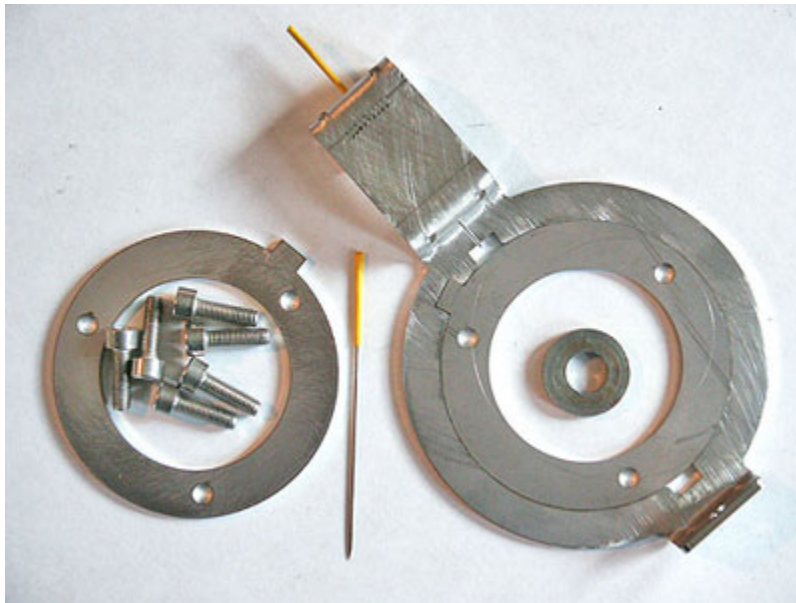


# PORSCHE 928

## 32V'r Valve Timing Instructions



Copyright 2009©  
Written by Mike Frye  
Edited by Adam G.

Sections:

Overview.....	3
Disclaimer/warnings/things to watch for.....	4
Terms and naming conventions used in this text.....	4
Tools required.....	5
‘Tuning’ or verifying that your valve timing tool is ready for use.....	5
Preparation.....	6
Check/adjust your belt tension first.....	6
Check the current valve timing.....	7
A few notes about timing adjustments.....	11
Installing the 32V’r spacer.....	12
Advancing the timing from where it is.....	13
Retarding the timing from where it is.....	14

## Overview-

The 32V'r valve timing tool is a precision tool designed to simplify the task of setting valve timing on a 32 valve Porsche 928 engine. The process outlined in the WSM is a very involved, time consuming, highly technical procedure involving removing the cam covers, and using expensive equipment. The 32V'r valve timing tool makes this same task possible by removing only the distributor caps, rotors, and both timing covers. Aside from the 32V'r tool, you will only need a 30mm open end wrench, a 17mm socket, 3/8" or 1/2" drive torque wrench, and the tools you would normally need to remove the caps, rotors and timing covers. See page 5 for a required tools list.

The procedures used for checking and setting the timing on your 32 valve Porsche 928 using the 32V'r are very simple. Since the valve timing (or cam timing) can be different for each bank of cylinders, you must set the timing for both cams and in fact, changing the timing for one may affect the other, so it's necessary to get a starting point, then verify several times as you work through the process.

The basic steps are:

1. 'Tune' your 32V'r (verify that it's not bent or warped) using the alignment bar. Make sure the indicator needle is straight and true.
2. Remove both distributor caps and rotors. Move wires back out of the way.
3. Remove both timing covers (on '85 cars, you may have to move the PSU (passenger side, US) ignition coil).
4. Rotate engine clockwise to 0 deg. TDC (0°T on the damper) using 27mm socket on crank bolt.
5. Install clamping rings with the tab or square 'key' pointing toward the large front indentation on each cam gear. It should be straight up, with tab to the upper left of the top mounting hole. Tighten each clamp ring bolt to snug, and then go around again tightening them evenly.
6. Place the 32V'r arm on the clamp ring on the DSU (Driver's Side, US) cam, which is for cylinders 5-8, so that the large ring is flush with the clamp ring. It is a precision instrument and will be tight, but don't force it on, press evenly until you can't feel border between the clamp ring and the 32V'r arm.
7. Stick the alignment needle through the holes in the top of the arm until you find the one that perfectly lines up in the deepest part of the 'V' timing mark. The hole you used indicates the current timing setting for cylinders 5-8. The center hole is slightly higher than the rest, and indicates 0 degrees of timing (no advance or retard on this cam). This is the factory setting. If the needle is not in the center raised hole, then your cam timing is either **advanced** (if it's to the left of center) or **retarded** from zero (if it's to the right of center). Write down your results for this side.
8. Repeat this process for the PSU (Passenger's Side, US) and note the results.
9. If timing is not what is desired, follow procedures for changing the timing listed later in this document.

## Disclaimer/warnings/things to watch for-

This manual and the 32V'r are offered for use by hobbyists and trained mechanics alike. A certain level of ability is assumed and any damage or injury incurred as a result of using this tool or following this manual is the responsibility of the user. The author of this document and inventor of the 32V'r accept no liability for said injuries or damage. By unpacking the 32V'r, the user accepts this agreement. It is assumed that the user has the basic knowledge and capability to successfully change a timing belt on a Porsche 928.

### !!!Warnings!!!

- >Do not run engine with indicator or spacer installed.
- >Indicator needles are sharp!
- >The 32V'r is a precision instrument; care should be taken to ensure that it is not damaged or bent.

## Terms and naming conventions used in this text

**DSU:** Drivers side US

**PSU:** Passenger side US

**TDC:** Top Dead Center

**BTDC:** Before Top Dead Center, or before zero degrees on the damper. When turning the engine through clockwise using the 27mm deep well socket on the crank bolt, it's important to know what you are looking for because you will arrive at the indications before top dead center, well, before you get to 0 degrees top dead center. As you crank it through, you'll get to 45 degrees Before Top Dead Center first (pointer on block will point to 4|5 on the damper). Then you will approach 2|0, 1|0, and 0|T, then if you continue you'll be After Top Dead Center and in the area of retarded timing.

**0 Degrees:** Timing indicator on block points to 0|T on damper.

**10 Deg. BTDC:** Timing indicator on block points to the 1|0 *to the right* of 0|T on damper

**20 Deg. BTDC:** Timing indicator on block points to the 2|0 *to the right* of 0|T on damper

**CW:** Clockwise, as you face the front of the engine leaning in over the radiator

**CCW:** Counter-clockwise (anticlockwise) as you face the front of the engine

You should never turn the crank in the counter clockwise direction, because the cam chain tension system is set up to work in only one direction. Reverse it and you could end up damaging things in there. If you miss your mark, you'll have to go around again.

\*\*\*\*\***32V'r Components**\*\*\*\*\*

**Clamp rings (2):** The two aluminum rings in the 32V'r kit.

**32V'r Arm (1):** The aluminum piece that fits on the clamp rings with the holes in it.

**Cam Bolt Spacer (1):** Spacer used to allow for adjustment of the cam gear relative to the cam. This spacer will be installed and then the cam bolt torqued down with the spacer and cam washer in place to allow for adjustment between the cam gear and cam.

**Alignment bar (1):** a short piece of aluminum bent to 90 degrees, used to true the 32V'r.

**Needle (2):** The pins that you'll use to check the valve timing.

**Clamp Ring Bolts (6):** These 4mm Allen bolts are supplied for attaching the clamp rings to the cam gears using the distributor rotor mounting holes.

## Tools required-

Aside from the 32V'r valve timing tool, you'll need the following basic tools:

30mm or 32mm open end wrench (for the cam washer, depending on the size of cam spacers in your car) *If it's 30mm as on the '85 shown in this manual, we recommend a Toyota special tie rod tool, p/n 09628-10020*

27mm deep well socket and breaker bar or long handled ½" drive ratchet for turning engine by crank bolt.

