Jacobs Vehicle Systems™

Jacobs Exhaust Brake™

EX3116/3126,
EX3126B, And TM3126B

INSTALLATION

FOR APPLICATION ON 3116, 3126, AND 3126B CATERPILLAR® ENGINES
Information in this manual was current at the time of printing and is subject to change without notice or liability. See the Jake Brake Product Reference Guide for Caterpillar Engines, Manual Form RENR 1370, and Jacobs website - www.jakebrake.com - for more information.

Table of Contents

1. Exhaust Brake Assembly Installation ........ 3
   A. Turbo-mount Applications .................. 3
   B. In-pipe Applications ....................... 4
2. Pneumatic Group Installation ............... 6
3. Controls Installation
   A. 3116 Mechanical Engines ................... 8
   B. 3126B Electronic Engines ................... 10
   C. 3126 Electronic Engines ................... 11
4. Final Test ...................................... 12
Appendix A
Installing the Jacobs Exhaust Brake with
Allison Automatic Transmissions ............. 13

Application Notes

A. Engine application:

For Caterpillar 3126B engines there are two aftermarket kits available: a turbo-mount design and a standard "in-pipe" design. The turbo-mount design eliminates cutting and welding of exhaust pipes, simplifying installation. The exhaust brake housing, however, extends approximately 3" from the turbo outlet. Before installing this type of exhaust brake, ensure there will be at least 3" of clearance between any exhaust component and the vehicle chassis and firewall after exhaust brake installation.

For Caterpillar 3116 and 3126 engines, a standard "in-pipe" kit is available.

For kit part numbers and further information, see the Brake Application Guide in the Jake Brake Product Reference Guide for Caterpillar Engines, Manual Form RENR 1370.

Installation is approved for all 3126 and 3126B engines. Installation on 3116 engines is limited to engines with S/N 2BK29931 and higher (all horsepower ratings) and 200 - 275 horsepower ratings built after August, 1992. Some earlier 3116 engines can be converted for higher back pressure. See Jacobs Product Advisory 94-2 for details (included in the Form RENR 1370).

B. Vehicles equipped with hydraulic brakes:
Vehicles that do not have an on-board air supply require the installation of an auxiliary air supply system. When an air supply is required, order the Pneumatic Group with Air Supply and Electrical harness Group. Follow the installation instructions included with the Pneumatic Group with Air Supply. See the Brake Application Guide for correct part numbers.

C. Vehicles with Allison Transmissions: For vehicles equipped with an Allison transmission, refer to Appendix A, Installing the Jacobs Exhaust Brake with Allison Automatic Transmissions. For information on the use of the exhaust brake on these vehicles, see Jacobs Exhaust Brake™ Application Note 93-1, available in the Jake Brake Product Reference Guide (see note at the top of this page).

Safety Precautions

The following symbols in this manual signal potentially dangerous conditions to the mechanic or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

**WARNING** THIS SYMBOL WARNS OF POSSIBLE PERSONAL INJURY.

**CAUTION** THIS SYMBOL REFERS TO POSSIBLE EQUIPMENT DAMAGE.

**NOTE:** INDICATES AN OPERATION, PROCEDURE OR INSTRUCTION THAT IS IMPORTANT FOR CORRECT SERVICE.

Fuels, electrical equipment, exhaust gases and moving engine parts present potential hazards that could result in personal injury. Take care when installing a compression brake. Always use correct tools and proper procedures as outlined in this manual.

**WARNING** THE JACOBS EXHAUST BRAKE™ COMPRESSION BRAKE IS A VEHICLE SLOWING DEVICE, NOT A VEHICLE STOPPING DEVICE. IT IS NOT A SUBSTITUTE FOR THE SERVICE BRAKING SYSTEM. THE VEHICLE'S SERVICE BRAKES MUST BE USED TO BRING THE VEHICLE TO A COMPLETE STOP.
Section 1: Exhaust Brake Assembly Installation

For turbo-mount models, follow the procedure in 1A. For in-line models, follow the procedure in 1B.

1A. Turbo-mount Installation

Refer to Figure 1 for the following procedures.

