Technical information:

Key engine braking technologies explained

Exhaust Brakes

The Jacobs’ Exhaust Brake® uses exhaust back pressure to dramatically increase braking power by restricting the flow of exhaust gases and increasing back pressure inside the engine. The increased back pressure creates resistance against the pistons, slowing the crankshaft’s rotation and helping to control vehicle speed.

As well as improving downhill vehicle control, the Jacobs’ Exhaust Brake reduces the use of the vehicle’s services brakes, extending brake life and cutting maintenance costs.

Jacobs’ Exhaust Brakes are actuated by pneumatics or electrically actuated including control to maintain optimal braking power across the speed range.

Jacobs’ Exhaust Brakes are designed, engineered and tested to OEM specifications.

Bleeder brakes

The bleeder brake is a simplified version of the traditional engine brake. When the bleeder brake is turned on, a piston extends to its full stroke and stays there, holding the exhaust valve open a small, fixed distance throughout the entire four-stroke engine cycle. Because the exhaust valve is only held open a fixed distance, it can be designed so that it does not put any load on the camshaft or overhead components. This makes the bleeder brake an ideal technology for smaller diesel engines.

The bleeder brake must be combined with either a variable-geometry turbocharger or an exhaust brake to optimise the retarding performance. The result of this combination is retarding performance capable of supplying much of a medium duty vehicle’s retarding needs with a low noise level similar to an exhaust brake.

The benefits of bleeder brakes are increased vehicle control; virtually silent operation, enabling use wherever and whenever needed; design flexibility to work with almost any engine; low added weight; no additional valvetrain loading; and reduced wear on engine, tyres, wheel ends, and friction brakes.

Compression release brakes

The Jacobs’ Compression Release Brake® takes the load off the friction brakes, turning the power-producing diesel engine into a power-absorbing air compressor using a compression-release mechanism. This decompression device works by opening the exhaust valves near the top of the compression stroke, releasing the highly compressed air through the exhaust system. Little energy is returned to the piston, and as the cycle repeats, the kinetic energy of the truck’s forward motion is dissipated.

Compression release brakes are typically capable of meeting 85 per cent of a vehicle’s braking needs; enable faster downhill control speed to maintain a higher average speed; reduce slowing times and distances on level terrain (slowing a heavily loaded vehicle from
90-70 kph/56-43 mph in 30 per cent less time and distance); significantly reduced brake wear; and lower cost of ownership.

Jacobs’ has also developed a compression release engine brake that can be used with hydraulic lash adjusters avoiding lash setting maintenance and providing lower engine noise form the valve train.

Variable Valve Actuation (VVA)

Variable Valve Actuation (VVA) works through precision valve actuation and control systems, allowing real-time adjustments to valve opening and closing. By creating a hydraulic link between the cam and the valve, VVA precisely tunes the engine across its operating range. This enables fast responses to the engine control module’s valve timing commands on a cycle-by-cycle basis, extracting superior performance from the engine.

Elegant in its simplicity, Jacobs VVA® can be integrated with minimum impact to engine overhead designs. It is one of engineering’s most powerful and cost-effective tools for meeting tightening fuel economy and emissions standards.

Through VVA technology Jacobs offers an entire suite of solutions to help achieve braking performance, fuel economy and emissions targets. This can range from fully flexible valve trains to very specific, targeted variability.

The wide-ranging benefits of VVA brakes are lower emissions; optimised fuel consumption; increased low-speed torque; improved transient response; individual cylinder control; and exhaust gas temperature control.

High Power Density (HPD) Brakes

The Jacobs' two-stroke engine brake for High Power Density (HPD) engines realises at least two times the available braking performance of a conventional compression release engine brake at lower engine speeds. This provides large displacement retarding power in small and medium displacement diesel and natural gas engines.

The HPD Engine Brake was developed by Jacobs in response to the drive by global engine suppliers to provide high power density engines for lower fuel economy. Optimal fuel economy is typically achieved at peak torque around 1200-1350 rpm, and HPD achieves the same retarding performance at 1400 rpm that previously occurred at 2100 rpm.

