**ANDREWS PRODUCTS, INC.**
**431 Kingston Ct.**
**Mt. Prospect, IL USA 60056**
**847-759-0190 (phone)**
**847-759-0848 (fax)**
**www.andrewsproducts.com**

# Installation Instructions: Gear Drive Cams 1999-2006 Twin Cam (except '06 DynaGlide)

A. This documentation applies to 1999-2006 twin 88 engines ***except for 2006 DynaGlides***. Cams for '06 DynaGlides are different. Cam lifts and durations for gear drive cams are shown on page 3 of this document.

B. Andrews Products "G" series cams which use S&S gear drives have ball bearings on both front and rear cams. Since gear drives generate much lower bearing loads than chain drives, there is no need for roller bearings. Also, gear drive cams with roller bearings will make more noise during engine operation.

C. Please refer to the H/D factory Twin 88 service manual section on camshaft removal and replacement. The procedure for retracting and removing sprocket chain tension devices is especially important.

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 288908. For a complete description of parts kits, please see bottom of page 2. In addition, an installation parts kit (Andrews Products part# 288901) must be used.

E. It is extremely important that instructions 13 and 16 be carefully followed. **Gear backlash must be correct!**

**General Instructions:**

1. All Andrews Products 12G, 21G, 26G, 31G, 37G and 50G Twin 88 cams are designed with stock size lobe base circles so the stock pushrod lengths will be correct. 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). 54G, 55G, 60G and other high lift cams will require adjustable pushrods.

2. If you want to save installation time by not having to remove fuel tanks and rocker boxes, stock pushrods can be cut with bolt cutters and removed in two pieces. Andrews Products EZ-install pushrods can then be installed. Part numbers for EZ-install pushrods are: 292188 for aluminum or 292088 for chrome moly steel.

3. Remove the 10 bolts holding outer cam cover. When this cover is reinstalled, a specific tightening sequence and torque setting for these 10 bolts as shown in a factory service manual must be followed.

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. As noted in factory service manuals, the outer chain tension shoe must now be retracted. This can be done with H/D tool set (part number H/D-42313, cam chain tension arm tool with retention pins).

6. Remove the retaining bolt holding the crankshaft sprocket and the retaining bolt holding the rear camshaft sprocket. There is an H/D tool (part# H/D-42314), crankshaft/camshaft sprocket locking tool that will simplify this task.

7. 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 is reinstalled with the new camshafts.

8. With the cam support plate out of the engine and both old cams removed, the internal and the external cam chain tension arms and springs can removed from the support plate since they are not used with gear drive cams.

9. If the inner needle case bearings have a lot of miles on them, we recommend replacing both camshaft needle bearings with new Torrington B148 needle bearings. This requires removing the original bearings from the right side engine case and using a correct tool for removal and reinstalling new bearings.

10. Drive gears can now be installed on both front and rear camshafts. *Note that there is a front gear for the front cam and a rear gear for the rear cam.* Gears can be assembled by pressing camshafts into drive gears *with drive keys in place*. ***Note also that the gears must be pressed onto the camshafts with timing marks facing the cam lobes!***

11. Cams with .550 or higher lift may require cutting material from the top of the case bearing boss to clear lobe tips.

12. 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 together!***

## Checking cam gear backlash

13. After new cams and gears are installed, backlash for inner cam drive gears (34T) 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. 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 rear cam gears (33-4272RX-S) or oversize rear cam gears (33-4272RZ-S) are available from Andrews.

14. With the cam support plate assembly 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.***

15. When reinstalling drive gear cap screws, 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 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)**

16. At this point, it is very 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. **Minimum of .0005 to .001 backlash must be present at each position**. Gear mesh must show that some backlash is 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***

17. Since the rear cam drive gear is larger than the original chain sprocket, the outer timing cover must be checked for gear clearance. If there is any interference, the inner surface of the cover must be relieved to provide .030" (1/32nd inch) minimum 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. EZ-install pushrods are made with 2 long ( exhaust), and 2 short (intake) rods. To install them, turn adjuster to the shortest length, then position in the engine, rocker arm end first. Swing the lower end into lifter. Lengthen pushrod adjuster to remove all free play. Lengthen adjuster screw 3.5-4 full turns (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 the 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.

20. For engines with stock pistons and stock heads, 12G, 21G, 26G, 31G and 37G cams will bolt in without head work. 50G cams need piston to valve clearances and valve to valve clearances checked. 54G, 55G and 60G cams need .620 minimum valve travel and .060 minimum piston to valve clearance. Andrews Products high lift spring collars (part no. 293115) will make head setups easier for all high lift camshafts.

