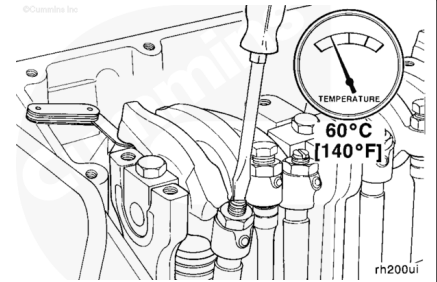


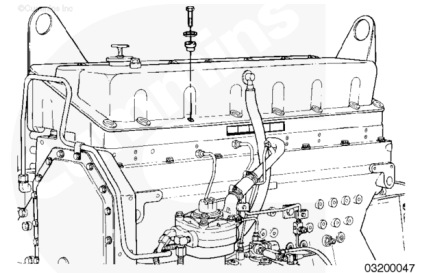
## Measure

### General Information

All overhead lash measurements **must** be made when the engine is cold. Stabilized coolant temperature **must** be at 60°C [140°F] or below.

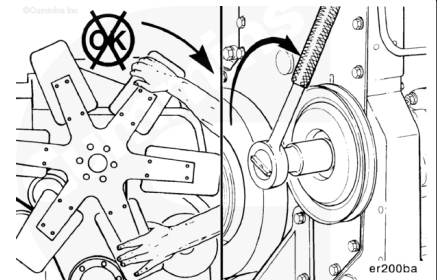


Remove the rocker lever cover. Refer to Procedure 003-011 in Section 3. (/qs3/pubsys2/xml/en/procedures/35/35-003-011-tr.html)



### ⚠ WARNING ⚠

**Do not pull or pry on the fan blades to rotate the crankshaft. Doing so can damage the fan blades. Damaged fans blades can cause premature fan failures, which can result in serious personal injury or property damage.**



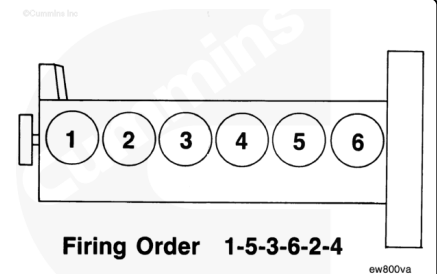
The valve set marks are located on the accessory drive pulley. The marks align with a pointer on the gear housing.

Use the accessory driveshaft to rotate the crankshaft.

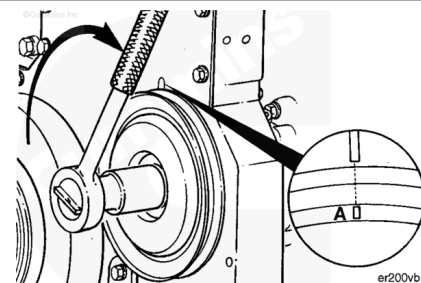
The crankshaft rotation is **clockwise**, when viewed from the front of the engine.

The cylinders are numbered from the front end of the engine.

The firing order is 1-5-3-6-2-4.

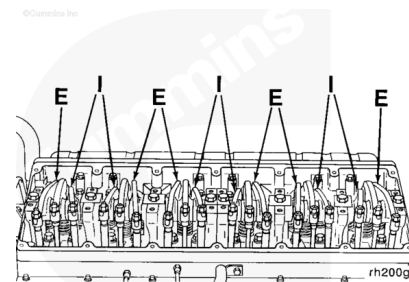


Rotate the accessory drive **clockwise** until the “A” valve set mark on the accessory drive pulley is aligned with the pointer on the gear cover.



Each cylinder has three rocker levers:

- The long rocker lever (E) is the exhaust lever.
- The center rocker lever is the injector lever
- The short rocker lever (I) is the intake lever.



