle

Twin Cam Gear Drive Cams

1999–2006 Twin Cams except '06 Dyna

2007–up Twin Cams and '06 Dyna

Grinds for both early and late gear-drive camshafts are listed below, but since both versions are very similar, the photo above shows only the 1999–'06 version. NOTE: The two versions of gear-drive camshafts are not interchangeable.

Andrews camshafts for gear drives are available as an alternative to stock cam chain drives. However, the drive gears must be obtained from your dealer. When deciding what cams to use in a Twin Cam setup, the most important consideration is a proper match between the piston compression ratio and intake cam duration. For best street performance, the static compression pressure should be around 175–180 PSI. Drag motors can handle still higher static pressures. Lower static pressure of 160 PSI are great for all around riding. For a more complete explanation of static compression pressure, see page 17 in this catalog.

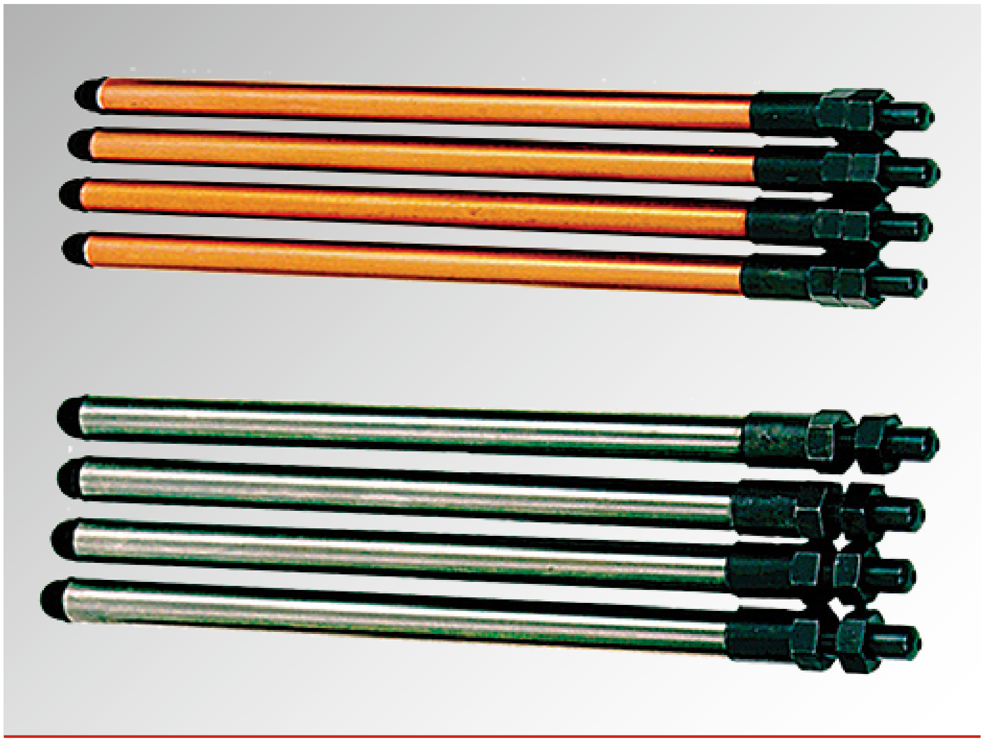
In the following listings, the top line for each grind shows intake data, the second line shows exhaust data, but cam grinds use the same specs for early and late versions of gear drive cams.

Touring and Performance Cams For Gear Drives

Part#	Year	Grind	Timing(*)	Duration .053	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock 88	(A)	Stock	-02/38 42/-03	216 219	255 259	.473 .474	.072 .110	Stock	Carbureted engine: stock cam data.
Stock 88	(B)	Stock	02/34 42/-03	216 219	255 259	.473 .474	.087 .110	Stock	Fuel-injected engine: stock cam data
288121G 216321G	99–06 07–up	21G 21HG**	10/30 40/08	220 228	255 264	.498 .498	.134 .121	Stock	Bolt-in cam: 96 inches more torque for all around riding stock CR (1700–4800 RPM).
288126G 216326G	99–06 07–up	26G 26HG	11/35 41/09	226 230	262 266	.490 .490	.138 .120	Stock	Bolt-in cam: 96–103 inches, stock comp ratio. Great for two up touring, big torque at mid RPM (1800–5200).
288131G 216331G	99–06 07–up	31G** 31HG**	10/46 52/08	236 240	272 276	.510 .510	.131 .120	Stock	Great cam for motors with 95+ inches and 10:1 CR. Lower TDC lift means easy installation.
288137G 216337G	99–06 07–up	37G 37HG	18/38 46/14	236 240	272 276	.510 .510	.174 .148	Stock	Hot street cams for 88 or 95 inches. 80+ HP possible with well-tuned 88 motor; more with 95.
288154G 216354G	99–06 07–up	54G 54HG**	16/42 43/15	238 238	273 273	.555 .555	.165 .158	Hi-lift Stock	Specially designed for 96 and 103 engines with CR up to 10:1 (2200–5600 RPM range).
288150G 216350G	99–06 07–up	50G 50HG**	20/48 54/18	248 252	283 287	.510 .510	.184 .168	Stock	Designed for easy installation in 95 inch motors with stock heads and 9.5 to 9.8 CR (2400-6000 RPM).
288155G 216355G	99–06 07–up	55G 55HG**	22/46 52/20	248 252	283 292	.550 .550	.197 .181	Hi-lift Stock	Great cam for 95 inch engines with 9.8-10.2 CR. Max HP/torque at mid and upper RPM (2600–6200).
288160G 216360G	99–06 07–up	60G** 60HG**	24/56 58/22	260 260	296 296	.560 .560	.205 .192	Hi-lift Stock	For well prepped 95–103 inchers with 10.0 10.5 CR, 100+ HP is within reach. (2700–6500+ RPM).
288167G 216367G	99–06 07–up	67G 67HG**	24/48 58/22	252 260	287 297	.570 .570	.209 .187	Hi-lift Stock	Performance cams for 95–107+ inches, 10.0 to 10.8 with high flow head setup. (2600–6400+ RPM).
288159G 216359G	99–06 07–up	59G 59HG**	29/57 63/27	266 270	303 307	.590 .590	.238 .218	Hi-lift	Great cam for 95–107+ inchers with 10:2 CR or higher. Max. torque and HP (2700–6500+ RPM).
288164G 216364G	99–06 07–up	64G 64HG**	30/62 66/30	272 276	307 312	.640 .640	.262 .232	Hi-lift	Big cams for mod fied 96–120 inch motors running 10.2 CR or higher. Heads must be set for .700 lift to 6500 RPM

*Timing and duration listed for .053 cam lift **These gear drive cams will only be supplied as custom grinds.

(Custom gear drive camshafts can be designed and made to order)



Twin Cam Pushrods 1999–up

Twin 88 pushrods are available with EZ-Install ends or standard adjustable tips. Both types are made in anodized aluminum or chrome moly steel. EZ-Install pushrods can be installed without removing gas tanks or rocker boxes. If you are using bolt-in cams, this is a big plus! These pushrods are a great match for ALL Andrews Twin cam camshafts. Extra long or short pushrods are available as specials. Call if you need them.

Shown from top to bottom:
EZ-Install Aluminum Pushrods. . . . . Part# 292188
EZ-Install Chrome-moly Pushrods. . . . . Part# 292088

Standard tip chrome moly and aluminum pushrods available until existing inventory runs out:
Chrome-moly Pushrods Part# 292288
Aluminum Pushrods . . Part# 292388

Twin Cam Springs & Collars 1999–2004

Kit includes four inner and four outer springs: for valve lifts up to .560. Installation does not require head machining. High lift springs and collars make installing big cams a lot easier.
High Lift Springs . . . . Part# 294150

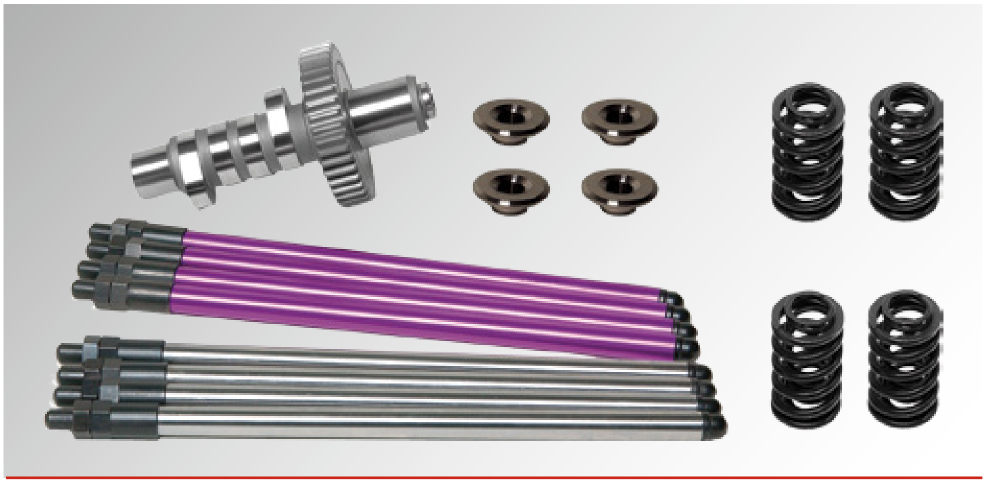
Designed to fit Twin Cam engines. Provides .050" more spring travel than stock collars. Collars are stronger and 10% lighter than stock collars, and use stock keepers.
Heat Treated Steel Spring Collars . . . . Part# 293115

Twin 88 Cam Drive Sprocket Kits (Silent Chain Drives)

Andrews heat-treated steel splined cam drive sprockets are an upgrade for rear camshafts, especially '99 engines. Kit includes three spacer shims and one grade-8 bolt and hardened washer. New splined sprockets can be set up to the same length as original stock sprockets. If you have a Twin Cam 88 engine with silent chains, splined steel sprockets are a worthwhile upgrade. Most early Twin Cam 88s already have spline drive sprockets as stock parts from H/D.
34-tooth Splined Cam Sprocket Kit . . . . Part# 288015
17-tooth Steel Crank Sprocket. . . . . Part# 288020

Evolution 80 Camshafts

1984–1999



Andrews Products Performance Cams mean extra power for Evolution engines. H/D hydraulic lifters are capable of 6000+ RPM with stock springs and no valve float. Aluminum (T7) or chrome-moly pushrods (EZ-Install type) are available to match any of our camshafts. Aluminum pushrods are lighter while the chrome-moly steel pushrods are more rigid for high performance.

**Regarding the cam listings below, please understand that the EV31 cam grind is NOT recommended for stock engines!*

Evolution 80 Pushrods, Springs, and Collars

Four inner and four outer springs: for Evolution engines used with steel spring collars, cam lifts of .550"+ can be accommodated. Installation does not require head machining.

EZ-Install Aluminum Pushrods . . . . Part# 292215
EZ-Install Chrome-moly Pushrods . . . . Part# 292245
High Lift Evolution Springs . . . . Part# 294150

Heat-treated steel-spring collars for all Evolution 80 engines. Provides .050" more spring travel than stock collars. Andrews collars are stronger than stock, approximately 10% lighter, and install with stock keepers.

Heat Treated Steel Spring Collars . . . . Part# 293115

Evolution 80 Touring and Performance Cams

Part#	Grind	Timing(*)	CL	Duration .053	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock '88–'91	(L)	01/37 53/-01	108 117	218 232	266 280	.495 .495	.091 .083	Stock	Listed for reference. 1984–87 cam is 212 deg. intake, 202 deg. exhaust, .472" lift on both valves.
Stock '92–up	(N) (w/carbs)	-02/30 31/-09	106 110	208 202	250 242	.472 .472	.070 .049	Stock	Listed for reference. "N" cam is close to '84–'87 specs Fuel Injector "O" cams are 200 deg. intake and 216 exhaust.
291117	EV31	10/46 52/08	108 112	236 240	270 274	.495 .495	.133 .122	Stock	*Super power for supercharged engines; Basically an EV27 cam with lobe timing set for superchargers.
291123	EV23	10/30 40/08	100 106	220 228	255 264	.498 .498	.134 .121	Stock	Bolt-in street cam with more torque and HP for all around riding with stock CR 1800–5200 RPM.
291113	EV13	15/31 45/13	98 106	226 238	270 280	.485 .495	.161 .148	Stock	Bolt-in touring cam for heavy bikes. More low and mid-range power than stock cam. Best cam for two-up riding.
291127	EV27	20/36 46/14	98 106	236 240	270 274	.495 .495	.182 .166	Stock	Great bolt-in cam for stock EV80 engines. Very strong, broad torque band pulls hard from 2000 to 5500 RPM.
291130	EV3	21/37 43/15	98 104	238 238	280 280	.495 .495	.197 .159	Stock	Bolt-in street cam for light bikes (FXRS, etc.). Lots more mid-range and upper end power, 2800–6500 RPM.
291146	EV46	25/41 49/17	98 106	246 246	283 283	.495 .495	.207 .163	Stock	Bolt-in performance cam; Longer duration than EV3 but higher static compression pressure; 2600–6000+ RPM.
291151	EV51	28/44 54/22	98 106	252 256	286 290	.510 .510	.233 .195	Stock	Easy install; longer duration for modified street engines hydraulic lifters–9.0 + CR, 2800–6500 RPM.
291159	EV59	28/48 56/24	100 106	256 260	290 294	.560 .560	.236 .208	Hi-lift	Modified 80–88 inch motors. Use with Andrews springs and collars. Power to 6000 RPM. OK with hydraulic lifters.
291172	EV72	30/54 60/28	102 106	264 268	298 302	.560 .560	.246 .230	Hi-lift	For 92 in.+ street motors. Use with Andrews springs and collars. Broad power, 2800–6000 RPM. OK for hydraulic lifters.

*Timing and duration listed at .053 cam lift. Special cams can be made to order with two front head set-ups, etc. Call for information and prices!

Shovel / Pan Camshafts

1948–1984

Shovel Pushrods

Andrews Products pushrods are available for all Shovel engines using stock diameter tubing so there is no cover tube interference. Extra long or short pushrods can be made up to order. Call us if you need them.

