GreenPower GreenVision 600/1000W

OEM design-in Guide

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Introduction

The latest Philips systems for horticulture are based on the GreenPower 600 and 1000W lamps and the full electronic GreenVision drivers. These new systems are giving the end-users the most reliable and efficient lighting system.

1.2 Version management

1.0	First document with lamp and driver information
1.1	Drawing of 600W attached, chapter inrush current added
1.2	DALI chapter attached
1.3	Minor driver modifications
2.1	New update of lamps and drivers
2.2	Minor changes

2 General Information Lamps

2.1 Lamp technology

Discharge tube

The discharge tube is made of PCA and has an electrode sealed into each end. The electrode consists of a tungsten rod with a tungsten coil around it. The coil is filled with an emitter, improving the ignition behaviour of the lamp. The rod is welded to a niobium tube, which is sealed in the PCA with a ceramic frit ring.

STEM (internal lamp construction)

The stem consists of a long and a short lead wire, welded to the niobium tubes. A solid-state getter is used to remove impurities from the outer bulb.

Outer bulb

The outer bulb of the Master GreenPower T 600W EL is made of hard glass and vacuum. For the Master GreenPower TD 1000W EL the outer bulb is made of quartz glass and filled with nitrogen.

Lamp cap

The Master GreenPower T 600W EL is fitted with a E40 lamp cap. The Master Green Power TD 1000W/400V EL is equipped with a Litze wires on both ends of the tube. Together with a tightly specified pinch (called a K12x30s base) it provides the

opportunity to position the lamp most accurate to optimize system performance together with the reflector.

Life and maintenance

Among the various HID products, SON systems performs best with respect to efficiency and lifetime. Master GreenPower lamps are designed for optimal growth light output over lifetime.

Electrical circuit and ignition

The Master Green Power 600 and 1000W EL are designed to be operated on a VHF (very high frequency) electronic driver. Detailed information can be found in the chapters of the GreenVision drivers.

Ignition

When testing ignition, be it in the lab or in a new installation, one has to pay attention to avoid the so-called “flash-mode operation”. Flashed lamps arise if one cuts the supply voltage immediately after ignition, and are recognized by a black deposit on the wall of the burner around the electrodes. These deposits could hamper reliable ignition. Simply burn the lamps for 3 minutes and the deposit will disappear.

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3 Luminaire Design

In this chapter, recommendations and values are given to enable an optimal luminaire design. The OEM is always responsible for a safe and sound connection of the lamp with the reflector.

The published lamp values concern lamps aged for ca.100 hours. All lamp testing for lamp starting, lamp warm-up and lamp electrical characteristics concern lamps, which are operated in a fixture specially, designed to operate the lamps in accordance with the specification.

It may be possible that for both the Green Power 600 and 1000W EL lamps, some of them will not run-up to the nominal power at first run-up attempt. Some lamps may need a few attempts in order to stabilize and run-up properly. Final stabilization can take 100 hours.
If run-up problems remain after 150 hours of operation, the lamps must be replaced.

Attention: a low environment temperature (<10°C) or severe forced ventilation may be the cause and therefore can extend the stabilization time.

GreenVision electronic gear for MASTER Green Power 600 and 1000W EL does not use ignition pulses. Instead a sinusoidal ignition voltage of maximum 2600 (600W) and 2400 (1000W) Vrms is used. Lamp holders should be designed to withstand these voltages over a limited ignition period.

3.1 IEC recommendations

The general recommendations for luminaire design by IEC and the national safety regulations (KEMA, VDE, NEMKO, ANSI, etc) are also applicable to SON luminaries. Lamp related data can be found in IEC 60662. The luminaire manufacturer is advised to conform to the international standards of luminaire design (IEC 60598-Luminaires)

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Mechanical specifications for Master Green Power 600W400V EL.

This lamp is specially designed for operation on very high frequency drivers (>100 kHz), at high temperatures. Lamp holder is E40.

The burning position of the 600W lamps is horizontal.

Mechanical specifications for Master Green Power 1000W400V EL.

This lamp is designed for operation on very high frequency drivers (>100 kHz), at high temperatures and high currents in aggressive atmospheres. Therefore this lamp has a K12x30s base which consist of a NiMn stranded wire and a well-defined pinch.

The inner parts of the pinch are defined according to drawing. (see following page) This may well serve for positioning the lamp in the fixture. Electrical contact has to be made by clamping the Litze wires between two hard, corrosion resistant, conducting surfaces. Clamping pressure must be maintained well over lamp life.

The burning position of the 1000W lamps is limited to Horizontal.

3.2 Maximum temperatures in the luminaire

The following tests have to be performed to ensure that the conditions in the luminaire do not cause premature failure of the lamp. To determine if the lamp-luminaire combination is acceptable, the lamps must be tested in horizontal position in the luminaire, at ambient greenhouse temperature.

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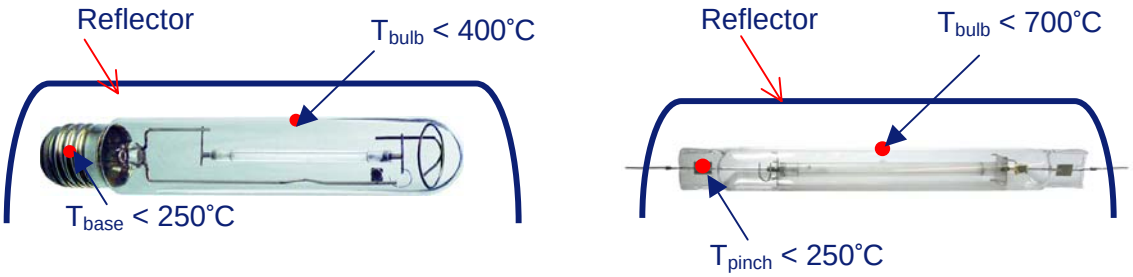
Test conditions

The lamps can only be operated on the corresponding Green Vision electronic drivers (see next chapters). They operate the lamps at the correct power level, in the specified mains voltage range the driver will yield the specified power at a value of 97% to 103% of the rated lamp power.

Attention: A 1000W lamp burning outside a luminaire (free burning) will not run up decently and therefore never reach the specified lamp power!

Fixation of thermocouples

The temperature can be measured using a thermocouple. The fixation of the thermocouple can be done with, for example Saurekit (Hoechst). This fixing cement can be easily made fit for use by dissolving it in water.



