Philips HPI (-T) Plus lamps

General information

Information for
Original Equipment
Manufacturers

HPI Plus BU
HPI-T Plus
HPI-T 2000W

PHILIPS

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Content

1. General Information

1.1 Introduction

Ever since the introduction of high-pressure mercury lamps, people have tried to improve its quality of light emitted. Among the things which made this possible was the use of fluorescent powders, but adding metals other than mercury in the discharge tube also helped. This development resulted in the introduction of Philips Metal Halide Lamps (HPI(-T)Plus).

The key features of Philips HPI (-T) Plus are as follows:

- **Both 250 W and 400 W BU and T- types are compatible on both mercury and high-pressure sodium ballasts.**
  This gives the following advantages – possibility to upgrade from mercury to HPI(-T)Plus which gives better TcoO an better white light, possibility to upgrade from high pressure sodium to HPI(-T)Plus which changes the light from yellow to white (+ better Ra), common gear tray and the HPI(-T)Plus lamps function on all mercury and HPS circuits.

- **Low initial costs.**
  Philips HPI(-T)Plus range of lamps run on low cost HPL ballasts and low voltage pulse SI parallel ignitors which allow for low initial costs.

- **Low maintenance costs.**
  Philips HPI(-T)Plus lamps use a 3 band halide filling in the quartz tube. This results in an excellent lumen maintenance and long lamp life, reducing maintenance costs.

- **Good colour quality.**
  The 3-band halide filling provides a natural colour impression and good colour stability over lamp life, providing a good and pleasant light quality.

1.2 Lamp Technology

Philips HPI(-T)Plus lamps can be identified by the following construction.

HPI Plus BU

HPI-T Plus

HPI-T 1000W

HPI-T 2000W

- Discharge tube.

The discharge tube is made of quartz and is so shaped that light is emitted having the correct colour temperature. A white layer of zirconium oxide is deposited to the outside of the electrode chambers, which serves to increase the wall temperature in this region. In some lamp types where this is not required this coating is not applied since it will have an adverse effect on the light output.

The discharge tube consists of mercury, metal halide compounds and an inert gas filling. Once the lamp is ignited the mercury and the metal halide salts reach a vapour state. In this state a thermal balance is formed with the non-aggressive metal halides near the wall of the discharge tube and the metal and halide ions in the centre of the discharge. The metal ions emit radiation whereas the mercury regulates the arc voltage and the heat in the discharge tube. Philips HPI(-T)Plus contains iodides of Sodium (Na), Thallium (Tl) and Indium (In). Sodium radiates light in the yellow region of the spectrum, thallium in the green region and indium in the blue region.

- Electrodes

The electrodes of HPI(-T)Plus lamps consist of three parts:
1. The lead out rod forming the connection outside the discharge tube.
2. The molybdenum foil, which provides a gas tight seal in the quartz between the lead out rod and the electrode.
3. The electrode itself.

- Outerbulb

The outerbulb is made of hard glass and is available in two versions, either in a clear tubular shape (HPI(-T)Plus-T) or an ovoid-coated version (HPI Plus BU). The outerbulb is filled with an inert gas and its main function is to protect the discharge tube so that it functions under optimum conditions.

- Lamp cap

All Philips HPI(-T)Plus lamps are fitted with an E40 lamp cap.

1.3 HPI technology versus NaSc technology

1.3.1 Introduction

Philips is the only major lighting supplier using a specific technology in the manufacture of metal halide (HPI (-T) Plus) lamps. All others use sodium scandium technology, which is a different principle for the generation of light.
There are various aspects which have to be considered when evaluating the performance of metal halide lamps :

* Salt in the discharge tube.
* Colour variation and colour shift.
* Tube geometry
* Lifetime and End of life behaviour
* Processing
* Ignition voltage

Given below is an indepth explanation on each of these elements:

1.3.2 Salt in the discharge tube

When metal halide lamps were introduced in the sixties the standard salt filling used by all lighting manufacturers was Sodium - Thallium - Indium (Na-Tl- In). Since the technology was at that time in a very primitive stage, problems were encountered in controlling product performance with respect to lifetime and blackening. Due to this most lamp makers switched to another salt composition, Sodium - Scandium (Na - Sc).
Since the 3 salt technology offers a better product, Philips maintained its belief in this concept and during the past 30 years has been continuously involved in product and process improvement.
The major advantage of the 3 salt technology is the superior maintenance when compared to Na-Sc lamps. This is because in the presence of Scandium the tungsten oxide which is used for the electrodes becomes unstable and a black tungsten layer is deposited on the wall of the discharge tube resulting in low maintenance. During the High Temperature Lamp Chemistry Symposium a report was presented confirming the fact that tungsten remains stable in the presence of Na-Tl-In, resulting is less blackening and therefore better maintenance ("Wall blackening in metal halide lamps containing scandium or rare-earth iodides", W. van Erk, H.L.M Cobben and P. Bennema, Proc. Third Int. Symposium on High Temp. Lamp Chemistry, Proceedings Volumne 93-16, Electrochemical society, page 94-107, 1993). The new pulse start systems improves the maintenance of Na-Sc lamps by about 5 % but is still much lower when compared to the 3 salt lamps.

1.3.3 Colour variation and shift

The colour variation is the difference in colour points between lamps at 100 hrs. This depends on the consistency with which the discharge tube is made and processed and is not dependent on the types of salts used. Since Philips has been focussing on one technology for the past 30 years we have been able to improve the processes continuously.