Aluminum Pushrods and Adjusters . . . . Part# 240055
4 aluminum pushrods and adjusters: quiet operation.

Chrome-moly (4130) Steel Pushrods. . . . . Part# 240030
4 steel pushrods and adjusters: maximum strength.

Whether you want a good street cam for a stock motor, a big cam for a dragster or something in between, Andrews Products can supply it. All Andrews cams for Shovel and Pan engines are computer designed and precision ground from alloy steel billets on Landis CNC cam grinders.

Rocker arm ratios: Shovel = 1.42, Pan = 1.5

				Duration		Valve Lift		Lift (**)		
Part#	Year	Grind	Timing(*)	.053	.020	Shovel	Pan	TDC	Springs	Application
Stock (Front cyl)		H	-06/46 44/20	220 244	256 282	.390 .390	.412 .412	.051 .176	Stock	Stock H/D front cylinder timing listed for comparison. Later stock "S" grind cams have similar specs.
Stock (Rear cyl)		H	14/38 44/20	232 244	274 282	.390 .390	.412 .412	.129 .176	Stock	Stock H/D rear cylinder timing listed for comparison. Later stock "S" grind cams have similar specs.
212011 212020 212030	48–69 70–77 78–84	J	21/41 41/21	242 242	292 292	.405 .405	.425 .425	.154 .154	Stock	Mild street: Pans and Shovels, smooth idle, more power thru RPM range. Bolts in with no head work. OK for stock heads.
212260 212263 212267	48–69 70–77 78–84	A2	19/43 50/18	242 248	280 290	.450 .450	.470 .470	.156 .142	Stock	Shovel bolt-in (except 1980–1981). More mid range and hi end power. Idle unaffected. (Head setup required on '80 & '81). (See note 1).
212130 212140 212150	48–69 70–77 78–84	1	16/36 36/16	232 232	288 288	.427 .427	.450 .450	.136 .136	Stock	Low compression piston version of an "A" grind cam for '74–'80 engines with 7.5:1 pistons.
212330 212340 212350	48–69 70–77 78–84	2	15/35 35/15	230 230	288 288	.490 .490	.512 .512	.133 .133	Hi-lift	Low compression version of a "B" grind cam. More power thru RPM range for engines with 7.5 pistons.
212351 212353 212358	48–69 70–77 78–84	B2	26/50 53/25	256 258	295 296	.485 .485	.507 .507	.187 .176	Hi-lift	Street/drags: More mid and high end power, smooth idle. Best cam for modified '74s–'80s and small strokers, Spring spacing required.
212420 212430 212440	48–69 70–77 78–84	BH	24/52 52/24	256 256	302 302	.450 .450	.470 .470	.156 .156	Hi-lift	Hydraulic version of a "B" cam. Usually a bolt-in, but spring spacing required on stock '80–'81 Shovel heads.
212533 212536 212539	48–69 70–77 78–84	7	29/53 59/27	262 266	303 325	.510 .510	.535 .535	.206 .186	Hi-lift	Upgrade of old #6. Great street cam for 84/88 inch strokers. Maximum torque comes on from 2200-6500 RPM.
212600 212610 212620	48–69 70–77 78–84	C	37/61 61/37	278 278	318 318	.525 .525	.550 .550	.234 .234	Hi-lift	Best cam made for big street engines. Strokers from 84 to 96 inches will really turn on with this cam. Broad torque band from 2000–7000+ RPM.

Note (1); 1980 and 1981 engines: The height of original stock H/D valve guides restricts spring travel (and valve lift) to .430 or lower!

*Timing listed at .053 cam lift. **TDC Shovel valve lift listed: TDC Pan valve lift will be 5% higher.

Shovel Valve Gear
Cam Gear Sizes

When installing cams in a shovel engine, the valve spring collars and related parts shown above will make things go a lot easier. Our springs and collars are designed for easy installation and maximum reliability.

High Lift Upper Spring Collars (4 pcs) . . . . Part# 271100
74/80 inch motors, cams to .600 lift can can be installed. T6 aluminum collars are coated, light, and very strong.

High Lift Springs (4 springs). . . . . Part# 272110
74/80 inch motors; correct spring force for performance cams. Installation does not require complicated machining.

Medium Lift Upper Spring Collars (4 pcs) . . . . . . Part# 276150
74/80 inch motors; works with stock springs, adds .060″ spring travel. The easy way to install B2 grind or #2 cams in stock heads.

Low Profile Lower Spring Collars (4 pcs). . . . . . . Part# 273120
Similar to stock 1980 style parts, but low profile for easy high lift cam installation. Required parts for 1980-style valve guides which utilize "K" line stem seals. Made from heat-treated steel.

Camshaft Gears: Size Information For Evolution, Pan, and Shovel

Andrews Products standard-sized cam gears (with one groove) will be correct size for most engines. For a small number of engines made with oversized drive gears (green or black color codes), large-size Andrews cam gears (part# 212077) may be needed for quiet operation. There are four basic differences in late cam gears (1990–1999) and early cam gears (1989–earlier):

1. Starting in 1990 stock H/D 42-tooth drive gears have two grooves on face of gear while 1978–'89 have one groove. Andrews drive gears (one groove) are designed to work with all EV-80 type engines '84 –'89 and '90–'99.
2. For 1990, the difference between the largest and smallest gears was reduced from .006 to .003 inches. The largest gears for all years are the same (green or black color codes).
3. Measuring pin diameters in H/D service books were changed in 1990 from .105 to .108 inches. Measuring the same gear with .108 pins will show a .012 larger measurement than a measurement with .105 pins.
4. Beginning in 1992, stock cam gear outer diameters were reduced by .025 inches. Andrews cam gears as well as earlier stock cam gears are interchangeable with later gears.

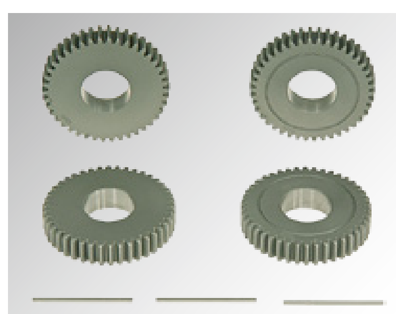
Evolution Cam Gears (1984–1999) (Oversize, Undersize, and Standard)

Gear	Size (.105 pins)	Size (.108 pins)	Color	Part#	
Oversize	2.7384	2.7502	Black	212077	
	2.7394	2.7506			
Undersize	2.7324	2.7472	Orange	212033	
	2.7334	2.7476			
Andrews Std.	2.7354 2.7364	2.7487 2.7491	Red	212055	H/D Stock
Gage pins: Part# 212116 (set of two .108 dia. pins)					
Gage pins: Part# 212105 (set of two .105 dia. pins)					

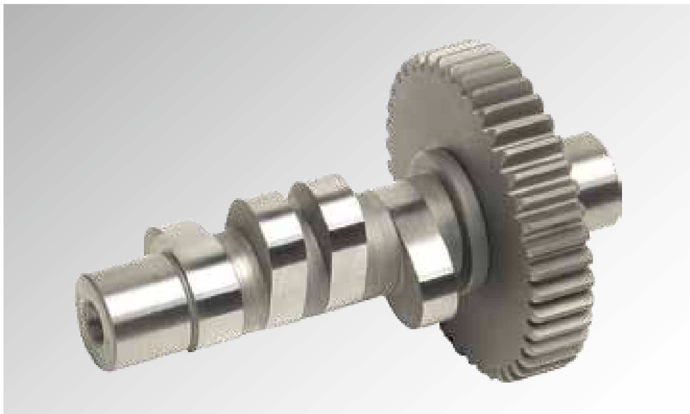
Gears measured over pins

Pan & Shovel Cam Gears (1948–1985) (Oversize, Undersize, and Standard)

	Cam Gear Sizes: (Measured over .105 pins)					
	Late (1978–'84)			Early (1948–'77)		
Gear	**Size**	**Color**	**Part#**	**Size**	**Color**	**Part#**
Oversize	2.7384 2.7394	Black	212077	2.7700 2.7705	Yellow	212088
Undersize	2.7324 2.7334	Orange	212033	2.7670 2.7675	Black	212044
Andrews Std.	2.7365	Red	212055	2.7690	Green	212066
H/D Stock	2.7364		——	2.7695		——
Gage pins: Part# 212105 (set of two .105 dia. pins)						



Knuckle Engine Camshafts



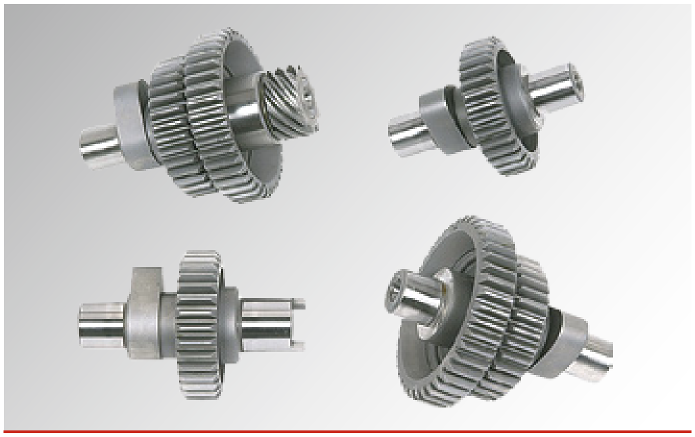
As amazing as it sounds, there are lots of Knuckle engines still going strong. Knuckles have been around for almost 80 years! How many other motorcycles can make this kind of a claim for long life and durability?

Old Knuckles Run Forever!

Part#	Grind	Timing(*)	Duration .053	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
212965	N	13/41 44/16	234 240	270 276	.348 .348	.089 .105	Stock	Stock Knuckle replacement cam. For stock motors and restoring an older classic engine, this is the cam to use.
212970	S	27/55 55/27	262 262	308 308	.370 .370	.130 .130	Stock	Bolt-in Knuckle performance cam for stock motors, smooth idle, strong pull to 6000 RPM. Knuckle equivalent of "B" cam.
212980	K	35/63 63/35	278 278	318 318	.368 .368	.156 .156	Stock	Knuckle performance cam for stroked motors; strong pull to 6000 RPM. This is the Knuckle equivalent of a "C" cam.

Knuckle cam bearings are ground to .8115 to fit stock bushings. * Timing listed at .053 cam lift.

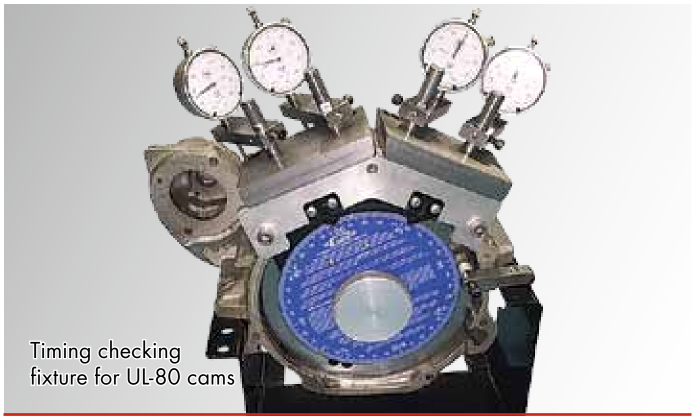
New Cams For UL-80 Big Twins (1937–1948)



Four new cam gears as shown: Andrews UL-80 cam gears are similar to original stock parts, but the lobes have been redesigned using modern computer cam design and smoothing techniques. . . . . Part# 214380

UL-80 Cam Bushing Inner Diameters		
Cam #	Cover bushing ID	Case bushing ID
#1	.7805	.6860
#2	1.1235	.6860
#3	.6860	.6860
#4	.6860	.6860

Valve lift = .375 inches; rocker ratio = 1 to 1
Duration = 212 degrees @ .053 tappet lift



Timing checking fixture for UL-80 cams

Cam inspection–Adcole 911 gage

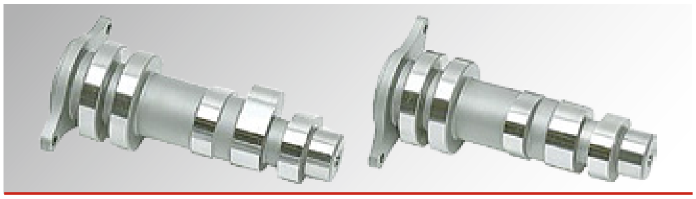
Indian and Victory Camshafts

Indian Thunderstroke 111 Camshafts (2013–up)

Indian 111 engines are already a performance favorite. Installing a set of three new Andrews cams is the best way to more power. All Andrews cams use Landis CNC cam grinders and computer-designed lobes.

Part#	Grind	Timing(*)	CL	Duration .053	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock	Intake Exhaust	-14/30 29/-10	112 109.5	196 199	229 231	.504 .504	.047 .051	Stock	Stock cam specs, listed for comparison.
269150	TS550	08/30 33/04	101 107	218 222	249 253	.550 .550	.136 .116	Stock	Higher valve lift and more duration means power from 2000–6000 RPM, stock or modified engines.
269170	TS570	12/36 48/04	102 112	228 232	259 263	.570 .570	.159 .116	Hi-lift	Still more lift and duration yields extra HP and torque in the 2200–6500 RPM range.

Victory Motorcycle Camshafts V2 Engine: 2009–up



Don't be misled by conservative ratings of Polaris Victory V2 engines. With four valve heads and 106 cubic inches, more power is readily available. V2 engines can be tuned to output a lot more usable power just by changing camshafts. If you want more performance from your V2 bike, the first thing on your list of modifications should be a pair of new Andrews Victory V2 camshafts.

Part#	Grind	Timing(*)	Duration .050	Duration .020	Valve Lift	Lift @ TDC	Springs	Application
Stock	Cams	02/40 38/-04	222 214	246 236	.394 .394	.056 .036	Stock	Stock 106 engine cams specs listed for comparison.
268413	V413	13/41 41/05	234 226	258 250	.413 .423	.099 .067	Stock	Easy installation (no head work) for a big boost in torque and HP at low and middle RPM speeds.
268472	V472	17/45 49/09	242 234	268 260	.472 .472	.115 .081	Hi Lift	Similar to stock cams, but timing advanced for more torque and HP at low and middle RPM speeds.