3.3 Maximum temperatures of bulb and cap

The temperature of the bulb and the base are the most critical.

The allowed temperature of the bulb, when measured at any point, depends on the material of the glass and the lamp wattage and should not exceed the following:

Lamp wattage	Glass type (bulb)	Max. allowed temp.
600W / 400V EL	Hard glass	400 °C
1000W/400V EL	UV block quartz	700 °C

The applied lamp cap or -pinch for both GreenPower lamps with the corresponding maximal temperatures are:

Lamp wattage	Lamp base	Max. allowed temp.
600W / 400V EL	E40	250 °C
1000W/400V EL	K12x30s	250 °C

These limitations are imposed by the lamp materials, but it should be understood that, in general, if the luminaire causes a lamp to reach these temperatures, it is probable that the voltage rise limitation **will be exceeded**.
Depending on application measurements of different luminaires, we advise for the GP 1000W EL a min. bulb temperature of 500°C, with the lamp voltage within the rated voltage range.
Under the same conditions, a min. bulb temperature of 350°C for the GP 600W EL is advised.

3.4 Operating Voltages in the luminaire

In order to obtain the nominal specified power, the lamp requires a rated lamp voltage in the luminaire :

- 600W GreenPower : 210 V
- 1000W GreenPower : 250 V

Burning the lamp in the luminaire, the temperature inside the lamp increases. More specific, the coldest spot temperature of the burner increases. This temperature determines the amount of amalgam in the discharge and thus the lamp voltage.

The SON lamp extinguishes if the temperature increase in the luminaire causes the voltage to exceed certain limits. The exact values are :

- 600W GreenPower 285V
- 1000W GreenPower 330V

In general the SON lamp will extinguish because of voltage rise before the material limits are reached. This means, this test is the most important.
Therefore designing a reflector for electronic lamps is best done in cooperation with Philips. Philips can provide the OEM with calibrated, measured lamps and drivers for the design-in of a new luminaire. Philips strongly advise an in-house evaluation of

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the total system after the design-in. Contact your Philips representative. For the way of working, see chapter 8.

3.5 Lamp voltage measuring

To measure the lamp voltage a high accuracy a meter with a frequency-range of 900 kHz or higher should be used, reason are the higher harmonics, using traditional equipment with lower range the accuracy will decrease (±3% with 120Khz meter)

Measurement conditions

- Use stable lamp situation (> 45 min after run-up)
- Use a lamp with at least 100 hours.
- Do not connect the device before ignition, meter could be damaged.
- Always measure lamp in the reflector

Alternative is to read the lamp voltage via the IR-interface (LED on GreenVision driver), Philips can provide a read-unit which should be used with a PDA, see more information in chapter 5.5

3.6 Lamp base & Lamp holders

Following lamp bases are applied:

- GreenPower-T 600W EL: E40
- GreenPower-TD 1000W: K12x30s

For the 1000W lamp :

Clamping the Litze wires should be done between two hard, corrosion resistant, conducting surfaces with following specification

- Support the lamp over at least 80% of the pinch surface
- The clamping force on the Litze wire should be of 5-15N
- Hardness of the contact material 180-200 HV
- Electrical resistivity of the clamp material max 8μΩm

Attention: OEM should take care under all circumstances the connection wires should be carefully isolated from touching. Precautions should be taken when wires are split.

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Recommended orientation of the GP1000W lamp in the luminaire is with the quartz tip downwards, and with the getter side on the hot (=shortest) wire of the electronic driver (see p. 21 of the Greenvision part).. This position ensures the smallest spread in lampvoltage and ignition voltage

Attention: Lamps could be extremely hot, users should be warned for this before lamp replacement.

Specific Lamp holder for the 1000W type can be obtained at :

O.M.T. s.r.l.
Via Tito Speri 7/E
25040 Nigoline di Cortefranca
ITALY tel. +39 30 984128 – 984181

Vossloh-Schwabe has developed a lamp holder as well:

Vossloh-Schwabe Deutschland GmbH
Postfach 28 69
58478 Lüdenscheid
Deutschland

3.7 Guidelines to comply with norms

UV-related data

The outer bulb is consisting of UV blocking glass or quartz and reduces the amount of UV to a very low and safe level.

Explosion risks

If used on GreenVision drivers there are no explosion risks for GreenVision lamps. If however the burner explodes, the outer bulb does not break.

Lamp blackening

A certain amount of lamp blackening during life is normal and unavoidable. As well as lamp blackening, discharge tube blackening arises over life.
Due to the use of a solid stage getter and an optimal electrode design, the blackening effect is reduced to a minimum.

3.8 Summary: attention points for luminaire design

Lamps are designed for use in open luminaires. When use in closed luminaires, overheating of the lamp will occur.

Always ask for calibrated lamps by Philips, they will be sent with the specific electrical data to obtain in the luminaire.

Operating Voltage range at rated power

- 600W GreenPower : 210 V – 275 V
- 1000W GreenPower : 230 V – 315 V

Switch of Voltage:

- 600W GreenPower : 285 V
- 1000W GreenPower : 330 V

Under too hot conditions e.g. in an optic that is too small in volume or that is not well designed, accelerated lamp blackening and short life will occur.

The OEM is always responsible for a safe and sound connection of the lamp with the reflector.

The OEM has to take care that no life voltage can be touched on the luminaire during operation and that supply voltage is always switched off during service and maintenance of the luminaire!

Lamps could be extremely hot, users should be warned for this before lamp replacement.