17mm socket (probably 3/8" and ½" drive

17mm box wrench

Torque wrench for the cam gear (3/8" or ½" drive)

8mm socket (for the distributor caps)

10mm socket (for the timing covers)

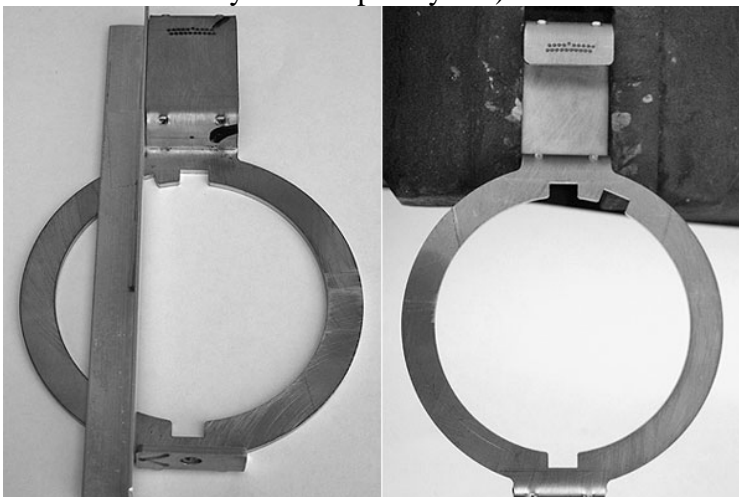
13mm socket (to move the ignition coil, passenger side US, if you have an '85)

4mm Allen key or wrench (for distributor rotor bolts and clamp ring bolts)

## 'Tuning' or verifying that your valve timing tool is ready for use-

In order to ensure that you get an accurate reading and setting from your precision manufactured 32V'r, you should verify that it is straight and true before beginning any of these procedures. The tool comes with an alignment bar that can be used to verify that your 32V'r is straight and true. There are 3 critical measurements that you should check and that take only seconds to perform.

1. Lay the 32V'r arm on a flat surface and verify that it lays flat and isn't cupped or bowed. Next lay the alignment bar so that the corner is against the top and bottom of the pieces that stick up on one side. If there is any angle or gap on one side, it must match on the other side. Simply flip the alignment bar over to compare it to the other side. If one side is off, you can use a vice to carefully align it so that the gaps or angles match. **Very** slight adjustment should be required.
2. Lay the alignment bar on the **front** of the 32V'r arm and verify that there is no gap anywhere.
3. Flip the 32V'r arm over on its back and verify with the alignment bar that there is no cupping or bowing on the back either. (Slide the alignment bar around and turn it to verify it's completely flat).



## **Preparation-**

Let's get started! This job shouldn't take more than 2-3 hours the first time, and less each time after that.

Step 1: Lay out your fender covers, get your gloves, goggles or safety glasses on (Safety first!), and get all the tools together.

Step 2: Remove both distributor caps, both rotors and both timing covers. If you're working on an '85, you'll have to loosen the PSU ignition coil and move it out of the way to remove the PSU timing cover. Same goes for the oil dipstick, but once the cover is out of the way, you should put the dipstick back in. It won't be in the way and it will keep you from dropping anything in there. Remove the upper fan shroud if you want more room.

## **Check/adjust your belt tension first-**

The Porsche 928 timing belt is rumored to be the longest timing belt ever used in a production car. If you haven't changed one yet, you probably shouldn't be attempting to set your valve timing, but that's your choice. It might be easier to manually pull the engine around if you remove all of the spark plugs, but even with the plugs in it can be done with a ½ inch ratchet and 27mm deep well socket on the crank bolt.