1. Loosen the “V” clamp holding the original exhaust pipe to the turbo. Remove the exhaust pipe. Inspect the exhaust pipe for any sign of rust or damage. Replace if necessary.

2. In most installations, the exhaust pipe must be shortened to allow installation of the exhaust brake housing. The most convenient method is to modify the exhaust pipe length at a slip joint. Using a torch, heat the pipe sufficiently to disassemble the slip joint. Then remove the required length of exhaust pipe.

3. The exhaust brake assembly is mounted to the turbo outlet using the gasket and clamp provided (see Figure 1). The gasket is coated with an adhesive to ease installation. Remove the backing from the adhesive and apply the gasket to the turbo outlet, taking care to center the gasket.

   **NOTE:** ENSURE THE GASKET IS CENTERED DURING INSTALLATION OF THE EXHAUST BRAKE. GASKETS NOT CENTERED CORRECTLY DURING INSTALLATION CAN CAUSE UNNECESSARY RESTRICTION OF EXHAUST FLOW AND POSSIBLE LOSS OF POSITIVE POWER, OR A LEAK DURING BRAKING AND LOSS OF BRAKING POWER.

4. Position the exhaust brake assembly so the air cylinder is either above the exhaust brake housing or on the side of the housing opposite the engine, and mount to the turbo using the clamp provided.

   **CAUTION:** TO PREVENT EXPOSURE TO EXCESSIVE HEAT, DO NOT INSTALL THE EXHAUST BRAKE ASSEMBLY WITH THE AIR CYLINDER FACING THE ENGINE SIDE OF THE HOUSING. TO PREVENT ACCUMULATION OF WATER IN THE SOCKET JOINT, DO NOT INSTALL THE EXHAUST BRAKE ASSEMBLY WITH THE AIR CYLINDER LOCATED BENEATH THE MAIN HOUSING.

5. When the exhaust brake assembly is properly positioned, torque the clamp bolts to 70 - 80 lb-in. (8 - 9 N•m).

6. Connect the original exhaust pipe to the exhaust brake housing. Use the clamp provided in the kit. No gasket is required between the exhaust brake assembly and the exhaust pipe. Tighten the clamp enough to loosely hold the parts in place.

7. Make the connection to the muffler using the parts (flex pipe and clamp) removed when the installation began. With the clamps still loose, align the exhaust system. Ensure that there is proper clearance between the exhaust system, including the exhaust brake components, and the engine and chassis. Now torque all the “V” clamps to 70 - 80 lb-in. (8 - 9 N•m).

   **Proceed to Section 2, Pneumatic Group Installation.**
1B. In-pipe Installation

Important Notes on the Positioning of the Jacobs Exhaust Brake™

A. Exhaust pipe arrangements vary from vehicle to vehicle. Install the exhaust brake no further than 48” (122 cm) from the turbocharger.

NOTE: INSTALLING THE EXHAUST BRAKE ASSEMBLY DOWNSTREAM FROM A FLEX PIPE OR NON-SEALED JOINT, OR INSTALLING THE ASSEMBLY FURTHER THAN 48” FROM THE TURBOCHARGER WILL RESULT IN POOR BRAKING PERFORMANCE.

B. Mount the exhaust brake in a vertical orientation with the exhaust brake air cylinder facing the front of the vehicle (refer to Fig. 2). This will ensure a flow of air over the cylinder.

C. When vertical orientation is not possible, the exhaust brake can be mounted in the horizontal position. Position the exhaust brake with the air actuator facing the side of the exhaust pipe but away from the engine (refer to Fig. 2).

CAUTION DO NOT POSITION THE EXHAUST BRAKE SO THAT THE ACTUATOR IS ABOVE OR BELOW THE EXHAUST PIPE.

Installing the exhaust brake assembly

1. Figure 1 indicates a typical arrangement of the exhaust brake and mounting hardware. Loosen the “V” clamps holding the original exhaust pipe arrangement in place. Remove the exhaust pipe, inspect for any sign of rust or damage. Replace if necessary.

2. Lay the exhaust pipe on the ground or bench with the exhaust brake and exhaust pipe sleeves, (see Fig. 2) and mark the pipe section to be replaced with the sleeves. Cut out the necessary pipe section and weld the sleeve to the two exhaust pipe lengths.