MASTER GP 600W400V EL:	0.18 kg
MASTER GP 1000W400V EL:	0.11 kg

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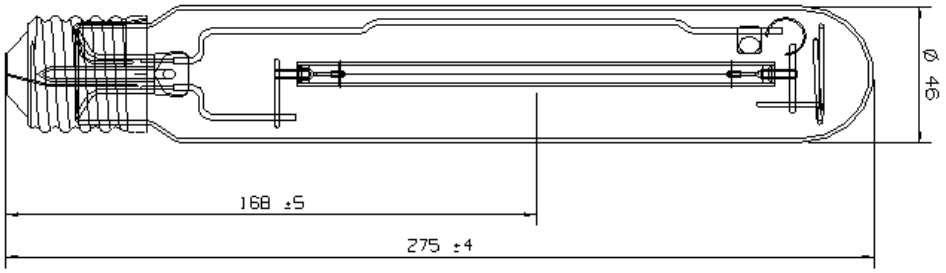
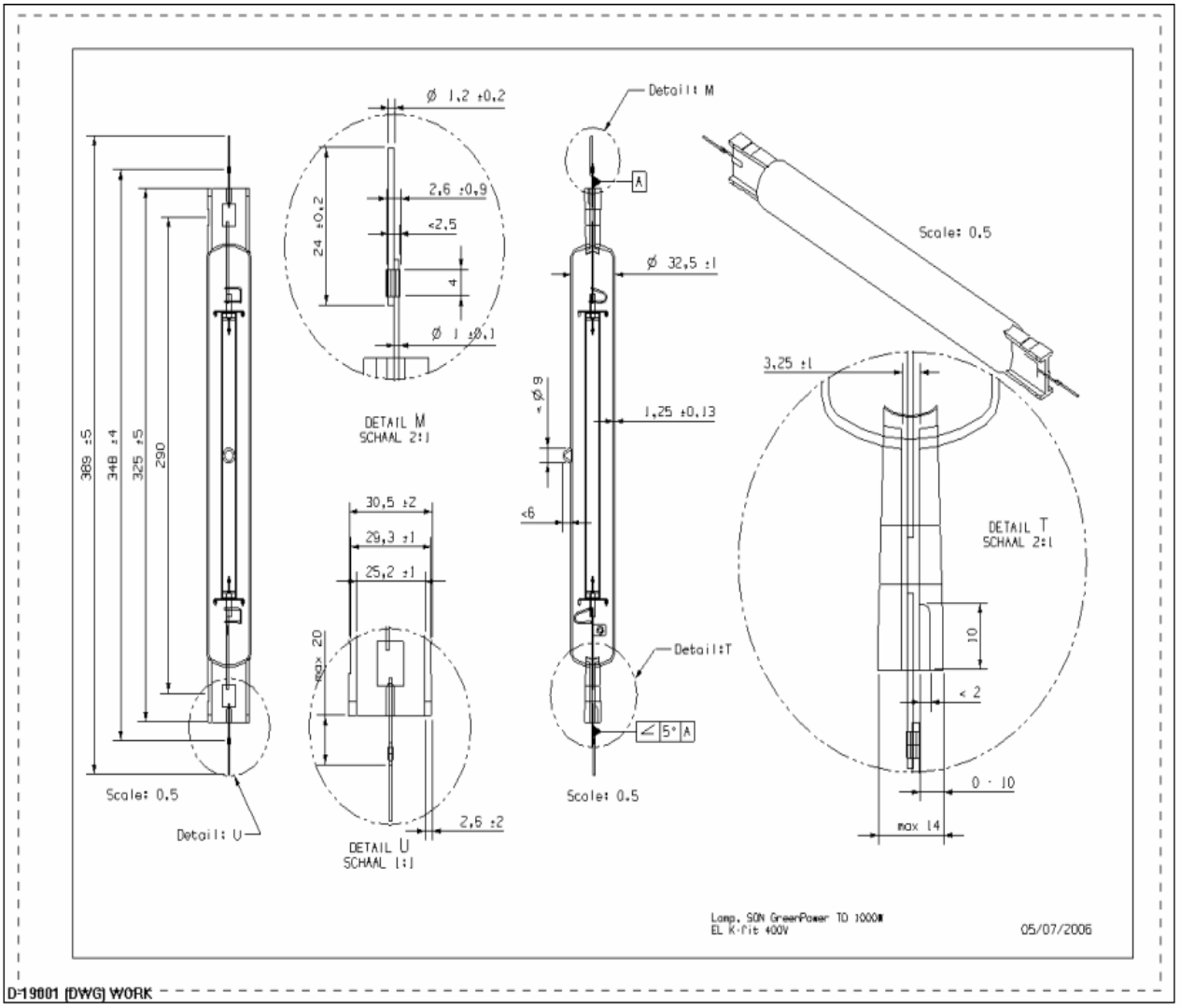
Drawing of GreenPower 600W



Drawing of GreenPower 1000W TD



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4 Lamp Operation

4.1 Ignition characteristics

MASTER GreenPower 600W and 1000W EL are designed to be operated on the GreenVision 600/1000W electronic gear, the ignitor is part of the gear.

4.2 Philips Integrated Antenna (PIA)

A Philips Integrated Antenna (PIA) is used in the GreenVision lamps to guarantee a reliable ignition with higher xenon pressures. An extra advantage of these lamps is the ability for hot re-ignition.

4.3 Run-up

The resistance of the gas in the discharge tube is related to the gas pressure of the different elements in the tube: immediately after ignition, the lamp voltage is lower than nominal and the current is higher. After 15-30 minutes the gas pressure has been built up and the lamp current and voltage reach the rated electrical values .

Some lamps may need a few run-up attempts in order to stabilize and run-up properly. A low environment temperature (<10°C) or severe air circulation may also be the cause.

The run-up current is limited & controlled by the GreenVision driver. Due to this limited run-up current it can even take up to 100 hours to finally stabilize at rated power. Only if run-up problems remain after 100 hours of operation lamps must be replaced.

4.4 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 driver will shut off to protect the system from overheating.

During operation, the lamp voltage will rise within the operation range. When reaching the maximum lamp voltage the GreenVision driver will shut off the lamp, the lamp has than reached end of life and needs to be replaced.

Operating Voltage range: at rated power

- 600W GreenPower: 210 V – 275 V, shut off at 285V
- 1000W GreenPower: 250 V – 315 V, shut off at 330V

A too high operating-temperature as a result of an incorrect luminaire or optic design or very high ambient temperatures can cause an early shut-off of the lamp.

4.5 Influence of ambient temperature on lamp behaviour

MASTER Green Power EL lamps may not run up decently or fall back to a lower power level at temperatures below 15°C or in operating conditions with high (forced) air circulation.
On the other hand, after several thousand hours of operation when the lamp voltage has risen, a very high ambient temperature (est. > 35°C) could cause a shut off of the GreenPower lamps. This has to be experienced on site.

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GreenVision Drivers

5.1 Driver technology

The GreenVision 600 and 1000W are from the start designed together with the lamp to reach maximum system performance. Since the long experience Philips has with end-users and OEM's we succeeded to design an optimized control-gear to be used in Greenhouses. Special requirements in these applications are the humid conditions, the electrical behaviour in large installations and of coarse to operate the lamp under all conditions as efficient as possible.