Valve and Injector Lash

**Injector and Valve Measurement Sequence**

Bar engine in direction of rotation	Pulley position	Set Cylinder	
		Injector	Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4

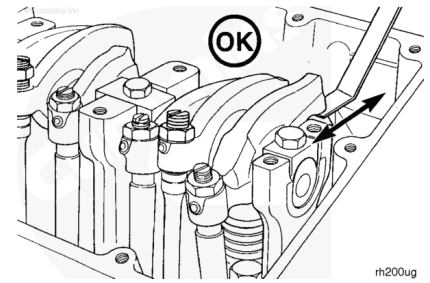
Firing Order is 1-5-3-6-2-4

When the “A” mark is aligned with the pointer, the intake and exhaust valves for cylinder number 1 **must** be closed. The injector plunger for cylinder number 1 **must** be at the bottom of its stroke. If these conditions are **not** correct, cylinder number 6 **must** be ready to check. Check the injector and valves on the cylinder. Make sure both the intake and exhaust valve rocker levers can be rattled by hand or the push tubes can be freely rotated.

Valve Lash

Use a set of feeler gauges to measure the amount of clearance (lash) between the crosshead and the rocker lever nose.

Measure and record the intake and exhaust valve lash. If the valve lash is **not** within the specifications listed below, the valve **must** be adjusted. See the Adjust step in this procedure.



ISM and M11 Valve Lash Recheck Limits

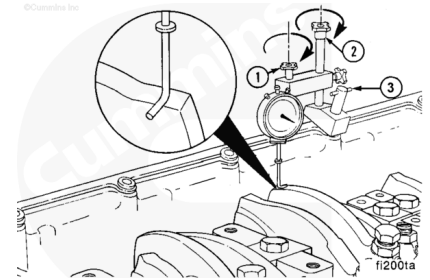
	mm		in
Intake	0.10	MIN	0.004
	0.41	MAX	0.016
Exhaust	0.46	MIN	0.018
	0.76	MAX	0.030

### Injector Lash

Install the dial indicator and the support from the injector travel measurement kit so the extension for the dial indicator is on top of the injector rocker lever, directly over the socket on the cylinder being checked.

Securely tighten the thumbscrew (1) and hold down the capscrews (2 and 3).

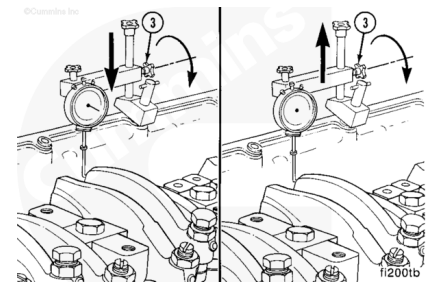
All adjusting screws **must** be tight for an accurate measurement.



The tip of the dial indicator extension **must** rest on the rocker lever, directly above the socket. If it does **not**, incorrect readings can result.

Loosen the thumbscrew (3), and lower the indicator against the injector rocker lever until the stem is fully compressed.

Raise the indicator approximately 12.7 mm [0.5 in] and tighten the thumb screw (3) to hold the indicator in position.

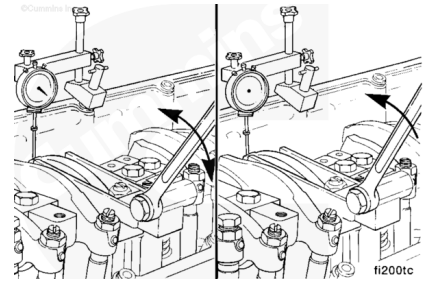


### ⚠ WARNING ⚠

**The injector plunger is under spring-tension. Do not allow the tool to slip. Serious personal injury can result.**

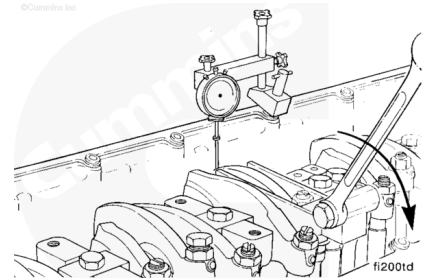
Actuate the injector plunger three or four times to remove the fuel from the injector assembly. Allow the lever to return slowly to prevent damage to the dial indicator.

Actuate the lever again. Set the dial indicator at zero while holding the injector plunger to the bottom of its travel.