If you have changed your timing belt, then you know that in order to set up the belt tension properly, you need to pull the engine around a few times and that aligning the belt on the right tooth on each side is critical. Being off by one tooth will throw the timing off by quite a bit and could potentially damage the engine. Similarly, if you set the valve timing with the tension too loose or (!) too tight, then change the tension, your timing will be affected and may need to be checked and adjusted again. Better to adjust the tension first (unless you're using a Porkensioner, in which case it should be fine already ☺). The technique and tools used for adjusting the belt tension are beyond the scope of this manual.

### **Check the current valve timing-**

Once you've adjusted or verified the timing belt tension you can begin the task of verifying/checking your current valve timing.

Turn the engine clockwise until you reach 0 degrees TDC (Engine timing mark points to O/T on damper as shown). Make sure the line is *exactly* on the mark, if it's even off by a little bit, it will affect your cam timing settings as well.





Your 32V'r kit includes two clamp rings and six Allen head clamp ring bolts (3 for each side). Place one of the clamp rings in place of the DSU distributor rotor, lining up the mounting holes so that the tab on the clamp ring faces the wide notch in the cam gear. It should be straight up if your engine is at TDC, and the top clamp bolt hole should be just to the right of center or 1 o'clock position. Install and snug down the three clamp bolts into the distributor rotor bolt holes, then go around and tighten them down again, maybe 1/8-1/4 turn. It's important that these three be tightened evenly and well, as this clamp ring will maintain the relationship of the cam gear to the camshaft when you remove the cam bolt later in the procedure.

Do the same on the PSU (cylinders 1-4).

