HID TROUBLESHOOTING GUIDE

CAUTION:

This information is provided for diagnostic use by competent licensed electricians familiar with the use of electrical test equipment, procedures for high voltage equipment installation, diagnostics and HID lighting. Personnel performing the work described must read and understand this entire section before beginning.

NOTES:

1- All tests must be performed with extreme care as exposure to hazardous voltages is likely with the inherent potential for shock hazards present including bodily injury and death .

2- All High Pressure Sodium lighting systems and some Metal Halide lighting systems (wattages up to 150 and all Pulse Start Lamps) employ an ignitor element in the electrical circuit (sometimes referred to as a "starter") which MUST be removed from the circuit before measuring open circuit (socket) voltage. Otherwise damage to the measuring equipment will result. This ignitor produces 1500 volts for lamp start up. Whenever the lamp is not on or is removed, this device **activates**. In some systems this ignitor is not a separate item but is integral in the ballast transformer itself. Ballast systems with integral ignitors may not be tested for open circuit voltage. Always refer to ballast label first.

3- All open circuit voltage measurements must be made with a TRUE RMS voltmeter. A common voltmeter will not be adequate for this purpose. The correct voltmeter will have the words "TRUE RMS" on the front panel.

Two diagnostic methods are provided here which may be combined as needed, when light fixtures fail to operate. The first (Inspection & Substitution) is best used to quickly and economically evaluate the component most likely to require replacement for the purpose of restoring operation. The second (Inspection & Test) is best used when it is important to also determine the specific cause of the failure. This may be the case when fixtures are in difficult to reach areas or are experiencing an abnormally high failure rate.

Following the two fixture diagnostic methods is a section that focuses on HID lamp performance troubleshoooting which can be useful when a higher than normal rate of lamp failures is experienced or when other lamp performance problems are evident.

FIXTURE INSPECTION & SUBSTITUTION METHOD

These suggestions are intended to serve as a guide in determining the component most likely to require replacement for the purpose of restoring operation quickly and economically and to suggest corrective or maintenance procedures. Individual fixtures can normally be restored to operation by replacing components in ascending order of cost and reliability until the fixtures works.

1- Before any components are checked internally in the fixture, make a visual inspection of the fixture itself and the supply wiring for loose connections or obvious damage.

2- Check for the correct supplied voltage at the ballast input. Measurement of supply voltage **must be made at the fixture,** not at the breaker panel or other locations which may not be the same.

- With the ballast energized, supply voltage should be within 10% of labeled input voltage for CWA (Constant Wattage Autotransformer) ballasts and within 5% for reactor and lead-lag ballasts.
- If the lighting is on a three phase system, be sure that all phases are energized. Any ballast on two phases that share a leg may end up in series if that leg is lost. The result is greatly reduced voltage and either reduced output or failure to start.

3- Check any system lighting controls (switches, circuit breakers, fuses, time clocks, or system photocells) to be sure they are working properly.

4- Replace the lamp with a known good lamp from an operating fixture.

5- Replace the ignitor or starter (when one is utilized).

6- Replace the capacitor and the ballast.

FIXTURE INSPECTION & TEST METHOD

In some Situations a full diagnostic procedure is necessary in addition to the inspection and substitution method described previously. This method is useful when fixtures are difficult to reach or are experiencing abnormally high failure rates. This method is also better suited to determining not only what component has failed in the system but what caused it to fail.

Inspect the outside first.
Before any components are checked internally in the fixture, make a visual inspection of the fixture itself and the supply wiring for loose connections or obvious damage.

Inspect the lamp.
1. Look for cracks in the bulb wall or broken parts internally.
2. Look for cracks or seal leakage where the envelope meets the base.
   (Separation of the base or discoloration on inside of the bulb wall).
3. Significant blackening of the arc tube located in the middle of the lamp.
4. Check to see if the ANSI designation is correct.
   The ANSI number for the lamp must match the ANSI number for the ballast in the system. The ANSI number would generally NOT match if a different wattage or light source were employed for either the lamp or the ballast.
5. Check for correct orientation of lamp base:
   Base UP (BU)
   Base Down (BD)
   Universal (U)

NOTE: Characters in parenthesis are typically used by the lamp manufacturer to indicate lamp orientation.

Inspect electrical system components.
1. Check leads for loose connections, damaged wires or loose wire nuts.
2. Check multi-tap ballast to make sure the incoming line voltages is on the proper tap of the ballast.
3. Check for swollen or ruptured capacitor case.
   4. Check to see if the capacitor rating and microfarad (uF) value, printed on the case, agree with the capacitor rating and microfarad value printed on the ballast label.
5. Check to see if the socket is broken or if the lamp is unable to make electrical contact in it.
6. Check ballast for breakage such as separation of metal frame which is made of many small plates. (This does not apply to electronic ballasts.)
7. Check ballast label to ensure correct type for the light source and wattage of the lamp used. Verify that the ANSI number is the same for both ballast and lamp.
8. Check to see that the ignitor is the correct type (where applicable) by comparing the part number on the ignitor case with the one printed on the ballast label.

