# CAMSHAFT INSTALLATION MANUAL

NAME OF PRODUCT	RB26 V-CAM SYSTEM STEP1 + V Pro Ver.4		
PART NUMBER	22007-AN014		
APPLICATION	NISSAN Skyline GT-R		
ENGINE	RB26DETT		
YEAR	BNR32: 1989/08 - 1994/12 BCNR33: 1995/01 - 1998/12 BNR34: 1999/01 - 2002/08		
REMARKS	X This kit was designed on a JDM vehicle and has not yet been tested in other markets.		
	<ul> <li>[ADVICE]</li> <li>Do not use this product if the bottom of the cylinder head or the upper side of the engine block has already been modified so an adequate valve recess cannot be maintained.</li> <li>Additional oil piping is required in order to install this kit.</li> <li>This kit does not include the camshaft for the exhaust side.</li> <li>It's recommended to upgrade the factory oil pump to the large capacity type.</li> </ul>		

This manual assumes that you have and know how to use the tools and equipment necessary to safely perform service operations on your vehicle. This manual assumes that you are familiar with typical automotive systems, basic service, and repair procedures. Do not attempt to carry out the operations shown in this manual unless these assumptions are correct. Always have access to a factory service manual. To avoid injury, follow the safety precautions contained in the factory service manual.

NOTICE

#### **REVISION OF MANUAL**

Rev. Number	Date	Manual Number	Details	
3-3.01	2011/2	E04121-N48090-00	1 <sup>st</sup> Edition	
3-3.02	2012/12	E04121-N48091-00	Parts list revised. Instruction added.	

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# INTRODUCTION

For your safety and optimal product performance, read all instructions thoroughly before installing and using this product. It is recommended to keep this instruction manual in the vehicle for easy reference. Installation must be done by a professional.

Refer to the factory service manual as well as this manual during removal and installation of factory parts. The factory service manual must be purchased if you don't have it

### **IMPORTANCT NOTICE**

- This manual indicates items you need to pay attention in order to install this product safely and lists precautions to avoid any possible damage and/or accidents.
- HKS will not be responsible for any damage caused by incorrect installation and/or use, or use after modification and/or dismantling of this product.
- This product was designed based on installation onto a specific factory vehicle or a vehicle using other HKS products. The performance and/or safety cannot be guaranteed if this product was installed onto other inapplicable vehicles.
- To use this product on the public road, follow the necessary procedures and regulations for modified vehicles.
- The specifications of this product are subject to change without notice.
- The instructions are subject to change without notice. Make sure you refer to the most recent instructions.
- For any lost, defective and/or damaged parts, contact your Authorized HKS Dealer.
- For any inquiry after installation, contact your Authorized HKS Dealer.

### **PRODUCT CHARACTERISTICS**

- This product was developed to add the variable valve system that was operated by the engine oil pressure to the intake camshaft for the vehicle with the RB26 engine. With this function, the valve timing can be continuously adjusted to be the target valve timing based on the preset 3D map.
- Adjusting the intake camshaft's valve timing corresponding to the engine conditions and/or engine rpm can improve various points compared with replacing the camshaft with the fixed valve timing.
- Limiting the overlap to the minimum at idling can stabilize the gas combustion and clean the exhaust gas since the engine vibration can be limited.
- Setting the intake valve timing earlier at low to mid engine RPM can increase the charging efficiency inside the cylinder; therefore, the torque can increase. Also, the valve timing can correspond to the engine RPM, so the engine performance can be improved in all range.
- The improved charging efficiency of the air-fuel mixture can increase the combustion gas; it has the same effect as the displacement was increased. The boost can be risen faster even the large size turbocharger is installed on the vehicle.
- Since this product is designed to use with Nissan factory pistons, simply replace the factory camshaft with this product; additional modification to the cylinder head or replacement of any valve system part are not required.

# **REQUIRED CONDITIONS:**

WA	RNI	NG

Over-Revving may cause damage to the engine. Avoid over-revving on downshifts, etc.

