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### Installation Instructions: Gear Drive Cams 2007- 2008 Twin Cam and '06 Dyna Engines

- A. This documentation applies to all '07-'08 twin cam engines and 2006 DynaGlides. Gear drive cams for '99-'06 engines are different. Cam lifts and durations for gear drive cams are shown on page 3 of this document.
  - B. Andrews Products "HG" series cams and S&S gear drives use plain journal bearings on the front and 1.000 inch drawn cup needle bearings for the rear cam journals. Cams and gears for the newer '06 Dynas and '07-'08 twin cam engines are NOT interchangeable with gear drive cams for '99-'06 engines using ball bearings.
  - C. Please refer to the H/D factory service manual for '06 Dynas and all '07-'08 regarding camshaft removal and replacement.
  - D. S&S camshaft drive gears must be installed with all gear drive cams. Andrews Products part number for gear drives (all 4 gears) is 216908. For a complete description of parts kits, please see bottom of page 2. In addition, an installation parts kit (Andrews Products part#216901) must be used.
  - E. It is extremely important that instructions 12 and 15 be carefully followed. **Gear backlash must be correct!**
4. Before proceeding further, put the transmission in 4th or 5th gear. With spark plugs removed (no resistance from compression pressure), position the engine (by turning rear wheel) so camshaft timing marks are aligned. This will simplify installation of new cams.
  5. Remove the retaining bolts securing the crankshaft sprocket and the rear camshaft sprocket. The best way to do this is with H/D tool (part# H/D-47941), crankshaft/camshaft sprocket locking tool. Also remove the retaining ring holding the front cam in place. The retaining ring and washer will be used for the new front cam.
  6. Remove the cam support plate. All four oil pump retaining bolts must be loosened to permit correct oil pump rotor alignment when the cam support plate with the new camshafts is reinstalled.
  7. Both stock hydraulic chain adjuster assemblies can now be removed. Be careful not to lose the pistons and internal springs which are part of the original chain tensioning and oiling system.
  8. Oil port covers can be installed over both original chain oil ports since the gear drives do not use chain lubricators.

#### General Instructions:

1. All Andrews Products 21HG, 26HG, 31HG, 37HG and 50HG Twin 88 cams are made with stock size lobe base circles so stock pushrods will be the correct length. If you are going to use the original pushrods, removing the fuel tank(s) and rocker boxes will be necessary. Mark the pushrods so they can be replaced in their original locations. (Not all stock pushrods are the same length). 54HG, 55HG, 60HG and other high lift cams will require adjustable pushrods.
2. If you want to save installation time and not remove fuel tanks and rocker boxes, stock pushrods can be cut with bolt cutters and removed in two pieces. New Andrews Products EZ-install pushrods (either aluminum or chrome moly steel) can then be used. Part numbers for EZ-install pushrods are: 292188 for aluminum or 292088 for steel.
3. Remove the 10 bolts holding outer cam cover. When this cover is reinstalled later, there is a specific tightening sequence and torque setting for these 10 bolts as shown in a factory service manual.
9. Drive gears can now be installed on both front and rear camshafts. Cam gears can be pressed onto each camshaft *with drive keys in place*. Note that there is a front gear for the front cam and a rear gear for the rear cam. **Also note that the gears are pressed onto the camshafts with the cam gear shoulders facing the cam support plate!**
10. Cams with .550 or higher lift may require cutting material from the top of the case bearing boss to clear lobe tips.
11. After drive gears and bearings have been assembled, both camshafts can be installed into the cam support plate. Cam lobe surfaces should be coated with engine oil or assembly lube. **At this point, timing marks on both cam drive gears must be correctly aligned!**

