User Guide

Precision Cam Degree Wheel Kit (11”)

555-81621

JEGS
Performance Products

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Read Before Installation

Thank you for purchasing the JEGS Precision Cam Degree Wheel Kit.

Please follow these detailed instructions to properly degree your camshaft.

The instructions include procedures for:

- Degreeing a Camshaft:
  - Cylinder Heads Off
- Degreeing a Camshaft:
  - Cylinder Heads On
- Checking the Piston to Valve Clearance
- Camshaft Terminology

For assistance or questions please contact the JEGS Tech Department at: *1-800-345-4545*

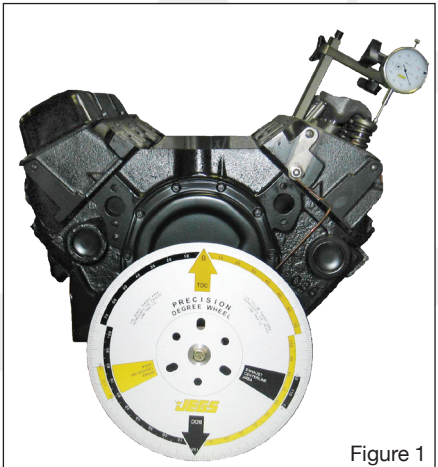

Figure 1

Instructions for Applications with the Cylinder Heads Off

Mounting the Degree Wheel

1. Install the timing set with the ***cam and crank gear aligned*** properly per the manufacturer's specifications.

2. Attach the ***Degree Wheel*** to the crank snout or balancer:
   - **Use *the supplied a*luminum** bushings if necessary to center **th**e degre***e wheel.***

3. ***Firmly a***ttach the pointer from your kit to the engine block.

Finding Top Dead Center (TDC)

1. Rotate ***crankshaft*** until the ***#1 piston*** is in the approximate TDC position.
   - Adjust your ***pointer to the 0º TDC position*** on the degree wheel.

2. Ensure you have a method of ***rotating the crankshaft*** without interfering with the degree wheel:
   - The crank can be rotated from the ***front*** or ***flywheel end***.
   - Greater leverage allows for smoother rotation during timing checks. (Figure 1)

NOTE:

Do not use the starter to turn the engine while degreeing.

3. With the degree wheel set at ***approximate TDC*** and a means of crank rotation established, proceed to install and set the piston stop:

Instructions continued on next page. →

Instructions for Applications with the Cylinder Heads Off

- Turn the crankshaft to lower the piston in the cylinder enough to move the degree wheel ***15–20 degrees***.

- Install the ***piston stop*** so that it contacts the piston (Figure 2).

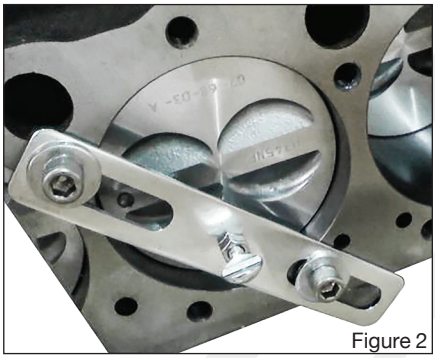

Figure 2

- Rotate the engine in the same direction until the piston ***returns up and contacts the stop***.
  - ***Note the degree reading*** on the degree wheel.

- Rotate the engine in the ***opposite direction*** until the piston again ***contacts the stop***.
  - ***Note* this second-degree reading.**

- ***Add the two-degree numbers*** together and divide by 2:
  - ***Example*:**
    - Stop point 1 = ***16°***
    - Stop point 2 = ***20°***
    - Total = ***36°***, divided by 2 = ***18°***
  - Therefore, ***18° from either stop point*** is true ***Top Dead Center.***

4. Set **true TDC:**
   - Use one of the following:
     - Move the ***pointer*** to align with the ***18° mark*** on the degree wheel

     - Carefully loosen the ***degree wheel*** (without moving the crankshaft) and rotate it to align the ***18° mark*** with the pointer.