- This product is designed based on Nissan factory engine. If the bottom of the cylinder head or the upper side of the engine block was modified, and the valve recess is insufficient, this product cannot be used.
- The allowable engine RPM to use this product with the factory valve spring is **8,000 rpm**.
- The following measurement and/or adjustment is required:
  - Valve Timing
  - Valve Clearance
  - · V-P (The clearance between the valve and piston)
- For optimal & safety product performance, the following is required:
  - · Fuel injection volume setting and Ignition timing setting
  - · Valve timing map editing.
- This product adjusts the valve timing by the engine oil pressure. In any of the following case, the oil pressure may be decreased, the optimum fuel injecting volume and ignition timing cannot be maintained:
  - The oil pump cannot provide sufficient amount of flow due to low engine RPM.
  - The engine oil viscosity is too low.
  - The oil temperature is too high; it lowers the oil viscosity and pressure.
  - The engine oil is degraded.
  - The clearance is too big due to the oil pump's abrasion.
  - The oil pump inhales air under rapid acceleration or circuit driving.
- It is recommended to replace the factory oil pump with the large capacity pump since the valve timing's variable operation at low engine RPM becomes unstable.
  - HKS RB26DETT Oil Pump Upgrade (P/N: 15003-AN001)
- HKS V-CAM SYSTEM was developed to improve engine output to a higher range. When the engine output is improved, water temperature and oil temperature will rise, and insufficient oil pressure and fuel volume will occur. Always maintain them for the optimal engine performance. If the vehicle uses under more than the factory allowable RPM, replace parts with high RPM resistance parts.

# PARTS LIST

NO.	DESCRIPTION	QT	IMAGE	REMARKS
1	Cylinder Head Cover	1	el a construction de la construcción de la construc	Intake side
2	Oil Control Valve (OCV)	1		
3	Camshaft Angle Sensor	1	Chille Chille	
4	Flange Bolt	2	No.	M6x14
5	Adaptor Connector	1	3	M16-NPT1/8
6	Oil Filter	1		
7	Head Cover Gasket	1	$\square$	
8	Oil Filler Cap	1	0	
9	Name Plate	1	Vcam	
10	Camshaft Step1	1	and the second second	248°-8.6mm
11	Socket Head Flange Bolt	1		M14x35
12	Variable Valve Timing Unit Step1	1	9	Only for Step1
13	Cover Plate	1	0	
14	Extra Low Head Bolt	3	0	M5x10
15	Oil Line Adaptor	1	10	
16	Joint Pipe	2		
17	O-Ring	4	0	I.D.5.5mm
18	Adaptor Plate	1	T	
19	Camshaft Cap Bolt	4	Å	
20	Self Lock Nut	4	9	M6
21	Flat Washer	4	Ö	M6

# PARTS LIST

NO.	DESCRIPTION	QT	IMAGE	REMARKS
22	Spacer	1	0	
23	Flat Head Bolt	1	Ì	M8x15
24	Rubber Washer	1	0	20mmx12mmx3
25	Flexible Hose L=600mm	1	$\bigcirc$	W/ 2 Nipples
26	Hexagon Fitting	1	4	
27	T-Fitting PT1/8	1	5	
28	V-Cam System Harness	1		For V-Cam System
29	F-CON V Pro Universal Unit	1		Universal Use
30	Conversion Harness	1		
31	Terminal Set (42012-AK016)	1		
32	Instruction Manual	1	iter in the second s	

# **INSTALLATION**

# 1. BEFORE INSTALLATIOIN

- (1) Prepare the following before installation:
  - Oil Outlet

Select the oil outlet position where the oil pressure can be maintained properly and after the factory oil filter. (E.g. the factory oil pressures sensor connecting point or the filter relocating type.) The provided Oil Filter cannot filter small impurities contained in the oil.

If the oil outlet is needed to be placed before the factory oil filter, insert a fine meshed filter to the oil piping.

- (2) Required Tools for Installation
  - Silicone Grease (equivalent to ThreeBond 1855)
  - Torque Wrench (Torque Spec. :3.0Nm 90Nm)
  - Vernier Callipers
  - Dial Gauge
  - Magnet Stand
  - Graduation Plate
  - Thickness Gauge

#### Use this instruction manual and the factory service manual as a reference.

#### 2. COMPONENTS FOR INSTALLATION

- (1) Make sure all necessary components are present and nothing is damaged.
- (2) Remove all sensors from the provided cylinder head cover.

### 3. CLEANING COMPONENTS

(1) Clean all sections oil may flow into such as the adaptor and/or inside pipes.

