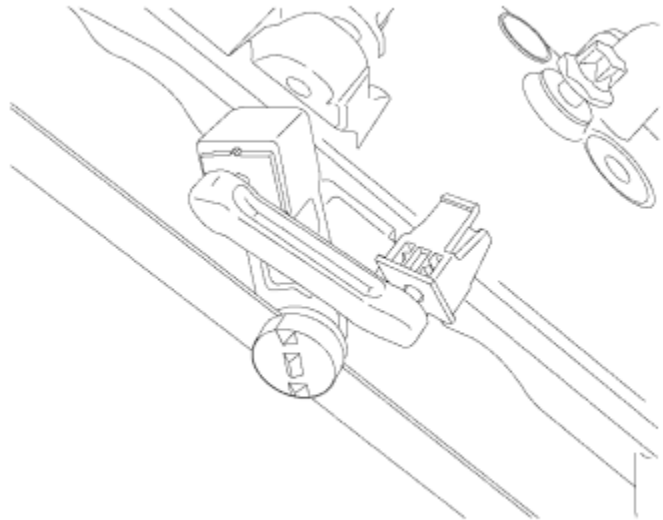


## Actuator-Swirl Valve

### DESCRIPTION

The swirl valve linkage links the swirl valves in the intake manifold to the swirl valve actuator.

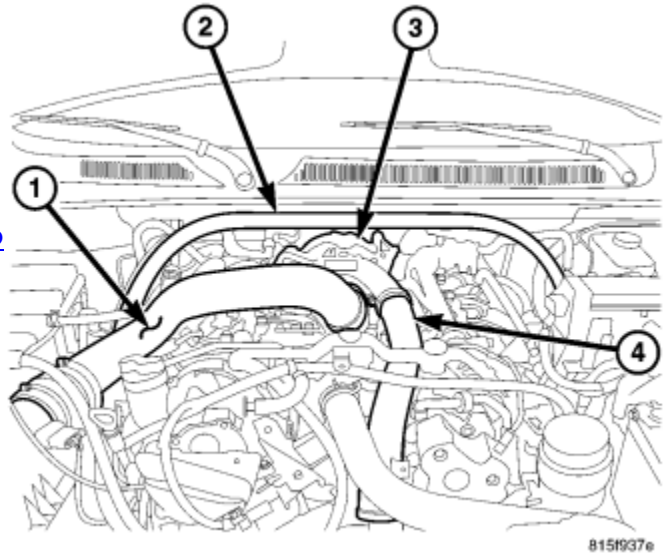
The swirl valve linkage has two different style clips. The square clip (1) is a two piece design, and the round clip (2) is a one piece design.