Efficiency

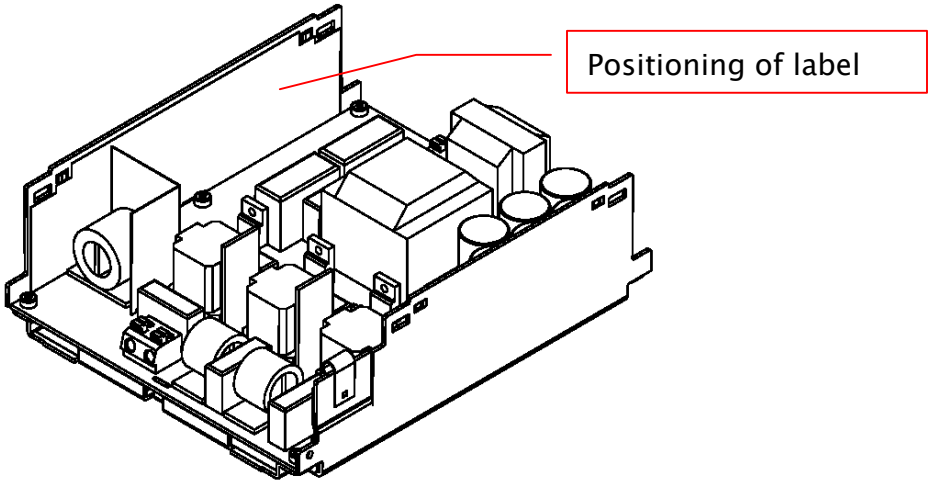
Drivers are based on the latest technology and components; a microprocessor is used to control the driver as efficient as possible under all circumstances. This intelligence made it possible to regulate the power of the lamp constantly, even when the voltage of the lamp increases or the mains voltage is changing.

Reliability

Because of the use of latest technology and the low component temperatures the reliability of the drivers is very high. Together with our partners special components were designed for these application to assure long lifetime.

5.2 Driver Dimensions and Mechanical Design In

Driver of both 600 and 1000W have similar dimensions (see below)



For a more detailed drawing and CAD files, please contact your Account-Manager.

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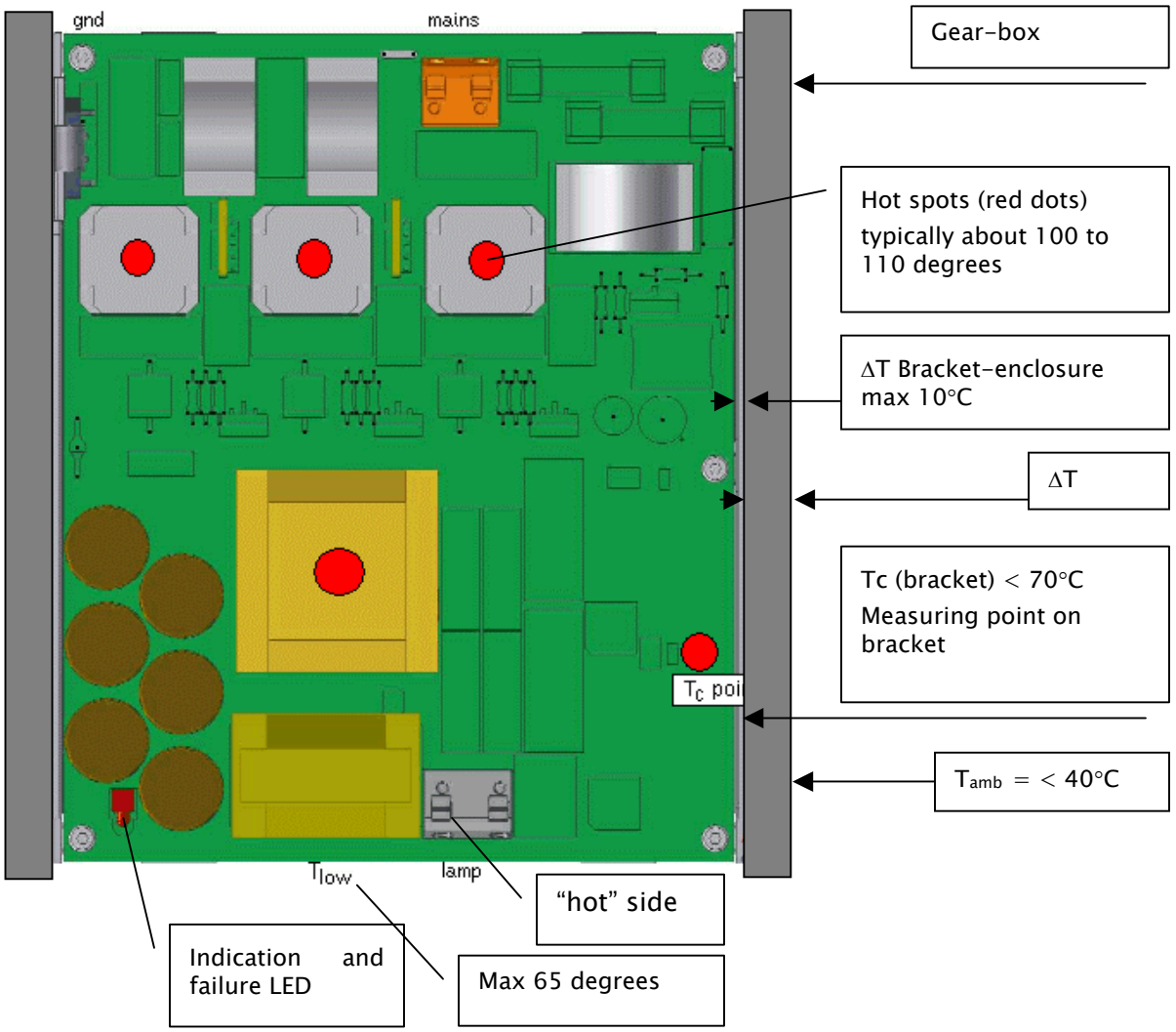
5.3 Driver Temperature Behaviour

Below picture indicates typical temperatures for reaching nominal lifetime and reliability.