Slowly release the actuator and check the dial indicator travel. Record the measured value.

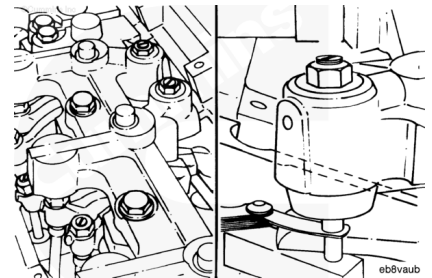
If the injector setting is **not** within the specification listed below, the injector **must** be adjusted. See the Adjust section in this procedure.



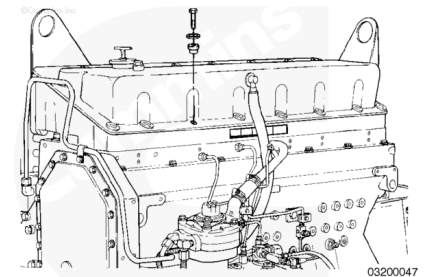
#### ISM and M11 Injector Lash Recheck Limits

mm		in
0.51	MIN	0.020
2.04	MAX	0.080

If the engine is equipped with engine brakes, check the brake piston clearance. Refer to Procedure 020-024 in Section 20. (</qs3/pubsys2/xml/en/procedures/35/35-020-024-tr.html>)



Install the rocker lever cover. Refer to Procedure 003-011 in Section 3. (</qs3/pubsys2/xml/en/procedures/35/35-003-011-tr.html>)



## Adjust

## General Information

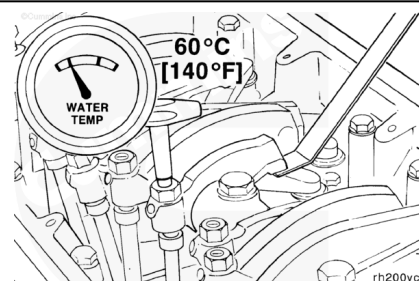
Valves, injectors, and engine brakes **must** be correctly adjusted for the engine to operate efficiently. Valve, injector, and engine brake adjustment **must** be performed using the values listed in this section. The accompanying table gives the adjustment specifications.

If the valves and injectors have been adjusted during troubleshooting or before this scheduled interval, adjustment is **not** required at this time.

### Valve, Injector, and Engine Brake Adjustment Specifications

	mm	in
Intake	0.36	0.014
Exhaust	0.69	0.027

All valve and injector adjustments **must** be made when the engine is cold (stabilized coolant temperature at 60°C [140°F] or below).



#### ⚠ WARNING ⚠

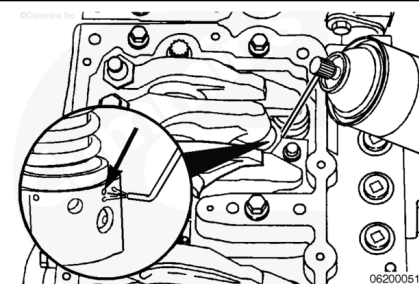
When using solvents, acids, or alkaline materials for cleaning, follow the manufacturer's recommendations for use.

#### ⚠ WARNING ⚠

Use skin and eye protection when handling caustic solutions to reduce the possibility of personal injury.

#### ⚠ WARNING ⚠

Some solvents are flammable and toxic. Read the manufacturer's instructions before using.

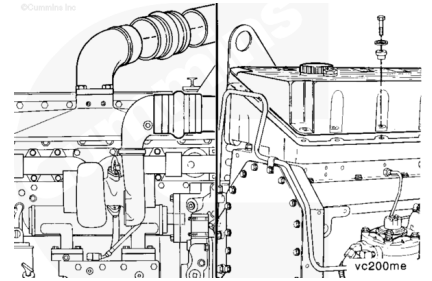


Clean the timing plunger to remove the varnish from the top edge.

Apply a non-chlorinated carburetor cleaner (Pyroil®, or equivalent). Use a narrow bore orifice or extension tube of 2 mm [0.079 in] maximum outside diameter (O.D.), into the injector weep hole.

