INTEGRATED ENGINE BRAKE

P55003 P-67 LoadLeash Kit: 2007½-2013 Dodge Pickup Trucks & Sterling Chassis Cab Trucks w/ Cummins 6.7L Diesel Engines

P55004 P-67 LoadLeash Kit: 2014 Dodge Pickup Trucks & Sterling Chassis Cab Trucks w/ Cummins 6.7L Diesel Engines
CAUTION:

This LoadLeash kit is NOT to be installed with ARP part # 247-4204 custom age 625 studs. It is permissible to install this LoadLeash kit with ARP part # 247-4202 ARP2000 studs.

Failure to follow the head bolt torqueing procedure with in this LoadLeash manual, may result in installation issues and forfeiture of warranties set forth in http://www.pacbrake.com/PDF/L6133.PDF

IF THIS VEHICLE IS EQUIPPED WITH ARP2000 HEAD STUDS, PART # 247-4202, PLEASE READ “IMPORTANT NOTE” AT STEP #10 OF THIS MANUAL.

BEFORE STARTING THE INSTALLATION, please read the entire installation manual carefully. Check that your Pacbrake LoadLeash™ kit is correct for the application and contains all the necessary parts.

NOTE: Due to the high complexity of the emission system strategy and the fact that the Pacbrake controller monitors the injector signals, you may experience a very rare event of unexpected engine brake interruption.

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REQUIRED TOOLS LIST

- Cummins #7471-B flywheel barring tool
- ½" drive ratchet
- ¾" drive ratchet
- 8mm, 10mm, 13mm, ½", 9/16" standard depth & deep depth sockets
- Phillips #2 screw driver
- 7/16", ½", 9/16", ⅜" and 19mm combination wrenches
- Diagonal cutters
- Pliers
- Wire Crimpers & Strippers
- Special Pacbrake jam nut wrench part # P55114
- ½" extension 3" long
- ¾" extension 3" long and 6" long
- ¼" drive ratchet
- Flat blade screw driver ⅛" x 2 and ¼" x 4
- Feeler gages
- 3/16" & 6mm Allen wrench (or 6mm Allen driver)
- Torque wrenches accurate @ 11 in-lbs (1.25 N•m), @ 89 in-lbs (10 N•m), @ 18 ft-lbs (24 N•m) and @ 77 ft-lbs (105 N•m)
- Thread Sealant
ENSURE THE PACBRAKE KIT CONTAINS EVERYTHING LISTED BELOW BEFORE STARTING THE INSTALLATION.

KIT CONTENTS

A  P55111 - Gasket, Lower (1)
B  P55102 - Assembly, Housing (1)
C  P55101 - Assembly, Hose (1)
D  M3466 - Bolt, Banjo (P55003 kits only) (1)
E  C20510 - Washer, Copper (2)
F  C11786 - Fitting #4 JIC-1/8” NPT (1)
G  M5510 - Double Ended Bolt (3)
H  M5512 - Crosshead (6)
I  C20284 - Controller (1)
J  M5514 - Nut, Hex Flange M8 (3)
K  M8194 - Scotchlock, T-Tap, 20 Gauge (1)
L  C20283 - Harness (1)
M  P55110 - Gasket, Injector Harness (1)
N  P55100 - SMBC (6)
O  P04300 - Solenoid, with Seals (1)
P  C10680 - Fitting, 90° #4 JIC-1/8” NPT (1)
Q  P55105 - Harness, Solenoid (1)
R  P34654 & P34655 - Terminal, Thru Head & O-Ring (1 each)
S  P55114 - SMBC Jam Nut Wrench
T  C11618 - Tie Strap (8)
GETTING STARTED

**IMPORTANT:** Ensure the vehicle has the VGT turbocharger enabled for exhaust braking. This is mandatory for the P-67 LoadLeash to function correctly. The vehicle must be road tested to ensure the VGT is functioning correctly **BEFORE** the P-67 kit is installed. If the VGT is NOT performing correctly, it MUST be repaired **BEFORE** the P-67 kit is installed for optimum braking performance.

1. **Electrical Installation**

   Consult with the customer for their choice of Pacbrake control switch location.

   A recommended location is the area behind the turn signal indicator, just above the lower dash panel.

   The lower dash panel needs to be removed to gain access. The dash switch requires a ½” hole be drilled to accommodate the dash switch.