# 4. REPLACING BAFFLE PLATE

- Remove the baffle plate with extra care, and make sure not to bend the plate when removing it from the factory head cover.
- (2) Clean the oil separator and baffle plate.
- (3) If the baffle plate was bent, make sure to repair the bent part.
- (4) Apply small amount of the liquid gasket to the inside of the cylinder head that comes in contact with the cylinder cover. Insert the oil separator, and secure the baffle plate using the factory bolts. (Dia.1)



# 5. REMOVING INTAKE CAMSHAFT

- (1) Remove the intake camshaft in accordance with the factory service manual.
- (2) Inspect the removed camshaft, camshaft cap, and lifter. If any defective was found, make sure to investigate what caused the defective. Replace the part(s) with a new one if necessary.

# 6. ADJUSTING VALVE CLEARANCE OF EXHAUST CAMSHAFT

- (1) Handle the exhaust camshaft in accordance with the factory service manual.
- (2) To rotate the exhaust camshaft, rotate the crankshaft, and lower the piston from the TDC.
- (3) Adjust the valve clearance to be within the standard value. Exhaust Side: 0.35 - 0.41mm (under cold condition)
- (4) After adjusting, leave the exhaust camshaft uninstalled.

# 7. ADJUSTING VALVE CLEARANCE WITH V-CAM

(1) Install the V-cam in accordance with the factory service manual.

#### CAUTION

• When tightening the cam cap, make sure the V-Cam is placed parallel. If the V-Cam is tilted, the thrust part may be caught causing damage to the V-Cam.

- (2) Adjust the clearance to be within the standard value. Intake Side: 0.42 - 0.48mm (Under cold condition)
- (3) Rotate the V-Cam to make sure if it rotates smoothly; then, remove the V-Cam.

# 8. INSTALLING OIL LINE ADAPTOR

- (1) Make sure there are no scratch and/or dust on the journal.
- (2) Apply engine oil to the journal.
- (3) Place the oil line adaptor as shown in Diagram 2.
- (4) Tighten the bolt with hand until bolt reaches to the bottom. Then, press and hold the oil line adaptor's mating side toward the V-Cam. Tighten the bolt equally at the point where there is no gap between the camshaft and the cap.

Torque Spec. N·m(kgf·m): T=2.7 -3.3 (0.3)

(5) Make sure if the oil line adaptor rotates lightly. If not, remove the oil line adaptor and reinstall it to prevent the engine seizure after starting the engine.



#### 9. INSTALLING V-CAM

- (1) Replace the factory cam cap bolts of the journal #1 and #2 (4 pcs) to the provided bolts.
- (2) Install the V-CAM in accordance with the factory service manual. Since the oil line adaptor rotates, make sure it won't be caught in the cylinder head.

Torque Spec. N·m(kgf·m): T=9 -12 (0.92 -1.2)

(3) Make sure the cylinder head does not come in contact with the oil line adapter when the mating side of the oil line adapter and the upper side of the cylinder head are put together.

#### **10. INSTALLING ADAPTOR MOUNTING PLATE**

- (1) Set the adapter mounting plate after making sure the direction of the plate is correct. (Dia.3)
- (2) If the oil line adapter does not rotate easily, it may come in contact with the cylinder head. If so, remove the camshaft, and shave the portion which comes in contact with the cylinder head.
- (3) Install the adaptor mounting plate using the provided flat washers and self lock nuts. (Dia.3)

Torque Spec. N·m(kgf·m): T=7 - 8 (0.71 -0.82)

#### **11.INSTALLING JOINT PIPE**

- (1) Clean the joint pipe. Install the O-ring to the both grooves of the joint pipe. (Dia.3)
- (2) Apply the silicone grease to the O-rings. Make sure they can be inserted to the head cover's installing hole. If they cannot be inserted to the hole, modify the edge of the hole's tapered section.
- (3) Install the joint pipe to the oil line adaptor's hole. (Dia.3)

### **12.INSTALLING EXHAUST CAMSHAFT**

(1) Install the exhaust camshaft in accordance with the factory service manual.

### 13. INSTALLING CAM OIL SEAL

(1) Apply the silicone grease to the inside of the oil seal, and install it onto the cylinder head.

CAUTION
 Do not drive the oil seal in too much since the connecting length of the oil seal and the variable unit is not long enough. It may cause oil leakage.