The driver is built into an aluminium U-bracket, to be placed within a hermetically sealed enclosure with good thermal contact between bracket and enclosure (ΔT < 10°C). Enclosure is assumed to have a thermal resistance to ambient of no more than:

600W Typically power loss of 20W, max ΔT is 70-10-40 = 20°C → $R_{th\ encl-amb}$ = 1.0°C/W

1000W Typically power loss of 32W, max ΔT is 70-10-40 = 20°C → $R_{th\ encl-amb}$ = 0.63°C/W

To prevent reflection of heat back to the electronic components it is highly advised to lacquer the blank metal of the housing of the gear-compartment. For preventing magnetic coupling between housing and lamp coil (nearby capacitors) there should be a minimum distance of 5-6 mm.

5.4 Lifetime

The temperature of the electronics is in practice the most important parameter for lifetime and reliability. In the design of the driver everything possible is done to keep the component temperature as low as possible but the design of the luminaire and the ability to guide the heat out of the luminaire is of utmost importance. For lowering the driver temperature the contact surface between the bracket of the driver and luminaire should be as large as possible, it's essential also over life this contact is maintained. The OEM should taken into account that typically a 10 degrees increase of the driver temperature the reliability/lifetime will be halved, vice versa when the temperature can be decreased the reliability will be doubled. Under all circumstances the maximum values may not be exceeded.

Other lifetime determining aspect is mains-voltage, installer should take care the safety values of the mains-voltage should never be exceeded. When using an energy-generation device (WKK); measures should be taken to prevent this.

Last issue is no proper connection to the lamp-wires of the 1000W, this will result generate high currents and voltage and will damage the lamp-holders but also the driver.

When after analysis of the driver the defect was caused by a too high temperature or the safety values of mains-supply were exceeded, the warranty will not be valid.

5.5 Status indication

For failure indication a LED is mounted nearby the lamp connectors, if the driver is working correctly it will be off. If the microprocessor has detected a failure mode it will be indicated as follows:

Status	Failure LED		Lamp consequences	Reset by
Ignition Busy	Continuous flashing	Ignitor is running Hot-lamp Driver too hot	Lamp or driver is cooling down until able to re-ignite	Not Applicable
EOL-Timer Expired	1 flash	Defect lamp	Change Lamp	Mains off
Cycle error	2 flashes	Wrong or defect lamp	Lamp is not ignited	Mains off
Low mains	3 flashes	Mains voltage is too low	Lamp is turned off	Mains within tolerance
Over Temperature	4 flashes	Temperature in driver is too high	Lamp is turned off	Mains off
Lamp voltage out of specification	5 flashes	Wrong or old lamp	Lamp is turned off	Mains off

Note: LED flash code = number of flashes during 3.6seconds. A flash is defined as the led being 256ms on and 256ms off.

Additionally to the visual signals the LED also transmits non-visual data, this data can be read by a special interface tool and displayed on a PDA. Philips can provide a read-unit which can be used with a PDA with Bluetooth, the following PDA's are tested:

- HP IPAQ H2215 (Pocket PC 2003)
- HP IPAQ 2490 (Windows Mobile 5)
- DELL X30 (Pocket PC 2003)
- ACER N310 (Windows Mobile 5)

The data transmitted contains:

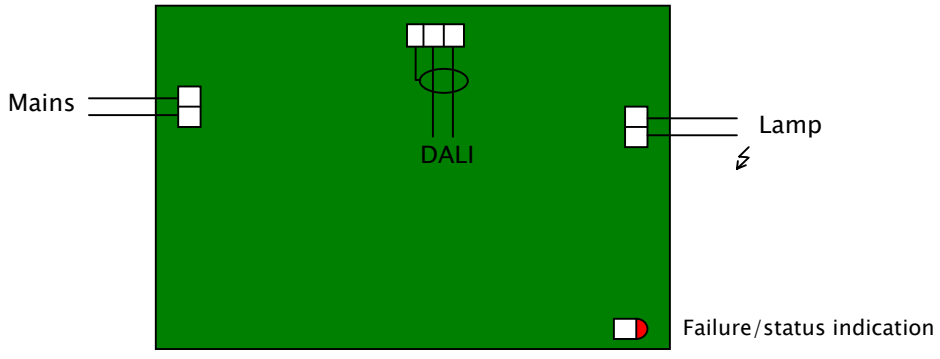
Actual lamp voltage
Actual lamp power
Driver temperature
UIC (Unique Identification Code), see also chapter DALI

5.6 Wiring

Because of the high frequency of the lamp current it is important to wire the luminaire in such a way that EM radiation is not reflected on the mains input. Some wires are more important than others, but in general take care to:

- Keep the wires as short as possible (<50cm), especially the “hot” wire to the lamp needs special attention. Furthermore it is advised to separate these lamps wires as far as possible from the mains wires. Prevent lamp wires to “see” the mains wires.
- Lamp wires should not be bend too sharply (see specification of wire) and needs to be protected against damaging of isolation.
- Mechanical stress on the connectors should be prevented.
- Take care the lamp wires never be short-circuited, the high current in combination with the ignition-voltage could result in dangerous situation.
- Keep the long wire of the 1000W close to the reflector, take care about the temperature of the reflector
- Prevent big loops, for EMC this will work as an antenna.
- Preferably use a low inductance wire to the lamp to keep the impedance of the wires as low as possible. Typical lamp current frequency is 120kHz.
- Do not use shielded wires for lamp connection (high capacitance to ground)
- Shielding of DALI lines is optional.

The driver needs to safety earthing, however to comply with the EMC rules the aluminium housing should be made contact with earth of the housing.



Since the driver is mounted in a metal housing no special safety earthing is needed, for EMC reasons the aluminium heat sink should electrically be connected to the metal casing of the fixture.

5.7 Electro-Magnetic Compatibility

The driver is tested and approved according to industrial regulations. When mounted in a luminaire, different behaviour can be found and therefore take care of wiring. See previous chapter about cabling.

5.8 Fixation in luminaire

The fixation in the luminaire is very important for reliable operation; the thermal contact between bracket and housing should be as close as possible. See also chapter 5.3.

5.9 Electro-Static Discharges

ESD can damage electronic circuits. When touching sensitive electronic components an electro-static discharge can cause damaging of the components, this will cause reduction of the lifetime of the control gear. It is therefore obligate to prevent discharges by precautions in assembly workshop at OEM. End-users should be advised not to open the luminaires, on the luminaire it should be indicated no serviceable parts are inside.

5.10 Trace ability

For trace ability reasons every driver will be marked with a date-code after the final testing. The code consists of production Year, Week and date of week.

