uv-technik meyer gmbh

Solid State AC-Power supply for uv lamps up to 6,000 W

BLP 60-LC

Replacement unit for older ALP 60, ALP 60/E and ALP 60/480

BLP 60-LC

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1 General

This power supply is based on the proven BLP 75 supplied to the uv curing market for some years.
It is a specially adapted version to be used as a replacement unit for the older ALP 60 unit, which is now over 10 years old and reaching the end of its life time.
Based on the same principal circuitry, but with improved technology and coupled with more than 12 years of experience with electronic power supplies, this BLP is a “state of the art” power supply for uv lamps.

The BLP 60-LC is designed to be electrically interchangeable with the ALP 60 (all versions.)

As an option a plate with adopted fixing points is available as well to get the same fixing points as the old ALP 60 (“BLP 60-MTPL”)

The existing interface box of the ALP 60, which supplies the 2 fiber optic cables for the control of the ALP 60 (or custom made interfaces), can still be used. 2 new fiber optic cables of 1m length are supplied with the BLP 60-LC. New interface boxes can be supplied as options (APF1 and AIF1)

1.1 Short technical data overview of BLP 60-LC

BLP 60-LC	
Output power	approx. 1200 – **6,000 W (continuous),** step less adjustable
Mains voltage supply	3x 376 to 3x 509 V (3x 528V for 1h within 24h operation)
Mains current (at 6000W)	3x 12A (400V) to 3x 10A (480V) (PF ≥ 0.8)
Mains frequency	50 to 60 Hz
Mains connection	L1, L2, L3, PE
Typical lamp arc length	~ 15 to 70 cm (6” to 27”) Hg lamps ~ 15 to 60 cm (6” to 24”), doped lamps
Lamp operating voltage	100 to 450 V (nominal value)
Lamp operating current	approx. 2 to 18 A
Duty frequency	approx. 255 Hz
Power loss	6 to 8 %
Ambient temperature	0° to 40°C (32 to 104 F)
Dimensions (WxHxL)	approx. 125 x 270 x 400 mm
Weight	15 kg
Cooling of the unit	external, with 2 mounted fans (internal supplied)

1.2 Replacement of a ALP 60 (all versions) with a BLP 60-LC

1) To replace a ALP 60 with a new BLP 60-LC please first identify a method for mounting / fixing the new unit or use option “BLP 60-MTPL” to use same fixation as ALP 60 in place.
2) Mount the BLP 60-LC into its new position.
3) Re-connect mains power supply (L1-L2-L3-PE) to the BLP 60-LC by using the new connector (included with BLP).
   Some ALP 60 versions have “B1” and “B2” terminals: do not use these cables any longer (“tie off, “isolate and hide in a safe location e.g. cable tray)
4) Re-connect lamp cables by using the connector for the BLP (included).
   If the lamp cables are shielded, reconnect shields with PE near or to the BLP 60-LC housing.
5) Re-connect the 2 fiber optic cables to the 2 light connectors on the BLP 60-LC.
   Connect the OUT from the control box to the IN connector on the BLP,
   Connect the IN from the control box to the OUT connector on the BLP.

   If you are unsure, which is IN and OUT:
   switch on the control and look into the open ends of the 2 fiber cable connectors. On one of them you should see a continuous or flickering red light. Insert the fiber cable with the red light into the IN connector of the BLP, the other to the OUT connector.
6) Run and test for correct operation.

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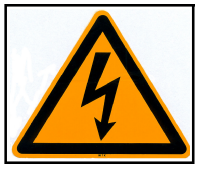
2 Safety Requirements:



To minimize the risk of electric shock while e.g. make service at the uv-lamp connected to the output of the power supply, it is important to switch off mains with a main switch or mains contactor in accordance with the national standards, before working at the parts connected to the power supply.

Reason: The uv-lamp is switched off by semiconductors, which have a high but not infinite resistance. So electric shock may occur, if mains is not disconnected.

This unit must be installed and connected by electrically competent personnel only !