# **14.INSTALLING REAR BELT COVER**

- (1) Remove the grommet and collar of the M8 bolt attached to the rear belt cover.
- (2) Insert the provided spacer; then, install the provided rubber washer to the back. (Dia.4)
- (3) Secure the rear belt cover using the provided flat head bolt. (Dia.4)

Torque Spec. N·m(kgf·m): T=16 - 22 (1.6 - 2.2)



# 15. INSTALLING VARIABLE VALVE TIMING UNIT

- (1) Degrease the edge of the V-Cm and the mating side of the variable timing unit.
- (2) After making sure the position of the dowel pin and dowel pin hole are correct, insert the variable valve timing unit into the V-Cam. (Dia.5)
  (Since the clearance of the shaft is narrow, insert the unit carefully so the both V-Cam and the unit are not damaged.)
- (3) After the dowel pin was inserted completely, install the provided socket head flange bolt.
- (4) Rotate the variable valve timing unit to the right slightly and hold it using the octagonal part of the camshaft's center; tighten the socket head flange holt. Do not put force toward the turning direction



bolt. Do not put force toward the turning direction of the unit.

Torque Spec. N·m(kgf·m): T=85 - 95 (8.7 - 9.7)

#### CAUTION

Do not loosen the bolt on the back of the variable valve timing unit. It may cause malfunction to the unit.

#### **16. MEASURING V/P**

- Set the dial gauge to the intake side lifter while the first cylinder's intake valve is not lifted. (Dia.6)
- (2) Rotate the crankshaft, and set the piston to the top dead center.
- (3) Rotate the V-CAM slowly. Once the valve touches the piston, stop rotating and check the lift value on the gauge.
- (4) Reverse the V-CAM and reposition it to the original position.
- (5) Verify the dial gauge points to 0 again.
- (6) Make sure the lift volume becomes more than 4.4mm
- (7) Remove the dial gauge, and install the exhaust camshaft.



### **17.INSTALLING TIMING BELT**

(1) Install the timing belt mating the match mark. (Dia.7)

#### CAUTION

This product was designed to use with the HKS Piston Kit; however, the gap between the valve and the piston at the most advance angle may be very narrow. Therefore, if the belt is positioned wrongly even by one tooth of the gear, it may cause damage to the engine.



(2) Adjust the tension of the timing belt accurately referring to factory service manual.

#### CAUTION

If too much tension was put on the timing belt, it may cause noise and/or damage to the camshaft after the engine is started.

(3) Make sure the O-ring is seated properly, and Install the cover plate using the provided extra low heal bolt and cover plate. Do not use a generic bolt; it may come in contact with the timing belt cover.

Torque Spec. N·m(kgf·m): T=2.7 - 3.3 (0.3)

#### **18. MEASURING VALVE TIMING**

- (1) Set the graduation plate and the dial gauge. Measure the valve timing at the primary rotation.
- (2) Measure the valve timing at 1mm lift, and calculate the median value.
  - ATDC more than 120°
- (3) If the median value difference is more than 10°, adjust the pulley position. One gear tooth of the pulley is equivalent to 15° of the crankshaft's angle.

# **19. INSTALLING HEAD COVER**

- (1) Install the gasket onto the groove of the head cover's bottom.
- (2) Place the head cover parallel to the cylinder head after making sure all necessary parts are installed correctly. Install the head cover carefully and accurately. Maintain the force on the head cover not to damage the O-ring of the joint pipe.
- (3) Make sure there is no gap between the head cover and the cylinder head.
- (4) Make sure the hole positions of the head cover and the cylinder head side are matched; then tighten the bolt.
- (5) If the holes are not matched, the inside of the head cover may come in contact with the baffle plate installed on the cam cap #3 and #4. If so, remove the cam cover and the baffle plate, and shave the portion of the baffle plate that comes in contact with the cam cover. (Dia.8)

### 20. INSTALLING CAMSHAFT ANGLE SENSOR

- Measure the distance between the trigger tip and the mount surface. The distance should be between approximately 29.5 – 31.0mm. (Dia.9) If the actual distance is not within this range, make sure the gasket is installed properly, or the head cover does not come in contact with other vehicle's parts.
- (2) Apply the silicone grease to the O-ring; then, insert the camshaft angle sensor. Tighten the bolt. (Dia.10)

Torque Spec. N·m(kgf·m): T=4.5 - 5.5 (0.46-0.56)





# 21. ASSEMBLING OIL FLOW PARTS

- Install the AN4 connector to the adaptor connector. Apply sealing material to the NPT1/8 tapered thread, or wrap sealing tape around the thread to prevent over-tightening.
- (2) Install the oil filter and adapter connector using the opposite of the disassembling procedure of the head cover temporarily installed. Apply silicone grease to the O-ring. (Dia.10)
- (3) Apply silicone grease to the O-ring of the oil control valve (OCV). Carefully insert the OCV to the end. After making sure the plate is placed properly, install the bolt.