The colour shift during lifetime is due to a number of changes which take place in the discharge tube during burning. These include changes in the molecular composition of the salts and the temperature of the cold spot due to the lamp wall blackening.
The temperature of the coldest spot in the discharge tube determines the colour point of the lamp. This temperature changes due to blackening resulting in a colour shift. As mentioned previously Na- Sc lamps have the tendency to make tungsten oxide unstable, blackening the discharge tube. This results not only in low maintenance but also colour shift due to the change in the temperature of the cold spot in the discharge tube.

1.3.4 Geometry of discharge tube

The shape and dimensions of the discharge tube are critical for the lumen output and colour point. Uniformity of the discharge tube over a period of time ensures that lamps from different batches give the same performance and this has to do with the process steps and the process control of these steps.
The inhouse capability of Philips in machine design and manufacture combined with the strong drive for quality and process control ensures that the discharge tube, the heart of the HPI lamp is made in a uniform and a reproducible manner.
The geometry of the discharge tube can be basically split-up into 2 sections, the central tubular part and the 2 ends where the electrodes are present. The central tubular section of Philips lamps have an uniform wall thickness which ensures controlled burning conditions. The two extremes with the electrodes are processed in such a way to ensure the correct thickness and shape which results in a controlled heat balance, critical for the lumen output and the colour point.

1.3.5 Lifetime and end of life explosion

The Na-Sc principle allows for a very restricted range of operating temperatures in the discharge tube. Lower temperatures will result in poor performance. Higher temperatures result in the Scandium becoming aggressive and changing the composition of the quartz. This results in shorter life and higher chances of end of life explosion.
The Na-Tl-In principle has a much wider operating range of temperatures. In addition these salts are much less aggressive compared to Scandium which means a longer lamp life and a much lower probability for explosion at end of life. Philips is the only lighting manufacturer to offer a teflon coated lamp for the use in open luminaires and in case of end of life explosion the Teflon coating will prevent the lamp from shattering.

1.3.6 Ignition Voltage

The lamp concept of Philips makes it possible for ignition at low voltages (540 - 900 V), even at very low temperatures. This means a low cost ignitor can be used which results in lower system costs.

1.3.7 Processing

The final quality of the lamp is determined by 2 factors : the quality of materials used and the quality of the lamp manufacture process. As mentioned earlier, Philips has been concentrated it's efforts on one technology and our sustained development efforts on both materials and on the lamp making have resulted in offering a quality product to the market.

1.4 Nomenclature

The name of the lamp family is

Metal Halide Lamps

The terms used in describing the various types are :

HPI(-T)Plus :	High Pressure Iodides
Plus:	Compatible for mercury (HPL) and high pressure sodium (SON) gear
BU:	Base Up
T:	Tubular
S:	Version with internal starter (self-starting)
P:	Version with a Teflon coating for use in open luminaries (protected).

Examples:

HPI Plus 250 W BU:	HPI	High Pressure Iodides
	Plus	Compatible for mercury (HPL) and high pressure sodium (SON) gear
	250	Lamp Wattage
	BU	Base Up
HPI Plus 400 W BUS:	HPI	High Pressure Iodides
	Plus	Compatible for mercury (HPL) and high pressure sodium (SON) gear
	400	Lamp Wattage
	BU	Base Up
	S	Internal Starter
HPI Plus 400 W BU-P:	HPI	High Pressure Iodides
	Plus	Compatible for mercury (HPL) and high pressure sodium (SON) gear
	400	Lamp Wattage
	BU	Base Up
	P	Protected version for open luminaires.
HPI Plus 250 W:	HPI	High Pressure Iodides
	Plus	Compatible for mercury (HPL) and high pressure sodium (SON) gear
	250	Lamp Wattage
	T	Tubular version

2. Luminaire Design

2.1 Introduction

In this chapter some recommendations and values are given to enable OEM's to design an optimum luminaire.

2.2 Position of components

The position of the system components is defined by the burning position of the luminaire and the maximum allowed temperatures of the different components.

2.3 Maximum operating temperatures

2.3.1 Lamp

Test Conditions
With regard to minimum ambient temperatures there are no special requirements for HPI (-T) Plus.
When used at very low temperatures, for example -20 °C, the lumen output can be expected to be a couple of percent lower than the nominal values.

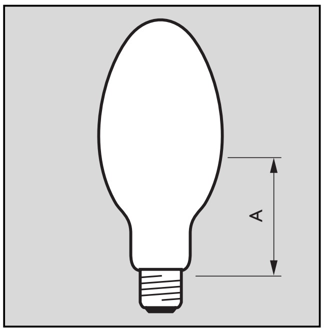
The maximum permissible temperature should be taken into account when designing luminaires for HPI lamps. The latter has to be measured in the most unfavourable, but still permissible, burning position of the luminaire.

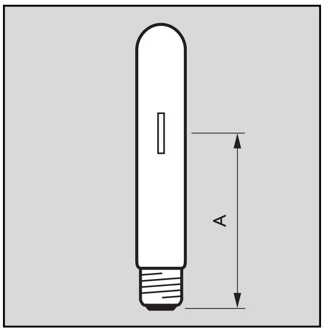
The lamp/luminaire combination should be operated at 105 % of the nominal mains voltage and 96 % of the nominal ballast impedance in an ambient temperature, which is the maximum permitted for the luminaire. Overpowering the lamp can also simulate the above situation.
The table below gives the W_{lamp} values, which should be applied for the various lamptypes.

Fixation of thermocouples
The fixation of the thermocouples on the lamp can be done with, for example, Saurekit (Hoechst). This fixing cement can be easily made fit for use by dissolving it in water.

