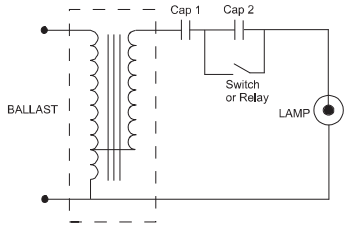
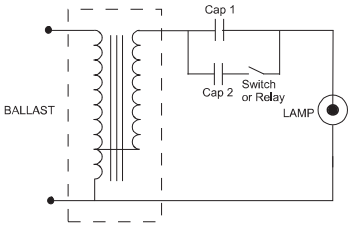
APPLICATION & INSTALLATION INFORMATION



Connection in series
Switch open for reduced light output

Switch closed for full light output



Connection in parallel
Switch open for reduced light output

Switch closed for full light output

Warranty of Philips Advance branded Ballasts and Components

All Philips Lighting Electronics magnetic HID ballasts and components are warranted for 2 years from the date of manufacture. eHID ballasts are warranted for 3 years. The date of ballast manufacture is stamped on the product. Contact Philips Lighting Electronics at 800-372-3331 and select option 2 (technical support) for additional information.

TROUBLESHOOTING

Safety

Safety measures should always be taken when troubleshooting HID systems. Most procedures will require that power be applied when electrical measurements are made. Wearing gloves and eye protection is a good practice when doing electrical measurements on HID systems.

TROUBLESHOOTING

Instruments and Test Equipment for troubleshooting

Only the input to HID lighting systems is a sine wave. Once the voltage and current is processed through the ballast and lamp, it is changed and is no longer a perfect sine wave. As a result of this transformation, **only TRUE RMS volt and amp meters will give proper readings.** TRUE RMS clamp-on current meters are also available and are most convenient when reading lamp current.

There are many brands of test meters available. Some indicate RMS and some indicate TRUE RMS on the meter. They are not the same. Only those that have TRUE RMS will read non-sinusoidal waveforms accurately. The RMS meters will give readings 10 to 20% low depending on the shape of the voltage or current waveform.

Some of these instruments will also read capacitance directly when connected to a disconnected, discharged capacitor.

There is no field usable meter to test ignitors.

Troubleshooting procedures

At times when an HID lighting system becomes inoperative, a complex and thorough, troubleshooting procedure may prove overly time-consuming. A simple series of checks can decrease this time considerably; a simple check of circuit breakers and power switches when a bank of fixtures becomes inoperative or a visual check or replacement of a lamp when an individual fixture becomes inoperative. At other times isolated inoperative fixtures may require systematic procedures to determine the cause of failure.

Normal End of Lamp Life

Most fixtures fail to light properly due to lamps that have reached end of life. Normal end of life indications are low light output, failure to start or lamps cycling off and on.

TROUBLESHOOTING

These problems can be eliminated by replacing the lamp. **Since many HID fixtures are not easily serviced due to their mounting height, the technician should take a replacement lamp when going up a ladder or on a lift.**

Mercury and metal halide lamps at end of life are characterized by low light output and/or intermittent starting. It is possible for metal halide pulse start lamps to cycle off and on like high pressure sodium lamps at end of life. Visual indications include blackening at the ends of the arc tube and electrode deterioration, but these are not conclusive. **The sure test is to replace the lamp.**

High pressure sodium lamps will tend to cycle at the end of life. After start-up, they will cycle off and on as the aged lamp requires more voltage to stabilize and operate the arc than the ballast is designed to provide.