3 Technical Data

3.1 General

Can operate mercury and metal halide lamps without any changes to the power supply.
Lamp power remote control
Lamp voltage monitor
Air cooling

Efficiency	typical 92%
Ambient temperature range:	**+0 to +40° C**,
Storage temperature range:	-10 to +70° C
Protection degree	IP 20
Built-in position BLP 60-LC	primarily upright with connectors down, or horizontal
Dimensions:	400 x 125 x 270 mm, incl. fan plus ≥ 35mm for undisturbed airflow
Weight:	~ 15 kg

3.2 Mains Input

Mains voltage and frequency:	
nominal:	3x 400 to 480V ±6% / 50 and 60Hz
short time:	3x 480V +10% for 1h within 24h operation 3x 400V –10%, needs real lamp voltage <480V
Mains connection:	3 phases plus Protective Earth (PE)
Power factor	about 0,8 at max. power
Fuse protection needed:	motor protection switch; setting current I_a could be calculated as follows: $I_a = 1{,}08 * P_{UV} / (U_{mains} * 0{,}8 * \sqrt{3})$ with P_{UV} = power of uv-lamp [W] U_{mains-} = actual mains voltage 3x 16A fuse link „gL“ could also be used
Typical inrush current when connected to mains:	typical 240A (0,01ms), 100A (0,3ms)
Remark:	This values are important for the right choice of a mains contactor, otherwise the contacts could be destroyed in the long run (contacts melt together).
Inrush current when starting the uv-lamp:	no inrush current
EMC	EN 55011, group I, class A (industrial areas)
Cooling fan	internally supplied

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3.3 Output for UV lamps

Lamp current about (the lowest lamp current depends on the lamp and its cooling conditions, possibly a lamp switches off at approx. 3 or 4 A)	~ 2 to 18A continuous
Frequency	about 255 Hz, rectangular
Suitable for nominal lamp voltage from	100 to 450 V to reach full max. power of BLP a higher than 100V operation voltage for the lamp will be recommended, due to the max. output lamp current of 18A, e.g. with 200V lamp voltage * 18A max. current a max power of 3600W is possible !
Continuous power output	up to 6000 W; good air cooling is recommended.

It is possible to pulse lamp power between min. and max. values within very short times, e.g. 1200 W and up to 6000W.

Pulse operation: (20-100%)	lamp current rise up time lamp current fall down time	≤ 20ms ≤ 20ms
Integrated ignition unit	Us = approx. 2x 2000V symmetric	

Power Supply is protected against short circuit on the output circuit

Power Supply is protected against ground fault on the output circuit

Power Supply is protected against open circuit (no lamp connected or cable disconnection)

Recommended maximum cable length (distance between power supply and uv-lamp):

for Hg lamps	max. 15 m
for doped lamps: (this values depends from cable capacitance and lamp igniting behavior)	max. 10 m

Cable should be shielded, due to the EMC-Standards. Shield must be grounded on 1 side only!!

3.4 Controlling and Indications

Mains ON delay time	After applying mains to the BLP the unit needs a delay time of ≤ 5 sec. to be clear to operate. **Advice:** while this ON delay time, the fault monitoring may cause short and irregular signals!

The following in- and outputs are only available with one of the interface boxes APF1 or AIF1.
In case of custom tailored controls, nothing changes to the ALP 60.

analogous input for lamp power control:	DC 0...10V, Ri ≥ 5 kΩ (input resistance) DC 0...1V = OFF DC 2...10V = ON and lamp power 20...100% within limits ~2...18A DC 8…10V = ignition, apply min. 5sec.

Advice: for lamp starting (burn in) a high DC input voltage is recommended, such as DC 8...10V.
After burn in reduce lamp power to the appropriate power of the lamp.

limits	max. DC 10V, short time up to DC 12V (max. 5 sec.)
analogous output for lamp voltage monitoring:	DC 0...8V = AC 0...500V lamp voltage (= ratio 1:62,5) DC 8,0...8,5V = BLP ready, input OFF DC 8,0...10V = BLP ignites and/or lamp is OFF DC 0...10V, 3mA
in case of a fault:	DC 0.2...1.5V = BLP faulty: = possible faults: ● overtemperature BLP and/or ● fan(s) faulty and/or ● ground fault in lamp circuit

If a fault is monitored, lamp will be switched off automatically and the DC 0...10V output voltage runs down to DC 0.2….1.5V (typically ~1.1.V), to allow PLC programs to detect a fault.

Reset: Overtemperature and Fan Faulty monitoring will be resetted automatically if fault disappears. In case of Ground Fault mains have to be disconnected to the BLP for at least 20 seconds.

