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Technical Bulletin

Electrical Considerations for Third-Generation HID Ballasts

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HID lighting is an advanced technology, providing superior light output, light quality, and lamp life. With proper installation, HID fixtures should provide years of trouble-free operation. In principle, installing an HID fixture is no different from installing a conventional halogen fixture. However, HID fixtures include electronic ballasts, and those ballasts can be more sensitive to wiring problems than other technologies. The following guidelines will help ensure proper installation and trouble-free operation:

1. Maintain Adequate Voltage

Background: Havis third-generation ballasts are rated for 12VDC through 24VDC operation, and constant light output will be maintained over that entire range. For halogen fixtures, low voltages will result in progressively decreasing light output, and can lead to shorter lamp life. However, most customers will only notice a very dim light. For HID fixtures, the ballast includes a voltage regulator. If the voltage dips below 10.5VDC or exceeds 30VDC at any time, the ballast protection circuit will turn off the fixture. If the input voltage is too low, the fixture may turn on normally, but when the voltage dips below 10.5VDC, it will turn off. Correspondingly, voltage above 30VDC, including spikes, can also cause the ballast to shut off.

Solution: Optimal performance can be reasonably assurred as long as the voltage at the fixture never falls below 12.0VDC while the fixture is operating. HID lights consume significant current, just as halogen and LED lights with similar rated wattage do. For HID lights, current consumption starts out low, but increases as the fixture comes to brightness. As the current increases, the input voltage to the fixture will drop. Therefore, all wiring must be sufficient to allow for voltage losses. For a 70W ballast, customers should design wiring to maintain at least 12.0VDC at the fixture for a 7A current draw (24VDC is 3.5A), and for a 150W ballast, customers should design wiring to maintain at least 12.0VDC at the fixture for a 14A current draw (24VDC is 7A.) Note that current will increase as voltage decreases. As a general rule of thumb, at least 12AWG wire should be used for short wire runs to a fixture only, and at least 10AWG wire should be used for short wire runs to a fixture with pole.

Warning: Because the input voltage is critical, it is required that HID lights only be operated while the vehicle they are mounted to is running and the alternator is providing power. If the engine is turned off and the lights are operated from battery power, input voltage to the fixtures can fall rapidly. Although the ballasts are internally protected from under-voltage, both ballast and lamp life could be shortened if the protection circuit activates repeatedly. Ballast or lamp failure due to low voltage operation is not covered under warranty.

Special Notes:

- The voltage must be measured as close to the ballast as possible. Measuring voltage at the base of a pole will not provide an accurate measure of voltage at the top of the pole, where it enters the fixture. Note: Never operate an HID fixture with the lensframe removed.
- Voltage must be measured when the fixture has reached full brightness. Best practice is to attach a voltmeter with fast-response min-max logging to the fixture, and start logging when

power is turned on. The lowest voltage read is the critical voltage input to the fixture, and should always exceed 12.0VDC.

- Voltage losses should be computed for each segment of wire independently, and then summed. A simplified table showing maximum <u>total</u> wire run lengths from the battery/alternator to the fixture for various wire gauges under various loads is shown below. "Pigtail" wire is for lights without a coil cord (such as brow mount) and "Coil" wire is for all pole versions and others with supplied cords.

	Wire	**14AWG**	**12AWG**	**10AWG**	**8 AWG**	**6 AWG**	**4 AWG**	**2 AWG**
70W/24V	Pigtail	50 ft	82 ft	130 ft	207 ft	329 ft	524 ft	836 ft
	Coil	40 ft	72 ft	120 ft	197 ft	319 ft	514 ft	826 ft
70W/12V	Pigtail	25 ft	41 ft	65 ft	103 ft	165 ft	262 ft	418 ft
	Coil	15 ft	31 ft	55 ft	93 ft	155 ft	252 ft	408 ft
150W/24V	Pigtail	25 ft	41 ft	65 ft	103 ft	165 ft	262 ft	418 ft
	Coil	15 ft	31 ft	55 ft	93 ft	155 ft	252 ft	408 ft
150W/12V	Pigtail	11 ft	18 ft	29 ft	39 ft	75 ft	120 ft	191 ft
	Coil	--	8 ft	19 ft	29 ft	65 ft	110 ft	181 ft

2. Maintain Adequate Current Supply

<u>Background:</u> As mentioned above, HID fixtures do not reach full brightness immediately. Current draw starts out low, and steadily increases as the light reaches full brightness. Until the lamp fully stabilizes, which can take several minutes, current draw can go up or down over a moderate range, either above or below the nominal rated current. This is due to manufacturing variations in both lamps and ballasts, as well as changing loading conditions on the power line due to other loads turning on and off. As a consequence, all components necessary to provide power to an HID fixture, such as switches, contactors, fuses, and wiring, must allow for additional current draw, especially during power-on.

<u>Solution:</u> All switches, fuses, contactors, etc., should be rated for at least 150% of the rated current draw of the HID fixture. For 70W fixtures, 10A at 12VDC (5A at 24VDC) minimum rating is recommended per fixture, and for 150W fixtures, a minimum rating of 20A at 12VDC (10A at 24VDC) is recommended per fixture.

<u>Warning</u>: Never start a vehicle engine with the lights already operating. Lights should never be turned on until after the engine is running. The engine starting cycle can create severe voltage spikes and dips that can damage any electronic device, including an electronic ballast.

<u>Special Notes:</u>

- This sizing guideline is due to natural fluctuations in operation, not due to inrush current. Havis ballasts have very low inrush current. If a ballast with higher inrush current is used, such as other manufacturers may supply, then an additional allowance will need to be made in sizing of switches, fuses, etc. In that case, a rating of at least 200% is recommended.
- Powering on multiple fixtures simultaneously will require adequate wiring, switches, etc. to allow for voltage losses and increased current draw of all fixtures combined.
- When operation is stable, current draw should be within about 10% of rated value for a 12 VDC input.