Critical temperature points
The critical temperature points are those of the lamp cap and outer bulb. The maximum temperature of the lamp cap should not exceed 250°C for HPI (-T) Plus 250 W/400 W and 300°C for HPI-T 1 kW/2 kW. This temperature has to be measured by fixing the thermocouple on the lamp cap (as close as possible to the solder on the side contact).

The temperature of the bulb is important since exceeding this will result in changes in the colour temperature and in the case of the "P" versions, degradation of the Teflon coating. The critical point, where the thermocouple has to be fixed (distance 'A' from the lampcap) is shown the in the following diagrams.





	Mercury gear (HPL)		High pressure sodium gear (SON)	
Lamp Wattage	**HPI-T Plus**	**HPI Plus BU**	**HPI-T Plus**	**HPI Plus BU**
250 W	250	256	295	302
400 W	390	400	445	454

Lamp Wattage	HPI-T
1000 W	985
2000 W / 220 V	1960
2000 W / 380 V	1930

Note: The above values of V_{mains} and W_{lamp} are only for safety measurements and are not valid for performance. In an installation, the V mains should be +/- 3 % of the rated ballast voltage for an optimum performance of the lamp.

	HPI-T Plus 250 W	HPI Plus 250 W BU	HPI-T Plus 400 W	HPI Plus 400 W BU(S)	HPI Plus 400 W BU(S)P
Maximum Bulb temp in °C	550	350	600	350	260
Distance A (mm.)	110	100	120	142	142

	HPI-T 1000 W	HPI-T 2000 W 220 V	HPI-T 2000 W 380 V
Maximum Bulb temp in °C	600	600	600
Distance A (mm.)	185	210	185

2.3.2 Components

The lifetime of the ignitor and ballast used is largely dependent on the operating temperature. To ensure proper lifetime the permissible maximum temperatures indicated by the manufacturer must be taken into account during luminaire development.

2.4 Influence of ambient temperatures

The temperature of the lamp will change with ambient temperature. In some applications the temperature may reach unexpected large values.

2.5 Lampholder / lampbase

Philips HPI (-T) Plus are fitted with E40 lampcaps. The lamp holders used must be able to withstand a voltage peak of 750 V for systems with mercury gear and 5 kV for systems with SON gear.

2.6 Explosion risk

As with all metal halide lamps, there is a remote possibility of explosion. This risk will increase with age, temperature or improper handling of the lamp.

Consequently, other than for the protected (P) versions, the lamps should be operated in fully enclosed luminaires which are able to capture the broken parts after failure.

2.7 Lamp blackening

A certain amount of lamp blackening during life is normal and unavoidable. This blackening is caused by a thin layer of electrode material deposited during life on the inner wall of the discharge tube. The electrode is designed for nominal lamp power so deviations in the lamp power caused by undervoltage or overvoltage of the mains supply will increase this blackening process.

2.8 Luminaire design

The luminaire manufacturer is advised to conform to the international standards of luminaire design (IEC 60598-Luminaires).

3. Lamp Specifications

3.1 Range and burning positions

The Philips HPI range:

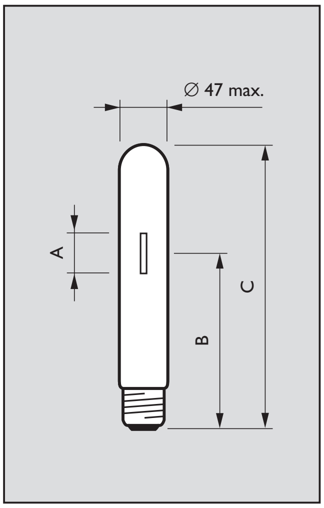
HPI Plus 400W		Ovoid lamps suitable for operation on mercury or HPS gear; horizontal burning position (+/- 20°)
HPI Plus 250 W	BU	Ovoid lamps suitable for operation on mercury or HPS gear; vertical burning position (+/- 15°)
HPI Plus 400 W	BU	Ovoid lamps suitable for operation on mercury or HPS gear; vertical burning position (+/- 15°)
HPI Plus 400 W	BU-P	Ovoid lamps suitable for operation on mercury or HPS gear; vertical burning position (+/- 15°)
HPI Plus 400 W	BUS	Ovoid lamps suitable for operation on mercury or HPS gear; vertical burning position (+/- 15°)
HPI Plus 400 W	BUS-P	Ovoid lamps suitable for operation on mercury or HPS gear; vertical burning position (+/- 15°)
HPI-T Plus 250 W		Tubular lamps suitable for operation on mercury or HPS gear; horizontal burning position (+/- 20°)
HPI-T Plus 400 W		Tubular lamps suitable for operation on mercury or HPS gear; horizontal burning position (+/- 20°)
HPI-T 1000W/220V		Tubular lamps; horizontal burning position (+/- 20°)
HPI-T2000W/220V		Tubular lamps; horizontal burning position (+/- 75°)
HPI-T 2000W/380V		Tubular lamps; horizontal burning position (+/- 20°)

3.2 Mechanical characteristics

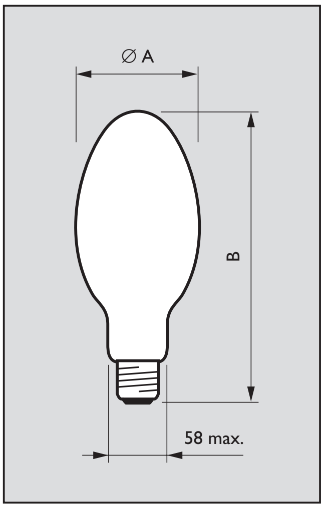
The drawings below give the dimensions of various lamptypes and wattages.