*Timing data listed for .050 VALVE lift

Victory Camshafts: 2002–2008 Freedom Engine

Victory Freedom engines have a lot of potential. With 92 cubic inches, four valve heads and a 9.2 compression ratio, more performance is only a pair of camshafts away. V-438 cams make a great setup with a street bike with stock engine or a tuned engine with stock or larger displacement.

The V-460 cams are a perfect match for the factory 100 kits.

NOTE: 2008 and later Vision and 2009 Hammer and Jackpot use different cams.

Part#	Grind	Timing(*)	Duration .050	Duration .020	Valve Lift	Lift @ TDC	Springs	Application +
Stock	—	08/40 40/04	228 224	255 253	.388 .386	.078 .076	Stock	Stock cams; valve event specs listed for comparison.
268450	V-438	17/45 46/11	242 236	269 265	.412 .406	.108 .085	Stock	More valve lift and duration means extra power thru RPM (2000–6000+) range for bolt-in or modified engines. Piston-valve clearance should be checked.
268460	V-460	18/54 48/16	252 244	282 276	.434 .426	.113 .107	Hi-lift	Higher lift cams for modified Freedom motors with big cylinders and higher CR. More torque and HP with factory 100 kits. RPM range: 2200–6500+.

Pushrod Adjustments and Hydraulic Lifters

Because we make many camshafts and pushrod sets for the H/D accessory market, we frequently hear the following question; "What is the proper procedure for adjusting the pushrods on my bike?"

The diagram at the right shows a cutaway schematic view of an adjustable pushrod and hydraulic lifter assembly. Labels identify some of the components. (Note that for this explanation, no check valve is shown but it is part of the lifter).

When hydraulic lifter units are first assembled (with no pushrod present), the compression spring pushes the hydraulic unit and pushrod seat upwards until the pushrod seat contacts the lower edge of the retaining ring. At this point the hydraulic unit cannot move any further upwards.

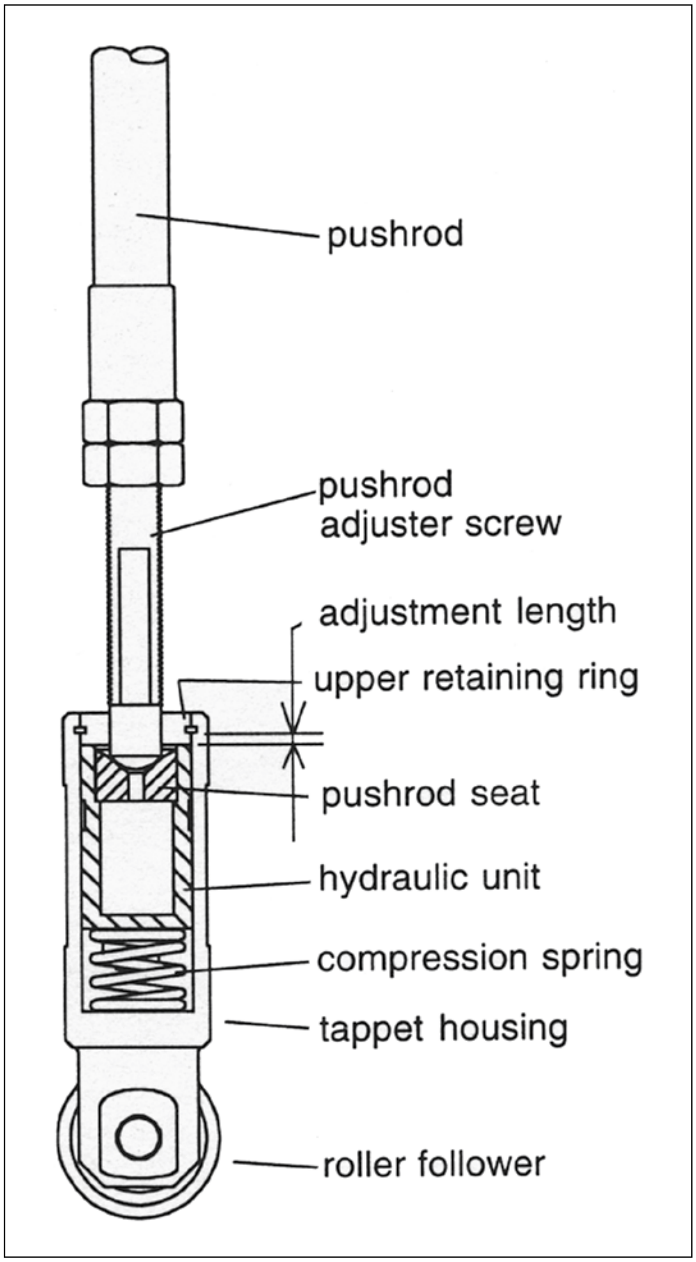
It can however move down approximately .150 inches. This downward travel is the adjustment range. In other words, the adjustment length starts at 0.0 and can be as much as .150 inches. Correctly adjusted lifters position the hydraulic units in the middle of the .150 travel range.

For hydraulic lifters to function correctly, the engine oiling system must operate with at least 10 to 15 PSI oil pressure. Pressurized oil will then fill the area around the compression spring. And as far as hydraulic lifters are concerned, more oil pressure will not result in lifters running better.

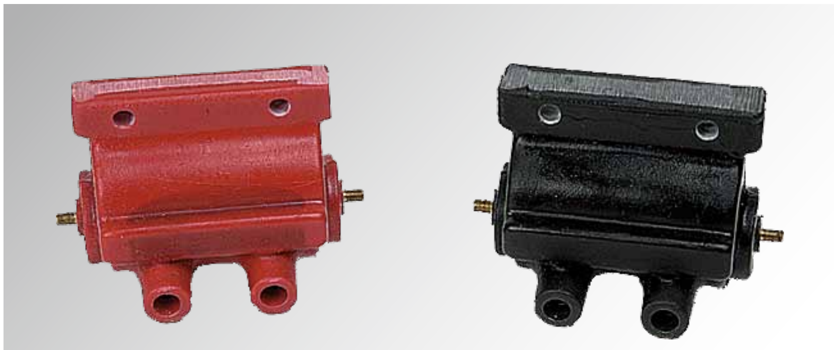
Pushrod adjustments may now be completed. First, with each roller lifter at the low lift point, lengthen the adjuster screw by hand until it makes tight contact with the pushrod seat in the lifter. Then, extend the adjuster screw down (making the pushrod longer) three or four full turns. (The exact number of turns is not critical).

Andrews Products adjuster screws for EV80 and Twin Cam pushrods are made with (5/16 x 32) threads, so three turns will lengthen the pushrod by .093 inches (3 x 1/32 = .093 inches). Each full turn of an adjuster screw changes the pushrod length by .032 inches.

The pushrod seat and hydraulic unit are now positioned to operate correctly, and will move up or down to compensate for engine expansion due to warm up or cooling down of the engine. As long as the hydraulic unit and pushrod seat can move up and down and not touch the upper retaining ring or "bottom out" during operation, the pushrod length has been set for the lifters to function normally.



Performance and Replacement H/D Ignition Coils



Replacement coils for Harley Davidson engines. Andrews SuperVolt Coils deliver 30,000+ volts. Models are available for both electronic (pointless) systems as well as earlier conventional battery and point ignitions.

Red coils fit 1985 and up engines. Black coils fit all H/D bikes thru 1980 with point type ignition sets. All of these coils will produce more voltage than stock coils.

Black Color Coil, 4.8 Ohms . . . . . . Part# 237230
Red Color Coil, 2.8 Ohms . . . . . . Part# 237240

Picking the Right Cam and Hydraulic Lifters

Picking The Right Cam

We often hear the question "What cam do I need for my bike?" and while there are no hard and fast rules for picking a cam for a specific application, some basic guidelines are worth considering. Keep in mind that performance camshafts are usually chosen for the basic purpose of producing more power from your engine. The three questions to answer before choosing a new cam are:

1. **Primary Application** Is the bike going to be used for all around street riding or is the goal to have an engine which is running at maximum torque and horsepower for track or drag racing?
2. **Type of Riding** Do you spend a lot of your time riding two-up on highway trips, or is it more important to have the most power? In other words is your riding style conservative or more aggressive?
3. **Engine/Bike Combination** This question relates to displacement (cubic inches), compression ratio, bike weight, and what kind of cylinder head modifications have been done. Have the intake and exhaust ports been changed to result in better flow efficiency? Does the engine have a higher than stock compression ratio to take advantage of a longer duration cam? Is the bike lighter like a Dyna or a heavy bagger?

To get the best cam for your bike, all of these factors have to be taken into account. Almost every type of engine modification imaginable has been performed on H/D type engines. Here is a short summary of modifications listed in order of increasing cost and installation complexity.

1. Relieved air cleaners
2. Higher output ignitions
3. Free flow exhaust system
4. Performance camshafts
5. Modified fuel injections (or)
6. Larger carburetors
7. High compression pistons
8. Big bore cylinders and pistons
9. Long stroke flywheels

It is important to note that too much cam sometimes results in poor low RPM response and power. Street bikes will often perform better with a mild cam than a more radical cam. While bigger cams may have a higher peak horsepower, a more conservative cam may feel stronger to street riders because maximum torque occurs at a lower RPM. Changing cams is the easy way to get more torque in the 2000–4000 RPM range. A cam with a longer intake duration will reduce static compression pressure at low speeds, which in turn tends to reduce low RPM torque. But with a longer-duration cam and a higher compression ratio, power at middle and high speeds will be increased, which is what you wanted all along. This is the main benefit of a good performance camshaft and a properly tuned engine.

For an engine with a cam properly matched to the displacement and compression ratio, the net result will be more power at middle and higher engine speeds. In general, higher compression ratios need longer duration cams. Bolt-in type cams are intended for stock compression ratios.

Camshafts and Hydraulic Lifters

There has always been a great amount of interest regarding the application of hydraulic lifters with performance camshafts. On H/D engines, this attention relates to Twin 88s, EV80 Big Twins, and Sportsters (1991 and later) since all of these engines now use hydraulic lifters as stock components.

Because we hear many questions about whether to use "solids" or "hydraulics" we felt that some discussion might help in deciding which type of lifter would be the best for specific applications. Each type of lifter design has distinct advantages.

First, all Andrews Products H/D camshafts will operate properly with hydraulic lifters if the engine and heads are set up correctly.

If hydraulic lifters are installed and correctly adjusted, they have some definite advantages:

- Quiet operation
- Long time service intervals
- No loss of lift and duration from heat expansion

For hydraulic lifters to operate properly in your engine, the most important point at the time of installation is to make sure that the oil feed holes in the lifter blocks are in position to feed oil to the lifters when the cam is positioned at the lowest lift point. For this to occur with high lift cams, it may be necessary to modify the lifter blocks or lifters so oil can flow into the lifter feed hole from the tappet body.

The real advantage of solid lifters relates to all out racing. For anything else, including most street riding, we recommend that hydraulic lifters be used.

For dragsters, a properly designed cam with solid lifters will be the best choice. But for most street bikes, the idea of low-maintenance hydraulic lifters is pretty attractive. New H/D hydraulic lifters work so well that unless you really need 6500+ RPM, don't bother with solid lifters on a street bike. Hydraulic lifters are a little harder to install and adjust, but you will end up with a quieter engine that needs less servicing.

Static Compression Pressure

Static Compression Pressure; What Is It?

Static or cranking compression pressure is what each cylinder experiences when the starter motor is turning the engine or when the engine is running at idle RPM. Please don't confuse static compression with "compression ratio" which refers to how much volume remains in the cylinder combustion chamber when the piston is at the top of its stroke. Static compression and compression ratio are related, but the definitions of each are different.

Compression pressures that are too high can result in difficult starting and detonation or "pinging" which in turn can cause engine damage.

Modifying an engine by changing pistons, camshafts, or compression ratios will all have a direct effect on static or cranking compres-sion pressure. If the static compression pressure is too high or too low, the engine will not run as well as it should, and in some cases the resulting problems can be serious. Static or cranking compres-sion can easily be measured with a compression testing gauge. Cost is usually less than 25.00 and most auto supply stores or well equipped motorcycle shops sell them. When installing cams with high lifts and long durations, a few general observations are worth keeping in mind. Remember that additional cam duration can pro-duce more usable power but too much duration may actually hurt overall performance. The problem of poor engine response starts when too much duration results in lower cylinder compression pres-sure (at low RPM) which in turn can greatly reduce low RPM engine torque and power. Too much duration in a cam lobe design will not result in the best performance for your engine.

What Causes High Static Compression Pressures?

1. Compression ratio set too high.
2. Intake cam duration too short.
3. Intake cam closing point advanced too much.

Compression pressures which are too high can result in detonation or "pinging," piston damage, and possible rapid starter motor wear.

What Causes Low Static Compression Pressures?

1. Compression ratio set too low.
2. Intake cam duration too long.
3. Intake cam closing point set too late.
4. Worn piston rings and/or burned valves.

Compression pressures which are too low will result in poor low RPM torque and sluggish throttle response.

How to Measure Compression Pressure

With a warm engine (not hot, just warm), static compression pressure can be measured with the following procedure:

1. Turn off fuel valve.
2. Make sure choke is off.
3. Transmission in neutral.
4. Remove both spark plugs.
5. Insert pressure gauge adapter into one head.
6. Hold throttle wide open*, a closed throttle will read low!
7. Turn engine with starter motor (or kick-start bar).
8. Measure cylinder pressure with gauge
9. Repeat procedure for second cylinder

*Important note: If the throttle is not held wide open and/or the choke is not off, the resulting pressure measurement will show a false low reading. Also, some gauges have a rubber tip instead of a screw-in adapter. Using either type of gauge, measuring static pressure in your engine is not difficult.