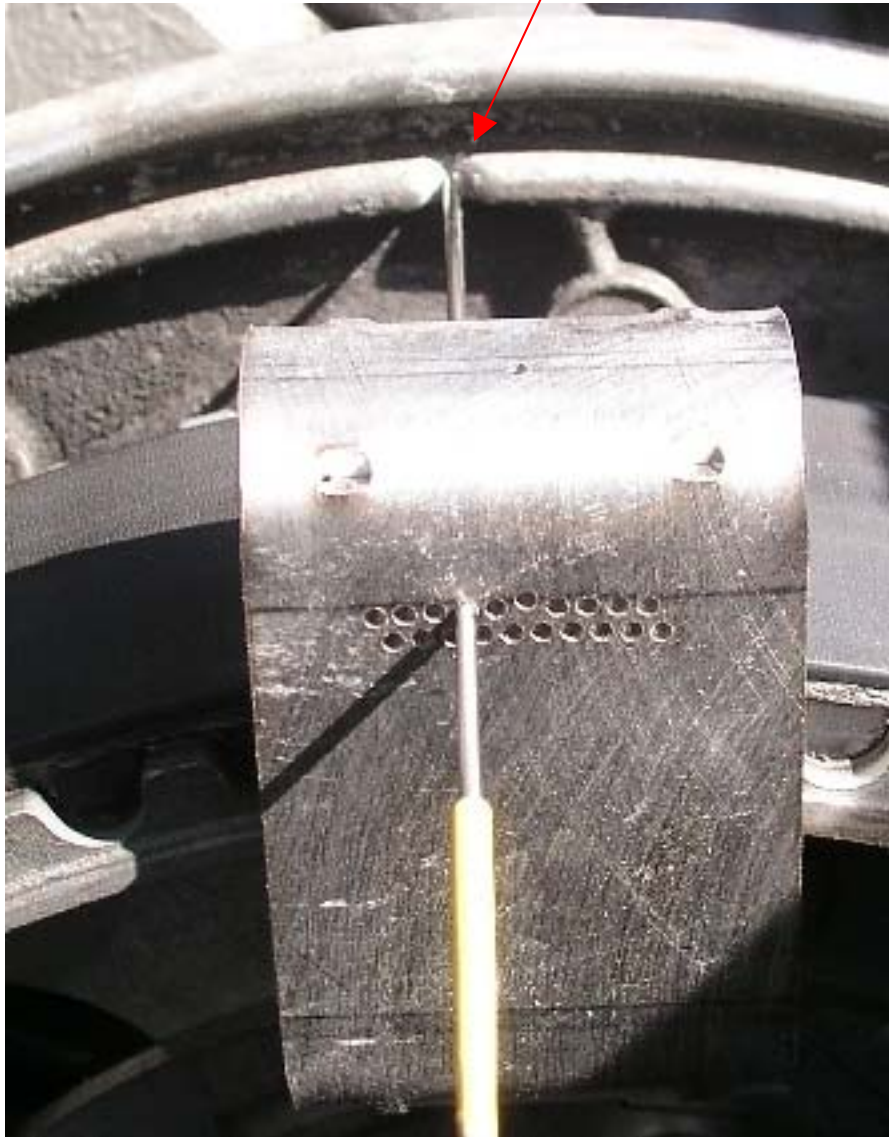




Back on the DSU, place the 32V's **arm** on the clamp ring. It should be a snug fit, don't force it, but make sure it's flush with the clamp ring all around.



Now, ***verify that the engine pointer is still pointing at zero degrees TDC*** and place the alignment pin into the hole that allows it to go to the deepest part of the alignment 'V' in the rear of the timing cover. If you're a little off, choose the next hole over, it should rest without bending or being forced at the deepest part of the 'V'. (This pic shows 4 degrees of advance timing)

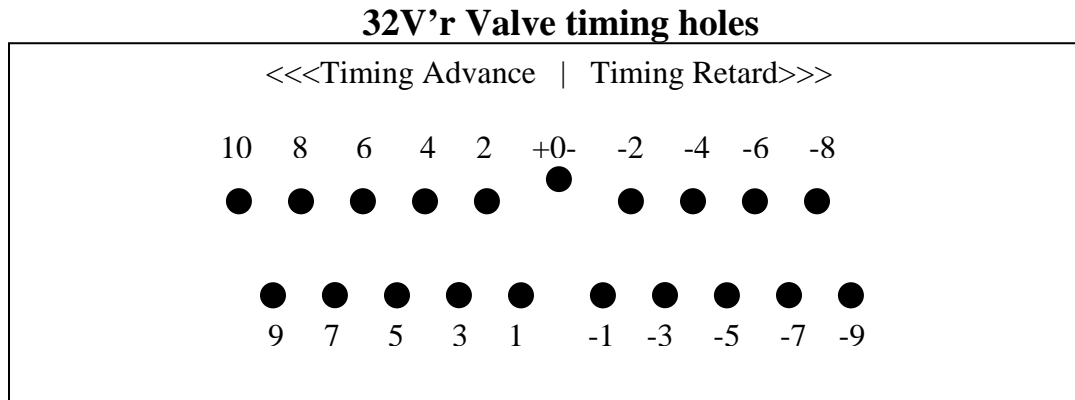


Take note of which hole you used. The center hole is slightly higher than the rest and indicates zero degrees of timing. The factory default timing is zero degrees.

***Each hole to the left of the center hole in a zigzag pattern represents 1 more degree of timing advance.***

***Each hole to the right of the center hole in a zigzag pattern represents 1 more degree of retard in timing.***

Note your current timing setting for cam 5-8 (PSU) and repeat the process for the 1-4 (PSU). One thing that is helpful to remember is that all of the holes in the top row are even numbers and the bottom row are all odd numbers. If you remember this, it's easier to read the tool.



### A few notes about timing adjustments-

The safest way to go with valve timing is factory default, which is zero degrees of timing (no advance, no retard). The designer, manufacturer, distributor of the 32V'r and this manual do not advise changing your timing to anything but the basic factory stock zero degrees of timing. There is a complex relationship between cam timing and ignition timing. Changing one thing can have unforeseen effects on performance, maintenance schedules and even the safety of running your engine if you don't know exactly what you're doing. Many factors go into the various maps of ignition timing and all would be affected by changing the valve timing.