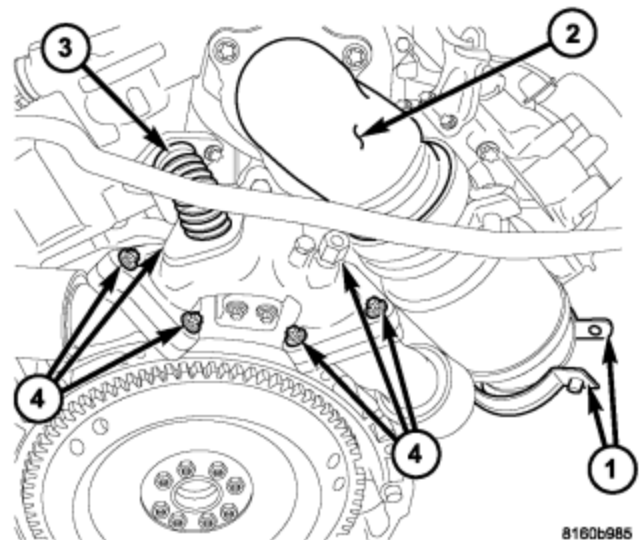
81913d54

# REMOVAL

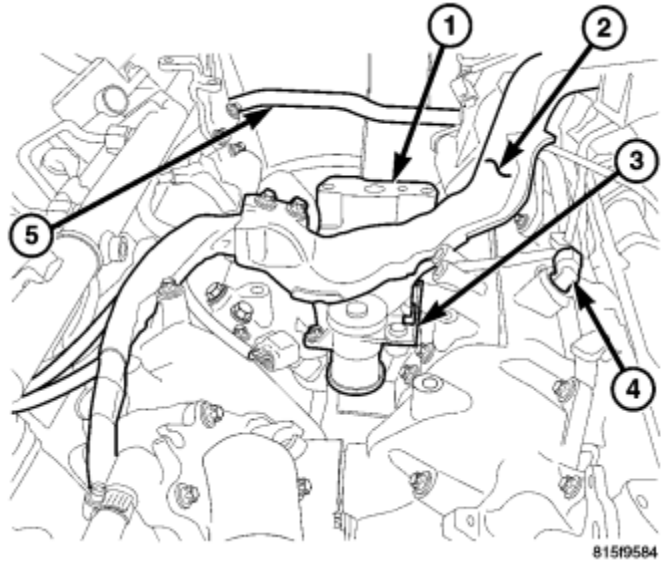
1. Disconnect the negative battery cable. ([Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL](#))
2. Remove the engine cover. ([Refer to 9 - ENGINE - REMOVAL](#))
3. Remove the air cleaner assembly. ([Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL](#))
4. Remove the air charge resonator.
5. Remove the air charge outlet tube (4).
6. Remove the vapor control valve.
7. Drain the coolant. ([Refer to 7 - COOLING - STANDARD PROCEDURE](#))
8. Remove the belly pan.



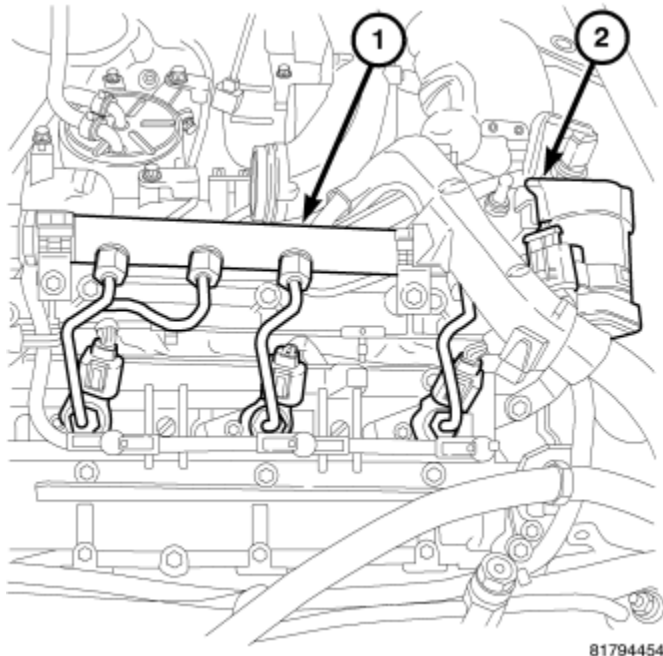
9. Remove the turbocharger. ([Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - REMOVAL](#))
10. Remove the EGR tube (3).



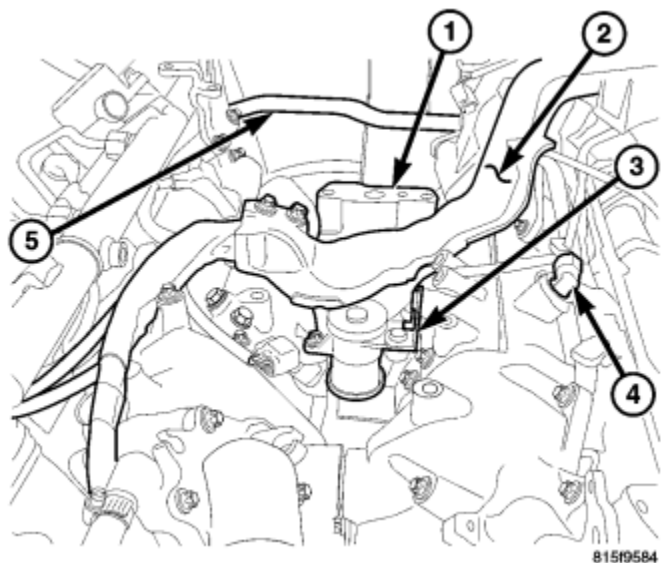
11. Remove the oil housing adapter (1).
12. Remove the rear engine lift bracket at the intake manifold.
13. Remove the front engine lift bracket at the cylinder heads.