Static Compression Pressure and Engine Performance

The figures below give some idea as to the significance of different pressure readings. Generally, higher static pressures mean more torque at lower RPM ranges. The trade off is that above a certain point (around 185 PSI) detonation enters the picture. What happens at higher RPM is less predictable and can't be easily determined from a static pressure reading. For the best overall engine performance, compression ratio, cam timing, duration, and fuel system tuning must all be correctly matched.

1. Less than 115 PSI: poor low speed response, hard starting. Pistons and cams not well matched or worn rings, valves.
2. 125 to 145 PSI: OK for stock or modified Shovel and Pan motors. But these are low numbers for a stock street motor.
3. 145 to 165 PSI: OK for modified street motors. Static pressures in this range will be work very well for street motors.
4. 165 to 185 PSI: Marginal for large displacement street motors, possible hard starting, detonation and overheating.
5. 185 PSI and higher: Strictly high performance; these numbers may need compression releases and/or octane boosters.
6. 220 PSI is OK with new H/D Milwaukee 8 engines, but the characteristics of four-valve cylinder heads changes everything.

The above recommendations are not absolute, but the point is that static compression is important. Proper matching of cams and compression ratios will allow engines to be modified for more performance and still run smoothly in street applications.

What Causes Cam Gear Noise?

Whenever a roller lifter in a Sportster engine passes maximum cam lift, the forces on the cam gear teeth change direction. If there is more than .002 backlash, the change of force and direction will result in an audible "click" as the backlash moves from one side of the tooth to the other. Gear noise will always occur at idle and lower engine RPM.

Stock EV Sportster cams are made with different gear sizes. They are color-coded by size and selectively fitted to engines at the factory to a minimum backlash in order to result in reduced gear noise during engine operation.

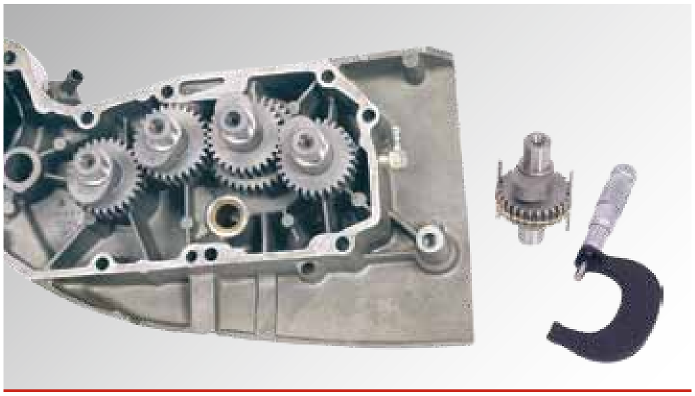
Andrews Products cam gears for EV Sportsters are made with gears in the middle of the size ranges so there is only a small chance of cam gears fitting too tightly. Cam gears which have excess backlash may rattle or “click” during operation. The “clicking” can sound like lifter noise. Unlike whining gears, rattling gears will not cause gear tooth failure or engine damage. If you don't mind the noise, it won't cause any engine problems.

Gears which are operating without enough backlash (fitted too tightly) will whine during operation. This condition is serious and can cause localized gear tooth overheating, gear tooth surface failure, and engine damage. Cam gears which fit too tight must be corrected with smaller size cam gears.

To correctly fit Andrews Products cams in your EV Sportster engine, the following procedure may be helpful

Measuring Cam Gears For Proper Fit

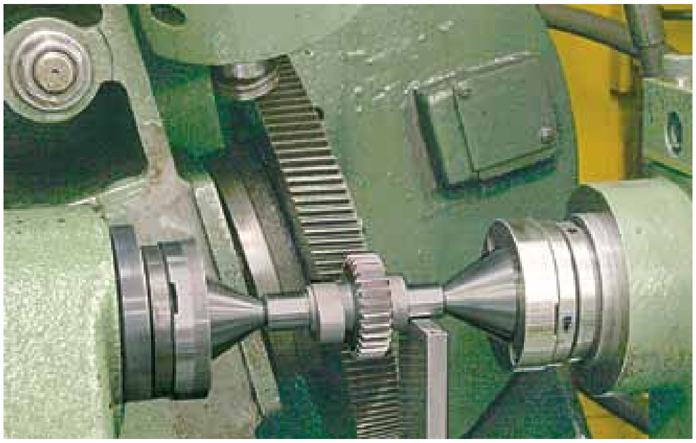
1. Install all four cam gears in cover (see photo at right) for a trial fit.
2. Manually turn all four gears and verify that they roll freely. If there is no tightness, proceed to step 6.
3. If there is any tightness, remove #4 cam, then #1, then #3, in that order so that the tight-fitting parts can be identified.
4. Measure each new cam gear with a micrometer using .108” dia. pins. Do the same with the stock cam gears. Note any differences in size.
5. Andrews Products makes undersize and oversize cam gears for all three production EV cam grinds. Unused parts may be returned and exchanged for under or oversized cam gears.
6. Install the cover onto the engine with no pushrods and only the #2 cam gear. Verify that the engine now freely turns. If so, the cam gear backlash is correct and you can continue to reassemble the engine.
7. If the #2 cam drive gear is tight, a smaller H/D pinion gear must be used. See page 19 for a procedure to determine the correct size of new pinion *(this procedure applies to Sportsters too)*.
8. Any two adjacent cam gears (1-2), (2-3), (3-4) can be installed in the cover to check for proper backlash by comparing the stock parts (two at a time) to the new ones.
9. Any significant differences in sizes between the stock cam gears and new cam gears should be investigated and understood before proceeding.



Custom Fitting Sportster Cam Gears

If the procedure for checking Sportster cams, shown above, clearly identifies individual cam gears that will not turn freely because of tight-fitting gear teeth, the teeth can be honed to a smaller size for a correct fit. It is very unlikely that you will ever need to do this but, if there is a problem, Andrews Products can custom fit Sportster cam gears to eliminate tight-fitting gear teeth.

Tooth sizing is performed on a National Broach GHH gear hone machine set up to adjust H/D Sportster cam gear teeth. Please call us for a Return Merchandise Authorization (RMA) before sending any parts back.



Sportster cam in National Broach GHH gear tooth hone machine

How To Find The Noise and Eliminate It

Why Do Gear Driven Cams Cause Noise?

Over the last few years there has been lots more interest in quiet engines. Since cam gear noise can sound like bad lifters, the explanation and discussion in the following section is appropriate.

Whenever the roller follower on a cam lobe passes the maximum lift point, the forces on cam drive gear teeth change direction. If more than .002 inches (.05mm) backlash is present between the cam and pinion gear, this directional change of force will result in an audible "click" as the backlash moves from the back side of each gear tooth to the front side.

While some positive backlash is necessary to prevent localized gear tooth overloading, excess backlash (and "clicking") may sound annoying but won't hurt anything.

Tight-fitting gears will cause very noticeable whining, which is definitely a much more serious problem. Gear tooth and bearing damage can result from running zero backlash. In this case, cam or pinion gears with smaller pitch diameters would be required.

Different size gears permit custom fitting for a specific engine. By choosing two gears which are compatible sizes for a given engine, gear backlash can be minimized so that gears will not whine or click but just operate quietly.

If you need them, Andrews Products makes cam gears one size larger than standard and one size smaller. H/D makes pinion gears in several different sizes.

If you are working with an engine that does not have quiet running cam gears to use as a starting point, another method may be used to size drive gears when installing new cams.

In this case it will be necessary to use either a larger cam gear, a larger pinion gear, (or both) to correct noisy gears. If the problem is excess whining, a smaller pinion or cam gear will be needed.

Measure pinion and cam (over pins) as in diagram below. Look in H/D service manual for part numbers listed by pin sizes. A decision must now be made regarding what size pinion or cam gear to choose. Our recommendation would be to pick two sizes larger to correct clicking (noisy gears) or two sizes smaller (to correct whining) as a starting point.

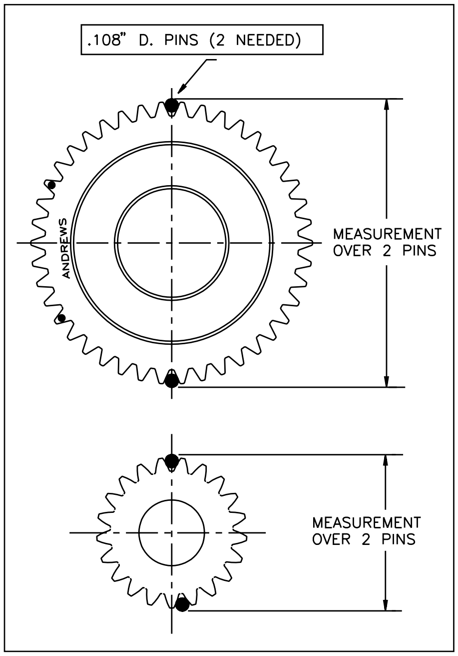
If both gears are sized properly for the engine, a very slight whine is normal. Only a small percentage of engines were made with larger size cam drive gears. The two largest sizes of cam drive gears will be color-coded green or black. If a particular engine has a stock cam with one of these color codes, matching cam drive gears and pinions for correct backlash can result in a quieter running engine whenever a new camshaft is installed.

Engines having cam gears color-coded red or blue should not require any cam or pinion gear changes.

What Can Be Done To Reduce The Noise

The factory service manual for Shovel and EV Big Twin engines lists different size pinion and cam gears. We are recommending that service manuals be used for reference. If your camshaft has been changed and your engine makes noise like lifters out of adjustment, the noise is most likely a result of excessive pinion to cam gear backlash. There are several possible techniques for reducing gear noise.

1. Remove the stock cam gear and press it onto the new camshaft. Stock gears will work OK with Andrews Products camshafts. To press a new gear onto a camshaft, the center of the 1/4" keyway (in the camshaft) must be exactly 180 degrees (21 teeth) from the pinion timing mark on the drive gear.
   OR
2. Measure the stock cam gear and pinion gear (over pins) as shown in the diagram. Write down the measurements.
3. Now measure the new cam gear (over pins) and write down that number also.
4. Subtract the new gear size from the stock size.
5. If the new cam gear is smaller than the stock gear (for clicking), add the difference (from step 4) to the size of the pinion gear to obtain a new (larger) pinion gear size.
6. If the new cam gear is larger than the stock gear (for whining), subtract the difference (from step 4) from the size of the pinion gear to obtain a new (smaller) pinion gear size.
7. Then match this size to a new pinion gear part number in the H/D manual and install it.
8. Remember to use the same size pins as the manual lists for measuring your gears! (.108" dia. or .105" dia.)



Sportster Cams
(Iron Head)

1957–1985

Shown is a late-style Sportster cam gear kit, lower collars, and pushrods made from either steel or aluminum. Steel pushrods are the best choice for stroker motors and drag applications where the greatest strength is needed. For street applications where quiet operation is desired, aluminum pushrods are the recommended choice. Both pushrod kits are made from 7/16″ diameter tubing which will not interfere with rod covers. Lower spring collars are similar to late-style H/D parts and will provide .060″ more spring travel than stock collars. High-lift cams are easier to install with Andrews collars.

4 Steel Pushrods . . . . Part# 240040
4 Aluminum Pushrods . . . . Part# 240060
4 Lower Spring Collars . . . . Part# 277160

Iron Head Sportster Cams

Part#	Year	Grind	Timing(*)	CL	Duration(*) .053	Duration(*) .020	Max. Lift	TDC Lift	Application
Stock	76–85)	Q	10/32	101	222	262	.400	.114	Specifications for stock Q cams listed for reference and
			35/07	104	222	262	.380	.114	comparison purposes.
214010	57–70	P	34/40	93	254	294	.400	.200	Kit includes two PB+ exhaust cams (#1 & #4). Must
214014	71–80	PB+	43/31	96	254	298	.410	.192	be installed with stock P intake cams. Bolt–in power
214020	81–84**								for all iron head Sportsters with no head work req'd.
214025	84–85***								(Stock P exhaust is .380 lift, 242 deg. duration)
214040	57–70	PB+	34/40	93	254	298	.410	.208	Bolt–in replacement cams for stock 'P' or 'Q' cams;
214045	71–80		43/31	96	254	298	.410	.208	more horsepower and torque with this great street
214050	81–84**								grind. Stock springs will rev. to 7000 RPM.
214055	84–85***								
214075	57–70	Y	35/47	96	262	310	.425	.206	Street 900/1000: Biggest cams available for no head
214080	71–80		53/29	102	262	310	.425	.182	work installation. Stock springs OK. Great mid-range
214085	81–84**								and upper end power. Compression ratios should be
214090	84–85***								9:1 to 10:1 for best output.
214105	57–70	R5	33/41	94	254	306	.445	.209	Street/Drags: Stock or modified 900/1000 motors and
214110	71–80		43/31	96	254	306	.445	.200	strokers. Big boost in torque over stock cams (2000–
214115	81–84**								7500 RPM). Stock springs OK, but checking valve and
214120	84–85***								piston clearances is required.

*Timing listed for .053 lift figures. **1981–early '84 cam gear kits (with generators) do not have tachometer drive gears.
***Late 1984 to 1985 cam gear kits (with alternators) do not have generator drive gears.

Sportster Evolution Cams

Andrews Products performance cams are available for all EV Sportster engines. Many of the cams listed below will run to 6500 RPM with stock hydraulic lifters. H/D hydraulic lifters are very proven units. We recommend they not be changed to solid lifters. For lower lift EV Sportster cams, stock base circle sizes are used so stock, non-adjustable, pushrods can be used. Adjustable aluminum or chrome-moly steel pushrods are also available.

Note: #2 cam drive gears on 2000 and up EV Sportster cams use 46 teeth; the '91–'99 #2 gears have 36 teeth. The 46 tooth drive gears from 2000 will install on 1991–'99 #2 cams.

EV Sportster Adjustable Length Pushrods
4 Aluminum Pushrods; '86–'90 . . . . Part# 292020
4 Chrome-Moly Steel Rods; '86–'90. . . . . Part# 292090
4 Aluminum Pushrods; '91–up . . . . Part# 292030
4 Chrome-moly Steel Rods; '91–up . . . . Part# 292085

High Lift Evolution Springs . . . . Part# 294150
Four inner and four outer springs. When used with heat-treated steel-spring collars, cam lifts of .550"+ can easily be accommodated. Head machining is not required.