NOTE: BE SURE TO CUT THE PIPE STRAIGHT AND WELD THE SLEEVES IN PLACE CAREFULLY TO ENSURE THAT NO LEAKS OCCUR IN THE SYSTEM. THE SECTION OF THE EXHAUST PIPE BETWEEN THE TURBO AND THE EXHAUST BRAKE ASSEMBLY WILL BE UNDER SIGNIFICANT INTERNAL PRESSURE, AND ANY LEAKS WILL SERIOUSLY AFFECT RETARDING PERFORMANCE.

3. Reinstall the exhaust pipe on the turbocharger using Jacobs gasket. The gasket is coated with an adhesive to ease installation. Remove the backing from the adhesive and apply the gasket to the turbo outlet, taking care to center the gasket.

NOTE: ENSURE THE GASKET IS CENTERED DURING INSTALLATION OF THE EXHAUST BRAKE. GASKETS NOT CENTERED CORRECTLY DURING INSTALLATION CAN CAUSE UNNECESSARY RESTRICTION OF EXHAUST FLOW AND POSSIBLE LOSS OF POSITIVE POWER, OR A LEAK DURING BRAKING AND LOSS OF BRAKING POWER.

4. Install the exhaust brake assembly at the other end of the section of pipe just installed using the gasket and the “V” clamp. Orient the exhaust brake assembly so the air cylinder bracket points away from the turbocharger. Make sure that the gasket is centered on the exhaust brake inlet. Install the “V” clamp and tighten enough to temporarily hold the parts in place.
5. Install the second section of exhaust pipe with the sleeve attached and clamp to the exhaust brake outlet using the “V” clamp provided. No gasket is needed between the exhaust brake and this pipe section.

6. Make the connection to the muffler using the parts (flex pipe and clamp) removed when the installation began. At this point, with the clamps still loose, align the exhaust system. Ensure that there is proper clearance between the exhaust system (including the exhaust brake components) and the engine and chassis. Torque all the “V” clamps to 70 - 80 lb.-in. (8 - 9 N•m).

7. One support boss is cast into the exhaust brake housing to facilitate the attachment of a support bracket. This support bracket is then fastened to a suitable engine, bell housing or transmission mounting point. The actual configuration of this support bracket and fasteners depends on the specific vehicle configuration. Failure to support the exhaust brake and exhaust system properly can cause damage to the exhaust system.

**NOTE:** MAKE SURE THAT THE GASKETS ARE INSTALLED BETWEEN THE TURBO OUTPUT AND THE EXHAUST PIPE AND BETWEEN THE EXHAUST PIPE AND THE EXHAUST BRAKE INLET. FAILURE TO CORRECTLY INSTALL THESE GASKETS CORRECTLY WILL RESULT IN A SIGNIFICANT LOSS OF RETARDING PERFORMANCE.
Section 2: Pneumatic Group Installation

Refer to Figure 4 when installing the pneumatic group.

III. Description

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pipe tee, 1/2 NPT</td>
</tr>
<tr>
<td>2</td>
<td>Reducer bushing, 1/2 - 1/4 NPT</td>
</tr>
<tr>
<td>3</td>
<td>90° street elbow, 1/4 NPT</td>
</tr>
<tr>
<td>4</td>
<td>Nipple, 1/4 NPT</td>
</tr>
<tr>
<td>5</td>
<td>Protection valve</td>
</tr>
<tr>
<td>6</td>
<td>Compression fitting assembly</td>
</tr>
<tr>
<td>7</td>
<td>Air brake tube</td>
</tr>
</tbody>
</table>

III. Description

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Compression fitting assembly</td>
</tr>
<tr>
<td>9</td>
<td>Solenoid valve</td>
</tr>
<tr>
<td>10</td>
<td>45° flared, 90° elbow, 1/8 NPT</td>
</tr>
<tr>
<td>11</td>
<td>Hose fitting assemblies (2)</td>
</tr>
<tr>
<td>12</td>
<td>Air brake hose</td>
</tr>
<tr>
<td>13</td>
<td>45° flared, 90° elbow, 1/4 NPT</td>
</tr>
<tr>
<td>14</td>
<td>Nipple, 1/4 NPT</td>
</tr>
</tbody>
</table>

FIG. 4
BLEED THE AIR TANK OF THE VEHICLE BEFORE STARTING THIS INSTALLATION.