## Checking cam gear backlash

12. Once the new cams and gears are installed, backlash for inner cam drive gears (31teeth) must be checked. Using a wooden rod, press down on the front cam through the exhaust lifter bore and hold the front cam from rotating. Gear backlash can be checked by turning the rear cam back and forth with your fingers. Some backlash must be present. Recommended operating backlash for cold gears is .0005 to .001. Cams should roll freely with **NO** binding. Cams with 0.000 backlash (too tight) may whine when running. Backlash greater than .002 is too much and can sound like noisy lifters at lower RPM. Either of these conditions must be corrected before continuing. Undersize and oversize rear cam gears are available:  
Undersize rear cam gear part# ..... 33-4287  
Oversize rear cam gear part# ..... 33-4288
13. With the cam support plate assembly now in the engine and correct backlash verified, the rear cam drive gear (62T) and the crankshaft drive gear (31T) can be installed, correctly timed and secured with the retaining cap screws. **Note that unlike chain drive cam installations, there is no thrust washer installed behind the rear 62T camshaft drive gear.**
14. When reinstalling drive gear retaining bolts, use Loctite retaining compound to secure the bolt threads. Bolt torque should not exceed 25 ft-lbs for 5/16 x 18 and for rear camshafts (3/8 x 24 bolt) should not exceed 35 ft-lbs. Please note that these bolts *must be rated grade 8*. (All grade 8 bolts have a 6 pointed star symbol on the top of the bolt heads).

### Checking pinion gear backlash (see page 4)

15. At this point, it is extremely important that the crankshaft gear (31 teeth) and the rear cam drive gear (62 teeth) be checked for proper backlash. **Before installing pushrods, rock the rear cam gear forward and backward with your fingers.** Backlash can be felt as "freeplay" between the two gears. Gear backlash must be checked at four **different** crankshaft positions by rotating the crankshaft 90 degrees and checking the backlash at each position. **A minimum of .0005 to .001 backlash must be present at EACH POSITION.** The gear mesh cannot be so tight that there is no backlash present.
- If checking cam gear backlash as described above shows no backlash, a smaller 31 tooth crankshaft gear MUST be used! This is a very important step; Do not skip it!***  
***Cam gears operating with no backlash can cause gear tooth failure and / or engine damage.***

Undersize pinion gear (to increase backlash):  
Andrews Part # ..... 33-4160X-S

Oversize pinion gear (to reduce backlash):  
Andrews Part # ..... 33-4160Z-S
16. If backlash is too tight after installing a small gear, pinion shaft runout **must be checked**. See photo, page 4. If the runout exceeds .004, TIR, (Total Indicator Readout) the decision is whether to repair the cause of the runout or not use gear drives.
  17. Since the rear cam drive gear is larger than the original chain sprocket, the outer cover must be checked for gear clearance. If there is **any** interference, the inner surface of the cover must be relieved to provide .030" clearance.
  18. Reinstall the outer cam cover with the 10 cover bolts. Cover bolts *must be tightened* to a torque specification of 90-120 in-lbs. The H/D service manual shows the correct tightening sequence.
  19. End play on both camshafts **after** installation in support plate must be **minimum: .010 - .020**.
  20. EZ-install pushrods are made with 2 long ( exhaust), and 2 short (intake) rods. To install, adjust pushrod to shortest length, then position in engine, rocker arm end first. Swing the lower end into lifter. Lengthen pushrod adjuster until free play is gone. Adjust pushrod 3.5-4 full turns longer (21-24 flats) and tighten locknut. Wait until hydraulic unit bleeds down and repeat procedure on next pushrod. When adjusting pushrods, make sure that cam lobe for that pushrod is on low lift point. Lifter housing covers can be temporarily removed to gain another 1/4 inch of clearance. Shorter pushrod cover tubes are available from H/D. They will make the pushrod installation and adjustment much easier. Part numbers are: 17938-83 and 17634-99. You will need 4 of each part number to install a complete set.
  21. For engines with stock pistons and stock heads, 21HG, 26HG, 37HG and 31HG cams will bolt in without head work. 50HG and 54HG cams need piston to valve clearances and valve to valve clearances checked. 54HG and 55HG and 60HG cams need .620 minimum valve travel and .060 minimum piston to valve clearance. With Andrews Products high lift spring collars (part# 293115; includes 4 pcs), setting valve spring travel for high lift cams will be easier. For engines with new heads, stroked flywheels and/or high compression pistons, the piston/valve and valve to valve clearance must be checked.
  22. 2006 Dyna engines and all '07/'08 twin 96 engines have "closed loop" type fuel injection systems which use oxygen sensors in both front and rear exhaust pipes. For highly tuned engines, it may be necessary to use a different fuel injection map but most cam changes with bolt in cams should not require much change. The closed loop injection systems should allow bolt in cams to operate satisfactorily without re-tuning the fuel injection.
  23. When tuning engines, always remember that your personal safety is the most important consideration.