HPI (-T) Plus General

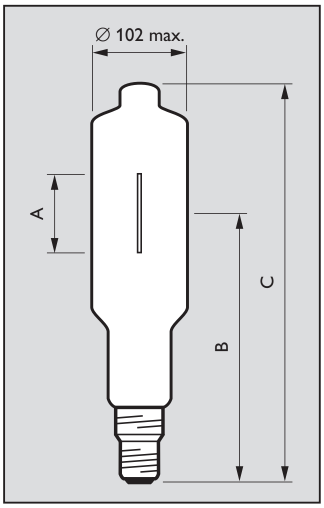
Lamp dimensions



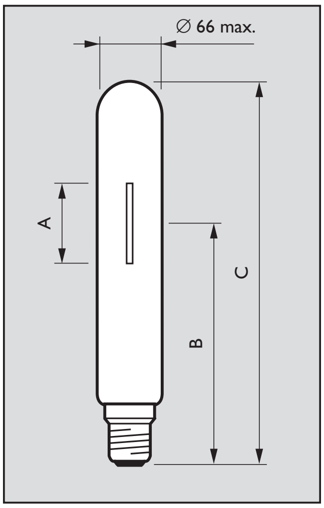
Type	A max.	B max.	C max.
Cap/base E40			
HPI-T Plus 250W	29	158	257
HPI-T Plus 400W	40	172	286



Type	A max.	B max.
Cap/base E40		
HPI Plus 250W	91	226
HPI Plus 400W	122	284



Type	A max.	B max.	C max.
Cap/base E40			
HPI-T 2000W/220V	89	290	430
HPI-T 2000W/380V	135	260	430



Type	A max.	B max.	C max.
Cap/base E40			
HPI-T 1000W	80	240	382

3.3 Electrical and lighting characteristics

3.3.1 Characteristics for HPI (-T) Plus lamp when operated on mercury gear

• HPI Plus and HPI Plus Bulamps on HPL gear

		HPI Plus 400 W	HPI Plus 250 W BU	HPI Plus 400 W BU-(P)	HPI Plus 400 W BUS - (P)
Luminous flux	lumen	30 000	19 000	35000	35000
Maximum luminance	cd/mm²				
Colour temperature	K	4300	4300	4300	4300
Chromaticity Coord.	x	369	380	380	380
Chromaticity Coord.	y	367	370	374	374
Colour Rend. Index	Ra	69	69	69	69
Lamp Wattage	W	390	256	400	400
Lamp voltage	V	125	128	125	125
Lamp current	A	3.4	2.2	3.4	3.4
Imax during starting	A	6.0	3.9	6.0	6.0
Lamp efficacy	lm/W	77	74	87	87
Vmin. for ignition	V	560	560	560	not allowed
Vmax. for ignition	V	750	750	750	not allowed
Nom. pulse width, 90% Vmax	us	> 260	>260	>260	not allowed
Pulse peak position		20 - 90 degrees of open circuit voltage			
Hot restrike		no	no	no	no
Vmin. open circuit	V	198	198	198	198
Ignition time	sec.	10	10	10	10
Run up time	min.	3	3	3	3
Re-ignition time	min.	15	15	15	15

• HPI-T (Plus) lamps on HPL gear

		HPI-T Plus 250 W	HPI-T Plus 400 W	HPI-T 1000 W	HPI-T 2000W 220 V	HPI-T 2000 W 380 V
Luminous flux	lumen	19000	35000	85000	189000	183000
Maximum luminance	cd/mm²				1000	760
Colour temperature	K	4500	4300	4300	4600	4600
Chromaticity Coord.	x	364	369	370	360	360
Chromaticity Coord.	y	383	375	380	380	380
Colour Rend. Index	Ra	65	65	65	65	65
Lamp Wattage	W	250	390	985	1960	1930
Lamp voltage	V	128	125	130	130	240
Lamp current	A	2.15	3.40	8.25	16.50	8.80
Imax during starting	A	3.90	6.0	14.2	28.4	15.3
Lamp efficacy	lm/W	76	90	86	96	95
Vmin. for ignition	V	560	560	560	560	900
Vmax. for ignition	V	750	750	750	750	1500
Nom. pulse width,90%Vmax	us	> 260	>260	>140	>80	>160
Pulse peak position		20 - 90 degrees of open circuit voltage				
Hot restrike		no	no	no	no	no
Vmin. open circuit	V	198	198	198	198	342
Ignition time	sec.	10	10	10	10	10
Run up time	min.	3	3	3	3	4
Re-ignition time	min.	15	15	15	15	20

3.3.2 Characteristics for HPI (-T) Plus lamp when operated on high pressure sodium gear

• HPI Plus and HPI Plus BU lamps on SON gear

		HPI Plus 400 W	HPI Plus 250 W BU	HPI Plus 400 W BU-(P)	HPI Plus 400 W BUS - (P)
Luminous flux	lumen	35000	25500	42500	42 500
Maximum luminance	cd/mm^2				
Colour temperature	K	3800	3800	3800	3800
Chromacity Coord.	x	400	390	400	400
Chromacity Coord.	y	380	370	380	380
Colour Rend. Index	Ra	69	69	69	69
Lamp Wattage	W	454	302	454	454
Lamp voltage	V	125	128	125	125
Lamp current	A	3.85	2.55	3.85	3.85
Imax during starting	A	6.0	4.5	6.7	6.7
Lamp efficacy	lm/W	77	84	93	93
Vmin. for ignition	kV	2.8	2.8	2.8	not allowed
Vmax. for ignition	kV	5	5	5	not allowed
Nom. pulse width, 90% Vmax	us				not allowed
Pulse peak position		20 - 90 degrees of open circuit voltage			
Hot restrike		no	no	no	no
Vmin. open circuit	V	198	198	198	198
Ignition time	sec.	10	10	10	10
Run up time	min.	3	3	3	3
Re-ignition time	min.	15	15	15	15