Visual indications include general blackening at the ends of the arc tube. The lamp may also exhibit a brownish color (sodium deposit) on the outer glass envelope. **The sure test is lamp replacement.**

Low pressure sodium lamps retain their light output but starting becomes intermittent and then impossible. Visual signs include some blackening of the ends of the arc tube. **The sure test is lamp replacement.**

Electronic Ballasts

Lamps operated by electronic ballasts will not exhibit the above metal halide symptoms at end of lamp life. Because electronic ballasts have sensing circuits to detect lamp end of life, a ballast connected to an inoperative lamp will likely be in a shut down mode or will not start. **When servicing the fixture, always disconnect or shut off power to that fixture for safety.** When the power is cycled off and then on, the

lamp may re-start and later go off and stay off. Visual indications of the lamp may be the same. **However, the true and sure test is to replace the lamp. After the lamp is replaced the POWER TO THE BALLAST MUST BE CYCLED OFF AND BACK ON FOR THE BALLAST TO RE-START THE LAMP.**

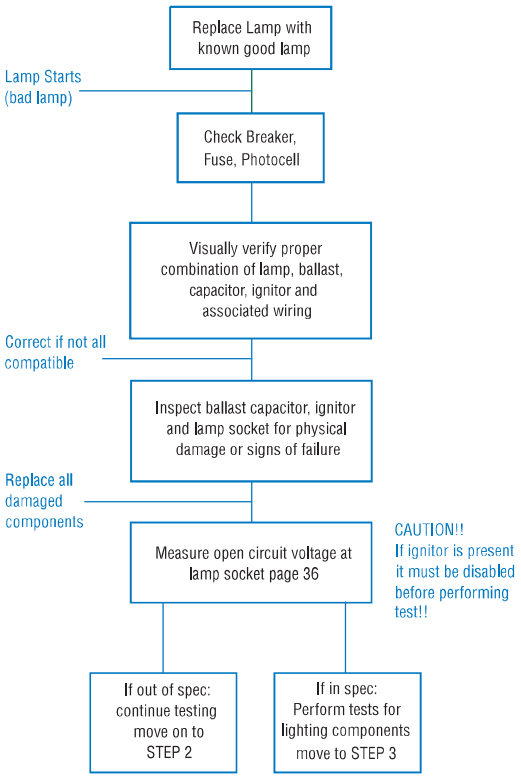
NOTE: When the power is cycled off and back on via a circuit breaker or switch, other fixtures on the same circuit will extinguish and not come back on until the lamps cool. The energized ballast will continue to produce high voltage starting pulses for a specified period, usually between 10 and 30 minutes depending on the ballast model, allowing enough time for the hot lamp to cool.

It is assumed at this point in the troubleshooting procedure that the lamp has been replaced with a known good lamp. If there is any doubt about a replacement lamp, it should be tested in an operational, good fixture.

Because troubleshooting can be time consuming, power to the fixture should be verified at the fixture. Photo cells, circuit breakers and switches should all be checked. The following flow charts are designed to minimize troubleshoot time and—if possible—eliminate taking the ballast housing apart.

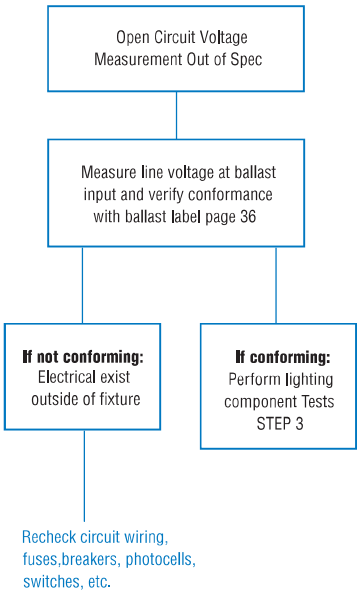
TROUBLESHOOTING HID FIXTURES

Lamp will not start (STEP 1)

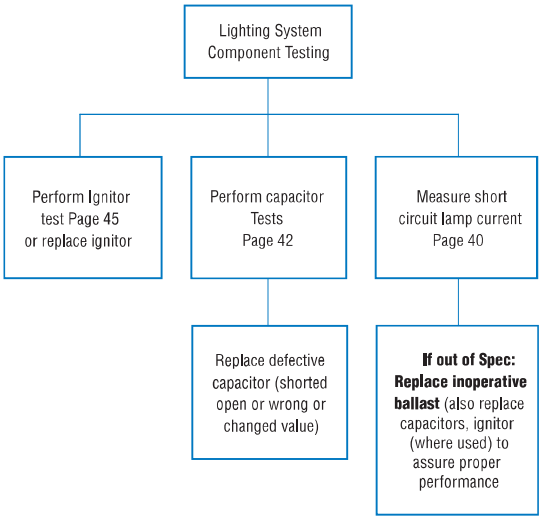


Measuring Line Voltage

Lamp will not start (STEP 2)