   - Rotate the engine in the opposite direction until the piston again ***touches the stop***.
     - The pointer should now align with the ***18° mark*** on the opposite side of the TDC mark.

     - If this is correct, you have found ***True TDC***.

5. ***Repeat the process*** to ensure accuracy:
   - If the degrees are not equal on both sides of TDC, ***repeat the procedure*** until consistent.

   - Once confirmed, ***remove the piston stop***.

Instructions for Applications with the Cylinder Heads Off

Mounting the Dial Indicator

1. Prepare the ***Dial Indicator Mount***:
   - Mount the ***dial indicator*** into a ***head bolt hole***.
   - ***Remove any obstructions*** that might hinder mounting.
   - Thoroughly ***clean any oil, grease, or lubricant*** off the cam lobe being measured.
     - Even small amounts of debris can significantly alter dial indicator readings.

CAUTION:

The dial indicator must be mounted securely. Any looseness will introduce major errors in measurement.

2. Use the ***Dial Indicator Extension***:
   - Use the ***5" dial indicator extension*** provided.
   - Mount the dial indicator so that the ***tip of the extension seats firmly in the lifter***.
   - Align the ***plunger as closely as possible with the lifter's axis***:
     - Avoid significant angles between the plunger and the lifter retainer.
     - Misalignment can introduce ***geometric errors*** into the lift readings. (See Figure 3)

3. Set Zero on the Base Circle:

- With the ***degree wheel and pointer properly set,*** and the ***dial indicator securely mounted***, proceed as follows:
  - Rotate the crankshaft until the ***cam's base circle*** is under the lifter for the lobe being measured (usually ***#1 intake***).
  - Set the ***dial indicator to zero*** at this base circle position.
  - Ensure the dial indicator is ***pre-loaded about 0.300"*** to prevent running out of travel.
  - ***Rotate the crankshaft*** to raise and lower the lifter ***several times***.
  - Confirm that the dial ***always returns to zero*** when the lifter is back on the base circle.

Figure 3

Instructions continued on next page. →

Instructions for Applications with the Cylinder Heads Off

4. **Troubleshooting Inaccurate Readings:**
   - If the dial does ***not return to zero***, check for the following:
     1. ***Dial indicator is not rigidly mounted***
     2. ***Lifter is not contacting the base circle solidly***
     3. ***Lifter may be sticking in its bore***
   - Identify and ***correct the issue before proceeding***.
     - You may need to apply ***slight finger pressure*** to the lifter during rotation.

> ***CAUTION:***
>
> ***Take care not to bump the dial indicator extension or its mount.***

Camshaft Specification Card

- The ***camshaft specification card*** contains all of the necessary information for:
  - ***Checking the timing accuracy***
  - ***Phasing of the camshaft***
- Always refer to this card during the degreeing process.

Important Procedural Note

- Always turn the engine in its ***normal direction of rotation***.
  - This compensates for any slack in the timing chain or gear drive.

Degreeing the Cam Using .050" Lift Figures

1. Refer to the ***cam spec*** card for the ***intake opening and closing*** points at ***.050" cam lift***.
2. Rotate the engine in the ***normal direction*** and:
   - Watch the ***dial indicator***.
   - When it moves to ***.050", stop rotation and record the number*** on the ***degree wheel***. (i.e. 28 BTDC)
3. Continue to rotate. ***Counting the number of times the dial indicator passes Zero (full rotation)***:
   - ***Stop*** when the dial indicator changes direction. Read and record the value on the indicator. ***This is the Cam/Lobe Lift.***
   - ***Example: The dial indicator passed Zero 4 times and stopped on .210***
   - ***Each full rotation = .100"***
   - ***The Cam/Lobe lift = .400" (4 full rotations) + .210 = .4210 This should match the cam card.***

Instructions for Applications with the Cylinder Heads Off

4. Keep ***rotating the engine*** (the dial indicator is now turning the opposite direction) ***until it passes Zero 4*** times (same amount it took to get to max lift)

5. Stop at ***.050"*** (This is the closing event) ***Record the number on the degree wheel*** (i.e. 62 ABDC)
   - If you go past either .050" point, back up at least ***.100***", then rotate forward again to .050" to remove slack from the timing chain.