   Install the Pacbrake switch and switch plate (as shown).

2. **Remove the driver side knee panel to gain access to the base of the steering column.**

   At the base of the steering column, locate the PINK with WHITE tracer wire. This is a 12 VDC ignition power supply.

   Install the RED t-tap connector onto this wire and connect to the RED fused wire of the Pacbrake harness.
3 Disconnect the negative and positive battery terminals from BOTH batteries.
   Route the switch harness through the fire wall, to the driver side of the engine compartment.
   Mount the controller to the power steering lines with the supplied tie straps.

4 Connect the 4 wires from the Pacbrake switch harness to the coinciding wires of the harness connected to the Pacbrake controller. Heat shrinkable butt connectors are provided.
   Once crimped, heat the connector to provide a water tight seal.
   Route the WHITE wire with 90° BLACK bullet connector, covered in loom, originating at the Pacbrake controller, through the firewall into the engine compartment.
   This wire will be connected in Step 17.

5 Route the BLACK wire of the harness to the negative terminal of the driver’s side battery.
   Crimp on the RED ring terminal and connect to the negative terminal stud.

6 Route the twisted & jacketed, YELLOW and GREEN wires of the Pacbrake harness to the forward injector harness plug and secure with supplied tie straps.
   Cut to length and strip off 3” of the jacket.
7

Using the supplied heat shrinkable BLUE butt connectors, splice the GREEN wire of the Pacbrake harness into the wire located in port “A” of the factory injector harness. (See attached photo for port locations).

Splice the YELLOW wire of the Pacbrake harness into the wire located in port “B” of the factory injector harness.

Using a heat gun, shrink and secure all the butt connectors.

8

Route the BLUE wire of the Pacbrake harness to the Crankshaft Speed Sensor, located below the harmonic balancer on the driver’s side of the engine.

Unlock and unplug the factory harness connector.

Remove the factory loom to gain access to splice the BLUE Pacbrake wire into the factory wire in Port # 3 of the factory connector, using the supplied heat shrinkable RED butt connector.

(See attached photo for port locations)

You may shorten the BLUE Pacbrake wire.

<table>
<thead>
<tr>
<th>CAV</th>
<th>CIRCUIT</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K853 18DB/BR</td>
<td>5 VOLT SUPPLY</td>
</tr>
<tr>
<td>1</td>
<td>K824 18DB/BR</td>
<td>5 VOLT SUPPLY</td>
</tr>
<tr>
<td>2</td>
<td>K975 18BR/OR</td>
<td>CKP SENSOR GROUND</td>
</tr>
<tr>
<td>2</td>
<td>K925 18BR/OR</td>
<td>CKP SENSOR GROUND</td>
</tr>
<tr>
<td>3</td>
<td>K24 18BR/LB</td>
<td>CKP SIGNAL</td>
</tr>
</tbody>
</table>
9 Secure all wires away from moving parts and heat sources using the supplied tie straps.

**NOTE:** Thoroughly clean the top end of the engine before removing the valve cover to prevent dirt from entering the engine when the valve cover is removed. Some engines may need to be cleaned again once the cosmetic covers are removed to ensure no dirt or dust enters the engine.

Remove the engine’s valve cover and the valve cover spacer (including the injector electrical harness) to gain access to the valve train.

10 **Head Bolt Replacement**

Remove the cover plate on the front passenger side of the flywheel housing to gain access for the barring tool.

Using a flywheel barring tool (Cummins #7471-B), rotate the crankshaft to align the TDC mark on the balancer to 12 o’clock. The mark must be aligned at 12 o’clock.

**THE ENGINE MUST BE AT TDC #1.**

This mark can be either TDC #1 or TDC #6.

Check if the rocker arms on the #1 cylinder are loose. If BOTH the intake and exhaust rockers on #1 cylinder are not loose, then the engine is positioned at TDC #6.

It is mandatory to rotate the engines crankshaft another 360° to attain TDC #1.

Once TDC #1 is obtained, remove the barring tool.

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**IMPORTANT:** If this vehicle is equipped with ARP2000 Head Studs, Part # 247-4202, you must ensure that the top of EVERY ARP stud DOES NOT protrude more than a maximum of 18.25mm or 0.718" from the cylinder head face (under the washer) to the top of the ARP head stud. Otherwise, interference with the LoadLeash will cause improper installation and engine failure!
It is mandatory to replace 3 of the existing 26 cylinder head bolts/aftermarket head studs with the Pacbrake double ended bolts provided.