## Andrews Products: '07-'08 & '06 Dyna Gear Drive Cam Timing Specifications

Andrews#	Grind	Timing*	CL angle	Duration*	Valve Lift	TDC Lift	Springs	Spring Travel**
-----	Stock	-09/25	110.0	196	.471	.087	Stock	.570
	'07-'08	42/-03	109.0	219	.474	.110	-	-
216312G	12HG	02/34 40/02	106.0 109.0	216 222	.489 .489	.091 .095	Stock -	.570 -
216321G	21HG	10/30 40/08	100.0 106.0	220 228	.498 .498	.134 .121	Stock -	.570 -
216326G	26HG	11/35 41/09	102.0 106.0	226 230	.490 .490	.138 .120	Stock -	.570 -
216331G	31HG	10/46 52/08	108.0 110.0	236 240	.510 .510	.131 .120	Stock -	.570 -
216332G	32HG	10/46 52/08	106.0 112.0	236 240	.570 .570	.131 .120	Hi-Lift -	.630 -
216337G	37HG	18/38 46/14	100.0 106.0	236 240	.510 .510	.174 .148	Stock -	.570 -
216354G	54HG	16/42 43/15	103.0 104.0	238 238	.555 .555	.165 .158	Stock -	.600 -
216350G	50HG	20/48 54/18	104.0 108.0	248 252	.510 .510	.184 .168	Stock -	.570 -
216355G	55HG	22/46 52/20	102.0 106.0	248 252	.550 .550	.197 .181	Hi-Lift -	.620 -
216360G	60HG	24/56 58/22	106.0 106.0	260 260	.560 .560	.205 .192	Hi-Lift -	.610 -
216367G	67HG	24/48 58/22	102.0 108.0	252 260	.570 .570	.209 .187	Hi-Lift -	.630 -

**The following two cam grinds are for highly tuned engines setup for max HP and drags**

216359G	59HG	29/57 63/27	104.0 108.0	266 270	.590 .590	.238 .218	Hi-Lift -	.650 -
216364G	64HG	30/62 66/30	106.0 108.0	272 276	.640 .640	.262 .232	Hi-Lift -	.700 -

\*Timing and durations are listed for .053 cam lift

\*\* Spring travels are listed as minimums

2007 and 2008 engines with new beehive type valve springs have longer valve spring travel than earlier twin cam engines.

Valve travel and piston clearance should always be checked for all engine modifications that include high compression pistons, head work and/or high lift cams.

*(Gear drive cam Installation requires kits shown on page 4 and one pair of camshafts)*

Each of the parts kits listed below can be ordered individually.

Parts Kit 216901

1. 1 outer oil port cover
2. 1 inner oil port cover
3. (2) INA inner bearings
4. Outer cover gasket

Parts Kit 216903

1. 1 crankshaft gear
2. 1 outer cam drive gear
3. 2 grade 8 retaining bolts
4. 1 retaining washer
5. 1 square drive key

Parts Kit 216908

1. 2 inner cam drive gears
2. 1 crankshaft gear
3. 1 outer cam drive gear
5. 2 grade 8 retaining bolts
6. 1 retaining washer
7. 2 # 404 Woodruff drive keys
8. 1 square drive key

**Complete 2007 gear drive cam kit ready for installation.**



Instrument setup for checking engine pinion shaft runout. If runout is greater than .003 TIR, Andrews Products recommends **NOT** installing gear drives without first re-truing flywheels to remove excess runout. Cam support plate **MUST** be installed for this test