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3.5 Cooling

An efficient cooling of the BLP 60-LC is important for the maximum possible output power and especially for life time. BLP 60-LC is equipped with two fans mounted in the middle on the rips of the cooling unit and on the side to cool the unit inside. Both fans are monitored by their turns per minute. If one fails, the BLP reacts with a “over temperature” monitoring.

Cooling depends from the amount of airflow through the rips of the cooling unit and the temperature of air as well as the ambient temperature. **Care have been taken to insure max. 40°C cooling air temperature in any case!**

It is recommended, that no heat producing parts radiate its IR to the BLP! In case apply shieldings by e.g. metal sheets.

Nevertheless, it is very important to run the units as cool as ever possible to have a long time and reliable operation. Imagine as a general rule for electronics: 10 K less results in double life time! 10 K more results in half life time!

For more information and installation, see paragraph 6.1

3.6 Repair of BLP 60-LC

Practice has shown, that the BLP 60-LC is a high reliable electronic power supply. Equipped with ground fault protection there should be nearly no extern fault, which could destroy the unit. But if it happens, it could be repaired by the manufacturer, because of its modular inner design.

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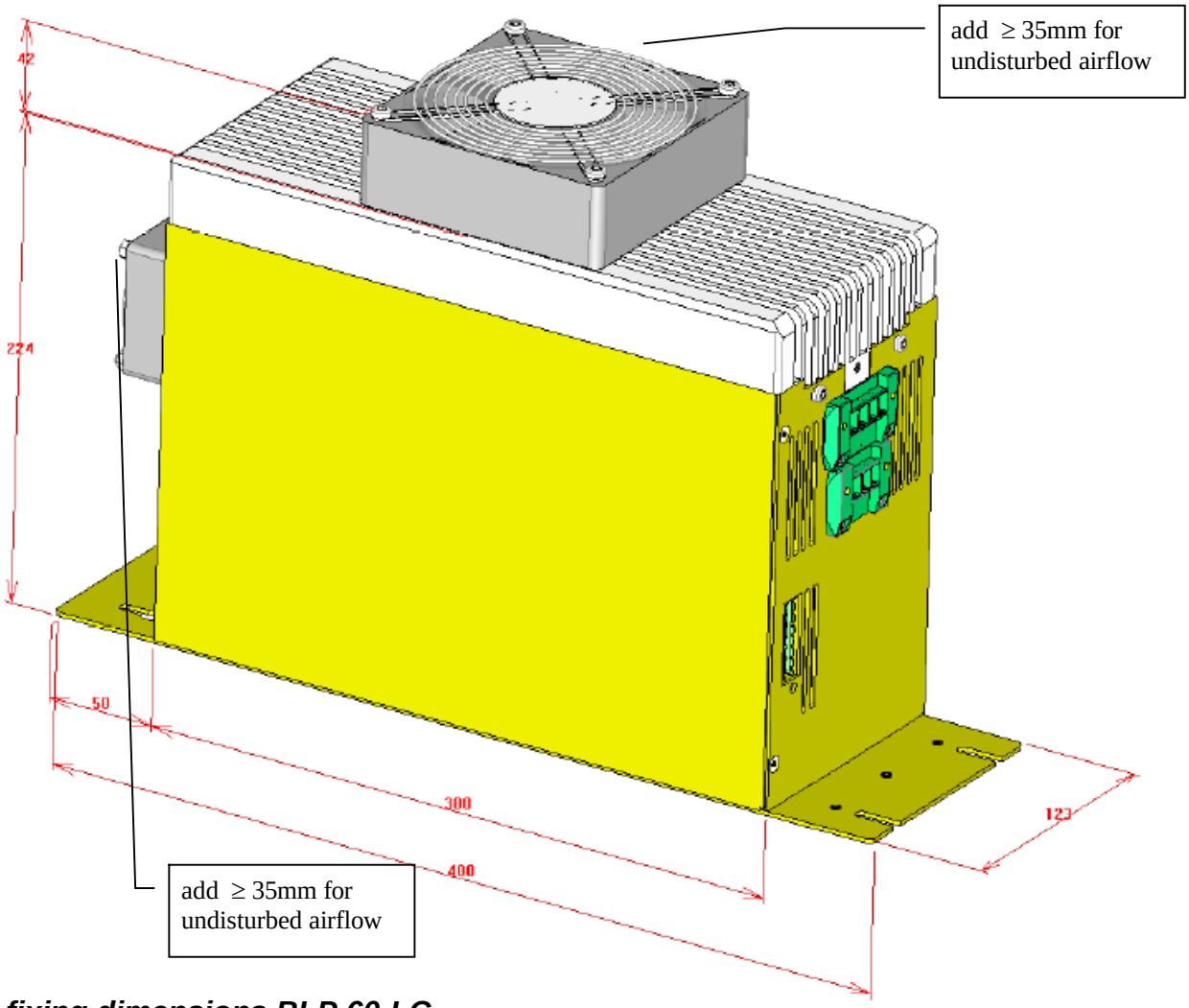
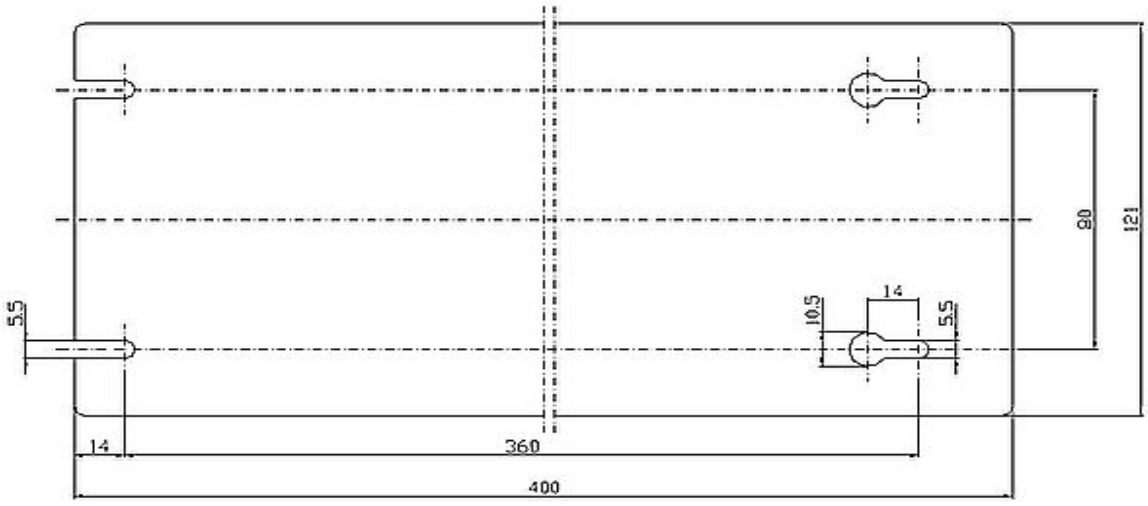
4 Dimensions BLP 60-LC