The bolts MUST be replaced one at a time.

The bolt installation locations are shown in the attached drawing.

Lightly lubricate a Pacbrake head bolt on the lower threads and under the hex head with engine oil and install.

Tighten each bolt as follows:

1) Torque bolt to 52 ft-lbs (70 N•m)
2) Back off 360°
3) Torque the bolt to 77 ft-lbs (105 N•m)
4) Tighten an additional ¼ turn (90°)

Repeat on the remaining 2 head bolts (one at a time) until all 3 Pacbrake head bolts are installed.

**IMPORTANT:** Under no circumstances should the engine crankshaft be rotated with a head bolt removed.
12 **Crosshead Replacement**

Locate the 6 replacement crossheads provided in the kit. These crossheads replace the factory exhaust crossheads.

The exhaust rocker arms are the longer of the two rocker arms. Use caution with the rocker arm as the foot that contacts the crosshead may separate due to a cracked retainer - this is a normal occurrence.

Starting with the #1 cylinder, rotate the exhaust valve adjusting screw counter-clockwise until the pushrod can be removed from under the adjusting screw.

Once the pushrod is removed from the rocker arm, the rocker arm can be rotated to remove the factory Cummins crosshead from the valve stems. Discard the Cummins crosshead.

Place the Pacbrake crosshead on the valve stems.

The Pacbrake crosshead must be installed with the domed side (slave piston contact surface) towards the exhaust manifold as shown in the photo.

Once the Pacbrake crosshead is installed, align the pushrod into the exhaust valve adjusting screw.

Rotate #1 cylinder exhaust valve adjusting screw clockwise back to it’s original position.

Repeat on cylinder #3 and cylinder #5 exhaust valves.

Ensure the bottom end of the push tube remains seated into the tappet socket before proceeding.
Valve Setting

Adjust the intake and exhaust valve lash for TDC #1 as instructed below. To obtain accurate measurements and adjustments, the engine coolant temperature must be less than 140°F (60°C).

Ensure you’re still on TDC#1 before performing a valve adjustment. From this position, the exhaust valves MUST be set on cylinders 1-3-5 and the intake valves MUST be set on cylinders 1-2-4.

Refer to the set clearances in the table on the right. Measure the valve lash by inserting a feeler gage between the rocker arm foot and the crosshead.

Once the valve is adjusted, torque the adjusting screw lock-nut to 18 ft-lbs (24 N•m). Mark the lock-nut with a metal marker to identify that it has been re-adjusted.

Once the exhaust valves on cylinders 1-3-5 and the intake valves on cylinders 1-2-4 have been adjusted, proceed to Step 14.

Using the engine barring tool, rotate the engine to TDC #6. Repeat Step 9 (crosshead replacement) on exhaust valves #2, #4 and #6.

Once the crosshead replacement is complete, the exhaust valves MUST be adjusted on cylinders #2, #4 and #6 and the intake valves MUST be adjusted on cylinders #3, #5 and #6, as per the valve lash chart in Step 13.

Re-adjust if necessary using the chart in Step 13.

Once complete, check all the exhaust valve adjusting screw lock-nuts to ensure all 6 have been torqued after the Pacbrake crossheads have been installed.
15 Gasket Installation

Install the supplied lower gasket into the groove on the underside of the Pacbrake valve cover spacer. Ensure the gasket bead is centered, not twisted in the groove and that there are no cuts, nicks or tears in the gasket that could cause an oil leak.

**CAUTION:** When installing the Pacbrake rocker housing spacer onto the cylinder head, do not slide the housing from side to side as the gasket can fall out or be damaged.

**USE EXTREME CAUTION NOT TO DRAG THE SPACER ACROSS THE ROCKER ARMS DURING THE INSTALLATION.**

16 Oil Pressure Supply to Pacbrake Spacer

**FOR 2007½ - 2013 MODEL YEAR TRUCKS ONLY: (WITH OIL PRESSURE SENSOR)**

Locate the oil pressure sensor on the driver’s side of the engine block.

*Note the existing orientation of the oil pressure sensor before removal. It will either be at 11 o’clock or 2 o’clock depending on the model year.*

Remove the banjo bolt and two copper washers (one on each side of the sending unit fitting).