If the entire overhead is to be reset, every injector is to be sprayed at this time.

Remove the rocker lever cover and gasket. Refer to Procedure 003-011 in Section 3. (</qs3/pubsys2/xml/en/procedures/35/35-003-011-tr.html>)

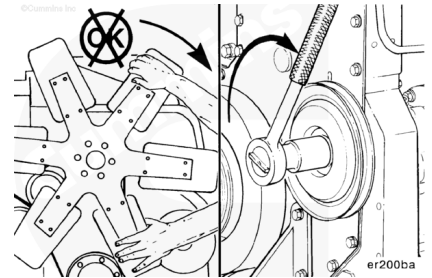


□ **WARNING** □

**Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.**

The valve set marks are located on the accessory drive pulley. The marks align with a pointer on the gear cover.

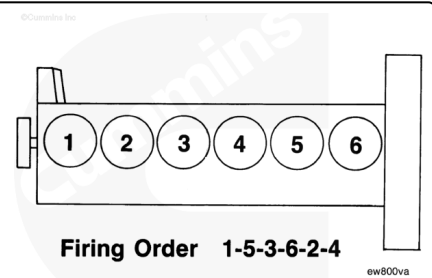
Use the accessory driveshaft to rotate the crankshaft.



The cylinders are numbered from the front gear housing end of the engine.

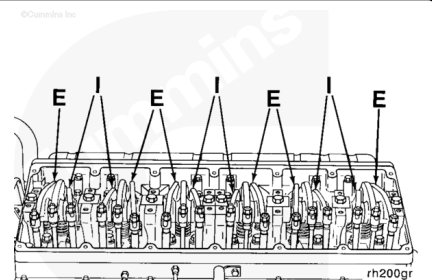
The crankshaft rotation is **clockwise** when viewed from the front of the engine.

The engine firing order is 1-5-3-6-2-4.



Each cylinder has three rocker levers:

- The long rocker lever (E) is the exhaust lever.
- The center rocker lever is the injector lever.
- The short rocker lever (I) is the intake lever.



The valves and injectors on the same cylinders are adjusted at the same index mark on the accessory drive pulley.

One pair of valves and one injector are adjusted at each pulley index mark before rotating the accessory drive to the next index mark.

Two crankshaft revolutions are required to adjust all the valves and injectors.

**Note :** See the example before attempting to begin the adjustment procedure.

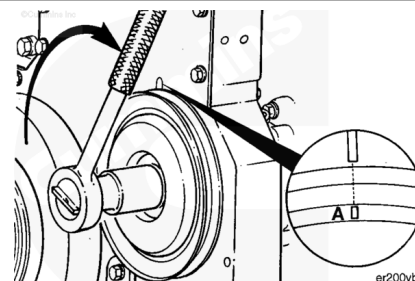
**Note :** Set the injector on the same cylinder before setting the valves.

Adjust all the injectors, valves, and brakes, if equipped, according to the following table.

Injector and Valve Measurement Sequence			
Bar engine in direction of rotation	Pulley position	Set Cylinder	
		Injector	Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4
Firing Order: 1-5-3-6-2-4			

The adjustment can begin on any valve set mark. In the following example, the adjustment will begin on the "A" valve set mark with cylinder number 1 valves closed and ready for adjustment.

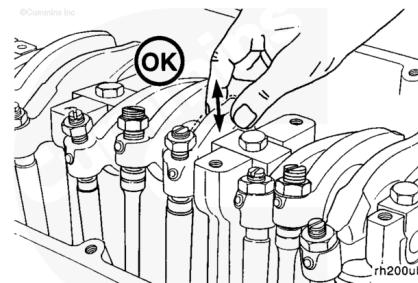
Rotate the accessory drive **clockwise** until the "A" valve set mark on the accessory drive pulley is aligned with the pointer on the gear cover.