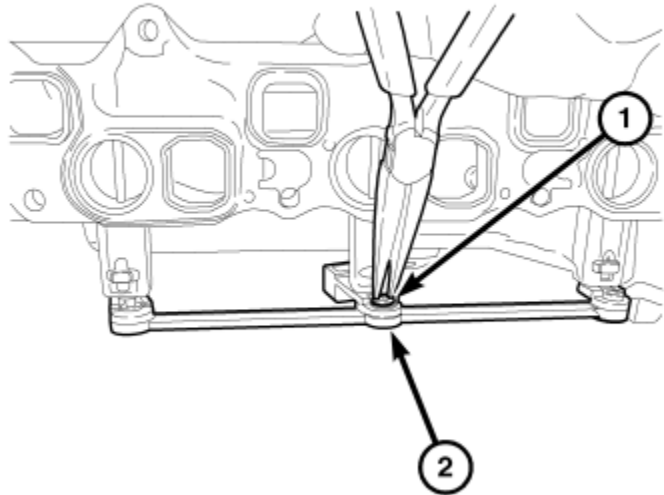
14. Remove the left fuel rail and lines. ([Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL](#))
15. Remove the right fuel rail and lines. ([Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL](#))



16. Disconnect the engine harness (2) and position aside.
17. Remove the swirl port actuator (3).
18. Remove the heater hose at the EGR valve.
19. Remove the EGR control assembly.



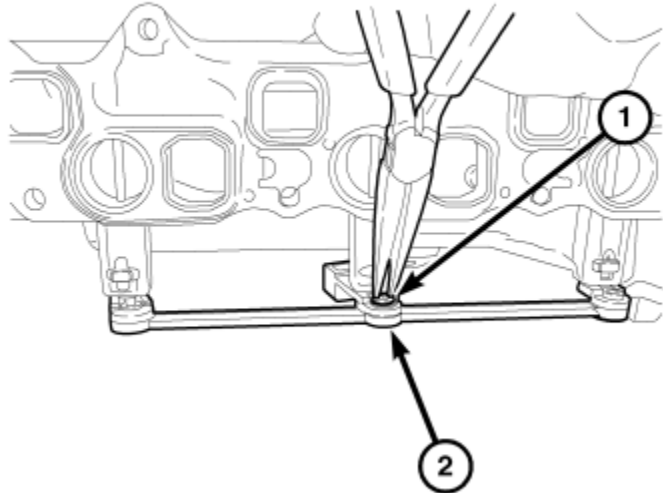
20. Remove the coolant hose at the thermostat housing.
21. Remove the glow plug module.
22. Remove the throttle control assembly.
23. Remove the intake manifold.
24. Loosen the EGR cooler bolts to gain access to the swirl valve linkage clips.
25. Remove the swirl valve linkage clips (2).



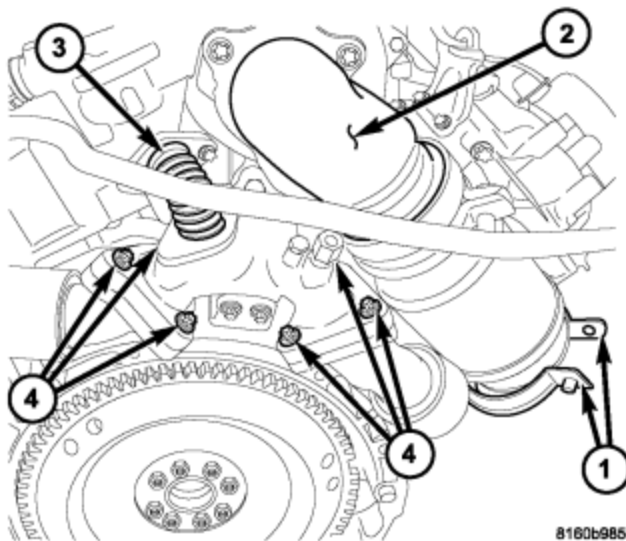
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# INSTALLATION

1. Install the round clips (2) into the swirl valve linkage.
2. Clean the intake manifold sealing surfaces.
3. Install new intake manifold gaskets.