For example: 5-25-2 means: =

Year2005, week25, day 2 (Tuesday)

On the label also a "code 128C" barcode will be printed with following format

date code (4 digits) , SW (2 digits), driver id (3 digits ,

Driver ID for 600W -9137 006 **037**26; 1000W - 9137 006 **038**26)

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5.11 DALI

The next step in technology in horticulture is the use of digital control. Philips has selected DALI (Digital Addressable Lighting Interface) as universal interface for the GreenVision drivers. This protocol is set out in the technical standard IEC 60929, more information can be found on http://www.dali-ag.org/.

With the DALI interface every individual driver can digitally be switched on and off and practically all information of a luminaire can be read-out. Examples are lamp power, mains voltage, driver temperature and many more. Dimming is at the moment disabled since we do not have sufficient experience on lamp-behaviour.

5.12 DALI cabling

The DALI lines of the Philips GreenVision drivers are polarity independent and protected against wire-mistakes. The Dali input of GreenVision is protected against maximum of 424 Volt, however please also check the maximum voltage of the control-system. To determine the maximum cable-length of the Dali line, the voltage drop must stay below 2.0V. Practically the maximum allowable cable length and wire gauge related to the Dali current can be read below.

	128mA	250mA	500mA
0.20 mm² (87.5 Ω /Km)	88 m	44 m	22 m
0.75 mm² (22.4 Ω/Km)	357 m	178 m	89 m
1.0 mm² (17.1 Ω/Km)	467 m	233 m	117 m
1.5 mm² (11.2 Ω/Km)	714 m	357 m	178 m
2.5 mm² (7.2 Ω/Km)			300 m

With the 460mA pulse of the WAGO module the maximum allowable length with 2.5 mm² is < 300 meters. (see above table) with supply of about 18 Volt PLC. Depending on the cable spec this will give about +/- 2 Volts loss. This is the Dali minimum spec for communication.

5.13 Functionality

The GreenVision drivers are internally protected for wrong commands and to make the drivers suitable for horticulture applications, following functionality is added:

- When switching only “on” and “off” by Dali there is no inrush current. The capacitors in the driver will stay charged. However an installer should take into account the high inrush current the first time the mains voltage is applied to the driver (see table in chapter 6.3.1).
- The stand-by power when switched off by DALI is maximum 2 Watt.
- Maximum drivers that can be on one DALI master unit is 63 drivers, one free short-address is needed to swap short-addresses.
- DALI commands can only be addressed via the short-address.
- To keep the lamps off when mains-voltage is applied the Dali broadcast command “off” must be send within 600 mSec. No other commands may be send to the driver in this period.
- For driver-identification all drivers have a so-called UIC, this UIC is transmitted by the LED and can be read-out via DALI. A special read-out unit can be ordered and via a PDA (Bluetooth) the sequence of luminaires in a project can be synchronized with the WAGO control-system. Drivers are default programmed on MASK. This means when there is a failure on the Dali line by short circuit or disconnection, lamps that are “off” will stay “off” and lamps that are “on” will stay “on”. According Dali specification drivers must be default programmed on level 254. This means on this point we are not 100% Dali complaint.

5.14 Monitoring

Besides all normal DALI commands the Philips GreenVision driver has the possibility to read-out

- Actual Mains voltage
- Actual Lamp voltage
- Lamp type
- Lamp power
- Run time of driver
- Over temperature time

Special error-code can be read-out (can be reset by DALI command)

- Driver over temperature
- Ignition time out
- Lamp voltage out of specifications
- Fading ready
- Lamp not in wanted power range
- Mains voltage out of specifications
- Mains voltage out of operation area (driver in stand by)

6 Installation & mounting

6.1.1 Connectors

Connectors type WAGO series 804 (both lamp and mains side).
Push in contacts suitable for 0.5 – 2.5mm2 massive or stranded wiring, recommended strip length of the leads is 10mm. For the DALI line WAGO series 250 is used, suitable for 0.5 – 1.5 mm², recommend strip length 7.5 – 8.5mm

Mains should be connected between two phases (400Volts), it is not allowed to use a Line-Neutral 400V system. The reason for this limitation is a too high voltage between line and ground.

To improve EMI behaviour the Bracket must be connected to ground, the contact-resistance should be <10 Ohm.

6.1.2 Lamps that can be driven by the driver

Because these driver/lamp systems are designed to get maximum efficacy and lifetime the only lamps which can be used are the GreenPower 600W-EL and GreenPower 1000W-EL
The 600W EL-lamps are marked with “Electronics” on the top of the outer bulb.

6.1.3 Suitable application for this driver

The drivers are designed to be used in a fixture with >IP65 protection.

6.1.4 Max number of drivers per MCB (miniature circuit breaker)

Compared to a conventional system the inrush current with electronic drivers is higher, the duration however is much shorter. Therefore MCB’s with “slow”

characteristics should be used. For maximum and duration of inrush current see the chapter on drivers and MCB specification.

6.1.5 Thermo-Switch behaviour

If the driver is used at too high temperatures a so-called thermo-switch will protect the driver against direct damaging. This state will be indicated by the failure indication (over-temperature) and can be reset by disconnecting the mains. If this continued the thermal connection of the driver with the casting should be tested.

6.1.6 Mains voltage

The driver is designed to operate within a mains input tolerance of ±3%. In this area the lamp power is regulated within ±3% of its nominal power. If the mains input is out of this area the lamp power is specified within ±5%. The nominal tolerances on the mains is between -8% and +6%. Mains voltages exceeding these values can damage the driver and will shorten lifetime.

Because the driver will regulate the lamp to a constant power, the input current will increase when the input voltage is lower. This ultimate will influence the power losses, so the worst-case temperature should therefore be measured at lowest mains voltage.

6.1.7 Over voltage

The driver has a limited protection against over voltage; over-voltage will negatively influence the lifetime and reliability. No warranty will be given if the mains-voltage exceeds below operation values (above 450V even fast surges can damage the driver direct)

		600W			1000W			
	Conditions	Min	typ	Max	min	typ	max	unit
Mains voltage V_{mains}	Operational performance	368	400	424	368	400	424	V
	Operational safety[1]	360		440	360		440	V

6.2 Specifications

Philips Lighting Electronics advises to communicate the following specification to your customers.