1. Install the protection valve at the outlet of the vehicle's existing air tank using the proper pipe fittings as indicated in Figure 3.

**WARNING** USE OF THE PROTECTION VALVE WILL MAINTAIN THE INTEGRITY OF THE ORIGINAL PNEUMATIC SYSTEM. UNDER NO CIRCUMSTANCES SHOULD THE PROTECTION VALVE BE OMITTED FROM THE INSTALLATION OF THE EXHAUST BRAKE.

**NOTE:** IF A FITTING IS NOT AVAILABLE ON THE AIR TANK AND A "TEE" FITTING IS EMPLOYED TO TAP INTO THE ORIGINAL PNEUMATIC CONNECTIONS, ENSURE THAT THE ORIGINAL AIR CONNECTIONS ARE CORRECTLY RETORQUED.

2. Install the solenoid valve on the chassis rail using existing predrilled holes. If no suitable location is available on the chassis rail, then mount the solenoid valve to the body sheet metal. Position the solenoid valve with its air exhaust port facing downward. Avoid excessive heat coming from the exhaust system. The distance from the solenoid valve to the air cylinder of the exhaust brake should be within the length of the supplied air hose.

3. Using the 1/4" - 18 NPT compression fittings, connect the solenoid port marked “1” or “P” to the air tank using the air tubing. When assembling compression fittings, cut the tubing ends squarely, then insert the tubing into the fitting until it bottoms on the seat. Tighten the nut until one thread remains visible on the fitting.

4. The supplied air hose, connects the solenoid port marked “2” or “A” to the exhaust brake air cylinder. Shorten the hose to the required length. Ensure that the minimum bend radius is 2” (51 mm). Install the end fittings on both ends of the hose according to the following steps:
   
a. Cut the hose squarely with a fine tooth hacksaw or cutoff wheel.

b. Put the socket in a vise.

c. Screw the hose counterclockwise into socket until it bottoms, then back off 1/4 turn.

d. Lubricate the nipple thread and inside of the hose liberally with a heavy oil or Aeroquip hose assembly lube, Aeroquip P/N 222070.

e. Screw the nipple clockwise into socket and hose. Leave 1/32” (0.8 mm) to 1/16” (1.6 mm) clearance between the nipple hex and socket.

5. Route the air tubing carefully and clamp using the clamps provided. Avoid tight bends, excessive heat coming from the exhaust system (+200°F/93°C) and ensure there is no possibility of abrasion through contact with chassis components.

6. If there is a plug in the exhaust port of the solenoid valve, remove it. Use the hose assembly to connect the solenoid port marked “2” or “A” to the exhaust brake air cylinder.
Section 3: Installation of the Controls

3.A. 3116 Mechanical Engines

Dash and Clutch Switches

1. Install the dash switch in a convenient location on the dashboard.

2. Install the clutch switch using the instructions included in the Clutch switch group.

Fuel Pump Switch Installation

1. Remove the two throttle return springs, throttle lever, bolt and washers. Note there is one washer on top and one below the throttle lever.

2. Remove the three bolts that attach the throttle linkage bracket to the engine. Using the template supplied in the kit, mark and drill the bracket with a “V” size (0.377”) or an M10 drill bit (see Fig. 4).

3. Reinstall the throttle linkage bracket. Torque the two M10 bolts to 33 - 47 lb.-ft. (45 - 65 N•m) and the M8 bolt to 15 - 25 lb.-ft. (21 - 35 N•m). Discard the throttle lever bottom washer and replace with the bracket included in the kit. Reinstall the throttle lever along with the upper washer (see Fig. 5). Do not torque the throttle lever bolt at this time.