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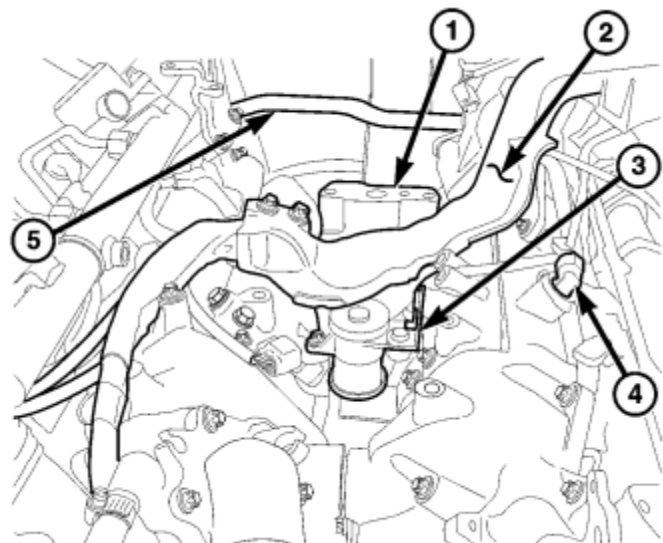


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4. Install the EGR cooler.
5. Position the intake manifold and torque to 20.34 N.m (180 lbs. in.)
6. Install the throttle control assembly.
7. Install the glow plug module.
8. Install the coolant hose at the thermostat housing.
9. Install the EGR control assembly.
10. Install the EGR control assembly chamber retaining bolts.
11. Install the EGR control assembly retaining bracket.

12. Install the swirl valve actuator. ([Refer to 9 - ENGINE/MANIFOLDS/ACTUATOR-SWIRL VALVE - INSTALLATION](#)).

13. Install the fuel filter assembly ([Refer to 14 - FUEL SYSTEM/FUEL](#)



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DELIVERY/FUEL FILTER - INSTALLATION).

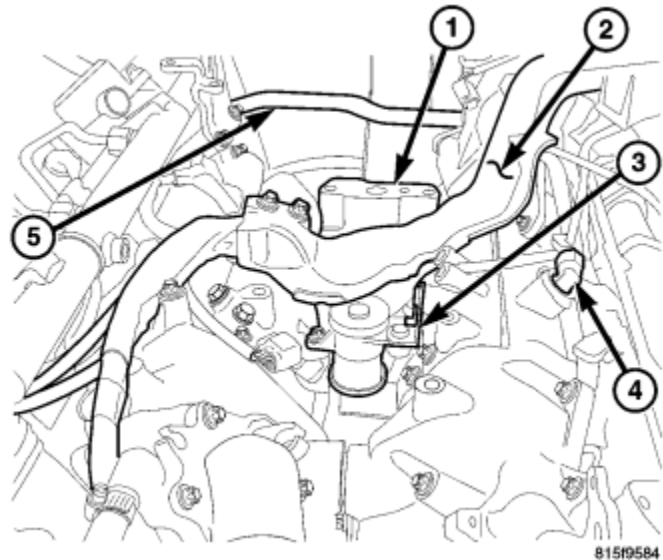
14. Install the fuel lines. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - INSTALLATION)
15. Position and connect the engine harness.
16. Install the front lifting bracket.
17. Install rear lifting bracket.
18. Install the EGR tube.
19. Install the turbocharger. (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSTALLATION)
20. Install the engine compartment lower silencer.
21. Fill the cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
22. Install the vapor control valve.
23. Install the charge air outlet tube (4).
24. Install the charge air resonator.
25. Install the air cleaner assembly. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION)
26. Install the engine cover. (Refer to 9 - ENGINE - INSTALLATION)
27. Connect the batteries. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - INSTALLATION)

# Linkage-Swirl Valve

## DESCRIPTION

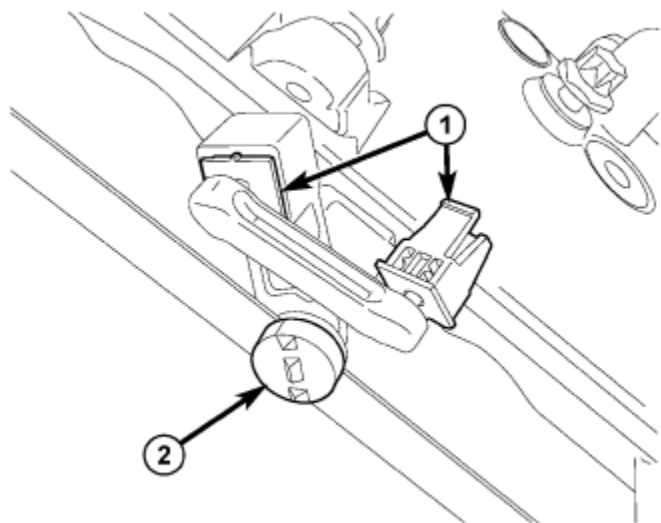
The intake manifolds feature swirl intake ports to reduce particulates at low engine speeds. Each cylinder incorporates one swirl port and one charge port. The swirl ports can be closed by the swirl valves. The valves are connected together via a linkage which is operated by the swirl valve actuator.