6.2.1 Technical

Input (mains side)

		600W			1000W			
Parameter	Conditions	Min	typ	Max	min	typ	max	unit
Mains voltage V_{mains}	Operational performance	368	400	424	368	400	424	V
	Operational safety[2]	360		440	360		440	V
Mains frequency f_{mains}	Operational performance	47.5		63	47.5		63	Hz
	Operational safety	45		66	45		66	Hz
Mains power P_{mains}	P_{la} = 615W		635	640				W
	P_{la} = 1000W					1032	1040	W
Mains current I_{mains}	At P_{la_nom}, V_{mains} = 400V		1.61	1.65		2.61	2.68	A
	At P_{la_max}, V_{mains} = 368V			1.9			3.0	A
Power factor	Within oper. performance mains and at P_{la_nom}	0.95	0,98		0.95	0,98		
Distortion	Within oper. performance mains and at P_{la_nom}	According to EN61000-3-2			According to EN61000-3-2			
THD			9	15		9	15	%
Inrush current I_{mains_pk}	V_{mains} = 424V, Z_{mains} = 0.4Ω + 0.8mH		120			175		A
Pulse duration			0.5			0.5		ms
Interference	Conducted	EN55015			EN55015			
	Radiated	EN55015, EN55022 level B			EN55015, EN55022 level B			

If 60s after ignition Vla < 50V the driver will switch off. If Vla > 50V at that time, run up will continue for another 240s after which the driver will decrease the lamp current to the maximum Ila_nom. Driver will **switch off** beyond this lamp voltage and report a lamp over voltage fault (LED indication)

Output (lamp side)

		600W			1000W			
Parameter	Conditions	Min	typ	Max	min	typ	Max	unit
Lamp power P_{la}	V_{mains} ±3% (P_{la_nom})	597	615	633	970	1000	1030	W
	V_{mains} −8%, +6% (P_{la_nom})	585		645	950		1050	W
Ignition voltage V_{ign}	C_{load} < 100pF[3]			2600			2440	V_{pk}

[2] Typically cable capacity 100pF/meter

Inrush current

The inrush current after switching on is depending on the moment the mains is connected, the peak currents as defined in above table are worst case with a typical inductance of the mains supply. For the 600W the peak current the value is 150Amp over a maximum time of 500uSec, for the 1000W the current is 175Amp. Please consult your installer and circuit-breaker how many drivers may be connected on one fuse.

6.2.2 Reliability

Lifetime: 50.000 hrs @ T_c (bracket) = 70 °C

Failure rate: < 2%/5.000 hrs @ T_c (bracket) = 70 °C

Protections: against lamp end of life
against overheating (when T_c exceeds 80°C),
against incorrect mains connection
against not connected lamp
against short circuited lamp

Immunity: Transient protection to comply with EN61547; surge test levels phase to phase or phase to neutral: 2kV. Any phase to ground: 4kV.

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6.2.3 Safety and Regulatory

Approbation:	approved for CE (VDE, KEMA)
Standards:	EN60928, EN60926 UL935-34 IEC 928-13
Vibration:	IEC 68-2-6-Fc (frequency 10 … 150Hz, acceleration 2G or amplitude 0.15mm. Frequency change 1 oct/min, 3 directions, 5 sweeps/direction)
Bumps:	IEC 68-2-29-Eb (acceleration 10G/16ms, 1000 bumps/direction) ULN-D 1672 (acceleration 30G, 2 per direction)
Drop test:	UND 1400
Temperature shock:	IEC 68-2-14-Na (5 cycles -25 … +80°C, 30 min., 2 chamber method)
Temperature cycle:	IEC 68-2-14-Nb (400 cycles -20 … +100°C)

6.2.4 Environmental conditions

Temperature:	No specification for ambient, as the driver will be built into an enclosure by the end user; $0°C < T_c < 70°C$ (normal operating limits), which should typically correlate with: $0°C < T_{amb} < 45°C$ (depending on luminaire) $-20°C < T_c < 80°C$ (operational safety limit); Lifetime will decrease with higher T_c (see also "Reliability")
Humidity:	To be built into a hermetically sealed enclosure (IP63), relative humidity < 70% (under all operating conditions)
Storage:	$-20°C < T_{amb} < 85°C$ relative humidity < 95% (non condensing)

6.2.5 Other specifications

Hum and Noise: < 45dBA at nominal operating conditions.

LED indicator: The driver features a LED indicator at the intended bottom side of the enclosure. When the driver detects a fault, a corresponding repetitive sequence of flashes will be emitted.

6.2.6 Safety Information: Electric, Magnetic and Electromagnetic Fields ("EMF")

1. Philips Royal Electronics manufactures and sells many products targeted at consumers, which, like any electronic apparatus, in general have the ability to emit and receive electro magnetic signals.
2. One of Philips' leading Business Principles is to take all necessary health and safety measures for our products, to comply with all applicable legal requirements and to stay well within the EMF standards applicable at the time of producing the products.
3. Philips is committed to develop, produce and market products that cause no adverse health effects.
4. Philips confirms that if its products are handled properly for their intended use, they are safe to use according to scientific evidence available today.
5. Philips plays an active role in the development of international EMF and safety standards, enabling Philips to anticipate further developments in standardization for early integration in its products.

6.3 Ordering

Philips code numbers

	Industrial packaging144pcs/pallet		Box packaging 1pcs/box
600W	Technical code	9137 006 03721	9137 006 03726
1000W	Technical code	9137 006 03821	9137 006 03826
600W DALI	Technical code	9137 006 18221	9137 006 18226
1000W DALI	Technical code	9137 006 18421	9137 006 18426