6. The ***opening and closing figures should be within ±1°*** of the cam card specs:
   - If not:
     - Repeat the procedure to rule out ***user or setup error***.
   - If figures are still off:
     - You may need to ***adjust cam timing*** by repositioning the cam in relation to the crankshaft.

Adjusting the Cam for Accurate Timing

- ***If cam is opening early:***
  - It is ***too far advanced***.
  - Move ***the cam opposite to the cam rotation***.
- ***If cam is opening late:***
  - It is ***too far retarded***.
  - Move the ***cam in the direction of cam rotation***.
- Use the appropriate components to adjust:
  - ***Offset bushings***
  - ***Offset keys***
  - ***Multi-indexed gears***
- If opening and closing figures at .050" are incorrect but equally off:
  - Intake and exhaust are off the ***same amount*** → Use an offset to correct.
  - Always ***recheck your figures*** after making any adjustment.
- If the intake and exhaust are off by ***different amounts***:
  - Duration or ***lobe separation may differ*** from the spec card.
  - Get in contact the ***cam manufacturer*** for clarification.

Degreeing the Cam Using the Intake Centerline Method

1. Understand the ***terminology:***
   - ***Lobe centerline (separation)*** = cam degrees between max lift of intake and exhaust lobes.
     - This is ***ground into the cam*** and ***cannot be changed.***
   - ***Intake/exhaust centerline*** = relates to the ***timing phase*** of the cam to the crankshaft.

Instructions continued on next page. →

Instructions for Applications with the Cylinder Heads Off

2. To find ***intake or exhaust centerline:***
   - Use the ***dial indicator*** on the intake lifter.
   - Rotate the engine ***in the normal direction to maximum lift*** (where dial indicator changes direction).
   - Set the ***dial indicator to zer***o at maximum lift.
   - Rotate engine ***backward*** until dial reads ***.100"***.
   - Turn engine ***forward*** again to ***.050"*** on the way up:
     - ***Record the degree number*** on the wheel.
   - Continue rotating past zero to ***.050" on the other side***:
     - ***Record this degree*** number as well.
3. Calculate ***intake centerline:***
   - Add the two degree numbers.
   - Divide the result by 2.
   - This value is the ***location of the maximum lift point*** of the intake lobe ***relative to the crankshaft***.

Establishing Performance Baseline and Adjusting Phasing

- Once cam is phased per spec, you can fine-tune timing to match your build:
  - You may ***advance/retard*** the cam up to ***6°***:
    - ***Advance*** = shifts powerband ***lower*** (more low-end torque).
    - ***Retard*** = shifts powerband ***higher*** (more top-end power).
- Adjusting cam timing affects ***piston-to-valve clearance:***
  - Advance ➔ less ***intake clearance***
  - Retard ➔ less ***exhaust clearance***

NOTE:

Do not remove the degree wheel if you plan to check piston-to-valve clearance next.

Refer to the piston-to-valve section of the instructions.

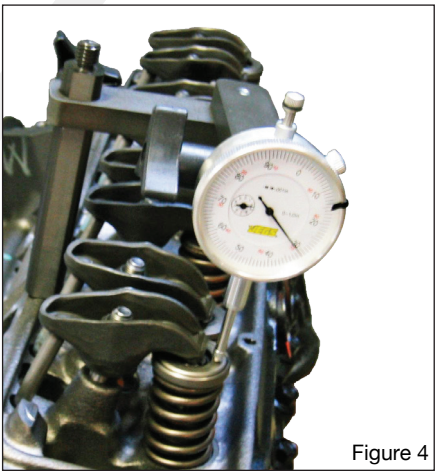

Figure 4

Instructions for Applications with the Cylinder Heads On

NOTE:

This method is not recommended for engines where the piston stop may contact the valves (e.g., Chevy angle plug heads).