The swirl valves are normally open by spring tension. The spring is integral with the swirl valve actuator. In the lower engine speed and load range, the swirl valves are closed by the swirl valve actuator. The entire air mass flows through the charge ports only, which results in greater swirling. The increased swirling produces uniform combustion for better engine performance and reduction of particulates. As rotational speed and load increases, the swirl valves open, so that optimal swirling and the required air mass are provided for the current operating conditions.



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The linkage between the swirl valve actuator and the intake manifold has two different style clips. The square clip (1) is a two piece design, and the round clip (2) is a one piece design.



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# REMOVAL

1. Disconnect negative battery cable. ([Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL](#))
2. Remove the engine cover. ([Refer to 9 - ENGINE - REMOVAL](#))
3. Drain the coolant. ([Refer to 7 - COOLING - STANDARD PROCEDURE](#))
4. Remove the strut tower support (2).
5. Remove the intake air housing and tube. ([Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL](#))
6. Remove the charge air cooler tube (4).
7. Remove the resonator.
8. Remove the EGR tube.

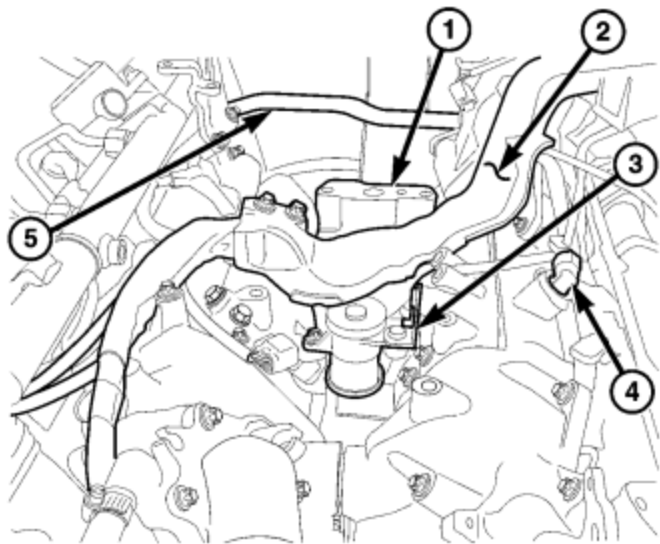


**CAUTION: Observe the position of the turbocharger oil passage housing and gasket. Failure to properly position the gasket during assembly will result in immediate turbocharger failure after assembly.**

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9. Remove the turbocharger (3). ([Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - REMOVAL](#))

10. Disconnect the engine harness and position aside.
11. Disconnect the swirl valve actuator connector.
12. Remove the swirl valve actuator (3) clips.
13. Remove the swirl valve actuator.