Heat Treated Steel Spring Collars . . . . Part# 293115
Heat-treated steel-spring collars for all EV Sportster engines. Provides .050" more spring travel than stock collars. Collars are stronger and 10% lighter than stock collars. Use stock keepers.

Evolution Sportster Cams

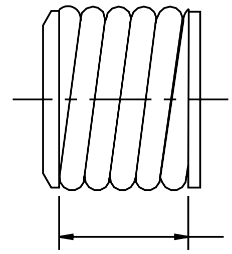
Part#	Year	Grind	Timing(*)	CL	Duration(*) .053	Duration(*) .020	Max. Lift	TDC Lift	Application
Stock	86–90	D D	02/41 41/02	109.5 109.5	223 223	270 270	.458 .458	.094 .094	Specifications listed for reference and comparison. (Note: 1986–1987 exhaust cam lift is .414").
Stock	91–up	W W	10/28 38/16	99 101	218 234	256 272	.474 .474	.122 .138	Late Sportster cam data listed for comparison. Late cams marked "D" ('91–later) have same specs as "W" cams.
298120 298125 298130	86–90 91–99 2000–up**	V2 N2	22/38 46/18	98 104	240 244	283 290	.465 .440	.180 .155	Bolt in cams for stock 883, 1100, & 1200 engines. More duration and lift means extra power thru RPM range. Use stock springs & hydraulic lifters: 2000–6000 RPM.
298135	2004–up	N3 N3	22/38 43/11	98 106	240 234	278 270	.465 .482	.181 .134	Bolt in power for '04 and later 883/1200s with stock springs and heads. Cams for '04–up heads with more than .550" lift may need new valves, springs, collars.
298140 298145 298150	86–90 91–99 2000–up**	V4 N4	30/46 52/24	98 104	256 256	296 296	.490 .490	.216 .189	Street/drags: Stock or modified 883/1100/1200. Stock springs / hydraulic lifters are recommended. RPM range: 2000–6000.
298180 298185 298190	86–90 91–99 2000–up**	V8 N8	32/44 56/28	96 104	256 264	296 302	.490 .500	.226 .212	Modified 1100–1200, stroked 883s with stock springs & hydraulic lifters. Same intake cam as N4: more exhaust cam duration. Great mid–range power: 2000–6500 RPM.
298160 298165 298170	86–90 91–99 2000–up**	V6 N6	34/50 56/28	98 104	264 264	302 302	.500 .500	.241 .212	Modified 1200 to 80 inches and/or high comp. pistons. Stock springs and hydraulic lifters are recommended: RPM range: 2500–6800.

*Timing listed for .053 lift figures. **2000 and later Sportster engines require a different #2 cam drive gear than '91–'99 engines.

How To Figure Out What The Installed Spring Height Should Be

1. Using both top and bottom collars, place spring assembly in a vise and close the vise until the outer spring is solid. Be careful when compressing springs in a vise, they can be ejected with great velocity!
2. Now measure the distance between spring lands as in the diagram and write down the number for later use. This is the Solid Height.
3. Calculate INSTALLED SPRING HEIGHT (min.) as follows: INSTALLED HT.= Solid Height + .060" + Max. Valve Lift
4. Max. valve lift can be taken from catalog figures. For example, max. valve lift for an EV59 cam is .560".
5. For an EV51 cam, using Andrews Products springs and collars;
   INSTALLED SPRING HEIGHT = 1.190"+.060"+.510" = 1.760"
6. This technique will work for any cam and spring system as long as measurements are carefully made.
7. During installation, make sure that .050 minimum clearance is present between top of valve guide and bottom of upper spring collar **at maximum cam lift**.
8. Solid height + .560" (see diagram) refers to spring forces **when the valve is seated.** (.560" is an assumed spring travel).

Spring shown compressed (in vise)



SPRING SOLID HEIGHTS	
Andrews Ev80 & T88	1.190"
Stock Ev80	1.250"
Andrews Shovel	0.900"
Stock Shovel	0.900"
Iron Sportster	0.910"

Measure only the solid length of spring.

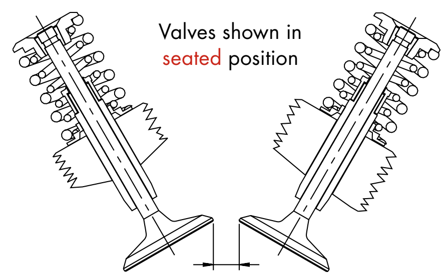
Spring Loads	Solid Height +.060*	Solid Height+.560*
Shovel	350 lbs.	160 lbs.
Evolution & Twin 88	350 lbs.	210 lbs.

*Andrews Products springs

How To Check For Possible Valve To Valve Interference

If your heads have large valves or new seats installed or if a new performance cam has been installed, being able to easily check for possible valve to valve interference is important. For all H/D heads (EV, FL, XL, etc.), a simple calculation can be done to see if valve to valve interference might be a problem which will need correcting before proceeding.

1. Andrews Products lists valve lifts at TDC (Top Dead Center) on all cam instruction sheets. For an EV51 cam, the TDC lift =.233" (see data on page 10).
2. Minimum valve to valve clearance should be .060".
3. Calculate the minimum valve separation distance as follows:
   Minimum Valve Separation Distance = TDC lift + clearance.
4. For EV51 cams, **minimum** Valve Separation = .233" + .06" = .293".
5. Measure minimum separation between the two valves **when they are seated** (as in diagram). If actual measurement is not at least .293", modifications will be necessary to avoid valve to valve interference. (Cut seats deeper or back cut valves.)
6. Remember, this technique is NOT for checking piston to valve clearance.



Minimum Separation Distance

Compression Ratio Changes

One of the best ways to increase the efficiency of any internal combustion engine is to raise the compression ratio. As long as fuel with enough octane rating is available (so it will burn without detonation), raising the compression ratio is a very effective performance boost.

The amount of material which must be milled from heads (or cylinders) to change compression ratios can be calculated. Although the equations shown in the next column may look too simple, they are correct!

Also, correction factors of 1.4 must be used for EV heads and 1.6 for Twin Cam heads since the outline shapes of the combustion chambers are not circular.

The stroke length (SL) and initial and final compression ratios need to be known. As an example, how much must be milled off EV80 heads to raise the compression ratio from 8.5 to 9.0: Stroke length=4.25 for a stock EV80. With the formula, T=.056 (see next column). All of the values in the following table were calculated with this formula.

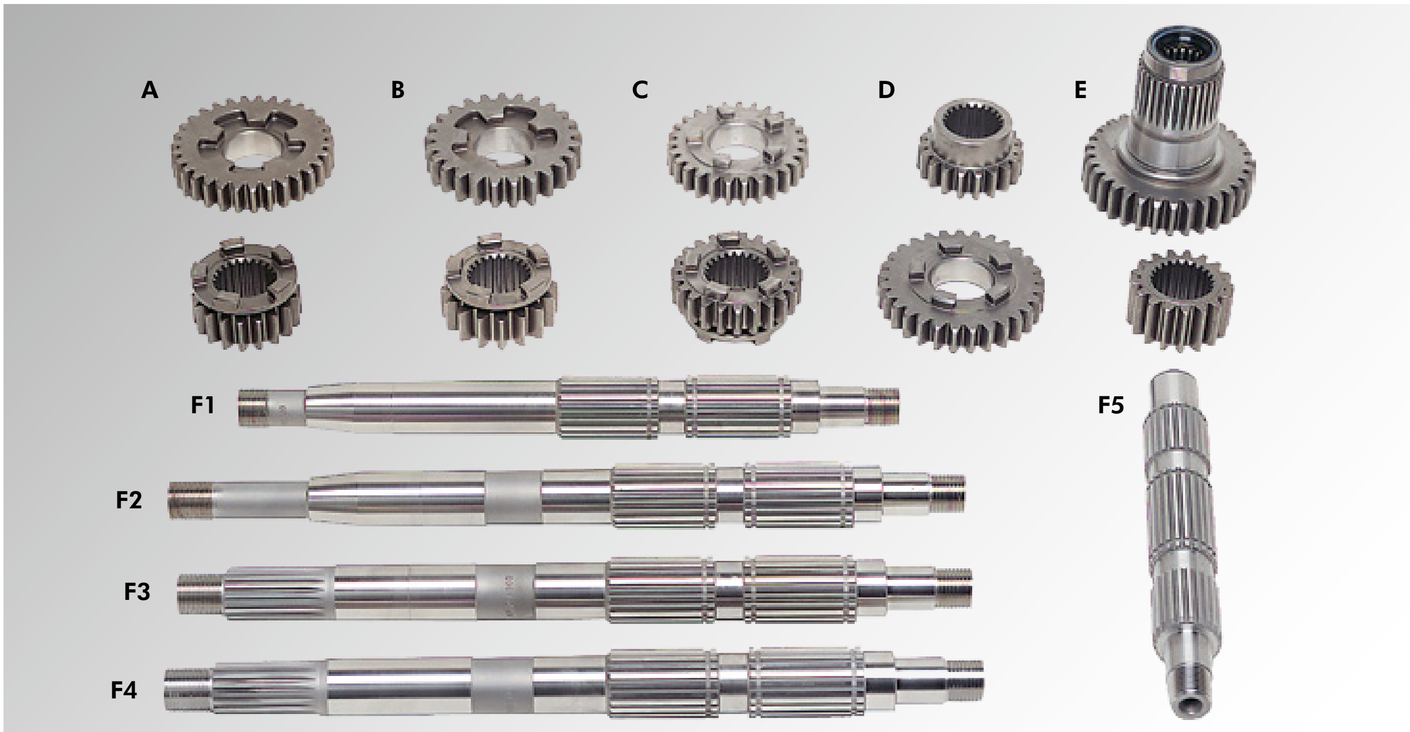
With this information, the amount (T), to be milled from the heads (or cylinders) can be calculated. But, if the bore is changed or different heads are used, the only way to be sure of the CR is to measure the combustion chamber volume on a complete, assembled engine and calculate the CR.

EV80: T = Stroke L x 1.4. x (1/(original CR-1)-1/(new CR-1))
T = 4.25 x 1.4 x (1/7.5–1/8.73) = .080 in. (EV80; 9.73:1)
Twin Cam: T = Stroke L x 1.6 x (1/(original CR-1)-1/(new CR-1))
T = 4.00 x 1.6 x (1/8.9–1/9.5) = .045 in. (TW88; 10.09:1)

For EV80 and Twin 88 (Stock bore & stroke):

Head Milling (T)	Compression Ratio	
	EV80	Twin Cam*
.000	8.50	9.00
.020	8.70	9.20
.040	8.90	9.40
.060	9.10	9.65
.080	9.34	9.90
.100	9.60	10.15

*Data shown for TC-88 engine *Data for TC-96 engines will be different



The EV80 Big Twin 5-speed gear box has been around since 1984 and the number of modifications for 1340 bikes continues to create interest. In addition to close-ratio first gears, Andrews Products also makes stock replacement gears for 1st, 2nd, 3rd, 4th, and 5th gears. All Andrews Products 5-speed gears are made from high alloy nickel steel and are heat treated and shot peened to give maximum durability and strength. Also, where applicable, lead-in ramps have been machined into most gears to improve shifting and reduce wear on drive dogs and drive slots.

A 3.24 Stock Ratio 1st Gears
1st Counter–31T . . . . Part# 296120
Replaces H/D #35622-79A
1st Main–18T. . . . . Part# 296125
Replaces H/D #35025-79

B 2.94 Close Ratio 1st Gear Set
1st Counter–25T; 1st Main–16T . . . . .Part# 296110
2.94 1st gears–close ratio shifting; 1st to 2nd.
At peak RPM, 2.94 gears will run +5 MPH over 3.24 ratio.

C Stock 2nd and 3rd Gears
2nd Counter or 3rd Main–27T . . . . Part# 296330
Replaces H/D #35027-79A
2nd Main or 3rd Counter–23T . . . . Part# 296220
Replaces H/D #35026-79A

D Stock 4th Gears
4th Main–29T . . . . Part# 296445
Replaces H/D #35028-79
4th Counter – 19T . . . . Part# 296440
Replaces H/D #35625-79A (1987–up); also replaces gear and spacer in earlier 5-speeds.

E Stock Main Drive Gears (Belt Drive)
Main-32T Drive-belt . . . . Part# 296585
Replaces H/D #35029-85
Main-32T Drive-belt . . . . Part# 296591
Replaces H/D #35029-91
5th Cntr Gear–17T . . . . Part# 296555
Replaces H/D #35626-79A

Stock Main Drive Gears (Chain Drive) (Not shown)
Main-32T Drive-chain . . . . Part# 296550
Replaces H/D #35029-79

F Transmission Shafts (All Years)
1 Chain Drive Mainshaft, 1981–84 L=12.065″ . . . . Part# 296800
Replaces H/D #35042-79
2 Belt Drive Mainshaft, 1985–89 L=14.095″ . . . . . Part# 296850
Replaces H/D #35042-85
3 Belt Drive Mainshaft, 1990 only L=13.605″ . . . . Part# 296900
Replaces H/D #35042-90
4 Belt Drive Mainshaft, 1991–up L=13.605″). . . . . Part# 296910
Replaces H/D #35042-91
5 Countershaft: all years, 1984–up . . . . Part# 296700
Replaces H/D #35632-79

Complete gear sets are available. Each set includes:
First Gear (specify ratio) (ctr & mn) . . . . 2 pcs
Second Gear (counter & main) . . . . 2 pcs
Third Gear (counter & main) . . . . 2 pcs
Fourth Gear (counter & main) . . . . 2 pcs
Fifth Gear (counter & main) . . . . 2 pcs
Countershaft . . . . 1 piece
Mainshaft . . . . 1 piece
Chain Drive (1981–1984) . . . . Part# 296081
Belt Drive (1985–1989) . . . . Part# 296085
Belt Drive (1990 only) . . . . Part# 296090
Belt Drive (1991–up) . . . . Part# 296091

Price sheet has listings of all combinations of gear kits and ratios.