The HPD system’s second braking event during each engine cycle is made possible by two dedicated rocker arms and two collapsible bridges per cylinder. The second braking event deactivates the main intake and exhaust events via the collapsible bridges and then actuates the two braking rockers to provide optimal braking power. Although this is a high performance solution, the system uses standard, proven technology components.

Jacobs’ HPD Engine Brake helps to reduce fuel consumption in addition to improving drivability and significantly increasing sustained braking power.

Rocker-Stop Device (RSD)

Jacobs developed a simple, cost-effective device to improve the smoothness of engine start-up and shutdown. The Rocker-Stop Device (RSD) eliminates engine-induced cabin vibration,
allows an increase in the frequency of engine shutdown to improve fuel economy, and increases driver acceptance of stop-start anti-idle technology.

RSD is a simple device that easily integrates onto multiple engine platforms. During start-up, the engine control unit (ECU) automatically activates the Rocker-Stop Device to keep the exhaust valves open, which keeps the engine in a decompressed state, decreasing the cranking torque and allowing the engine to spin at a higher speed. During shutdown, the ECU also activates the device to keep the exhaust valves open, enabling the engine to coast to a smooth shutdown without causing the cab to shake.

As well as eliminating cabin vibration, RSD increases engine cranking speed by up to two times normal speed for easier start-up and improved cold-start; and reduces starter system wear.

*Cylinder Deactivation*

Based on technology generated from HPD braking, Jacobs’ cylinder deactivation system can be applied to diesel engines to improve emissions through faster Selective Catalytic Reduction (SCR) light off due to higher exhaust temperature. This flexibility allows cylinders to warm up the after-treatment system more quickly during cold start and maintain the SCR temperature during low load operation, thereby reducing harmful NOx emissions.

**About Jacobs Vehicle Systems**

*Jacobs Vehicle Systems* is headquartered in Bloomfield, Conn., where it has a 260,000 square foot design, testing and manufacturing facility, with support sites in Europe, Japan and China. Jake Brake® products are used by North American heavy-duty diesel engine manufacturers as well as Hino, Hyundai and Mitsubishi in Asia and DAF and Daimler in Europe. Registered to the ISO 14001 and TS16949 standards, Jacobs Vehicle Systems is the world’s leading producer of vehicle retarding and valve actuation technologies and can be found at [www.jacobsvehiclesystems.com](http://www.jacobsvehiclesystems.com) or [www.jvsengineering.com](http://www.jvsengineering.com).

**Images**

Exhaust Brake:

This advanced-technology, constant back pressure exhaust brake (Model ZQ01) uses a special spring to balance the back pressure via moving the seal bar. It can provide higher back pressure at low rpm, providing 20% more power than a fixed orifice exhaust brake, and protects the engine by releasing the back pressure when the rpm is too high.
<table>
<thead>
<tr>
<th>Brakes Type</th>
<th>Description</th>
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<tr>
<td><strong>Bleeder Brake:</strong></td>
<td>JVS designs and manufactures a variety of bleeder brakes, which are simplified versions of the traditional engine brake. This Model 2700 is for the 9DF engine of SDEC in China, diesel engine provider to a wide range of truck builders.</td>
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<td><strong>Compression Release Brake:</strong></td>
<td>Launched first in Europe in 2014, this MX 11 compression release brake for DAF/PACCAR features a three-stage Jacobs Engine Brake® with a dedicated rocker assembly that actuates one exhaust valve per cylinder. This integrated engine brake minimises weight while providing market-leading braking power.</td>
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<td><strong>Variable Valve Actuation Brake:</strong></td>
<td>Precision Valve Actuation and control systems from Jacobs offer an entire suite of solutions to help engine manufacturers achieve performance, fuel economy and emissions targets. By creating a hydraulic link between the cam and the valve, VVA precisely tunes the engine across its operating range.</td>
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<td><strong>High Power Density Brake:</strong></td>
<td>The Jacobs two-stroke engine brake for High Power Density (HPD) engines realises up to two times the available braking performance of a conventional compression release brake. The second braking event per engine cycle is enabled by two dedicated rocker arms and two collapsible bridges per cylinder.</td>
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Rocker-Stop Device:

The RSD is a simple device that easily integrates onto multiple engine platforms to improve the smoothness of engine start-up and shutdown.