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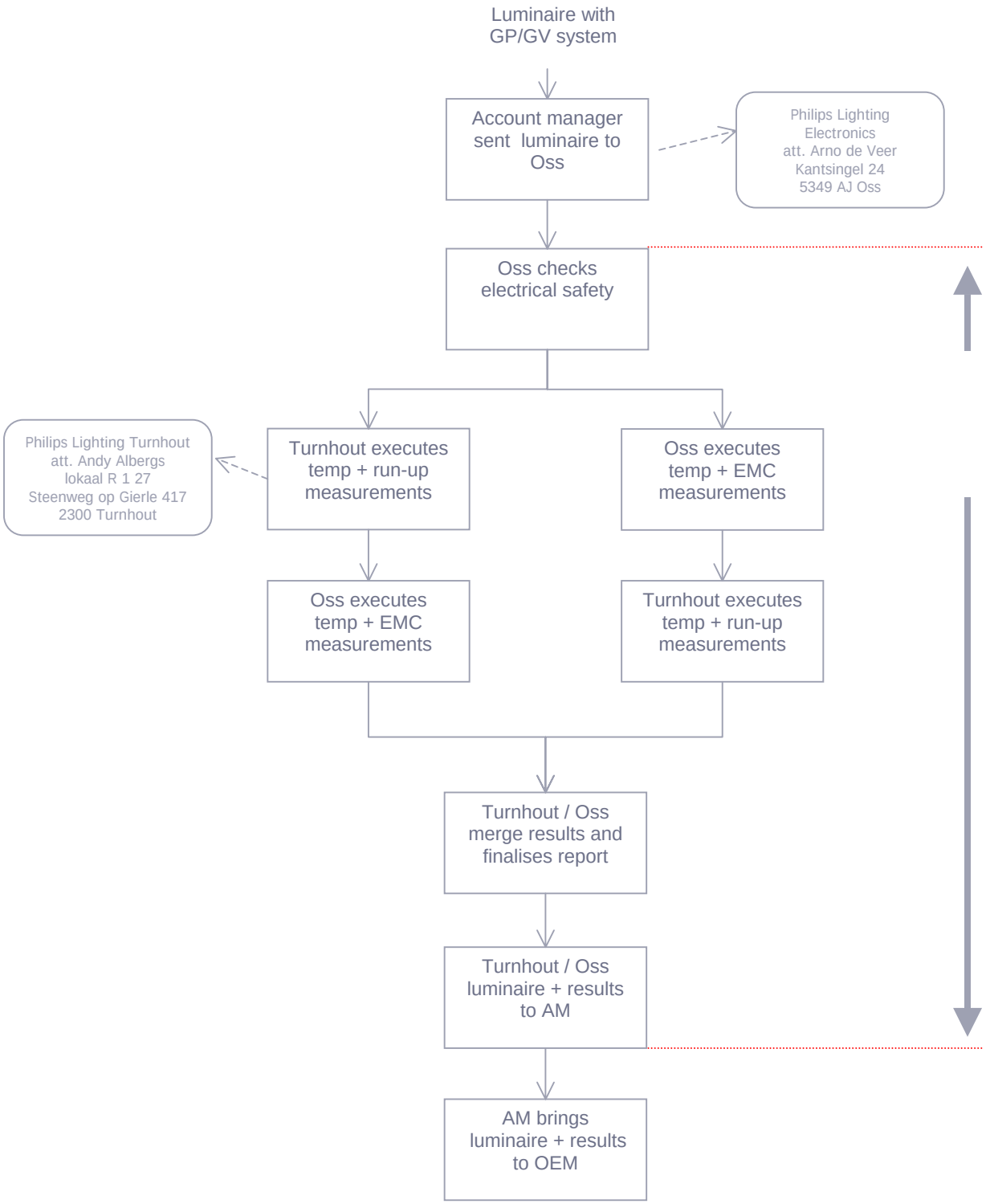
7 Advised communication

7.1 Promotion

Unique selling points of the GreenVision drivers are:

- Extremely efficient (~97%),
  - Less energy-consumption for highest umol/W ratio
  - Low self-heating and therefore reliable.
- Constant lamp power
  - Maximum utilization of TE/installation (+10..15% compared with em)
  - Equability of grow light, a voltage-drop of 3% will be fully compensated by the electronic driver.
- Constant power factor
  - Power-factor is typically 0.98, this will maximize the utilization of TE/installation because real power (Watts) will be closer to apparent power (VA). This will be constant over total lifetime.
  - No replacement of regenerated capacitors
- Small and lightweight
  - Compared to a conventional system the weight and size are reduced dramatically.
- Cross-phases input
  - Of course Philips has chosen for the latest technology and uses cross-phases (400V) mains supply. This has resulted in a lower mains current and lower power losses.

8 Process flow system evaluation



9 Frequently Asked Questions

Find below the most frequently asked questions and answers:

Can also other lamp types be used?

The special design of the new electronic GreenPower lamps makes the combination with the GreenVision drivers extremely reliable and Philips therefore guarantees the lifetime of both lamps and drivers. Other combinations are not tested and therefore no warranty can be given.

Can Philips help with integration of the driver in my luminaire?

Yes, if you need assistance to build the device in your luminaire, Philips will help were needed.

What happens if there is not a proper thermal connection with the luminaire?

If the thermal connection as described in chapter 5.3 is too high the temperature of the electronics will exceeds the lifetime temperatures and lifetime of the driver will be decreased. No warranty will be given by Philips if after analysis the temperature of the driver was too high.

What happens if the mains-voltage exceeds safety operation value?

The driver is designed to withstand normal tolerances of mains-voltage (+6%), if however the safety values are exceeded the driver will be damaged. No warranty will be given by Philips if after analysis the mains-voltage has exceeds the safety value.

Is a specific reflector needed?

The lighting system consists of a lamp, control gear and reflector. All these components should be aligned, for the reflector specific design rules should be taken into account. Please consult your Philips contact.

Why is the driver not dimmable?

Philips believes the most important benefit for the grower is efficiency, by using the latest technology and components Philips has managed to design the most efficient driver with a efficacy of 97%. Furthermore at the moment when HPS lamps are dimmed their efficacy will decrease rapidly.

How can I prevent EMC problems?

Basic EMC rules for design-in of an electronic HID driver.

- Never bundle mains and lamp wiring.
- The distance between mains and lamp wiring should be as wide as possible.
- Keep mains wiring in the luminaire as short as possible.
- Wiring inside the luminaire should be as straight as possible.

The run-up time of the lamp is too long?

Due to the lamp behaviour, new lamps could initially have a slow run-up. Final behaviour will be reached after several run-up sequences and 150 burning hours. Other reason for slow run-up is a low temperature of the electrodes, this could even be the reason why the 1000W lamp does not run-up at all and stays at a 70 to 80% power-level.

Next steps?

Philips is constantly working to improve the systems used for horticulture lighting because we believe this will improve our quality of living. In future therefore more efficient lighting may be expected but also we're working on other features to improve the total installations.

10 For more information

Please contact your local sales representative.

Check OEM application guide for general information about electronic drivers, or visit one www.lighting.philips.com or our special horticulture site.