4.1 fixing dimensions BLP 60-LC



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5 Trouble shooting BLP 60-LC

fault	measuring/indication	reason	elimination
BLP 60-LC or lamp could not be started	DC-output voltage about ≥ 8.0 V	DC input voltage < 8,0V reignition after switch off will not run because of still too hot uv-lamp uv-lamp is destroyed or has a malfunction	apply DC input >8V for ignition wait for cooling down lamp check uv-lamp check terminations and wiring to the lamp
auto turn off while running	DC-output voltage 0.2...1.5 V	Supply fuse(s) are blown or general mains fault uv-lamp is destroyed a too long mains short cut or break down occurred lamp too cold and shut off when running in stand by a longer time	check mains fuses etc. check terminations and mains contactor (1 contact burned out ?) *automatic RESET when all 3 phases are reconnected !* Check cooling of lamp
same	DC-output voltage 0.2...1.5 V	ground fault in lamp circuit	check terminations and wiring to the lamp RESET by switching OFF-ON mains for at least 20 sec. OFF
same	DC-output voltage 0.2...1.5 V	thermal switch off, BLP too hot because of overload, or bad cooling or too high ambient and/or cooling air temperature or blocked or defective fans	air stream impeded ? air filters in cabinet polluted ? fans blocked or defective ? Measuring: at the right or left side at middle height of cooling unit near housing of BLP 60-LC : ≤ 50°C recommended, 60°C max *automatic RESET after cooling down BLP 60-LC !*
same	DC-output voltage ≤ 0,2V	Mains fault short circuit in lamp circuit BLP 60-LC defective.	check mains voltages check terminations and wiring to the lamp replace BLP 60-LC
asymmetrical mains phase currents	current L1, L2, L3 is different	A difference of about 1A is normal. Asymmetrical mains voltage missing of 1 phase of mains	Nothing to do. check mains load generally check mains fuses