Transmission Ratios, Pulleys, and MPH

MPH	15	20	25	30	35	40	45	50	55	60	65	70	75	80
	Miles Per Hour and RPM In Any Gear													
	5 Speed–'85–'93 (Except '93 Softail) / Stock 32T Front / 70T Rear Pulley / 3.37 Final Drive Ratio													
5th	-	-	-	-	-	1812	2038	2264	2491	2717	2944	3170	3397	3623
4th	-	-	-	-	1950	2228	2507	2786	3064	3343	3621	3900	4178	4457
3rd	-	-	-	2174	2536	2899	3261	3623	3986	4348	4710	5072	5435	-
2nd	-	-	2503	3003	3504	4004	4505	5005	5506	-	-	-	-	-
1st	2203	2937	3671	4405	5140	5874	-	-	-	-	-	-	-	-
	5-Speed '94–'06 (Except '95 Softail) / Stock 32T Front / 70T Rear Pulley / 3.15 Final Drive Ratio													
5th	-	-	-	-	-	1693	1905	2117	2329	2540	2572	2964	3175	3387
4th	-	-	-	-	1823	2083	2344	2604	2865	3125	3385	3646	3906	4167
3rd	-	-	-	1995	2327	2660	2992	3324	3657	3989	4322	4654	4987	-
2nd	-	-	2339	2806	3274	3742	4210	4677	5145	-	-	-	-	-
1st	2038	2717	3397	4076	4755	5435	-	-	-	-	-	-	-	-
	Twin Cam 6-Speed Andrews 30T Front Pulley / 70T Rear Pulley / 3.15 Final Drive Ratio													
6th	-	-	-	-	-	-	1905	2117	2329	2540	2752	2964	3175	3387
5th	-	-	-	-	-	1998	2248	2498	2747	2997	3247	3497	3746	3996
4th	-	-	-	-	2060	2354	2649	2943	3237	3531	3826	4120	4414	4709
3rd	-	-	-	2185	2549	2913	3277	3642	4006	4370	4734	5098	5462	-
2nd	-	-	2444	2933	3421	3910	4399	4888	5376	-	-	-	-	-
1st	2122	2829	3536	4243	4950	5658	-	-	-	-	-	-	-	-
	Twin Cam 6-Speed Andrews 30T Front Pulley / Stock 66T Rear Pulley / 2.97 Final Ratio ('06 Dynas with stock 32T front / 70T rear pulleys are similar–2.95 final drive ratio)													
6th	-	-	-	-	-	-	1796	1996	2196	2395	2595	2794	2994	3194
5th	-	-	-	-	-	1884	2120	2355	2591	2826	3062	3297	3533	3768
4th	-	-	-	-	1942	2220	2497	2775	3052	3330	3607	3885	4162	4440
3rd	-	-	-	2060	2404	2747	3091	3434	3777	4121	4464	4808	5151	-
2nd	-	-	2306	2768	3229	3690	4151	4613	5074	-	-	-	-	-
1st	2000	2667	3333	4000	4667	5333	-	-	-	-	-	-	-	-
	Twin Cam 6-Speed '09–2016 Flht / Stock 32T Front / 68T Rear Pulley / 2.87 Final Drive Ratio													
6th	-	-	-	-	-	-	1735	1928	2121	**2314**	2507	2700	2892	3085
5th	-	-	-	-	-	1821	2048	2276	2503	2731	2959	3186	3414	3641
4th	-	-	-	-	1877	2145	2413	2681	2949	3217	3485	3753	4021	4290
3rd	-	-	-	1989	2321	2653	2984	3316	3647	3979	4310	4642	4973	-
2nd	-	-	2226	2671	3117	3562	4007	4452	4898	-	-	-	-	-
1st	1933	2577	3222	3866	4510	5155	-	-	-	-	-	-	-	-
	Twin Cam 6-Speed All '07 –'08 Flht, '07–16 Softail and '07–16 Dynas / Stock 32T Front / 66T Rear Pulley / 2.79 Final Ratio ('06 Dynas with ANDREWS 34T front / 70T rear pulley are similar with a 2.78 final drive ratio)													
6th	-	-	-	-	-	-	1688	1875	2063	**2251**	2438	2626	2813	3001
5th	-	-	-	-	-	1771	**1992**	2213	2435	2656	2877	3099	3320	3541
4th	-	-	-	-	1825	2086	2346	2607	2868	3128	3389	3650	3910	4171
3rd	-	-	-	1935	2258	2581	2903	3226	3548	3871	4194	4516	4839	-
2nd	-	-	2166	2600	3033	3466	3899	4333	4766	-	-	-	-	-
1st	1880	2506	3133	3759	4386	5013	-	-	-	-	-	-	-	-

For Twin Cam H/D bikes the chart above can be used to estimate vehicle speed in 5 MPH groups for any gear and desired RPM.

Pick the chart box that matches your bike and transmission and number of belt pulley teeth. Then look up the RPM for the MPH you are looking for.

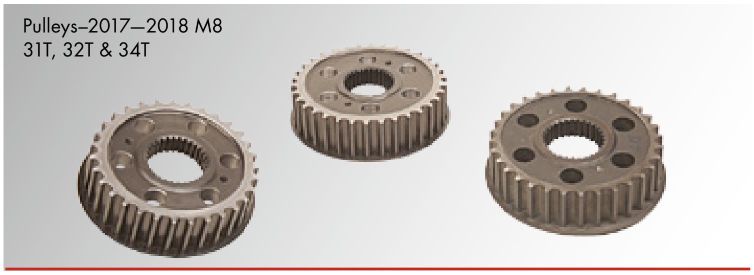
Example: Stock Twin cam FLHT (bagger), six speed transmission, 32T front pulley, 66T rear wheel pulley will be listed in the last box above. In 5th gear and 45 MPH, the engine speed will be **1992** RPM as shown above in bold red text.

As a further illustration, what is the difference in engine RPM between a 2009 FLHT and a 2007 FLHT at 60 MPH in 6th gear? For the 2009 chart, engine speed at 60 MPH is **2314** RPM. For the 2007, RPM in 6th gear at 60 MPH is **2251** which is lower by **63** RPM, or approximately 3% lower for the 2007 set up.

Milwaukee 8 pulley setups will be the same as 6 speed Twin Cam charts above.

These differences may look small on paper but to a rider on a bike, they can feel very significant.

Pulleys: 2017—2018 M8 (all models)



Pulleys–2017—2018 M8
31T, 32T & 34T

Power Pulleys

31 Tooth . . . . 3% More RPM

2017-2018 M8 . . . . Part# 290318

Overdrive Pulleys

34 Tooth . . . . 6.4 % Less RPM

2017-2018 M8 . . . . Part# 290348

Belt pulleys for new Milwaukee 8 bikes: 31 tooth power pulley, 34 tooth overdrive pulley and stock replacement (32 tooth) pulley. Page 24 shows the effect, in RPM, of changing transmission pulleys to different numbers of teeth. The final drive ratios are also shown.

The final drive ratio of engine RPM to rear wheel RPM on any HD bike can be calculated as follows:

Final Drive Ratio = (# clutch teeth / # engine teeth) x (# rear wheel teeth / trans teeth)

For M8 Baggers: FDR=46/34 x 68/32 = 2.87

For M8 Soft Tails: FDR = 46/34 x 66/32 = 2.79

Stock Pulleys

32 Tooth . . . .

Stock Replacement

2017-2018 M8 . . . . Part# 290328

Pulleys–'85–2006
(5-speed trans)

Pulleys–All
6-speeds (30T, 31T, 32T, & 34T)

Pulleys are available for most Twin Cam and EV80 transmissions. Pulleys are made with 29, 30, 31, 32, 33 & 34 teeth for 5 speeds and 30, 31, 32 or 34 teeth for stock H/D 6 speed transmissions.

All 2007–16 Twin cams and '06 Dynas MUST use '07 type pulleys. Pulleys made for earlier 5 speed transmissions will not fit H/D 6 speed transmissions!

Pulleys: 2007–2017 Twin Cams

Final Drive Ratio ('07 - '08) All models . . . . . . 2.97 (AP 30T)
Final Drive Ratio ('07 - '17) Soft Tail & Dyna . . 2.79 (stock 32T)
Final Drive Ratio ('07 - '08) Baggers . . . . . 2.79 (stock 32T)
Final Drive Ratio ('09 - '16) Baggers . . . . . . 2.87 (stock 32T)
Final Drive Ratio ('09 - '16) Baggers . . . . 2.97 (AP 31T)

Speedometer calibration modules - Available from Dakota Digital for correcting speedometer readings for pulleys with different numbers of teeth than stock. Part # is SIM-1A.

Other years as listed below

Power Pulleys

30 Tooth . . . . 6.4% More RPM

(200 RPM increase @ 60 MPH, high gear)
All '07–up & '06 Dyna . . . Part# 290306
'94–'06 except '06 Dyna . . Part# 290304
'85–'93 . . . . Part# 290300

29 Tooth . . . . 9% More RPM

'94–'06 except '06 Dyna . . Part# 290294
'85–'93 . . . . Part# 290290

Power Pulleys

31 Tooth . . . . 3% More RPM

'07–UP & '06 Dyna . . . . Part# 290316
'94 –'06 except '06 Dyna. . Part# 290314
'85–'93 . . . . Part# 290310

Also Available

32 Tooth . . . . . Stock Replacement

'07–'16 & '06 Dyna . . . . Part# 290326
'94–'06 except '06 Dyna . . Part# 290324
'85–'93 . . . . Part# 290320

Overdrive Pulleys

NOTE: 34 Teeth; NOT for '07–16 baggers!

34 Tooth . . . . 6.4% Less RPM

(187 RPM drop @ 60 MPH, high gear)
'06 Dyna . . . . Part# 290346
'94–'06 . . . . Part# 290344
'85–'93 . . . . Part# 290340

33 Tooth . . . . 3% Less RPM

'94–'06 except '06 Dyna Part# 290334
'85–'93 . . . . Part# 290330

Belt Drive Sprockets–Installation Notes

For pulleys with more teeth than stock (33T-34T), rear axle must be adjusted forward. Pulleys with less teeth than stock (30T, 31T or 29T) require the rear axle to be adjusted towards the rear of the bike.
Rear axle position adjustment for each tooth change on transmission sprocket = + /–.125 inches (3.2mm)
Rear axle position adjustment for each tooth change in belt length = + /–.280 inches (7.1 mm)
If there is not enough axle adjustment for the new pulley, use a belt with more (or less) teeth than stock.

Big Twin 4-speed transmissions have been built since 1936 in several versions. They were included on bikes with Knuckle engines, Pans, Shovels, and some '84 and '85 Evolution 80s. They all used this transmission. With Andrews 4-speed gears, transmissions last longer, shift faster, and just plain run better. Bikes with Andrews gears feel so good that it's hard to believe until you experience the difference for yourself.

A 2.44 1st Gear Set (1959 thru 1984)
Part# 201105 Best choice for Superglides, choppers, and lighter bikes with stock or smaller motor or trans sprockets. This is a 'no clunk' 48 MPH, 1st gear. Installation in '80–'84 FX requires a 21 tooth 2nd gear. (17T & 20T on cluster; 24T on counter gear).

2.60 1st Gear Set ('59 thru '84) (24T & 16T) (Not shown)
Part# 201145 This ratio works best with "E" glides and heavier bikes with motor or trans sprockets having more teeth than stock sprockets. Installation in '80–'84 FX requires 21T (1.82 ratio) 2nd gear for this 1st gear. (16T & 20T on cluster; 24T on counter gear.)

3.00 1st Gear Set (Original stock ratio) (Not shown)
Part# 201090 ('59 thru '84) (15T & 20T cluster; 26T counter gear)
Part# 201094 ('36 thru '58) (15T & 20T cluster; 26T counter gear)
Part# 206215 ('36 thru '58) (24T short 3rd main gear-required for installation of original style 1st gear).

Combination 2.24 1st–1.65 2nd Gear Set (Not shown)
Part# 201020 If you want peak RPM thru the quarter mile, this gear set will provide the super close ratio shifting to handle it. OK for street or drags with any size motor.

B Shift Forks
Part# 209750 (1-2 fork) (replaces H/D# 34159-36)
Part# 209760 (3-4 fork) (replaces H/D# 34158-36)
One piece cold-forged forks. Fully heat treated and black oxide coated, a must for all transmission rebuilds.

C Shift Clutches
Part# 205120 (1-2 clutch) (replaces H/D# 35665-36)
Part# 205340 (3-4 clutch) (replaces H/D# 35440-38)
Replacement clutches are specially heat treated and shot peened for super durability. 3-4 clutches are face milled and have longer lead in ramps for more positive shifts.

D Stock 2nd Gear (1.82 Ratio) (21T)
Part# 202160 (replaces H/D# 35751-36) Stock 2nd gear with drive slots include lead-in ramps for more positive 1-2 shifts. This 21-tooth gear fits 1941–1979. It will also fit later transmissions but requires one of the first gear sets shown in paragraph **A**.

E & F Close Ratio 3rd Set (1.35 Ratio) (18T & 23T)
Part# 203365 (early) For transmissions built before mid '76, to serial# U-8958 (or lower) with loose needle bearings.
Part# 203375 (late) For transmissions built after mid 1976, from serial# U-8959 (or higher) with caged needle bearings.
New design drive slots include lead-in ramps for quicker, more positive shifting (same as stock 3rd and 4th gears).

Stock 3rd (1.23 Ratio) (17T & 24T) (Not shown)
Part# 206220 (replaces H/D# 35306-59) (Mainshaft 3rd)
Part# 206215 (replaces H/D# 35306-36) (Mainshaft 3rd)
(This gear requires 1936-58 style cluster gear)
Part# 206330 (replaces H/D# 35700-36) (Cluster: '36–'76)
Part# 206335 (replaces H/D# 35700-76) (Cluster: '76–'86)
Replacements for stock main and countershaft 3rd. The design of drive slots on mainshaft gear has been upgraded to include lead-in ramps for quicker, more positive shifting.