Having said that, it's a general rule of thumb that within a certain range, as you advance timing it will generally (all other things being equal) slide your power curve down in the RPM range at the expense of top end torque, and as you retard the timing it will move it up in the RPM range. We do not recommend anything but the factory setting of zero degrees, but using this tool will enable you to set it to any setting from +10 to -9 degrees of zero if you are experienced in this type of thing, know what you're doing, and are willing to take the associated risks. The designer of the 32V'r has tried settings between zero and about 5 degrees of advanced timing along with other modifications in test scenarios in a controlled environment. Performance chips like the EZF'r, Autothority or eBay 'clone' chips introduce more aggressive fueling and ignition timing maps into the equation. When using these, even a couple of degrees of advance timing (to bring the torque curve down in the range) could have adverse effects. Further discussion of the effects of non-factory timing is beyond the scope of this manual.

NOTE: When adjusting the timing for the PSU cam (cylinders 1-4) there will be quite a bit of spring tension and the cam will try to rotate CCW once you loosen the clamp ring bolts. You should also add 2 degrees of timing to the desired setting to account for flex in the tensioner on this side. For 0 degrees, set for +2 degrees of advance, then when you pull it through a few times it should read 0. For 2 degrees advance, set it for +4, then when you pull it through a few times, it should show 2.

### **Installing the 32V'r spacer-**

Before adjusting the timing on either cam gear, you'll need to install the spacer supplied with your 32V'r kit. This spacer will allow you to use a 30mm open end wrench (or the suggested Toyota special tie rod tool) to counterhold the spacer and a 17mm box wrench to loosen the cam bolt to adjust the cam gear location relative to the cam shaft. This procedure is the same on both cam gears.

- The clamp rings will be holding the cam gear on the cam shaft, so make sure they're snug.
- Remove the 32V'r arm and place it back into the case.
- Next, counter hold the cam spacer with the 30mm wrench or Toyota special tie rod tool, *p/n 09628-10020* and loosen the 17mm cam bolt. If it hasn't been removed recently you might need some penetrating oil to break it free. Do not turn the cam at all, as you may rotate the engine. If the engine timing mark is no longer pointing to O/T, you'll have to go back and set everything up where it was and start over.
- Reinstall the cam bolt with the 32V'r spacer inside the stock spacer and torque it to 47 ft. lbs. counter holding it the whole time with the 30mm wrench. If the engine pointer is still pointing at O/T, you're ready to adjust the timing.