21. For engines with new heads, stroked flywheels and/or high compression pistons, the piston/valve and valve to valve clearance must be checked.

22. Tuning engines with new cams may require carburetor re-jetting. For stock H/D Keihin CV carbs and 26G or 37G cams, #48 slow jets and #175 main jets are good sizes to start from.

23. Tuning fuel injected engines with big cams usually requires installation of a Power Commander, Race Tuner or similar setup. This will permit different calibration maps to be used for the fuel injection so fuel mixtures can be correctly set over a wide RPM range.

24. When tuning engines, always remember that your personal safety is the most important consideration.

## Andrews Products: 1999-2006 Gear Drive Cam Timing Specifications

| Andrews# | Grind | Timing* | CL angle | Duration* | Valve Lift | TDC Lift | Springs | Spring Travel |
|---|---|---|---|---|---|---|---|---|
| -------- | Stock (A) | -02/38 | 110.0 | 216 | .473 | .072 | Stock | Stock |
| | 99 (carb) | 42/-03 | 109.0 | 219 | .473 | .110 | - | - |
| -------- | Stock (B) | 02/34 | 106.0 | 216 | .473 | .087 | Stock | Stock |
| | 99 (fuel inj) | 42/-03 | 109.0 | 219 | .473 | .110 | - | - |
| 288112G | 12G | 02/34 | 106.0 | 216 | .489 | .091 | Stock | .550 |
| | | 40/02 | 109.0 | 222 | .489 | .095 | - | - |
| 288121G | 21G | 10/30 | 100.0 | 220 | .498 | .134 | Stock | .560 |
| | | 40/08 | 106.0 | 228 | .498 | .121 | - | - |
| 288126G | 26G | 11/35 | 102.0 | 226 | .490 | .138 | Stock | .550 |
| | | 41/09 | 106.0 | 230 | .490 | .120 | - | - |
| 288131G | 31G | 10/46 | 108.0 | 236 | .510 | .131 | Stock | .560 |
| | | 52/08 | 112.0 | 240 | .510 | .120 | - | - |
| 288132G | 32G | 10/46 | 106.0 | 236 | .570 | .131 | Hi-Lift | .630 |
| | | 52/08 | 112.0 | 240 | .570 | .120 | - | - |
| 288137G | 37G | 18/38 | 100.0 | 236 | .510 | .174 | Stock | .560 |
| | | 46/14 | 106.0 | 240 | .510 | .148 | - | - |
| 288154G | 54G | 16/42 | 103.0 | 238 | .555 | .165 | Hi-Lift | .615 |
| | | 43/15 | 104.0 | 238 | .555 | .158 | - | - |
| 288150G | 50G | 20/48 | 104.0 | 248 | .510 | .184 | Stock | .560 |
| | | 54/18 | 108.0 | 252 | .510 | .168 | - | - |
| 288155G | 55G | 22/46 | 102.0 | 248 | .550 | .197 | Hi-Lift | .610 |
| | | 52/20 | 106.0 | 252 | .550 | .181 | - | - |
| 288160G | 60G | 24/56 | 106.0 | 260 | .560 | .205 | Hi-Lift | .620 |
| | | 58/22 | 106.0 | 260 | .560 | .192 | - | - |
| 288167G | 67G | 24/48 | 102.0 | 252 | .570 | .187 | Hi-Lift | .630 |
| | | 58/22 | 108.0 | 252 | .570 | .187 | - | - |
| ***The following two cam grinds are for highly tuned engines setup for max HP and drags*** | | | | | | | | |
| 288159G | 59G | 29/57 | 104.0 | 266 | .590 | .238 | Hi-Lift | .650 |
| | | 63/27 | 108.0 | 270 | .590 | .218 | - | - |
| 288164G | 64G | 30/62 | 106.0 | 272 | .640 | .262 | Hi-lift | .710 |
| | | 66/30 | 108.0 | 276 | .640 | -.232 | - | - |

Timing and durations are listed for .053 cam lift

*(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 288901
1. 2 # B148 Torrington needle bearings
2. 2 # 6004 Nachi ball bearings
3. 1 # 5100-78 snap ring
4. 1 Cam cover gasket

Parts Kit 288908
1. 2 inner cam drive gears
2. 1 crankshaft pinion 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

Parts Kit 288903
1. 1 crankshaft pinion gear
2. 1 outer cam drive gear
3. 2 grade 8 retaining bolts
4. 1 retaining washer
5. 1 square drive key

**Complete '99-2006 gear drive cam kit ready for installation.**

*Cover gasket is not shown but is part of kit 288901.*

**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**