4. Install the provided switch in the switch bracket as shown. Orient the switch bracket so that the switch contact face is perpendicular to the switch axis (see Fig. 6). Once this adjustment has been made, torque the throttle lever bolt to 15 - 25 lb.-ft. (21 - 35 N•m). Reinstall the throttle linkage springs.
5. Adjust the position of the switch so that the switch plunger is depressed when the throttle lever is at its low idle position. At the proper adjustment, there should be a 0.010 - 0.015" (0.254 - 0.381 mm) gap as shown in Fig. 7. In this position, the throttle lever must be stopped against the idle speed stop bolt.

6. Hold the switch in position and torque the locknuts to 5 lb.-ft. (7 N•m).

**NOTE:** ADJUST (IF NECESSARY) THE LOW IDLE RPM ACCORDING TO THE ENGINE SHOP MANUAL. NOTE THAT EVERY IDLE SPEED ADJUSTMENT WILL REQUIRE A FUEL PUMP SWITCH POSITION ADJUSTMENT.

**Wire Harness Installation**

Use the harness group supplied and make the connections shown in the wiring diagram in Fig. 8.

---

### Wiring Diagram, 3116 Engines

**Fig. 8**

**NOTE:** Connect all grounds to a common bolt or a good chassis ground.

**018899 wire harness**

**FUEL PUMP SWITCH**

**10A fuse or engine circuit breaker** (required for installation - not included)

**Key-switched power**

**Dashboard switch**

**Clutch switch**

**Exhaust Brake**
3.B. 3126B Electronic Engines

1. Install the dash switch in a convenient location in the dashboard.

**NOTE:** THE SWITCH GROUP USES LOW-RESISTANCE GOLD-PLATED CONTACTS AS REQUIRED BY THE ENGINE CONTROL MODULE. ANY SUBSTITUTE SWITCH MUST HAVE GOLD-PLATED CONTACTS.

2. Connect the green and gray wires on the Relay harness to the back of the switch as indicated in Figure 9.

3. Connect the pink/white wire to keyed ignition.

4. Connect the brown wire to Pin 12 on the Engine Control Module (ECM) P1 connector (see Fig. 9).

5. Plug the connector on the Solenoid harness to the corresponding connector on the Solenoid.

6. Connect the gray wire on the Solenoid harness to the dash switch as shown in Figure 9. Connect the green wire on the Solenoid harness to a good chassis ground.

---

**Wiring Diagram, 3126B Engines**

![Wiring Diagram](image)

FIG. 9
3.C. 3126 Electronic Engines

1. Install the dash switch in a convenient location in the dashboard.

**NOTE:** THE SWITCH GROUP USES LOW-RESISTANCE GOLD-PLATED CONTACTS AS REQUIRED BY THE ENGINE CONTROL MODULE. ANY SUBSTITUTE SWITCH MUST HAVE GOLD-PLATED CONTACTS.

2. Connect the green and gray wires on the Relay harness to the back of the switch as indicated in Figure 10.

3. Connect the pink/white wire to keyed ignition.

4. Connect the brown wire to Pin 40 on the Engine Control Module (ECM) P1 connector (see Fig. 10).

5. Plug the connector on the Solenoid harness to the corresponding connector on the Solenoid.

6. Connect the gray wire on the Solenoid harness to the dash switch as shown in Figure 10. Connect the green wire on the Solenoid harness to a good chassis ground.

---

Wiring Diagram, 3126 Engines

![Wiring Diagram](image-url)
Final Test

1. Start the engine and run at low idle speed with the transmission in neutral and the parking brake set.

2. Turn on the dash switch. The exhaust brake should come on within 0.25 seconds. Step on the accelerator pedal and increase engine speed. The exhaust brake must turn off at 900 ± 50 RPM. Take your foot off the pedal and the exhaust brake should turn on again within 0.25 seconds.

3. With the engine at idle, step on the clutch pedal. Again, the exhaust brake must turn off immediately. Take your foot off the clutch pedal and the exhaust brake should turn on again.

NOTE: ON ELECTRONIC ENGINES, THE EXHAUST BRAKE WILL ONLY OPERATE ABOVE 900 RPM WHEN DECELERATING.

4. Check for exhaust gas leakage around the “V” clamps at the turbo outlet and exhaust brake inlet. No leakage is allowed as this will reduce the effectiveness of retarding performance.