• HPI-T Plus lamps on SON gear

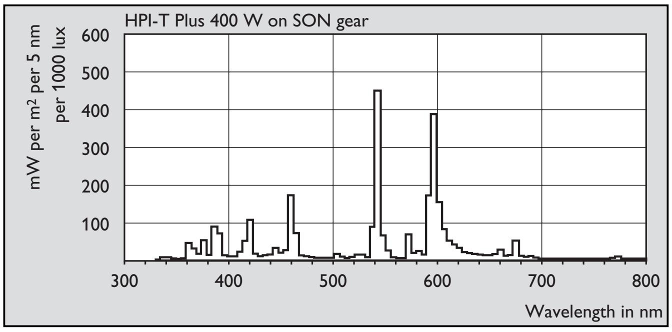
		HPI-T Plus 250 W	HPI-T Plus 400 W
Luminous flux	lumen	23000	38000
Maximum luminance	cd/mm^2		
Colour temperature	K	3800	3800
Chromacity Coord.	x	384	380
Chromacity Coord.	y	385	370
Colour Rend. Index	Ra	65	65
Lamp Wattage	W	295	445
Lamp voltage	V	128	125
Lamp current	A	2.50	3.80
Imax during starting	A	4.50	6.70
Lamp efficacy	lm/W	78	85
Vmin. for ignition	kV	2.8	2.8
Vmax. for ignition	kV	5	5
Nom. pulse width, 90% Vmax	us		
Pulse peak position		20 - 90 degrees of open circuit voltage	
Hot restrike		no	no
Vmin. open circuit	V	198	198
Ignition time	sec.	10	10
Run up time	min.	3	3
Re-ignition time	min.	15	15

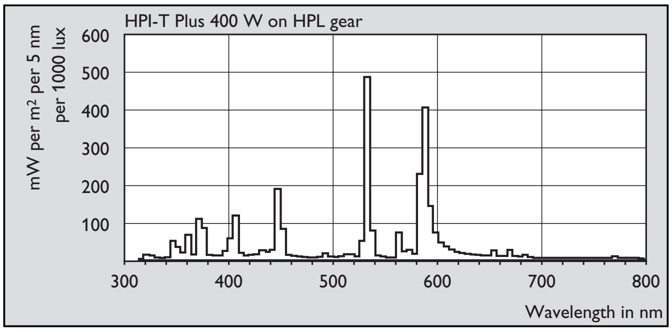
3.3.3 HPI (-T) plus on CW-gear

• HPI-T (-T) Plus lamps are not developed for CW-gear as the lamps will burn on underpower, causing a much shorter lifetime.

3.4 Spectral power distributions

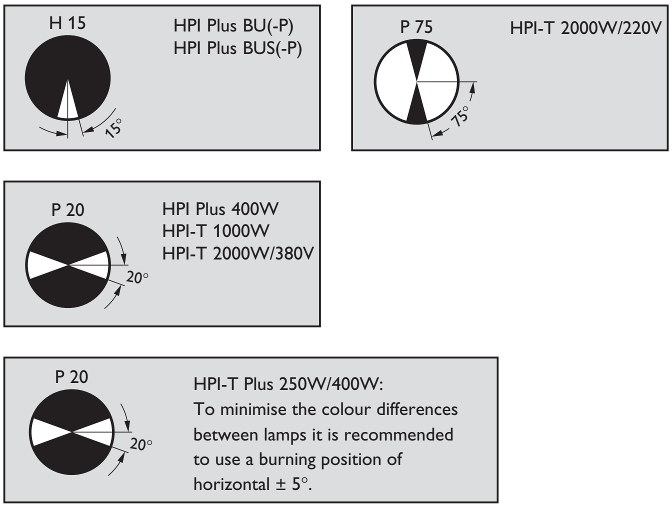
The normalised spectral power distributions are given in the following diagrams.





3.5 Burning positions

The allowed burning positions are shown below:



(Diagrams showing the permitted burning positions of the lamps)

3.6 Lamp disposal

The burner of HPI (-T) Plus lamps contains a small amount of mercury, which is essential for their operation.
For reliable starting, all lamps use krypton -85 in the discharge tube. When these lamps are destroyed the gaseous krypton -85 will be instantaneously mixed with the surrounding atmosphere and no increase in background radiation will be measurable. In view of the low content of krypton -85 concerned, no special measures are required.

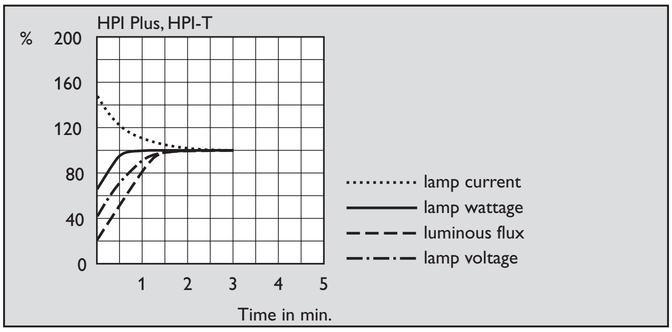
Since waste legislations and possibilities for disposal vary from country to country, local regulations should be followed with respect to lamp disposal.