Because engine designs vary (piston/chamber/spark plug/valve locations), interference can occur.

If in doubt, remove the cylinder head and refer to the "Instructions for Applications with the Cylinder Heads Off" section.

Mounting the Degree Wheel

1. Install the ***timing set*** with cam and crank gear aligned per ***manufacturer's specifications***.
2. Remove the ***rocker arms*** (optional, but simplifies the process).
3. Attach the ***degree wheel*** to the crank snout or balancer:
   - Use the ***aluminum bushings*** (supplied) if needed for centering.
4. Firmly attach the ***pointer*** from your kit to the engine block.

Mounting the Dial Indicator

1. Mount the dial indicator into a ***valve cover bolt hole***: (Figure 4)
   - Remove any obstructions.
   - Thoroughly ***clean the cam lobe*** of any oil, grease, or debris.
2. If using **Rocker Arms OFF**:
   - Use a ***pushrod with an oil hole*** as an extension.
     - The indicator tip centers in the pushrod tip's oil hole.
   - Install the pushrod in the ***#1 intake lifter***.
   - Align the dial indicator ***plunger axis*** as closely as possible with the lifter.
     - Misalignment introduces ***geometrical errors***.
3. If using **Rocker Arms ON**:
   - Set valve lash on ***intake and exhaust to exactly zero***:
     - Pushrods should still spin freely by hand.
   - Mount the indicator with its ***tip on the retainer***.
   - Align plunger axis with retainer to avoid geometry errors.

CAUTION:

Ensure the dial indicator is securely mounted — looseness will create major errors.

Instructions continued on next page. →

Instructions for Applications with the Cylinder Heads On

Zeroing the Dial Indicator

With degree wheel and pointer set, and dial indicator mounted:

- Rotate the crankshaft until the ***cam's base circle*** is under the lifter for the measured lobe (usually ***#1 intake***).
- Set the ***dial indicator to zero***.
- Pre-load the dial indicator about ***.300"*** to avoid bottoming out.
- Rotate the crankshaft ***multiple times***:
  - Ensure the indicator consistently returns to ***zero*** at the base circle.
- If not:
  - Check for:
    1. Loose dial indicator mount.
    2. Poor lifter contact with base circle.
    3. Sticking lifter.
  - Apply light ***finger pressure*** to lifter during crank rotation if needed.
  - Avoid bumping the pushrod.

Accurate readings depend on good ***cam bearings*** and ***proper radial clearance***. Excessive clearance distorts tappet movement data.

Checking Base Circle Runout

- Now is a good time to check for ***base circle runout*** (wobble or out-of-round condition).
- If noticeable runout exists:
  - Adjust the dial indicator so the runout is ***equally divided*** on both sides of zero.
  - This minimizes timing measurement error.

Camshaft Specification Card

- The ***camshaft specification card*** contains all of the necessary information for:
  - ***Checking the timing accuracy***
  - ***Phasing of the camshaft***
- Always refer to this card during the degreeing process.

Important Procedural Note

- Always turn the engine in its ***normal direction of rotation***.
  - This compensates for any slack in the timing chain or gear drive.

Instructions for Applications with the Cylinder Heads On

Degreeing the Cam Using .050" Lift Figures

1. Refer to the ***cam spec*** card for the ***intake opening and closing*** points at ***.050" cam lift***.

2. Rotate the engine in the ***normal direction*** and:
   - Watch the ***dial indicator***.
   - When it moves to ***.050", stop rotation and record the number*** on the ***degree wheel***. (i.e. 28 BTDC)

3. Continue to rotate. ***Counting the number of times the dial indicator passes Zero (full rotation)***:
   - ***Stop*** when the dial indicator changes direction. Read and record the value on the indicator. ***This is the Cam/Lobe Lift.***
   - ***Example: The dial indicator passed Zero 4 times and stopped on .210***
   - ***Each full rotation = .100"***
   - ***The Cam/Lobe lift = .400" (4 full rotations) + .210 = .4210 This should match the cam card.***

4. Keep ***rotating the engine*** (the dial indicator is now turning the opposite direction) ***until it passes Zero 4*** times (same amount it took to get to max lift)

5. Stop at ***.050"*** (This is the closing event) ***Record the number on the degree wheel*** (i.e. 62 ABDC)
   - If you go past either .050" point, back up at least ***.100***", then rotate forward again to .050" to remove slack from the timing chain.