Torque Spec. N ⋅ m(kgf ⋅ m): T=7 - 8 (0.71 - 0.82)

(4) Connect the oil outlet and the adaptor connector using the oil piping. Secure the piping to prevent unnecessary force while the engine is running.

Please refer to "1. Before Installation" for the oil outlet position.

# 22. ASSEMBLING ENGINE

- (1) Reconnect all wires and pipes removed to install the V-Cam.
- (2) Connect the V-Cam System Harness referring to the F-CON V Pro's manual and the manual included with the V-Cam System Harness.

# After installation is complete, check the following:

#### Check the following before starting the engine:

- Make sure the valve timing is within the designated value.
- Make sure the valve clearance is within the standard value.
- Make sure the clearance between the valve and piston (V-P) is more than the designated value.
- Make sure pipes and hoses are routed and connected correctly.
- Make sure hoses are not twisted or bent.
- Make sure the engine oil level is between H L.
- Make sure all bolts and nuts are tightened securely.
- Make sure all installed components do not come in contact with any other parts.
- (1) Make sure oil, coolant, and/or fuel are not leaking.
- (2) Disconnect the coupler from the oil control valve (OCV).

#### CAUTION

• Once the coupler is disconnected from the OCV, the camshaft does not advance. Disconnect the coupler till the initial setting is complete to avoid possible damage to the engine.

(3) Before starting the engine, remove the spark plugs and run the cell motor for a few seconds to increase the oil pressure.

#### Start the engine and check the following:

- Make sure oil is not leaking.
- Make sure air is not leaking.
- Make sure the installed parts do not come in contact with any other parts.
- Make sure all bolts are not loosened after stopping the engine. Re-tighten bolts if necessary.
- (1) Before starting the engine, initial setting of the F-CON V Pro and V-Cam System must be done using the Power Writer. Refer to the F-CON V Pro's manual and the manual included with the V-Cam System Harness for initial setting procedures.
- (2) During starting the engine, adjust "Cam Offset IN1" of the parameter setting's valve timing items to be the same value of "Actual Valve Timing 1" and "Max Retard Angle" on the Power Writer's monitor. (Refer to the F-CON V Pro's manual.)
- (3) After idling, adjust the ignition timing. The valve timing is changed when the installing position of the crankshaft's angle sensor is changed. If the valve timing is changed, adjust "Cam Offset IN1" of the parameter setting's valve timing items. (Refer to the F-CON V Pro's manual.)
- (4) After stopping the engine, reconnect the OCV coupler; then, restart the engine. Make sure the "Actual Valve Timing1" on the Power Writer's monitor changes as the engine RPM increases.
- (5) Complete settings of the fuel, ignition, and valve timing. The values from the database have been preset to the valve timing map.
- (6) Do not increase the engine RPM to the higher range right after installation is complete. Drive in moderate RPM range for a while.

#### MAINTENANCE

Daily check-up on the vehicle must be done by the owner.

- Do not conduct any operation not stated in the user's manual. Contact the dealer.
- Choose the appropriate spark plug for your driving conditions. HKS Super Fire Racing Plug is recommended. Contact the dealer to select appropriate heat range.
- Change the engine oil regularly. Using HKS engine oil is recommended.
- Check the tension and abrasion of the timing belt every 10,000km.

Pay attention to the following during and after driving:

- Practice idling or after-idling if necessary.
- Do not raise the RPM rapidly, or rev the engine a few times while in neutral when the engine is not warmed up, yet. Even after the engine is warmed up, revving the engine a few times while in neutral should be avoided to prevent the engine from being damaged.

#### WARNING

- If any leakage (oil and/or water) is noticed, do not start the engine.
  - While driving, any unusual symptom such as rapid decline of the oil pressure is noticed, stop driving immediately. Make sure oil is not leaking. If oil is leaking, do not restart the engine. Contact the dealer for repair the leakage.
  - Follow the dealer's instruction.
     If the oil leakage is in a terrible condition, ask the dealer for the temporary measure.
     It may cause a fire.
- When any damage or unusual symptom is noticed, do not bring the vehicle to the dealer by driving to prevent additional damage.
- Do not try to repair the vehicle by yourself. Consult your dealer for repair.
- Any unusual noise, smell, and/or vibration while driving is noticed, takes necessary measure referring to the factory service manual.