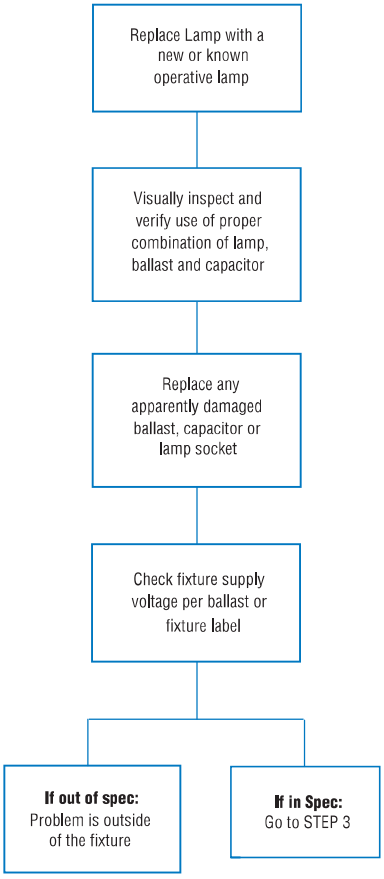


Lamp will not start (STEP 3)



TROUBLESHOOTING

Lamp Cycles



Measure the line voltage at input to the fixture to determine if the power supply conforms to the requirements of the lighting system. For constant wattage ballasts (CWA, CWI), the measured line voltage should be within ±10 % of the nameplate rating. For reactor (R) or high reactance (HX) ballasts, the line voltage should be within ±5 % of the nameplate rating.

If the measured line voltage does not conform to the requirements of the lighting system, as specified on the ballast or fixture nameplate, the electrical problem exists outside of the fixture which can result in non-starting or improper lamp operation.

Check breakers, fixture fuses, photocells and switches when no voltage reading can be measured. High, low or variable voltage readings may be due to load fluctuations. **The supply voltage should be measured with the defective fixture connected to the line and power applied to help determine possible voltage supply problems.**

If the proper input voltage is measured, most HID fixture problems can be determined by measuring open circuit voltage and short circuit current.

Measuring Open Circuit Voltage

To determine if the ballast is supplying proper starting voltage to the lamp, an open circuit voltage test is required. The proper test procedure is:

1. Measure input voltage (V1) to verify rated input voltage is being applied to the ballast.

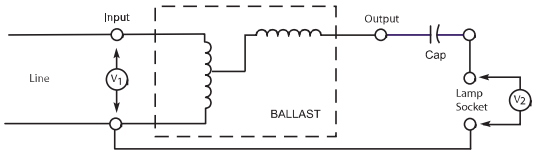
2. If the ballast has an ignitor [HPS, low wattage MH (35W to 150W) or pulse start MH], the ignitor must be disconnected or disabled with a capacitor (1000 pF or larger) across the voltmeter input to protect the meter from the high voltage ignitor pulse. **Some ballasts have an integral or built in ignitor. If you are not sure if an ignitor is used put a capacitor across the meter for all open circuit voltage measurements.**

3. With the lamp out of the socket and the voltage applied to the ballast or the proper tap of the ballast with multiple voltage inputs, read the voltage (V2) between the lamp socket center pin and shell. Some lamp socket shells are split. Make sure connection is being made to the active part. The reading must be within test limits shown in table on page 38. Open circuit voltage must be measured with a TRUE RMS voltmeter to provide an accurate reading.