Electrical Tests
1. Check for the correct supplied voltage at the ballast input. Measurement of supply voltage must be made at the fixture, not at the breaker panel or other locations which may not be the same.
   • With the ballast energized, supply voltage should be within 10% of labeled input voltage for CWA (Constant Wattage Autotransformer) ballasts and within 5% for reactor and lead-lag ballasts.
2. If the lighting is on a three phase system, be sure that all phases are energized. Any ballast on two phases that share a leg may end up in series if that leg is lost. The result is greatly reduced voltage and either reduced output or failure to start.
3. Check any system lighting controls (switches, circuit breakers, fuses, time clocks, or system photocells) to be sure they are working properly.
4. Check the open circuit voltage of the fixture (voltage to the socket with the lamp removed).

DANGER! Please read and understand the following notes before conducting electrical tests.
NOTES:
A. All tests must be performed with extreme care as exposure to hazardous voltages is likely with the inherent potential for electrical shock including bodily injury and death present.
B. All High Pressure Sodium lighting systems and some Metal Halide lighting systems (wattages up to 150 and all Pulse Start Lamps) employ an ignitor element in the electrical circuit (sometimes referred to as a “starter”) which MUST be removed from the circuit before measuring open circuit (socket) voltage. Otherwise damage to the measuring equipment will result. The ignitor produces 1500 volts for lamp start up. Whenever the lamp is not on or is removed, this device activates. In some systems this ignitor is not a separate item but is integral in the ballast transformer itself. Ballast systems with integral ignitors may not be tested for open circuit voltage. Always refer to ballast label first.
C. All open circuit voltage measurements must be made with a TRUE RMS voltmeter. A common voltmeter will not be adequate for this purpose. The correct voltmeter will have the words “TRUE RMS” on the front panel.

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TYPICAL OPEN CIRCUIT VOLTAGES (Lamps Removed) FOR HID SOURCES

NOTES:
1- Open circuit voltages are provided for diagnostic use by a competent licensed electrician only.
2- All High Pressure Sodium sources and some Metal Halide sources employ an ignitor which must be removed from the circuit before measuring open circuit voltage. Otherwise, damage to the measuring equipment will result. The ignitor produces 1500 volts for lamp start-up. Ballasts with integral ignitors should not be tested.
3- All open circuit voltage measurements must be made with a TRUE RMS volt meter. A common voltmeter will not be adequate for this purpose.

High Pressure Sodium (60 Hz)	**OPEN CIRCUIT VOLTS**
35 Watt	120
50 Watt	120
70 Watt	120
70 Watt – CWA ballast	105
100 Watt	120
100 Watt – CWA & Reg. Lab ballasts	115
150 Watt – 55 volt lamps	120
150 Watt – CWA ballast w/ 55 volt lamp	110
150 Watt – Reg. Lag ballast w/ 55 volt lamp	120
150 Watt – 100 volt (S56) lamps	230
150 Watt – CWA 100 volt lamps	180
200 Watt	230
200 Watt – CWA ballast	195
200 Watt – Reg. Lag ballast	225
250 Watt	230
250 Watt – CWA ballast	187
250 Watt – Reg. Lag ballast	215
250 Watt – Low Loss Reg. Lag ballast	220
400 Watt	230
400 Watt – CWA ballast	191
400 Watt – Reg. Lag ballast	215
1000 Watt – CWA ballast	435

NOTES:
Normal and High Power Factor Ballast circuit given unless noted as follows:
CWA = Constant Wattage Autotransformer Type Ballast Circuit.
Reg. Lag = Regulated Lag Type Ballast Circuit.
Other notes refer to specific lamp types.

Metal Halide (60 Hz)	**OPEN CIRCUIT VOLTS**
50 Watt	230
70 Watt	230
100 Watt	277
100 Watt – CWA ballast	240
150 Watt	230
150 Watt – CWA ballast	187
150 Watt – M107 lamp (operated on 175 watt ballast)	300
175 Watt – CWA ballast	300
250 Watt	250
250 Watt – CWA ballast	290/310
400 Watt – CWA ballast	310
1000 Watt – CWA ballast	425

HID LAMP PERFORMANCE TROUBLESHOOTING

Normal End of Lamp Life

1. Normal end of life is important to understand for troubleshooting. It occurs when the lamp has aged to the point that the arc can no longer be sustained. End of life can be induced prematurely when lamps are operated at improper voltages, temperatures and positions.
   - Mercury and Metal Halide lamps tend to emit low light output at end of life and starting will become intermittent. There will also be significant blackening on the arc tube located at the center of the lamp.
   - High Pressure Sodium lamps retain their light output at the end of life, however, starting becomes intermittent at first and then impossible. There will be some blackening on the end of the arc tube located in the center of the lamp.
   - Verify average rated lamp life as published by the lamp manufacturer and compare it to the actual life of the lamps in the system. Remember that the average rated life is not the same as the minimum life expectancy. The average rated life means that for a population of lamps, the average lamp lasted this long. When a system of lamps installed at the same time reaches the average rated life, we can expect half of the population of lamps to have failed. It is always important to be aware of the operation of the system when evaluating lamp life. For example, is the system operated round the clock either intentionally or as the result of faulty controls?