When the "A" mark is aligned with the pointer, the intake and exhaust valves for cylinder Number 1 **must** be closed. If these conditions are **not** correct, cylinder number 6 injector and

valves **must** be ready to set. Set the injector and valves on the cylinder so that both the intake and exhaust valve rocker lever arms are loose and can be moved from side-to-side.

Both valves are closed when both rocker levers are loose and can be moved from side-to-side.



## Injectors

Loosen the injector adjusting screw locknut.

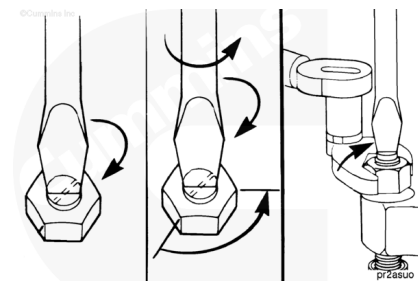
Use a screwdriver or a box end wrench, if equipped with engine brakes) to adjust the screw. Bottom the injector plunger three or four times to remove the fuel.

Turn the adjusting screw in until it just bottoms the plunger.

**Note :** Do not use excessive force when bottoming the plunger.

Back out the adjusting screw two flats, 120 degrees.

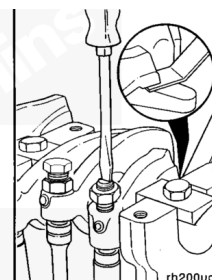
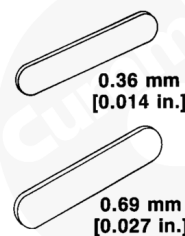
Hold the adjusting screw, and tighten the locknut.



**Torque Value:** 61 n•m [ 45 ft-lb ]

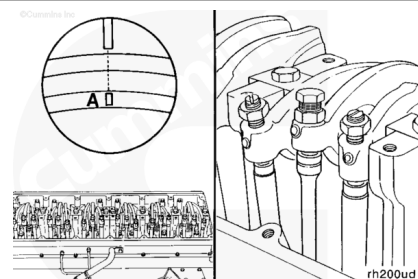
After setting the injector, set the valves on the same cylinder.

### Feeler Gauges



## Valves

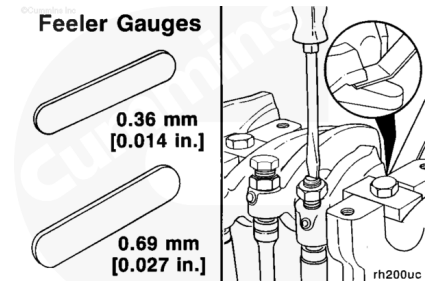
With the "A" valve set mark aligned with the pointer on the gear cover and both valves closed on the cylinder to be adjusted, loosen the adjusting screw locknuts on the intake and exhaust valves.





Select a feeler gauge for the correct valve lash specification.

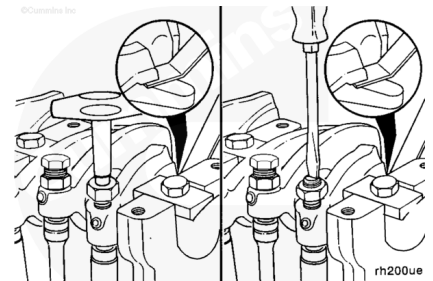
Valve Lash Specifications			
	mm		in
Intake Valve	0.36	MIN	0.014
Exhaust Valve	0.69	MIN	0.027



Insert the feeler gauge between the top of the crosshead and the rocker lever pad.

Two different methods for establishing valve lash clearance are described below. Either method can be used; however, the torque wrench method has proven to be the most consistent. It eliminates the need to feel the drag on the feeler gauge.

- **Torque Wrench Method:** Insert the correct feeler gauge. Use an inch-pound torque wrench, Part Number 3376592, normally used to set preload on top-stop injectors, and tighten the adjusting screw.



**Torque Value:** 0.7 n•m [ 6 in-lb ]

- **Touch Method:** Tighten the adjusting screw until a slight drag is felt on the feeler gauge.

Hold the adjusting screw in the position shown. The adjusting screw **must not** turn when the locknut is tightened.