4. Constant wattage (CWA, CWI) ballasts have a capacitor in series with the lamp. If the capacitor is open there will be no open circuit voltage. Measure the voltage on both sides of the capacitor. If the voltage exists on the ballast side but not on the lamp side, **change the capacitor and re-measure the open circuit voltage at the lamp socket. If there is still no voltage disconnect the lamp socket from the ballast and measure open circuit voltage again. Once a voltage is measured test the lamp socket for shorts with an Ohm-meter or replace the lamp socket. An ohm-meter test is not conclusive as the test is at low voltage and the failure may be due to the open-circuit voltage.**

TROUBLESHOOTING

OPEN-CIRCUIT VOLTAGE TEST



OPEN-CIRCUIT VOLTAGE TEST LIMITS

	LAMP		RMS
	Wattage	ANSI Number	Voltage*
MERCURY BALLASTS	50	H46	215-270
	75	H43	220-275
	100	H38	225-285
	125	H42	230-290
	175	H39	200-290
	250	H37	210-295
	400	H33	210-285
	2-400 (Series)	2-H33	445-545
	1000	H36	385-465
METAL HALIDE BALLASTS	35/39	M130	205-290
	50	M110 or M148	235-300
	70	M85	200-270
	70	M98 or M143	205-290
	70	M139	220-280
	100	M90 or M140	210-315
	150	M81	215-265
	150	M102 or M142	180-300
	175	M57 or M107	275-355
	175 P.S	M137 or M152	250-340
	200 P.S.	M136	215-330
	250	M58	270-345
	250	M80	215-265
	250 P.S.	M138 or M153	245-330
	320 P.S.	M132 or M154	240-310
	350 P.S.	M131	240-315
	400	M59	250-360
	400 P.S.	M135 or M155	235-340
	400 P.S.	M128	285-345
	2-400 (ILO)	2-M59	300-360
	450 P.S.	M144	235-340

TROUBLESHOOTING

	LAMP		RMS
	Wattage	ANSI Number	Voltage*
METAL HALIDE BALLASTS	750 P.S.	M149	305-390
	875 P.S.	M166	375-455
	1000	M47	385-485
	1000 P.S.	M141	370-475
	1500	M48	405-530
	1650	M112	420-510
	2000	M134	405-495
HIGH PRESSURE SODIUM BALLASTS*	35	S76	114-126
	50	S68	114-140
	70	S62	100-135
	100	S54	95-135
	150	S55	100-135
	150	S56	165-250
	200	S66	205-260
	250	S50	170-255
	310	S67	155-255
	400	S51	170-255
	430	SonAgro S145	180-220
	600	S106	200-265
	750	S111	200-245
	1000	S52	395-485
LOW PRESSURE SODIUM BALLASTS	18	L69	280-330
	35	L70	430-530
	55	L71	430-530
	90	L72	430-575
	180	L74	610-760

*Always disconnect the ignitor where equipped (typically used with metal halide <150W, pulse start metal halide, and high pressure sodium) before measuring the output voltage of ballasts. High voltage starting pulses can damage commonly used multi-meters

As an alternative, this test may be performed by screwing an adapter into the lamp socket for easy access. Some lamp sockets have a split shell and an adapter assures good electrical connection.

Short Circuit Lamp Current Test

Do not be concerned about momentarily shorting a magnetic HID ballast output. They will not instantly burn up. An HID ballast is designed to limit current at the specified value range.

To assure that the ballast is delivering the proper current under lamp starting conditions, a measurement may be taken by connecting an ammeter between the lamp socket center pin and the socket shell with rated voltage applied to the ballast. If available, a lamp socket adapter may be used as described in the open circuit voltage test.

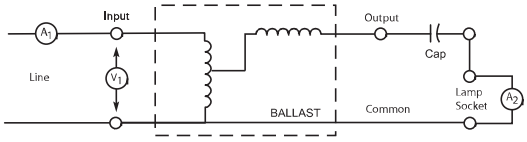
1. Energize ballast with proper rated input voltage.
2. Measure current with ammeter at A1 and A2 as shown in the diagram shown below.
3. Readings must be within test limits shown on page 41.

A clamp-on TRUE RMS ammeter may also be used to perform this test by placing an 18 gauge wire between the lamp and common leads of the ballast. When using a clamp-on ammeter for this measurement, be certain the meter is not near the ballast magnetic field or any steel object that may affect the reading.