Lamps Will Not Start

1. Check to see if lamp is loose in the socket.
   • Check for arcing (blackening) at the center contact button and retighten lamp until it is properly seated. Tightening too much may cause lamp breakage.
2. Check to see if lamp has failed or is damaged.
   • Visually inspect for loose broken internal parts or broken bulb wall.
   • Visually inspect for separation of the lamp base. Check for looseness or for significant discoloration of the bulb wall near the base.
   • Test the lamp in an adjacent fixture that is operating properly.
3. Check to assure that the voltage at the fixture is not too low.
   - Ensure nameplate rating for the ballast. The voltage should be within 5% for reactor and high reactance ballasts, and within 10% for all others:

Lamp Cycling (starting and shutting off repeatedly)

1. Lamp cycling is a common end of life failure mode for High Pressure Sodium lamps. (See above).
2. Check the photocell (if applicable):
   - If a photocell is used to switch the fixture, cover the photocell window or eye completely with black electrical tape and check for proper operation.

   A. If the cycling STOPS, re-aim the photocell (or the fixture) to reduce fixture light spill onto the photocell eye.

   B. If the cycling CONTINUES, replace the photocell with a shortening cap if available or bypass the photocell completely in the circuit temporarily. If the lamp remains on the photocell is defective. If the cycling STILL CONTINUES, the lamp is probably bad.
3. Check the capacitor:
   - Verify the capacitor has the correct microfarad (uF) value as specified on the ballast.
   - Inspect the capacitor for a swollen or ruptured case. Disconnect the capacitor and discharge it by shorting across its terminals with a piece of insulated wire. Use an analog ohmmeter set on its highest scale to test resistance.
   - If the resistance starts low and gradually increases, the capacitor is good.
   - Any other reading indicates either an open or short circuit condition and the capacitor is bad.
4. Check the ballast:
   - If it is an older system, it could be simply the normal end of ballast life. Replace the ballast, capacitor (if present) and ignitor (if present).
   - If the ballast is located in an extremely high ambient temperature, it can overheat the ballast or other parts. Check for discoloration of the ballast or other parts. Also check for failed capacitor (see above).
   - Check ballast open circuit voltage (see charts on previous page).

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Off Color (Color Shift) Lamp Or Low Light Output

1. Install a known good lamp from a similar fixture.
   - If lamp is near its normal end of life, low light output may be noticeable.
   - Color shift will occur as a lamp ages. The color of the light source (called Chromacity) tends to vary somewhat from lamp to lamp in all Metal Halide lamps. However, because the chromacity changes with time as the lamp ages, differences become most noticeable when new lamps are introduced into an aging group of lamps. Spot replacement of older lamps is the most common cause of dissatisfaction with lamp color.

GROUP RELAMPING IS HIGHLY RECOMMENDED.

   - Color differences in the light source can also be exaggerated when lamps of different types and manufacturers are used adjacent to one another. Variations in the thickness of the phosophor coating of coated lamps can also cause color variations.
   - Lamp color is also affected by wattage variations, which can be as wide as +/- 7.5% according to ANSI standards. Interchanging different lamps may minimize apparent color differences.
   - Color difference in walls, ceilings, office partitions, and floors, as well as other sources of illumination can affect apparent lamp color.
2. Check lamp specifications for specific base orientation: “Base up or Base down”.
   - Certain Metal Halide lamps have a special position oriented mogul base which must be utilized with the corresponding position oriented socket. Use the specified lamp only in the correct position. If this is not done, the arc tube will not be correctly oriented and low light output or possible lamp failure can result.
3. Clean the reflector, refractor, and/or lens to make sure the transmitting medium is not distorting the fixtures light output.
4. Inspect the capacitor for a swollen or ruptured case.
5. Check the ballast open circuit voltage (see above charts).
6. Check for a low supply voltage condition (see above charts).

Short Lamp Life

1. Verify the correct ballast type and wattage, and correct capacitor value.
2. Check the input voltage and verify that it does not exceed 10% ballast input voltage shown on the label.
3. Inspect the capacitor for a swollen or ruptured case.
4. Check the lamp specification for “base up” or “base down” position specifics. Use the specified lamp only in the current orientation.
5. Replace with a known good lamp.

Electrical System Components

Ignitor

For High Pressure Sodium and low wattage Metal Halide only. This component is used as a starting aid only.

CAUTION: Never attempt to measure the voltage pulse of the ignitor (2500 volts). Attempting to measure this could destroy the measuring equipment.

1. Install a known operating lamp. If the lamp fires, the ignitor is good.
2. Install a known operating ignitor. If the lamp starts, the original ignitor was either bad or miswired. If the lamp fails to start, check the ignitor as follows:
   - For 35-150W High Pressure Sodium with a 55V lamp, install a 120V incandescent lamp in the socket. If the lamp burns, the ignitor should be replaced.
   - For a 150-400W High Pressure Sodium lamp with 100V lamp, install a mercury lamp of the same wattage. If the lamp burns, the ignitor should be replaced.
   - For a 1000W High Pressure Sodium, check the ignitor by replacing the original ignitor with a known working unit.