**Torque Value:**

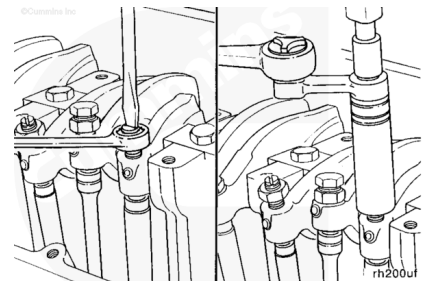
Without torque wrench adapter:

1.61 n•m [ 45 ft-lb ]

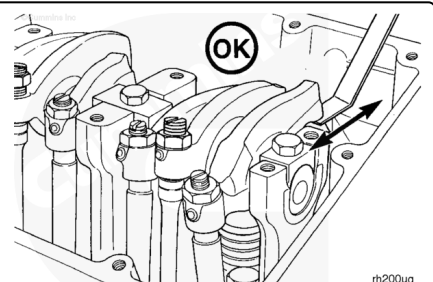
**Torque Value:**

With torque wrench adapter, Part Number 3163196:

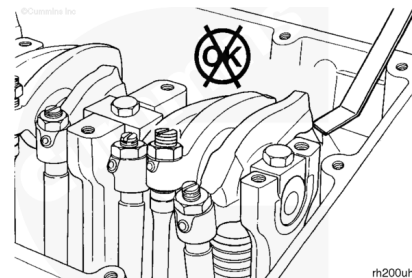
1.47 n•m [ 35 ft-lb ]



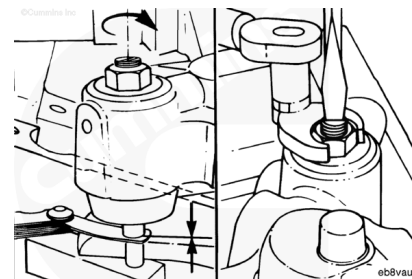
After tightening the locknut to the correct torque value, check to make sure the feeler gauge will slide backward and forward between the crosshead and the rocker lever with **only** a slight drag.



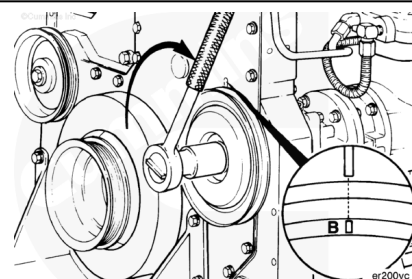
If using the touch method, attempt to insert a feeler gauge that is 0.03 mm [0.001 in] thicker between the crosshead and the rocker lever pad. The valve lash is **not** correct when a thicker feeler gauge will fit.



If the engine is equipped with an engine brake, adjust the brakes. Refer to Procedure 020-024 in Section 20. (</qs3/pubsys2/xml/en/procedures/35/35-020-024-tr.html>)



After adjusting the injector, valves, and engine brakes, if equipped, on the appropriate cylinder, rotate the accessory drive pulley, and align the next valve set mark with the pointer on the gear cover.

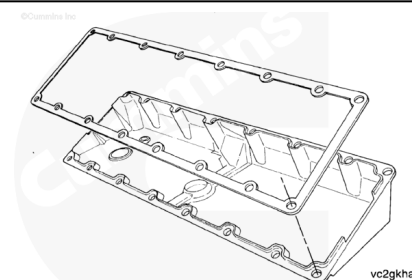


If the rocker lever cover gasket was **not** damaged, it can be used again. If the gasket was damaged, it **must** be discarded and a new one installed.

Install the rocker lever cover gasket.

Install the rocker lever cover. Refer to Procedure 003-011 in Section 3. (</qs3/pubsys2/xml/en/procedures/35/35-003-011-tr.html>)

If damage resulted in coolant, oil, excessive fuel or excessive black smoke entering the exhaust system, the aftertreatment system **must** be inspected. Refer to Procedure 014-013 in Section 14. (</qs3/pubsys2/xml/en/procedures/101/101-014-013.html>)



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**Last Modified: 07-Oct-2011**

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