4. Lamp operation

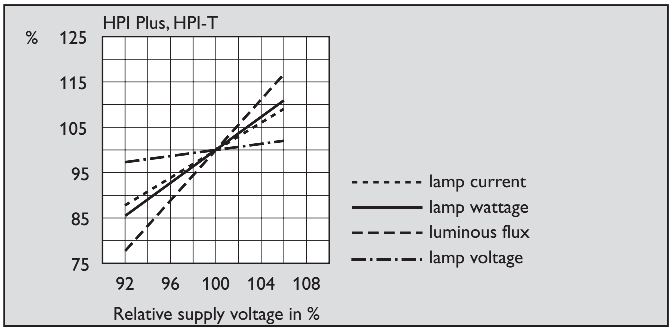
4.1 Starting characteristics

The resistance of the gas in the discharge tube is related to the gas pressure of the various elements in the tube. Immediately after ignition, the lamp voltage is lower than nominal and the current is higher. After some minutes the gas pressure has been built up and the lamp current and voltage stabilise to their rated values and nominal lamp performance is reached.

The graph below shows the starting characteristics for the HPI (-T) Plus range. These values have been measured at nominal supply voltage using a reference ballast.



Lamp performance during run-up



Effects of mains voltage variations

4.2 Lifetime performance

	HPI–T Plus 250 W	HPI-T Plus 400 W	HPI-T 1000 W 220 V	HPI-T 2000W 220 V	HPI-T 2000 W 380 V
Life 5 % failures (hrs)	5000	5000	3000	3000	3000
Life 20 % failures (hrs)	10000	10000	6000	6000	6000
Average life 50% failures	20000	20000	10000	10000	10000
Lumen maintenance					
2000 hrs (%)	90	90	90	90	90
5000 hrs (%)	85	85	85	85	80
10000 hrs (%)	75	75	75	75	75

4.3 End-of-life behaviour

The lamp voltage (Vlamp) is a very important parameter during the life of the lamp. If the Vlamp rises too much, the lamp will cycle and/or extinguish and has to be replaced.

Possible causes of a rising of Vlamp:
1. The electrodes are wearing out: the electrode distance increases, causing the voltage to rise.
2. A change in the chemical composition of the filling of the discharge tube, e.g. sodium migration through the quartz wall of the discharge tube.
3. A too high operating temperature as a result of an incorrect luminaire or optic design or very high ambient temperatures.
4. Underpowering/dimming.

4.4 Cycling

During operation, the polarity changes every half cycle of the frequency of the mains supply (with conventional gear). At that moment the lamp needs a sufficient voltage potential to reignite immediately: the re-ignition voltage (Vre-ign). When the lamp is re-ignited, the voltage drops to a lower value. During life Vre-ignition will rise (and so also Vlamp). If Vre-ign rises above the incoming voltage of the ignitor, the lamp will become unstable, but will continue to burn, helped by the pulses of the ignitor. When the Vre-ign rises above Vmains, the lamp will extinguish, cool and re-ignite again. To eliminate this cycling it is advisable to use a timed ignitor SN58T15, this ignitor has a build-in timer-circuit that will stop the igniton after 15 minutes.

5. Control gear for HPI (-T) Plus lamps

5.1 Introduction

As common to all gas discharge lamps, Philips HPI lamps need a control gear in order to ignite and to control the current. This gear is normally a copper/iron ballast for current control, an ignitor for starting and a capacitor for power factor correction.

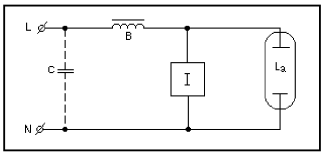
5.2 Control Units

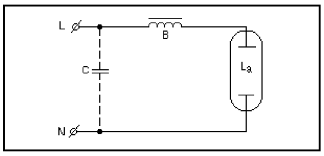
5.2.1 Circuit diagrams HPI (-T) Plus 250 and 400 W

Details for operation on mercury gear

HPI Plus 400 W
HPI Plus 250 W BU
HPI Plus 400 W BU(P)
HPI -T Plus 250 W and 400 W

HPI Plus 400 W BUS(P)





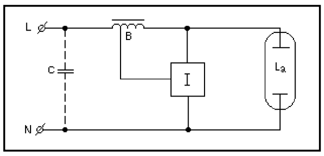
B	**Ballast**
C	**Capacitor**
I	**Ignitor**
La	**Lamp**

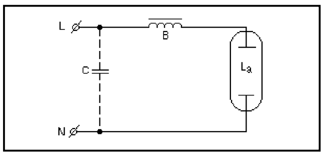
Lamp	Ballast	Ignitor	Power factor correction Capacitor value (µF/V)
HPI Plus 400W	BHL 400	SI 51	28 / 250
HPI Plus 250 W BU	BHL 250	S1 51	18 / 250
HPI Plus 400 W BU(P)	BHL 400	SI 51	28 / 250
HPI Plus 400 W BUS (P)	BHL 400	not allowed	28 / 250
HPI -T Plus 250 W	BHL 250	SI 51	18 / 250
HPI -T Plus 400 W	BHL 400	SI 51	28 / 250

Details for operation on high pressure sodium gear

HPI Plus 400 W
HPI Plus 250 W BU
HPI Plus 400 W BU(P)
HPI -T Plus 250 W and 400 W

HPI Plus 400 W BUS(P)