6. Confirm the dial returns to ***zero*** at the base circle.

7. The ***opening and closing figures should be within ±1°*** of the cam card specs:
   - If not:
     - Repeat the procedure to rule out ***user or setup error***.
   - If figures are still off:
     - Adjust cam relative to crankshaft:
       - Opens early → too advanced → move opposite cam rotation.
       - Opens late → too retarded → move in cam rotation direction.
     - Use offset bushings, keys, or multi-index gears to adjust.

8. If both open/close figures are off by the ***same amount***, and both intake/exhaust match:
   - Use the correct ***offset adjustments***.
   - Recheck figures after every adjustment

9. If they don't match:
   - Duration or ***lobe separation*** may differ from spec.
   - Contact the ***cam manufacturer*** for help.

Instructions continued on next page. →

Instructions for Applications with the Cylinder Heads On

Degreeing the Cam Using the Intake Centerline Method

Understand terms:

- ***Lobe separation*** = cam degrees between intake and exhaust max lift.
  - Built into the cam and ***cannot be changed***.
- ***Intake/exhaust centerline*** = refers to cam ***timing phase*** to the crankshaft.

Procedure:

- Set dial indicator on ***intake lifter***.
- Rotate in normal direction to max lift (dial changes direction).
- Set dial to ***zero*** at max lift.
- Back the engine up until the dial reads ***.100"***.
- Turn forward again to ***.050"*** and ***record degree wheel number***.
- Continue past zero to the ***other .050"*** mark and ***record again***.
- Add both degree numbers and divide by ***2***.
  - This value is the ***intake lobe centerline*** in crank degrees.

NOTE:

Do not remove the degree wheel if you plan to check piston-to-valve clearance next.

Refer to the piston-to-valve section of the instructions.

Checking Piston to Valve Clearance

Why It's Important

- High-performance cams may reduce ***valve-to-piston clearance*** near ***TDC on overlap***.
- Even if clearance seems safe at low RPM, it can become insufficient due to:
  - Valve "float"
  - Rod stretch
  - Valve train deflection
  - Other dynamic forces at high revs

Minimum Recommended Clearances

- ***Intake valves***: at least ***.080"***
- ***Exhaust valves***: at least ***.100"*** (more heat expansion)
- If using ***aluminum rods***, add ***.030"*** to both values

Additional Considerations

- ***Aftermarket cylinder heads*** often have altered:
  - Valve angles
  - Valve positions
- These changes may ***misalign piston*** reliefs and require ***broader clearance checks***.

Method: Using Light Checking Springs

- Install light checking springs in place of valve springs:
  - Allow valves to be ***easily depressed by hand***
  - Enable measurement of valve-to-piston clearance throughout crank rotation

With High Ratio Rockers

- If using or planning to use ***higher-than-stock rocker ratios***:
  - Perform clearance checks ***with the higher ratio rockers installed***
  - Higher ratios result in ***increased gross valve lift***

Procedure:
Valve Clearance Measurement

1. Install ***rocker arms*** and set ***valve lash to zero***.
   - Zero lash helps verify you have ***adequate clearance flexibility***.
2. Understand the typical clearance windows:
   - ***Exhaust valve***: check from ***15° to 5° before TDC*** (overlap cycle)
   - ***Intake valve***: check from ***5° to 15° after TDC*** (overlap cycle)
   - These are ***360° from compression TDC***, during the ***valve overlap phase***.

Instructions continued on next page. →

Checking Piston to Valve Clearance

Step-by-Step:
Exhaust Valve Clearance Check

1. With the ***degree wheel still mounted and TDC set***:
   - Ensure ***zero valve las***h.

2. Turn engine to ***15° before TDC (overlap)***.

3. Position the ***dial indicator tip*** on the ***exhaust valve spring retainer***.
   - Preload the dial about midway and set to ***zero***.