The short circuit current test will also determine a defective capacitor in constant wattage circuits. A shorted capacitor will result in high short circuit current, while an open capacitor or low value capacitor will result in no or low short circuit current.

TROUBLESHOOTING

SHORT-CIRCUIT CURRENT TEST



SHORT-CIRCUIT LAMP CURRENT TEST LIMITS

	LAMP		Secondary Short Circuit Current Amps
	Wattage	ANSI Number	
MERCURY BALLASTS	50	H46	.75-1.60
	75	H43	.85-1.50
	100	H38	1.15-2.00
	125	H42	1.60-2.60
	175	H39	1.90-3.30
	250	H37	2.60-5.00
	400	H33	4.55-7.10
	2-400 (Series)	2-H33	4.4-5.40
	1000	H36	5.50-6.70
METAL HALIDE BALLASTS	25/39	M130	0.40-0.80
	50	M110 or M148	0.65-0.95
	70	M85	1.10-1.40
	70	M98 or M143	0.70-1.25
	70	M139	1.05-1.40
	100	M90 or M140	1.00-1.65
	150	M81	2.10-3.00
	150	M102 or M142	1.60-2.90
	175	M57 or M107	1.50-2.00
	175 P.S.	M137 or M152	1.60-1.95
	200 P.S.	M136	1.80-2.70
	250	M58	2.00-3.00
	250	M80	3.20-4.00
	250 P.S.	M138 or M153	2.35-3.05
	320 P.S.	M132 or M154	2.90-3.70
	350 P.S.	M131	3.25-4.40
	400	M59	3.25-4.60
	400 P.S.	M135 or M155	3.25-4.60
	400 P.S.	M128 or M135	3.30-4.05
	2-400 (ILO)	2-M59	3.90-4.80
	450 P.S.	M144	3.85-5.10

TROUBLESHOOTING

	LAMP		Secondary Short Circuit Current Amps
	Wattage	ANSI Number	
METAL HALIDE BALLASTS	750 P.S.	M149	4.90-6.00
	750 P.S.	S111	9.20-11.70
	875 P.S.	M166	4.45-5.40
	1000	M47	4.70-6.40
	1000 P.S.	M141	4.60-6.90
	1500	M48	7.00-10.50
	1650	M112	7.80-9.60
	2000	M134	9.80-12.00
HIGH PRESSURE SODIUM BALLASTS*	35	S76	0.9-1.40
	50	S68	1.30-2.20
	70	S62	1.70-2.90
	100	S54	2.40-3.60
	150	S55	3.50-5.50
	150	S56	2.20-3.80
	200	S66	2.50-3.85
	250	S50	3.15-5.30
	310	S67	4.10-6.30
	400	S51	4.90-7.50
	430	SonAgro S145	6.00-7.40
	600	S106	6.85-10.50
	750	S111	9.20-11.70
	1000	S52	6.40-7.80
LOW PRESSURE SODIUM BALLASTS	18	L69	0.30-0.40
	35	L70	0.50-0.70
	55	L71	0.50-0.70
	90	L72	0.90-1.12
	180	L74	0.90-1.20

Capacitor Testing and Ballast Performance

1. Disconnect the capacitor from the circuit and discharge it by shorting the terminals or wires together.

2. Check the capacitor with an ohmmeter set to the highest resistance scale
   - If the meter indicates a very low resistance then gradually increases, the capacitor does not require replacement.
   - If the meter indicates a very high initial resistance that does not change, it is open and should be replaced.

- If the meter indicates a very low resistance that does not increase, the capacitor is **shorted** and should be replaced.

The ohmmeter method of testing capacitors will only determine open or shorted capacitors. The capacitance value can be tested by many available portable TRUE RMS meters having that capability, though a test using a dedicated capacitance meter is more conclusive.

The capacitance value will affect lamp performance of Constant Wattage ballasts in ways that cannot be determined by the ohmmeter method. **A capacitor may look good visually, but should be tested for capacitance value or replaced.**

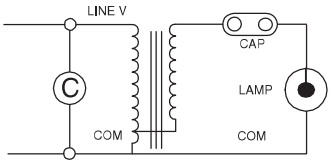
The capacitor in a reactor or high reactance ballast circuits will only affect the ballast power factor and not ballast operation. Capacitor failure in these circuits will cause line supply current changes possibly causing circuit breakers to activate or fixture fuse failures.