Install the Pacbrake banjo bolt and the two replacement copper washers provided. Ensure the correct orientation of the oil pressure sensor, then torque the banjo bolt to 18 ft-lbs (24 N•m).

Install the #4 JIC to 1/8” NPT fitting provided into the end of the banjo bolt using a good quality thread sealant.

**FOR 2014 MODEL YEAR TRUCKS ONLY: (WITHOUT THE OIL PRESSURE SENSOR)**

Locate the hex drive ORB plug on the driver’s side of the engine block. Using a 6mm Allen key or driver, remove the plug and discard, as the plug will not be reused.

**NOTE:** You may need to gently tap the Allen key or driver so that it’s fully seated in the plug - to ensure it doesn’t get stripped upon removal.
FOR 2014 MODEL YEAR TRUCKS ONLY: (WITHOUT THE OIL PRESSURE SENSOR)

Install the supplied M14 ORB to 1/8" NPT fitting in to this port. Torque fitting to 33 ft-lbs (45 N•m).
Install the #4 JIC to 1/8" NPT fitting provided, into the end of the fitting using a good quality thread sealant.

Before installing the Pacbrake spacer on the engine, clean the top of the cylinder head spacer gasket mating surface.

**IMPORTANT: The gasket must be completely dry and free of oil before installation.**

Remove the RED thread cover from the oil supply fitting at the rear of the spacer. Remove both RED port plugs from the oil supply hose.
Loosely connect the straight fitting end of the Pacbrake oil supply line to the fitting at the rear of the spacer.

HELPFUL ADVICE...
Be sure to loosely connect the oil supply line to the spacer prior to installing the spacer, otherwise it will be nearly impossible to access it.

Position the Pacbrake spacer over the 3 Pacbrake head bolts.
Route the Pacbrake oil supply line to the Pacbrake banjo bolt (2007½-2013) or ORB fitting (2014), connect and tighten. Ensure the oil supply hose is not contacting any moving parts.
Lift the Pacbrake spacer off the head bolts enough to access the oil supply line at the rear of the Pacbrake spacer and tighten the line to the fitting.
Connect the WHITE solenoid signal wire with the 90° bullet connector to the bullet terminal on the rear of the Pacbrake spacer.
Install the 3 flanged hex nuts provided on to the Pacbrake head bolts.
Loosely install the factory spacer capscrews into the Pacbrake spacer.
Starting with the center fasteners, working your way out, torque the factory capscrews to 18 ft-lbs (24 N•m) and the Pacbrake flanged hex nuts to 27 ft-lbs (36 N•m).
Route and secure the oil supply line using the tie-straps provided, away from heat sources or moving parts.
Adjusting the Standard Modular Braking Components (SMBC)

The engine should be on TDC #6 as left on Step 10.

- The SMBC can be adjusted on cylinders #2, #4 and #6. Back off the lock nut enough to allow the SMBC to be adjusted. Using a 3/16” Allen wrench, rotate the SMBC until it contacts the Pacbrake crosshead, then turn the SMBC an additional one full turn clockwise to squeeze out the trapped oil.

- Back off the SMBC to obtain clearance between the cross head and the SMBC.

- Rotate the SMBC clockwise until it just contacts the Pacbrake crosshead, to establish zero lash between the Pacbrake crosshead and the SMBC.

- Back off the SMBC EXACTLY ½ of a turn. This is to achieve a clearance of 0.025”. Using the Pacbrake lock nut wrench, torque the lock nut to 31 ft-lbs (42 N•m) while ensuring the SMBC does not rotate.

**NOTE:** The Pacbrake lock nut wrench must be kept 90° to the torque wrench. If the wrench cannot be kept @ 90°, a Torque Wrench Extension Calculation must be used to achieve the correct torque (as shown)

- Repeat the adjustment on the remaining two cylinders.

- Using the barring tool, rotate the engine to TDC #1.
  REMOVE THE BARRING TOOL and reinstall the cover plate.

- The SMBC can now be adjusted on cylinders #1, #3 and #5 by repeating the steps above. Ensure all SMBCs have been adjusted before proceeding.
Installing the Spacer Gasket/Injector Harness

Wipe the oil from both sides of the Pacbrake supplied valve cover gasket and inspect it for imperfections that could cause an oil leak.