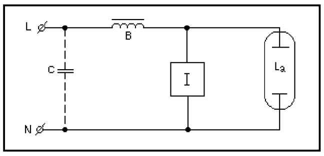


B	**Ballast**
C	**Capacitor**
I	**Ignitor**
La	**Lamp**

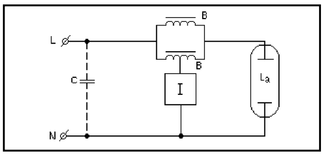
Lamp	Ballast	Ignitor	Power factor correction Capacitor value (µF/V)
HPI Plus 400W	BSN 400	SN 58, SN 58 T5	42 / 250
HPI Plus 250 W BU	BSN 250	SN 58, SN 58 T5	32 / 250
HPI Plus 400 W BU(P)	BSN 400	SN 58, SN 58 T5	42 / 250
HPI Plus 400 W BUS (P)	BSN 400	not allowed	42 / 250
HPI -T Plus 250 W	BSN 250	SN 58, SN 58 T5	32 / 250
HPI -T Plus 400 W	BSN 400	SN 58, SN 58 T5	42 / 250

5.2.2 Circuit diagrams HPI -T 1000 W and HPI -T 2000 W 220V/380 V

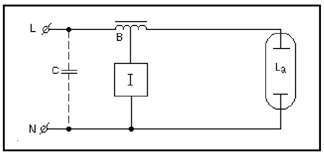
HPI -T 1000 W



HPI -T 2000 W 220 V



HPI -T 2000W 380V



B	**Ballast**
C	**Capacitor**
I	**Ignitor**
La	**Lamp**

Lamp	**Ballast [Hz]**	**f**	**Ignitor**	**Power factor correction Capacitor value (µV/F)**
HPI -T 1000 W	BHL1000L02	50	SI52	65/250
	BHL1000L62	60	SI52	54/250
HPI -T 2000 W 220 V	BHL2000L78	50	SI52	125/250
	BHL1000L62*	60	SI52	120/250
HPI -T 2000 W 380 V	BHL2000L50	50	SI54	35/420

**two ballasts connected in parallel*

5.2.3 Inrush current

The inrush current (DC current just after ignition, which is not limited by the ballast during one period) should be not higher than 20 times the nominal lamp current.

5.3 Restart

HPI lamps cannot be used for immediate hot restrike. Base up lamps will ignite after 3-10 minutes depending on the used gear (SON-Mercury).

5.4 Line voltage variations and dimming with conventional gear

Temporary deviations in line voltage of less than ± 5% of the rated ballast voltage will hardly affect lamp life. There is, however, some influence on the colour temperature. For a continuous deviation of more than 3%, it is recommended to choose another ballast rating. Together with a variation of +/- 3% in ballast impedance, there is in this case already a variation possible of 6%.

5.5 Noise

Conventional gear can generate some continuous noise due to the copper-iron ballast. In a warm restart situation or at end-of-life of the lamp the ignitor will audible by a 'hum'.

5.6 Fusing, insulation of pulse voltage

Since the energy required to ionize the gas prior to starting the discharge is high, the combination of peak voltage and width of the ignitor pulse is critical. To ensure that the high voltage cable between ignitor and lampholder reaches the lamp, the capacitance of the high voltage cable between ignitor and lampholder should not exceed the specified value. For ignitors producing pulses up to 5 kV, the distance between the high voltage conducting wire and earthing parts of the luminaire should be at least 10 mm. When using insulators, this creep distance may have to be increased, depending on the material used to avoid slide sparks over the insulators.

5.7 Design

5.7.1 Ballast-design

The heavy-duty designed ballasts are for applications in humid environments or in luminaires with low protection class, the basic design may be used in luminaires with sufficient protection.

5.7.2 Ignitor-design

Both ignitor types (SI51 and SN58) are in click-housing for fast mounting but also in the more universal stud-housing.

Annex 1: Ordering data for Philips HPI (-T) Plus lamp

12 NC	Actual DESCRIPTION	EOC	MOQ
9280 767 09803	HPI(-T)PLUS PLUS 250W BU E40	871150018114515	12
9280 767 09811	HPI(-T)PLUS PLUS 250W BU E40	871150018114515	12
9280 767 09817	HPI(-T)PLUS PLUS 250W BU E40	871150018114530	24
9280 731 09803	HPI(-T)PLUS PLUS 400W E40	871150018108410	6
9280 743 09803	HPI(-T)PLUS PLUS 400W BU E40	871150018252410	6
9280 743 09811	HPI(-T)PLUS PLUS 400W BU E40	871150018252410	6
9280 743 09817	HPI(-T)PLUS PLUS 400W BU E40	871150018252442	14
9280 743 09843	HPI(-T)PLUS PLUS 400W BU E40	313918098042410	6
9280 820 09903	HPI(-T)PLUS PLUS 400W BU-P E40	871150019482410	6
9280 747 09803	HPI(-T)PLUS PLUS 400W BUS E40	871150018111410	6
9280 747 09811	HPI(-T)PLUS PLUS 400W BUS E40	871150018111410	6
9280 802 09903	HPI(-T)PLUS PLUS 400W BUS-P E40	871150019317910	6
9280 802 09943	HPI(-T)PLUS PLUS 400W BUS-P E40	313918018634510	6
9280 761 09203	HPI(-T)PLUS-T PLUS 250W E40	871150017989015	12
9280 761 09211	HPI(-T)PLUS-T PLUS 250W E40	871150017989015	12
9280 761 09217	HPI(-T)PLUS-T PLUS 250W E40	871150017989043	77
9280 761 09243	HPI(-T)PLUS-T PLUS 250W E40	313918018405115	12
9280 737 09203	HPI(-T)PLUS-T PLUS 400W E40	871150017990615	12
9280 737 09211	HPI(-T)PLUS-T PLUS 400W E40	871150017990615	12
9280 737 09217	HPI(-T)PLUS-T PLUS 400W E40	871150017990643	77
9280 737 09243	HPI(-T)PLUS-T PLUS 400W E40	313918018401315	12
9280 740 09203	HPI(-T)PLUS-T 1000W E40	871150018373645	4
9280 740 09242	HPI(-T)PLUS-T 1000W E40	313918018402045	4
9280 740 09255	HPI(-T)PLUS-T 1000W E40		4
9280 740 09269	HPI(-T)PLUS-T 1000W E40		4
9280 736 09203	HPI(-T)PLUS-T 2000W 220V E40	871150018376745	4
9280 736 09242	HPI(-T)PLUS-T 2000W 220V E40	313918018430345	4
9280 736 09255	HPI(-T)PLUS-T 2000W 220V E40		4
9280 718 09203	HPI(-T)PLUS-T 2000W 380V E40	871150018379845	4
9280 718 09211	HPI(-T)PLUS-T 2000W 380V E40	871150018379845	4
9280 718 09242	HPI(-T)PLUS-T 2000W 380V E40	313918018403745	4