Ballast Continuity Checks

Continuity of Primary Coil

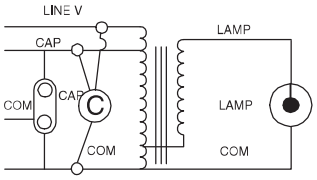
1. Disconnect the ballast from power source and discharge the capacitor by shorting its terminals or wires together.

2. Check for continuity of ballast primary coil between the voltage input leads as shown below.

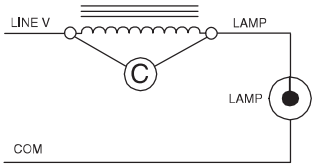


Constant Wattage (CWA, CWI) Type Ballast
Between Common and Line leads
(CWA shown)

TROUBLESHOOTING



High Reactance (HX) Type Ballast
Between Common and Capacitor leads

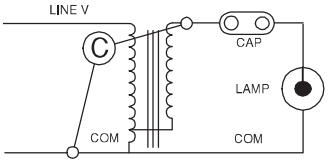


Reactor (R) Type Ballast
Between Line and Lamp leads

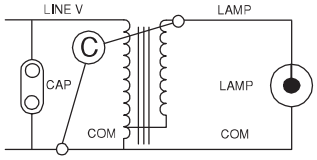
Continuity of Secondary Coil

1. Disconnect the ballast from power source and discharge the capacitor by shorting its terminals or wires together.

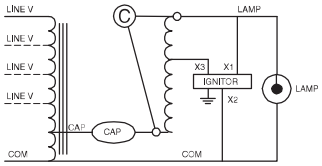
2. Check for continuity of ballast secondary coil between lamp and common leads as shown below.



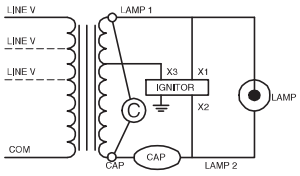
Constant Wattage (CWA, CWI) Type Ballasts not using Ignitors
Between Common and Capacitor leads (CWA shown)



High Reactance (HX) Type Ballast
Between Common and Lamp leads



Constant Wattage (CWA) Type Ballast
Where Ignitors are used



Constant Wattage (CWI) Type Ballast
Where Ignitors are used

Ignitor Testing

Ignitors are used as a lamp starting aid with all high pressure sodium, low wattage metal halide and pulse start lamps.

Measurement of the starting pulse characteristics of an ignitor is beyond the capability of instruments available in the field. In laboratory tests, an oscilloscope equipped with a high voltage probe is used to measure pulse height and width. In the field, some simple tests may be performed to determine if the ignitor is operable. **It is first assumed that the lamp has already been replaced with a known operable lamp.**

1. Replace the ignitor with a known operable ignitor. If the lamp starts, the previous ignitor was either mis-wired or inoperative.

2. If the lamp does not light check the open circuit voltage and short circuit secondary current or refer to Flow Chart Step 3 on page 34.

Further Magnetic Ballast Checks

Probable Causes of Inoperable Ballasts

1. Normal ballast end-of-life failure
2. Operating incorrect lamps. Use of higher or lower wattage lamps than rated for the ballast may cause premature ballast end-of-life.
3. Overheating due to heat from the fixture or high ambient temperatures causing the ballast temperature to exceed the specified temperature.
4. Voltage surge from lightening or power source malfunction.
5. Mis-wired, pinched or shorted wires.
6. Shorted or open capacitor.
7. Incorrect capacitor for the ballast.
8. Capacitor not connected to the ballast correctly.

Probable Causes of Shorted or Open Capacitors

1. Normal capacitor end-of-life failure.
2. Overheated due to heat in the fixture or ambient temperature.
3. Capacitor mounted too close to ballast.
4. Incorrect voltage or capacitor value for ballast.
5. Mechanical damage such as over-tightened capacitor clamp.