Place the gasket/injector harness onto the Pacbrake spacer, ensuring the Pacbrake solenoid wire is not pinched between the gasket and the Pacbrake spacer.

Connect the injector harness to the solenoid terminals noting the correct wire orientation. Torque the injector harness nuts to 11 in-lbs (1.25 N•m).

**IMPORTANT! The injector wires, when tightened, must have a minimum of ⅛” clearance between the terminal and the SMBC cast towers.**

Ensure the injector wires are not in a location where they could be pinched by the gasket, or near a rocker arm that could damage the wire.

**BE VERY CAREFUL NOT TO OVER TIGHTEN THE INJECTOR TERMINAL NUTS AS DAMAGE TO THE FUEL INJECTOR WILL OCCUR.**
20 **Double-check the installation before re-installing the engine valve cover. Ensure that none of the injector wires are touching the SMBC cast towers.**

Torque the valve cover capscrews, starting with the center working out, to 18 ft-lbs (24 N·m).

Wipe the oil from the crankcase cover vent gasket and inspect for imperfections that could cause an oil leak. Replace if necessary.

Install the crankcase cover vent assembly and torque the capscrews to 89 in-lbs (10 N·m).

Connect the valve cover breather hoses and all the attaching parts removed to gain access to the valve train.

Connect the injector wiring harness to the connector on the valve cover gasket connector.

21 Install the supplied thermal label to the area shown on the right. This label is found within the info pack L7663.

22 Reconnect the vehicle batteries, start the engine, and check for oil leaks.
DRIVER’S GUIDE: OPERATING YOUR LOADLEASH ENGINE BRAKE

FUNCTIONALITY
Pacbrake’s LoadLeash for Cummins 6.7L engines is a “weeper” or “bleeder” type engine brake which works in tandem with the vehicle’s variable geometry turbo (VGT) exhaust braking feature.

It functions by holding the exhaust valves slightly off the seat during the complete engine cycle with the VGT providing exhaust backpressure and increased boost pressure.

Two braking strokes are achieved:
1. The first braking cycle is accomplished during the exhaust stroke when the piston is pushing the cylinder pressure past the open exhaust valve against the “closed” VGT.
2. The second braking cycle occurs during the compression stroke with the piston is pushing the cylinder pressure past the open exhaust valve against the “closed” VGT. The expansion stroke is eliminated by the open exhaust valve.

With work being done on both the compression stroke and exhaust stroke we are now doing retarding work on two engine cycles.

OPERATION
For optimal braking, the following switches must be in the ‘ON’ position:

- Tow/Haul
  (to provide auto-downshifting in RAM / Sterling trucks with auto transmissions)
- Exhaust Brake
- LoadLeash LED Switch

An alternative method is manually downshifting using the +/- switch on the column selector. This can be achieved with the Tow/Haul ‘OFF’ and the Exhaust Brake & LoadLeash Switches ‘ON’.

DRIVING IMPRESSIONS
Pacbrake’s LoadLeash, used in tandem with the VGT exhaust braking feature, will result in a 40% increase in retarding HP when measured at the rear wheels (assuming 60 HP of drivetrain friction).

LoadLeash + VGT = 360RHP  |  VGT Only = 210RHP

“Seat of the pants” feel is noticeable, particularly above 2500 RPM with a heavy load. Manual downshifting may be required.

The LoadLeash is stronger at all RPMs and in most cases will control the vehicle/load in a chosen gear without the rapid downshifting and high engine RPM experienced with the exhaust brake use alone.

The LoadLeash engine brake meets all municipal sound bylaws.
ELECTRICAL SCHEMATIC:
CUMMINS 6.7L
DIESEL ENGINES

PACBRAKE CONTROL UNIT

- Ignition Power
- Connected At Switch
- Negative Battery Terminal
- Splice in Step 7
- Splice in Step 8
- ‘A’ ‘B’
- 3 AMP
- A B C

Red Pin 21
Purple Pin 18
Grey Pin 10
Yellow Pin 13
Black Pin 20
Blue Pin 17
Green Pin 15
YellowYellow Pin 5
Purple Pin 24
Black Pin 21
Blue Pin 5
Green Pin 13
Yellow Pin 10

Dash Switch

PACBRAKE  
2007½-2014 Cummins 6.7L Engine Brake