G Stock Main Drive Gear (4th)
Part# 204260 (1936–1976) (26 Teeth)
(replaces H/D# 35065-65)
Part# 204280 (1977–1986) (26 Teeth)
(replaces H/D# 35067-77 and 35067-84)
Replacement 4th gears are made with wider drive slots and steeper lead-in ramps for more positive 3-4 shifting. The "O" ring groove is a design update for all chain drive 4th gears from 1977 thru 1986.

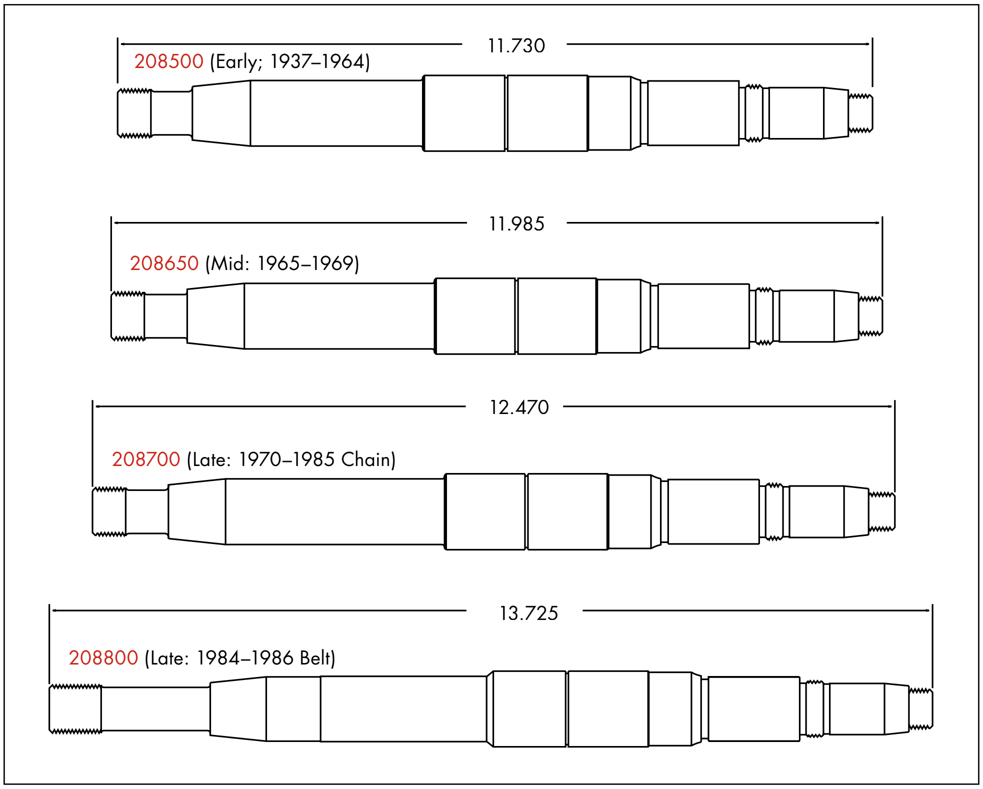
H Transmission Mainshafts
Part# 208500 (early) H/D# 35040-50, 1937–1964
Part# 208650 (mid) H/D# 35039-65, 1965–1969
Part# 208700 (late) H/D# 35039-70A, 1970–1985 chain
Part# 208800 (late) H/D# 35039-85, belt drive, Late 1984–'86
Replacement mainshafts for all versions of Big Twin boxes. Made from aircraft alloy steel. Heat treated and finish ground to ensure maximum durability.

I Transmission Countershafts
Part# 207650 (1941–early 1976) (replaces H/D 35614-65)
Part# 207770 (late 1976–1979) (replaces H/D 35614-77)
Part# 207800 (1980–1985) (replaces H/D 35614-80)
Three types of countershafts fit transmissions thru 1985. They are not interchangeable, so make sure before you order.

J Transmission Rebuilding Kits (Small Parts)
Bushings, gaskets, locks, keys, and ferrules for completing a 4-speed transmission rebuild. These parts are made by JIMS.
Kit# 210925 (1936–1976)
Kit# 210950 (1977–1979)
Kit# 210975 (1980–1984)

Transmission Gear Kits (Not shown)
Gear kits must be ordered by part numbers listed below which specify year and 1st and 3rd ratios. Each gear kit includes six gears, two shift clutches, and two forks as shown on previous page. (Shafts and small parts kits must be ordered separately.)
Kit# 210150 (2.44 1st, 1.35 3rd) (1936–1976)
Kit# 210250 (2.44 1st, 1.23 3rd) (1936–1976)
Kit# 210350 (2.60 1st, 1.35 3rd) (1936–1976)
Kit# 210450 (2.60 1st, 1.23 3rd) (1936–1976)
Kit# 210550 (2.44 1st, 1.35 3rd) (1977–1984)
Kit# 210650 (2.44 1st, 1.23 3rd) (1977–1984)
Kit# 210750 (2.60 1st, 1.35 3rd) (1977–1984)
Kit# 210850 (2.60 1st, 1.23 3rd) (1977–1984)

4-Speed Transmission Mainshaft Lengths



Andrews Products makes four different versions of 4-speed Big Twin transmission mainshafts.

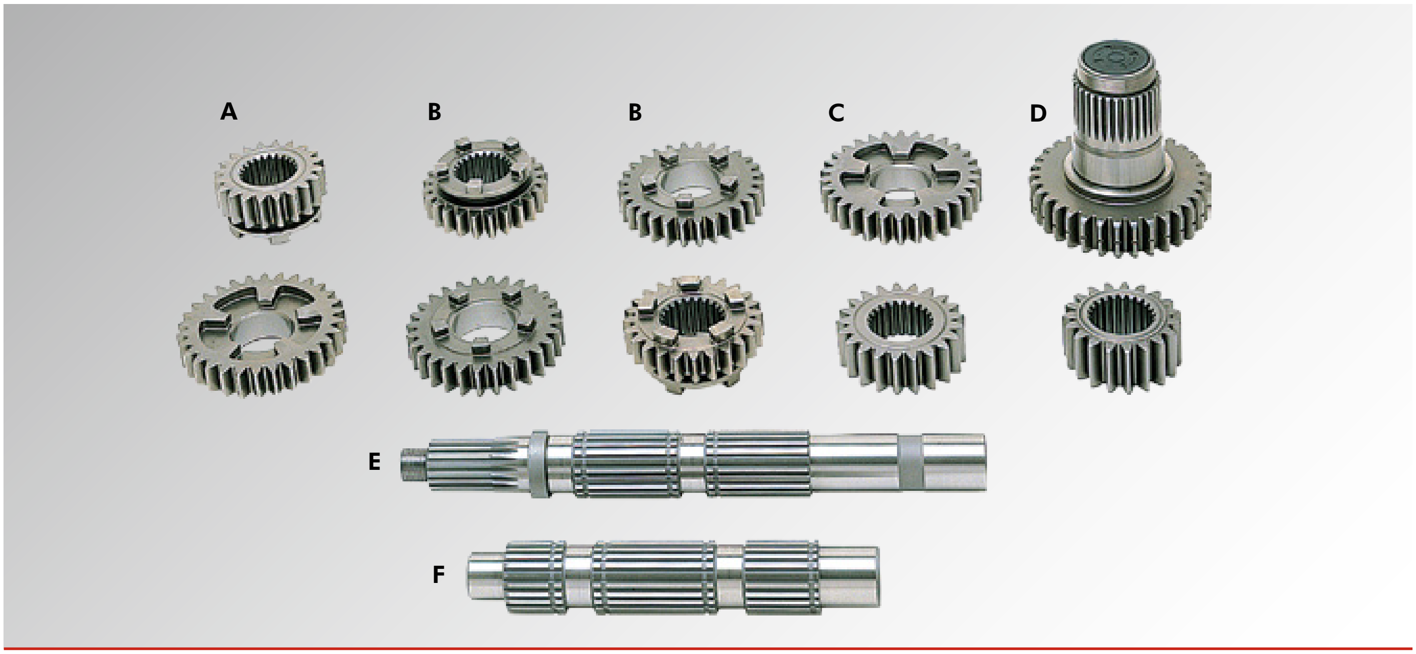
For everyone who calls us about transmission shaft lengths and asks us to look up correct blueprint length dimensions, here they are!

Regarding one additional mainshaft: H/D part number 35039-84 fits belt drives. This is the same part as H/D 35039-85 except that 35039-85 uses a different drive key. It is very important that the correct drive key be used.

The H/D part number for the drive key is 37523-85. Andrews Products part number for the belt drive transmission shaft is 208800.

Sportster Gears EV 5-Speed

1991–2003 For Complete Sets



All 5-speed Sportster gears are made from high nickel alloy steel. Gears are then heat treated and shot peened to give maximum durability and strength. Also, where applicable, drive dogs have milled lead-in ramps to improve shifting and reduce wear on drive dogs and slots.

A 2.61 Close Ratio 1st Gear Set
(2 pieces) 2.61 1st gears provide true close ratio shifting into 2nd gear plus 7 MPH of useable 1st gear.
(20T & 30T) . . . . Part# 299110

B Stock 2nd and 3rd Gears
(2nd main and 3rd counter) (H/D #35771-89) (24T) . . Part# 299102
(3rd main and 2nd counter) (H/D #35772-89) (28T) . . Part# 299103

C Stock 4th Gears
(4th main gear) (H/D #35773-89) (30T) . . . . . . Part# 299104
(4th counter gear) (H/D #35775-89) (21T) . . . . . Part# 299144

D Stock Main Drive Gears
(Main drive) (H/D #35034-89) (33T) . . . . Part# 299105
(Counter drive gear) (H/D #35633-89) (19T) . . . . Part# 299155

E Transmission Mainshaft
(Mainshaft) (H/D #35640-89) . . . . Part# 299180

F Transmission Countershaft
(Countershaft) (H/D #35641-89) . . . . Part# 299170

EV Sportster 5-Speed Gear Sets (Not shown)
(1991–2003) (Later years have differences) . . . . Part# 299900
2004 and later Sportsters cannot use many of the earlier years gears. 5-speed EV Sportster transmission gear sets are available as complete kits. Each kit includes the parts as shown: 1st, 2nd, 3rd, 4th, 5th gears, mainshaft, and countershaft.

Internal Transmission Ratios

Gear	Close First	% Change	Stock First	% Change
1st	2.368	22%	2.7796	27%
2nd	20026	27%	2.026	27%
3rd	1.489	18%	1.489	18%
4th	1.216	18%	1.216	18%
5th	1.000		1.000	

Special Ratio Sportster 5-Speed Racing Gears

S Ratio Gears (1st and 2nd)
(2 gears) 2.368 1st gears. (22T & 30T) . . . . Part# 299816
(2 gears) 1.876 2nd gears. (25T & 27T) . . . . Part# 299724

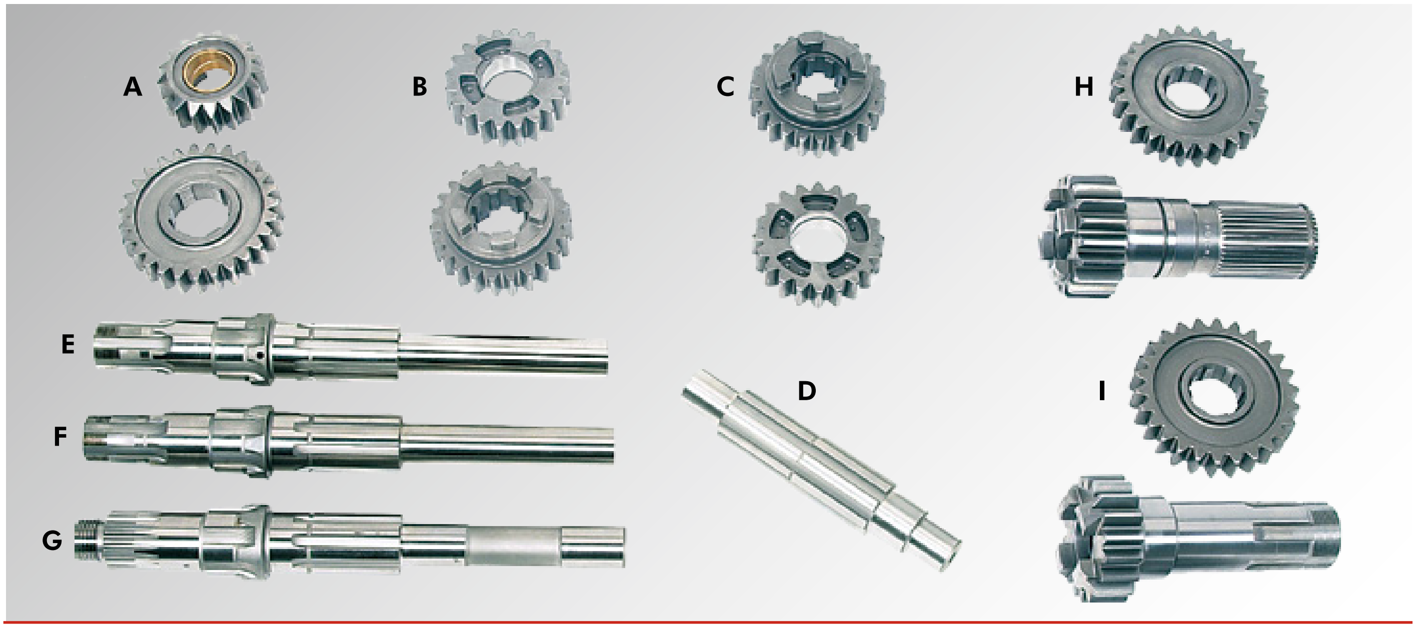
Y Ratio Gears (1st, 2nd, 3rd, 4th)
(2 gears) 2.026 1st gears. (24T & 28T) . . . . Part# 299717
(2 gears) 1.670 2nd gears. (25T & 26T) . . . . Part# 299727
(2 gears) 1.364 3rd gears. (22T & 28T) . . . . Part# 299737
(2 gears) 1.158 4th gears. (20T & 30T) . . . . Part# 299747

Internal Transmission Ratios

Gear	S Ratio	% Change	Y Ratio	% Change
1st	2.368	21%	2.026	17%
2nd	1.876	21%	1.670	18%
3rd	1.489	18%	1.364	15%
4th	1.216	18%	1.158	14%
5th	1.000		1.000	

Ratio "S" includes 1st and 2nd gears (4 piece set).
Ratio "Y" includes 1st, 2nd, 3rd and 4th (8 piece set).