5. Before returning the vehicle to service, make a final check of wiring and air tubing/hose routing to make sure that it does not run against hot surfaces or is abraded or kinked. Take the vehicle out for a road test to ensure that the system is functioning correctly.

NOTE: UNDER NORMAL OPERATING CONDITIONS, DO NOT USE THE EXHAUST BRAKE AT IDLE ENGINE SPEED.
Appendix A - Installing the Jacobs Exhaust Brake™ on vehicles equipped with Allison Automatic Transmissions

When installing the Jacobs Exhaust Brake™ on vehicles equipped with Allison Automatic transmissions, some modification of the wiring provided in the kit may be required. For specific information by model, refer to the procedures below.

For additional information on the use of the Jacobs Exhaust Brake with automatic transmissions, see Application Notes 93-1 (P/N 021163).

Allison AT and MT Series Transmissions

When installing the Jacobs Exhaust Brake Model 3116 on vehicles equipped with the Allison AT or MT transmissions, follow the installation instructions included in this manual with the following exception: splice together the two wires connected to the clutch switch. Refer to the wiring diagram on page 9 for wire identification.

When installing Models 3126 or 3126B on vehicles equipped with Allison AT or MT transmissions, no Modifications to the installation are required.

Allison MD Series ("World") Transmissions

Use of the Jacobs Exhaust Brake on Allison MD Series transmissions requires special programming of the Allison Transmission. Refer to Application Notes 93-1 for more information. Application Notes 93-1 is available in the Jake Brake® Product Reference Guide for Caterpillar Engines, Manual Form RENR 1370, or from Jacobs website (www.jakebrake.com).

Wiring of the exhaust brake with the Allison MD transmission requires interfacing with the Allison transmission controls. Modification of the wiring harness included in the kit must be made by the installer. Refer to the wiring diagrams below and on the next two pages when wiring the exhaust brake.

Wiring Diagram: Model EX3116 with the Allison World Transmission
Wiring Diagram: Model EX3126B with the Allison World Transmission

NOTE: Connect all grounds to a common bolt or a good chassis ground.

12V Relay base

Pin 86 green
Pin 87 gray
Pin 85 pink/white

Flyback diode (prewired to relay base)

2-position ON/OFF switch
(Back side of switch module)

10A fuse or engine circuit breaker (required for installation - not included)

Key-switched power

Pin 30 silver

Pin 87A brown

Pin 85 light gray

Pin 86 Pin 87A green

To Allison ECU Pin 132
Pin 86 Pin 87A silver

Pin 86 Pin 87A gray

Pin 85 Pin 87A gold

Alternative installation for vehicles equipped with the Allison Vehicle Interface Module (VIM)

Pin D2 Allison VIM Pin E2

To PIN 12 of ECM Connector P1

To Allison ECM wire 119

Pin 86 Pin 87 A 119 green

Pin 87 A 119 gray

Pin 85 Pin 87 A 119 brown

Pin 30 Pin 87 A 119 silver

Engine ECM

P1 P2

Exhaust brake solenoid
Wiring Diagram: Model EX3126 with the Allison World Transmission

- 12V Relay base
- Pink/white
- Gray
- 2-position ON/OFF switch
- ENGINE
- E.C.M.
- OEM harness
- (Back side of switch module)
- Caterpillar harness
- Green
- Gray
- Gold contacts
- Flyback diode (prewired to relay base)
- Exhaust brake solenoid
- Pin 86
- Green
- Silver contacts
- Pin 87
- Pin 85
- Pin 87A
- Pin 85
- Pin 30
- Key-switched power
- Pin 30
- To Allison ECU Pin 132
- Alternative installation for vehicles equipped with the Allison Vehicle Interface Module (VIM)
- Pin D2
- Allison VIM
- Pin E2
- Pin 86
- Pin 87A
- Pin 30
- Pin 85
- Pin 87
- To Allison ECM wire 119
- Silver contacts
- Green
- Gray
- Pin 40 of ECM Connector P1
- To Pin 40 of ECM Connector P1
- To PIN 40 of ECM Connector P1
- Green
- Gray
- Brown

NOTE: Connect all grounds to a common bolt or a good chassis ground.