4. Depress the valve via the ***rocker arm*** until it contacts the piston.
   - ***Record the dial reading*** — this is the clearance.

5. Rotate engine ***forward in 2° increments***:
   - Check and record clearance at each step until ***TDC***.

   - Since the valve moves during rotation:
     - Either ***subtract from initial zero*** or ***reset the dial to zero*** before each reading.

Step-by-Step:
Intake Valve Clearance Check

1. Move the ***dial indicator to the intake retainer***.

2. Begin at ***TDC*** and rotate forward to ***15° after TDC***.

3. Repeat the same procedure as for the exhaust:
   - Depress the valve at each 2° increment
   - Measure and record clearance

REMINDER:

Advancing *the cam reduces intake clearance.*

Retarding *the cam reduces exhaust clearance.*

Camshaft Terminology

ADVANCE
- In engine timing, this occurs when combustion begins before the piston reaches TDC.
- In camshaft timing, advance allows the intake and/or exhaust valves to open and close earlier in the engine cycle.

ASYMMETRICAL
- A cam lobe design where the opening and closing ramps differ.
- Used to achieve high velocity on opening and slower velocity on closing.

BASE CIRCLE
- Also known as the heel.
- The lowest point of the cam lobe; the valve is fully closed here.

CAM (LOBE) LIFT
- Distance the cam lobe rises away from the base circle of the camshaft. It is the distance the lifter moves on the cam.

CAM PROFILE
- The actual shape of the camshaft lobes, which determines valve motion.

CLOSING RAMP
- The section of the lobe from the nose to the base circle.
- Controls the valve's return to the closed position.

DUAL PATTERN
- Camshaft with different profiles on the intake and exhaust lobes.

DURATION
- The amount of crankshaft rotation (in degrees) that a valve remains open.
- Advertised duration varies by manufacturer.
- Duration at .050" is a standardized and more precise measure.
  - Short duration = more low RPM power.
  - Long duration = more high RPM power.

HEEL
- The lowest point on the lobe, opposite the nose can also be referred to as the foot.

INTAKE CENTERLINE
- The midpoint of the intake lobe's movement.

LOBE SEPARATION ANGLE
- The cam degrees between intake and exhaust max lift points.
- Affects powerband characteristics:
  - Wide angle = broad powerband
  - Narrow angle = more low RPM torque

NOSE
- Highest lift point on the cam lobe.

OPENING RAMP
- Section from base circle to nose.
- Controls the valve's opening speed and lift.

Camshaft Terminology

OVERLAP

- The period when both intake and exhaust valves are open as the piston is at TDC.

RAMP SPEED

- The rate at which valves open/close, determined by the cam ramp angle.
- Faster ramps = more aggressive valve action.

SINGLE PATTERN CAMSHAFT

- Same duration and lift on both intake and exhaust lobes.

SYMMETRICAL

- A cam lobe design where opening and closing ramps are identical.

TOP DEAD CENTER (TDC)

- The highest point of piston travel within the cylinder bore.

VALVE LIFT

- The maximum distance the valve opens, usually in inches.
- Higher lift = greater airflow and potential torque increase.
- Cam (Lobe) Lift x Rocker Arm Ratio = Valve Lift

Helpful Tools and Products

- 555-81610 Dial Point Indicator
- 555-81625 Dial Indicator Bridge
- 555-28000 Assembly Lube
- 555-81615 Dial Indicator Magnetic Base
- 555-80521 Stud Mounted Valve Spring Compressor
- 555-80096-1 Cordless 60 LED Worklight
- 555-80598 Chevy Camshaft Installation/Removal Tool
- 555-80599 Universal Camshaft Installation/Removal Tool
- 555-28060 Engine Oil Suppliment Break-In Oil
- 555-80535 Valve Spring Mic: 1.400” - 1.800”
- 555-80536 Valve Spring Mic: 1.800” - 2.200”