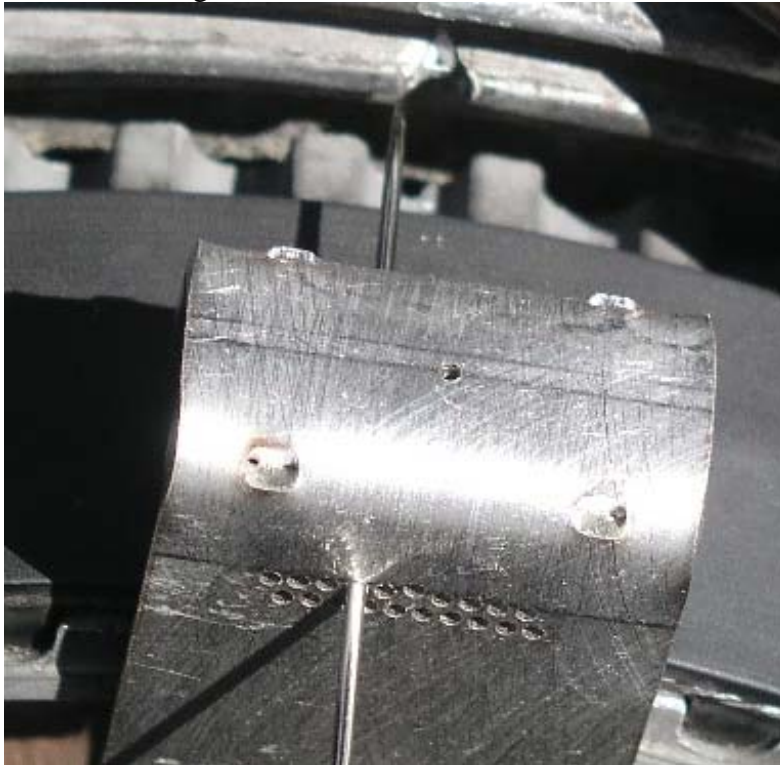


### **Advancing the timing from where it is-**

If your current cam timing is zero degrees or less than the setting you desire, setting the cam timing can be done at zero degrees TDC.

Rotate the engine to 0 degrees TDC if it's not already there. Install the 32V'r spacer as described on the previous page. Then:

> Install the 32V'r arm on the cam you are working on pressing it flat and flush with the clamp ring. The arm should be at the top as shown below. Place the alignment pin in the hole corresponding to the desired cam timing and through the corresponding hole in the back as shown. Slide the pin so that it's almost making contact with the lip of the rear timing cover, but not touching it.



Next use the 17mm box wrench to hold the 17mm cam bolt, and carefully loosen the three clamp ring bolts. When you loosen the third one, the only thing holding the current cam timing will be the 17mm wrench. Turn the cam bolt clockwise using the wrench until you reach the point where the alignment pin is exactly in the center of the deepest part of the 'V'. Push the pin in to verify while carefully holding the 17mm wrench still. While holding the cam position with the 17mm wrench, tighten the clamp ring bolts back down to hold the cam gear relative to the cam shaft.

> Zero degrees is the center hole

>2 degrees advance is 2 holes to the left of center (the first hole on the top row)

>2 degrees of retard is 2 holes to the right of center...

Rotate the engine a few revolutions either by hand or by the key with relay XXV (LH relay) removed and verify the timing. Remove the cam bolt, remove the 32V'r spacer, reinstall cam bolt and cam spacer, torque to 47 ft/lbs.



### **Retarding the timing from where it is-**

If you wish to retard your timing from its current position, you'll need to rotate the engine almost all the way around again to 20 degrees BTDC, because the valve springs will not allow you to do it at TDC. Install the 32V'r spacer as described on page 10.



With the engine at 20 degrees BTDC and the 32V'r spacer installed, reinstall the 32V'r arm. Slide the pin into the hole that corresponds to the desired timing setting. It should be to the right of the current setting if you are attempting to retard the timing.

With the 32V'r arm in place and the pin almost touching the rear timing cover:

Using the 27mm deep well socket on the **crankshaft bolt**, and **rotate the engine** until the pin is perfectly aligned with the deepest part of the 'V' on the timing cover. Slide the pin in to verify that you're in the right spot. The engine should stay there without requiring you to apply pressure to the crank bolt.

This next part may require two people, as it requires you to hold the cam bolt while turning the crank bolt (engine) a few degrees.



Hold the cam bolt with the 17mm wrench, and loosen the clamp ring bolts.



When you loosen the last clamp ring bolt you'll be holding the cam in position against pressure of the valve springs which will be rotating the cam CCW. While holding the cam in position with the 17mm wrench (with the needle of 32V'r in deepest part of the 'V'), rotate the engine clockwise to O/T. Once there, tighten the clamp ring bolts and then release the 17mm wrench.

Once the clamp ring bolts are snugged down, remove the 32V'r arm, rotate the engine a few revolutions either by hand or by the key with relay XXV (LH relay) removed and verify the timing. Remove the cam bolt, remove the 32V'r spacer, reinstall cam bolt and cam spacer, torque to 47 ft/lbs.

Once you've turned the engine over a few times and verified the timing on both cams, you can remove the clamp rings and reinstall the timing covers, rotors, caps and plug wires. Congratulations, you're done!