Annex 2: Ordering data Philips gear 250/400W

12 NC	Actual DESCRIPTION	EOC	MOQ
	Basic		
9137 002 149..	BHL250 L200 (220V/50Hz)	8711500737441	6
9137 002 150..	BHL250 L201 (220V/60Hz)	8711500737472	6
9137 002 151..	BHL250 L202 (230V/50Hz)	8711500738172	6
9137 002 152..	BHL250 L207 (230/240V/50Hz)	8711500737236	6
	Heavy-duty		
9136 039 203..	BHL250 L11 (220V/50Hz)	8711500934109	6
9136 039 213..	BHL250 L30 (220V/60Hz)	8711500934628	6
9136 039 204..	BHL250 L40 (230V/50Hz)	8711500916594	6
9136 039 205..	BHL250 L32 (240V/50Hz)	8711500915795	6
	Basic		
9137 002 153..	BHL400 L200 (220V/50Hz)	8711500737502	6
9137 002 154..	BHL400 L201 (220V/60Hz)	8711500737533	6
9137 002 155..	BHL400 L202 (230V/50Hz)	8711500739216	6
9137 002 156..	BHL400 L207 (230/240V/50Hz)	8711500737267	6
	Heavy-duty		
9136 049 203..	BHL400 L11 (220V/50Hz)	8711500934680	6
9136 049 213..	BHL400 L30 (220V/60Hz)	8711500934727	6
9136 049 204..	BHL400 L40 (230V/50Hz)	8711500914743	6
9136 049 205..	BHL400 L32 (240V/50Hz)	8711500915818	6
	Ignitors for BHL ballasts		
9136 195 199..	SI51	8711500908353	48
9137 001 436..	SI51-S (Stud-mounting)	8711500747501	48
	Basic		
9137 002 140..	BSN250 L300 I (220V/50Hz)	8711500739117	4
9137 002 141..	BSN250 L301 I (220V/60Hz)	8711500739131	4
9137 002 142..	BSN250 L302 I (230V/50Hz)	8711500739155	4
9137 002 143..	BSN250 L407 I (230/240V/50Hz)	8711500738523	4
	Heavy-duty		
9136 250 903..	BSN250 L08 (220V/50Hz)	8711500934161	4
9136 250 913..	BSN250 L43 (220V/60Hz)	8711500934765	4
9136 251 504..	BSN250 L33 (230V/50Hz)	8711500934802	4
9136 251 605..	BSN250 L34 (240V/50Hz)	8711500932464	4
	Basic		
9137 002 451..	BSN400 L300 I (220V/50Hz)	To be advised	4
9137 002 452..	BSN400 L301 I (220V/60Hz)	To be advised	4
9137 002 392..	BSN400 L302 I (230V/50Hz)	8711500746238	4
9137 002 393..	BSN400 L304 I (240V/50Hz)	8711500746214	4
	Heavy-duty		
9136 230 603..	BSN400 L08 (220V/50Hz)	8711500934185	4
9136 230 613..	BSN400 L43 (220V/60Hz)	8711500934208	4
9136 230 904..	BSN400 L33 (230V/50Hz)	8711500914840	4
9136 231 005..	BSN400 L34 (240V/50Hz)	8711500912402	4
	Ignitors for BSN ballasts		
9136 195 799..	SN58	8711500907554	48
9137 001 248..	SN58-S (stud)	8711500741769	48
9137 001 349	SN58T15 (timed)	8711500743183	48
9137 001 375	SN58T15-S (timed & stud)	8711500745941	48

Ordering data Philips gear 1000/2000W

12 NC	Actual DESCRIPTION	EOC	MOQ
	High-power		
9137 002 184..	BHL1000 L02 (220V/50Hz)	8711500062314	1
9137 002 174..	BHL1000 L43 (220V/60Hz)	8711500062307	1
9137 002 173..	BHL1000 L78 (230/240V/50Hz)	8711500062376	1
9137 002 180..	BHL2000 L78 (230/240V/50Hz)	8711500063854	1
9137 002 183..	BHL2000 L50 (380/400V/50Hz)	8711500062291	1
9137 002 179..	BHL2000 L76 (380/400/415V/50Hz)	8711500063847	1
	Ignitors for High-power		
9136 195 299..	SI52	8711500908377	48
9136 191 499..	SI54	8711500908339	20

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