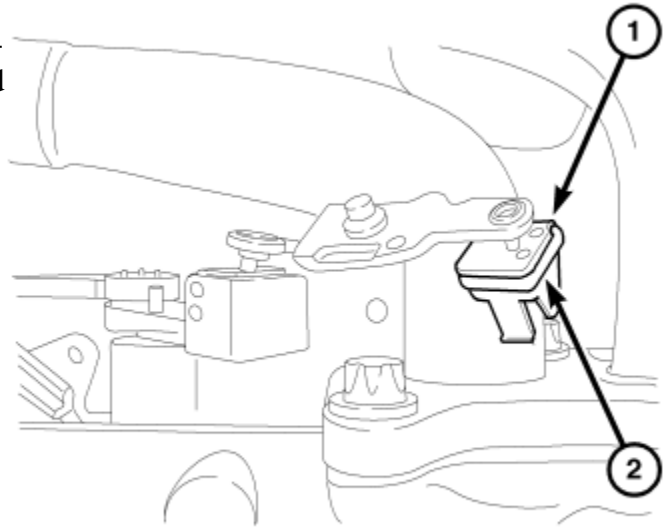


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# INSTALLATION

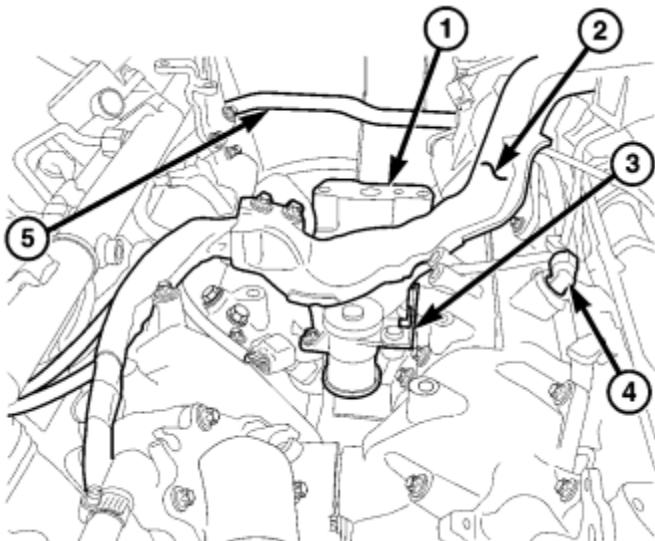
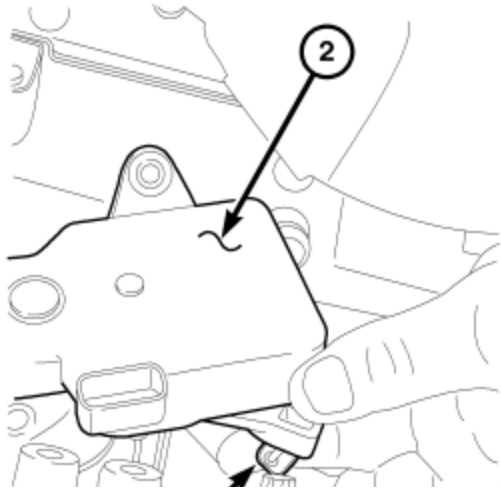
1. Assemble the two halves of the square clip around the actuator arm, and place a 5/16" O-ring (2) around the base of the clip (1) to hold it together.



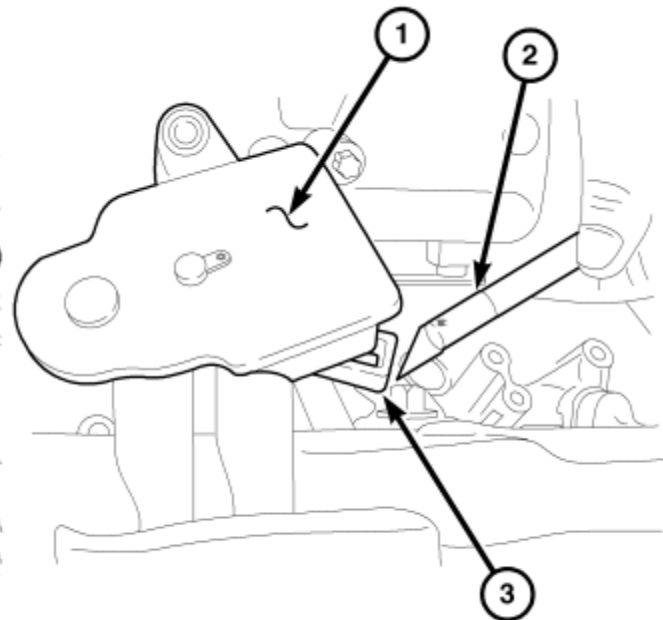
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2. Position the clip into the actuator arm and push the clip partially into the arm.

3. Cut the O-ring and press the clip the rest of the way into the actuator arm. Make sure the clip clicks into place.



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4. Install the swirl valve actuator. Tighten the bolts to 8 nm (44 lbs. in.).
5. Connect the swirl valve connector.
6. Position and connect the engine harness.

**CAUTION: Observe the position of the turbocharger oil passage housing and gasket. Failure to properly position the gasket during assembly will result in immediate turbocharger failure after assembly.**

7. Install the turbocharger. ([Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSTALLATION](#))

8. Install the EGR tube.
9. Install the resonator.
10. Install the charge air cooler tube (4).
11. Install the air cleaner housing and air tube. ([Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION](#))
12. Install the strut tower support (2).
13. Fill the cooling system. ([Refer to 7 - COOLING - STANDARD PROCEDURE](#))
14. Install the engine cover. ([Refer to 9 - ENGINE - INSTALLATION](#))
15. Connect the battery. ([Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - INSTALLATION](#))



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