Sportster Gears
4 Speed



Transmission gears listed on this page will fit Sportster 4-speed transmissions made from 1956 thru 1990. All Andrews 4-speed Sportster gears are made from high nickel alloy steel which is heat treated and shot peened for maximum durability. Shot peening greatly improves the wear resistance of drive edges and slots. All Sportster gearboxes run better with Andrews gears.

A Stock 1st Gears
Main 1st (27T) (replaces 35277-52A). . . . . Part# 251050
Counter 1st (17T) (replaces 35760-73 late only, 1973–1985). To fit 1986 and later requires early countershaft #259010 . . . Part# 251060

Wide Ratio 1st Gear Sets (Not shown)
Changes 1st from 2.52 ratio to 2.68 for more low end torque with 21T or 22T trans sprockets.
(Late only, 1973–1985). To fit 1986 and later requires early countershaft #259010 . . . . Part# 251010

B Stock 2nd Gears
2nd main (23T) (replaces 35296-56 & 56A). . . . . . Part# 252020
2nd counter (20T) (replaces 35750-58 & 58A) . . . Part# 252040

C Stock 3rd Gears
3rd main (20T) (replaces 35305-56 & 56A) . . . . . Part# 253050
3rd counter (23T) (replaces 35709-54A & 54B) . . . Part# 253030

Transmission Shafts (Not shown)
Replacement transmission shafts for standard H/D part numbers. Our shafts are made of super alloy material for maximum strength and durability on this most critical part.

D Countershaft (1956–'84) . . . . Part# 259010
(replaces H/D# 35613-58)

E Early Mainshaft (1956–'69 kick start) . . . . Part# 258080
(Replaces 35044-56) (Drilled thru for clutch rod)

F Late Mainshaft (1971–'84) . . . . Part# 258120
(Replaces 35046-71) (Solid shaft; no thru hole)

G Mainshaft (alternator) (Mid '84–'90) . . . . Part# 258190
(Replaces 35036-84A) (Solid shaft; no thru hole)

H Evolution / Alternator "C" Ratio Gear Set
(Mid 1984–1990) (26T & 18T) . . . . Part# 254850
(26T Countershaft drive gear: all years) . . . . Part# 255620

The following gears fit all '84–'90 alternator engines. All 1987–1990 4-speed Sportsters have "C" ratio main drive gears as stock parts.

I "C" Ratio Main Drive Gear Sets
(1971–'78) (26T & 18T) . . . . Part# 254720
(1979–'84) (26T & 18T). . . . . Part# 254740
(26T Countershaft drive gear: all years) . . . . Part# 255620

Stock Ratio Main Drive Gears (17T & 27T) (Not shown)
Clutch gear ('71–'78) (17T) (replaces 37448-71) . . . Part# 254710
Clutch gear (1979–'84) (replaces 37448-79). . . . . Part# 254730
(27T Countershaft gear) (replaces 35695-58) . . . . Part# 255580

Complete Gear Sets (Includes the following parts)
("W" 1st, stock 4th) (1973–'78) . . . . Part# 250100
("W" 1st, "C" 4th) (1973–'78). . . . . Part# 250200
(Stock 1st and 4th) (1973–'78) . . . . Part# 250300
(Stock 1st, "C" 4th) (1973–'78) . . . . Part# 250400

The Andrews Products Price Sheet shows a complete listing of all combinations of gear kits with available ratios for generator engines (1979–'84) and alternator engines (1984–'90).

Sportster gear ratios are listed below for comparison.

Stock Ratios		"W" Ratios[1]	"W" Ratios[2]	"C" Ratios
1st	2.52	2.68	2.44	2.29
2nd	1.83	1.83	1.66	1.66
3rd	1.38	1.38	1.26	1.26
4th	1.00	1.00	1.00	1.00

(1) "W" Ratio 1st plus stock main drive (27/17 teeth)
(2) "W" Ratio 1st plus "C" Ratio main drive (26/18 teeth)

ANDREWS

Questions and Horsepower Charts

Frequently Asked Questions

Why should I buy Andrews Products parts for my bike? Why is Andrews different than the competition?
We simply have the best products. We've been in the cam and gear business for over 45 years. Our 45,000 square foot plant located in Mt. Prospect, Illinois, has the most sophisticated manufacturing equipment in the industry. We make everything we sell, we are not in the business of distributing parts for others. Top NASCAR teams use Andrews Products transmissions and gears for their race cars. All Andrews parts are manufactured in the United States. We do not sell any parts from foreign countries.

Do you have a written warranty for your products?
Our written warranty is shown on the next page of this catalog.

Do you exhibit at industry trade shows?
Yes, we participate at shows in Indianapolis, Cincinnati, and some regional dealer shows.

Does Andrews offer custom manufacturing services?
We will quote and make special camshafts to customer specifications. We do not make custom gears unless the quantity justifies a production run of the parts.

Cam Related Questions

What are conversion cams for Twin Cam engines?
Conversion cams allow engines made from '99 through 2006 to be fitted with late style 2007 roller chain cam drives.

What are the benefits of using Andrews conversion cams?
All '99–'06 Twin cam engines (except '06 Dynaglides) use silent chains to drive the camshafts. To keep proper chain tension, spring powered shoes are used. But the heavy spring loads mean that chain tensioner shoes can wear and cause noise and potential engine damage if they fail. By changing to 2007 roller style chains, long term engine reliability is improved. and the recommended 2007 style oil pump has a much higher oil flow rate for better engine cooling, a big added benefit.

How are conversion cam parts supplied?
Conversion parts as listed in this catalog, must be purchased from an H/D dealer. (Andrews camshafts for conversion kits must be purchased separately).

Can I use the stock '07 cams and chains on earlier engines?
No, the inboard bearings on 2007-style camshafts will not fit early engines; cam bearing size is different for 1999–'06 cams.

I don't want to change from stock cams. What can I do to eliminate the old-style chain drives and spring powered chain tensioners and still use conversion cams?
The best way to do this is to install a conversion chain drive and a 21N cam which has similar performance to stock '99–'06 cams but slightly more power. No retuning should be required.

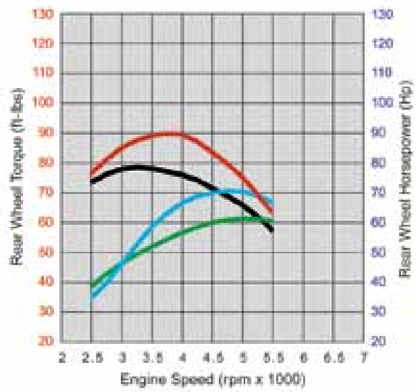
I plan on installing new cams in my Twin Cam motor. What can be done to simplify the installation?
Stock pushrods can be cut and removed easily without taking off the gas tanks and rocker covers. Andrews EZ-Install pushrods can then be installed after new camshafts are in place.

Can I install gear drives in my stock Twin Cam engine?
Yes, but gear drive cams require two new camshafts and set of four drive gears. Gear drives cannot be used with stock cams.

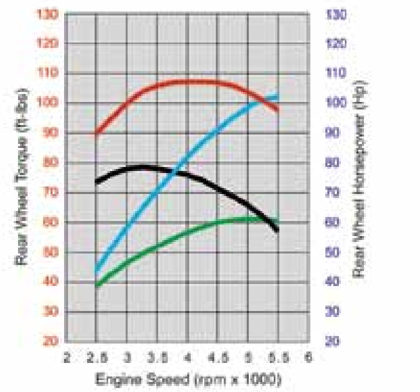
Can Andrews make custom-fitted tooth sizes for Sportster cam gears?
No, we cannot supply Sportster cam gear teeth to a specified size. But if your new Sportster cam gears are too tight in the engine, we can hone the cam gear teeth to fit correctly.

Can Andrews make custom cams to my specifications?
Yes, we can design and make custom cams with any lift, duration, and timing for all current and most older H/D engines. Call for pricing and delivery on all custom cams.

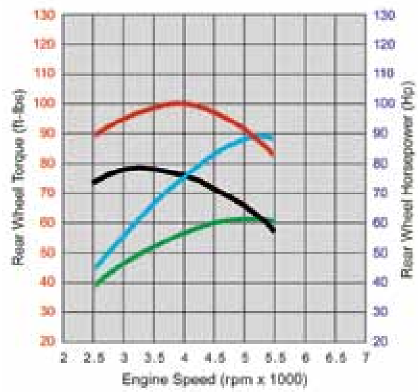
Horsepower and Torque Comparisons



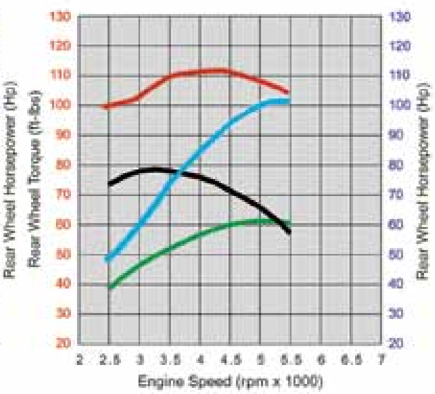
#21 cam: 88 inches chain drive; stock heads



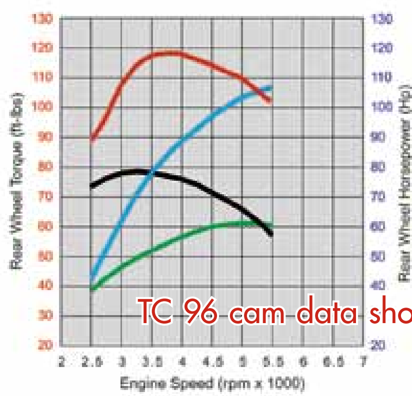
26G cams: 95 inches; 10:1 CR; modified heads



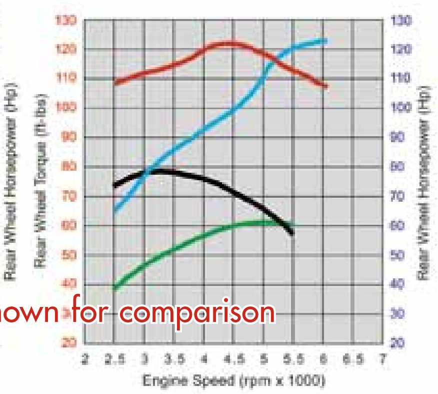
37 cams: 95 inches; 9:8 CR; Pro street heads



32 H cams: 110 inches CVO; slip-on mufflers



#54 H cam: 2007 FL; head work; Free flow exhaust



#67 cam: 107 inches; 10:4 CR; Pro street heads

TC 96 cam data shown for comparison

Torque and horsepower curves are for various combinations of cam grinds, engine sizes and tuning levels. Different engine sizes (cubic inches), compression ratios and cylinder head efficiency may show widely different HP and torque results on the dynamometer. The guide below shows what each curve means.

- Andrews cam: torque
- Andrews cam: horsepower
- Stock TC 96 cam: torque
- Stock TC 96 cam: horsepower

Keep in mind that dynamometers will show different results for a similar engine setup. When choosing modifications for your engine, the most important part of the plan is to pick the right cams and head work for the application you want. The best cams for bolt-in street use will be milder grinds that do not require head work.

If you want a great running street bike stay away from 10.5 compression ratios and dragster grinds. Simple ideas and changes work best!

Sales and Warranty Policies

Sales Policies

Payment Terms
Visa and Mastercard payments for orders are accepted. All non credit card orders will be sent COD, payable by certified check or money order unless Andrews Products has approved company check payments in advance.

Ordering Cams Not Listed In This Catalog
Cam grinds which are not currently listed in the catalog are available as special orders. Custom ground or special order cams are priced and quoted on an individual basis. Call for information.

Foreign Shipments
All foreign orders must be prepaid in U.S. dollars including freight and forwarding charges. Andrews Products, Inc., will provide bank wire transfer information for foreign orders upon request.

Shipping Carrier
All shipments will be sent United Parcel Service (UPS) ground service unless other arrangements have been agreed upon in advance. All shipping expense will be charged to customer.

Claims of Shortages
Claims of shipment shortages should be made to Andrews Products, Inc., as soon as possible. Damaged shipment claims must be made directly to the shipping carrier.

Returned Goods
Any parts returned for credit, exchange, or inspection should not be sent without calling for a Return Merchandise Authorization number (RMA). A 20% charge will be deducted from the original invoice price on all items accepted for return. Custom or obsolete parts will not be accepted for return credit or adjustment unless there is a warranty question. Andrews Products reserves the right to make changes to prices or sales policies at any time without notice.

Shipping Charges for Returned Goods
Shipments must be sent freight prepaid. Any shipments sent freight collect will be refused. Goods must be packed to prevent damage in transit. Goods damaged because of improper packing will not be accepted for credit.

Limited Warranty Policy

Andrews Products, Inc. warrants that its products as shown in this catalog are free from defects in material and workmanship for 90 days from the purchase date. The warranty extends to original retail purchasers only and is not transferable.

Because of the great variety of possible modifications and changes made to motorcycles and/or engines which may affect the performance or durability of other related components, Andrews Products, Inc., obligation under this warranty extends only to the repair or replacement of parts specifically manufactured or sold by Andrews Products, Inc.

Not covered by warranty are parts which show evidence of misapplication, abuse, improper maintenance, any alterations from their original configuration, or failure to follow installation instructions.

In addition, Andrews Products, Inc., reserves the right to change products, specifications, or prices at any time without obligation to modify previously manufactured parts.

No person, company, or other organization is authorized to assume for Andrews Products, Inc. any warranty responsibility or make any binding judgements regarding warranties of any parts which may become the subject of a warranty claim.

On specific parts which are returned showing damage due to normal wear, Andrews Products, Inc., may offer new replacement parts charged to the customer at a reduced cost.

Parts which have been replaced for any reason become the property of Andrews Products, Inc., and will not be returned under any circumstances.