



VEHICLE LIGHTING: XENON HIGH INTENSITY DISCHARGE (HID) LAMPS

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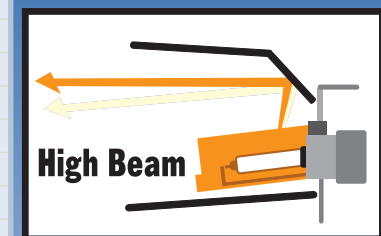
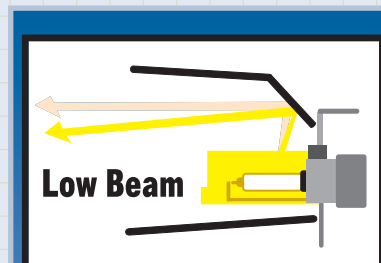
HIGH INTENSITY DISCHARGE (HID) HEADLIGHTS are being installed on more car models every year, and they're available aftermarket for cars, trucks and motorcycles. HID lights work the same way as streetlights and neon signs. A glass or quartz tube is filled with special inert gas, and electrodes are sealed into each end of the tube. When current is passed through the tube, the gas gets hot and emits light. Unless the tube is tinted, the gas inside determines the color of the light. Neon emits red light; mercury emits blue light. The Xenon gas used in HID headlights emits virtually full-spectrum white light, so objects illuminated by it appear almost the same color as they do in daylight. Xenon comprises a little less than 1 percent of the air around us.

Aside from the electronics and power supply, the lamp itself can last many times longer than an incandescent light bulb. It produces more than twice as much illumination as a halogen bulb, and it uses only 35 watts as opposed to the 55 watts of standard H4 halogen bulbs. The gas glows at more than 1650°F (900°C), and getting the current flow started can take up to 30,000 volts.

The lamp itself operates on AC voltage, so each HID headlight assembly includes the lamp, a ballast unit and a starter, sometimes called the ignition unit. The ballast contains the DC/AC power converter and a control unit that regulates AC voltage

output, provides gradual warm-up of the lamp after cold-start and an instant restart if needed. The control unit also can sense a failed or damaged lamp and will turn off the power to prevent injury or unwanted ignition of other substances.

The Xenon lamp is used only for low beam headlights on earlier HID systems, and a standard halogen bulb is used for high beams. However, what's called a "Bi-Xenon" system is rapidly becoming common, using a single HID lamp and a mechanical means of switching between low and high beams. The lamp's tube looks like a light bulb with a thin bare wire running alongside it from the base to



HID: HOW IT WORKS

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the electrode at the other end of the tube. This assembly is mounted inside a reflector, just like a regular light bulb, but the method of switching the beams depends on the type of headlight system.

In a reflector-type headlight system, the beam pattern is altered by moving the lamp/reflector assembly or by moving the lamp inside the reflector. Most OE installations tilt the lamp/reflector assembly up for high beams and down for low beams using a simple two-position actuator. More sophisticated systems use a motor to position the reflector, so in addition to switching beam heights, the control unit reads suspension position sensors and operates the motor to keep the headlight beam level with the road.

Projector beam headlights are becoming more common, especially in

HID systems. The lamp is still mounted inside the reflector, but a lens is positioned a specific distance in front of it. Between the reflector and lens is a shutter that moves up and down to cut off part of the light pattern reaching the lens. As in the reflector beam system, the shutter can be moved with a simple two-position actuator or a motor, but because the reflector doesn't move, the beam's hot spot remains in the same position relative to the vehicle. This means that as the vehicle moves over bumps in the road, the headlight beam's hot spot can momentarily flash at oncoming traffic. The same thing happens with conventional headlights, but it's far more noticeable and distracting because HID lights are so bright. This makes the moving-reflector system more desirable, even with its increased cost and complexity.

Probably the simplest way to use HID for both low and high beams is by moving the lamp itself in a fixed reflector. The lamp socket at the back of the reflector is moved laterally or tilted by a simple two-position actuator. This changes the position of the lamp's hot spot in the reflector just enough to change beam height. A specially designed reflector is needed, but this system can be easily designed for aftermarket retrofit.

The next generation of headlight technology is on the way: reflectors that track steering wheel movements to "shine around the bend." These lights are ready now, but actual production hasn't started yet. Eventually HID technology will be replaced by Light Emitting Diodes (LEDs), but we can expect a dramatic increase in the use of HID headlights for many years to come.