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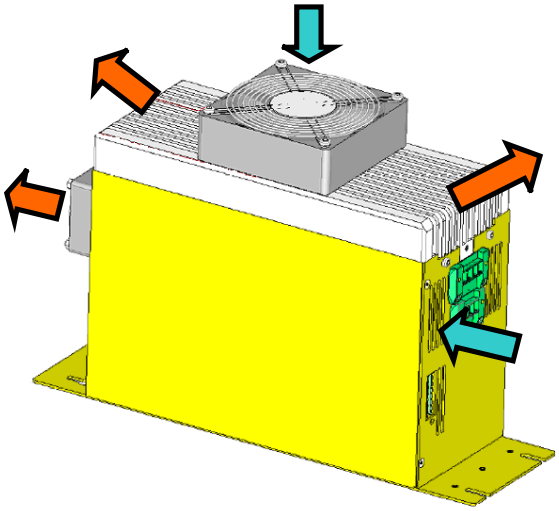
6 Installation

6.1 Mounting and Cooling

An efficient cooling of the BLP 60-LC is important for the output power (otherwise possible shut OFF) and especially for life time. BLP 60-LC is equipped with two fans mounted in the middle on the rips of the cooling unit and on the side to cool the unit inside. All fans of BLP 60-LC are supplied internal and supervised of their function. If defective or blocked, BLP 60-LC monitors “overtemperature”.

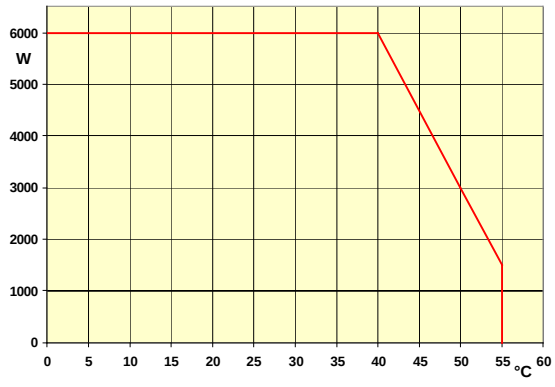
Cooling depends mainly from the amount of airflow through the rips of the cooling unit and the temperature of air as well as the ambient temperature. To reach the full output power of 6000W, an airflow of about 300m³/h have to blown directly to the rips of the cooling unit. To ensure good air flow, a minimum distance of 50mm from air in- and outlet is recommended.

IMPORTANT: The cooling air temperature and the ambient temperature must not exceed 40°C !



If the unit is installed inside a cabinet or a other housing, care have to be taken to avoid high temperatures inside this housing by flowing it by air. The amount of air depends from ambient temperature and power loss of the BLP 60-LC . Power loss is about 8% of the real maximum lamp power. Distance to any air flow blocking parts and BLP 60-LC / fan should be minimum 50mm.
A general rule for power electronics says: as cooler the ambient air is, the longer and better are reliability and life time of the unit. Half temperature will double life time.

Derating curve BLP 60-LC



The derating curve shows the maximum allowed lamp power over cooling air /ambient temperature

6.1.1 Cabinet cooling

As an example: with 6kW lamp power, 40° C inside cabinet temperature, 35°C max. outside cabinet temperature an air flow of 320 m³/h throughout the cabinet is recommended. The BLP 60-LC should be positioned near the cold air entry.

Rough calculation for needed air flow throughout a housing/cabinet:

$$V = 3{,}3 * \frac{P_{LOSS}}{40°C - T_{AMBIENT,\,max}}$$

with

V	=	air volume in [m³/h]
P_{LOSS}	=	loss power of BLP in [W] (P_{LOSS} 8% of max. lamp power)
$T_{AMBIENT,\,max}$	=	max. possible air temperature outside the cabinet/housing, e.g. in summer.

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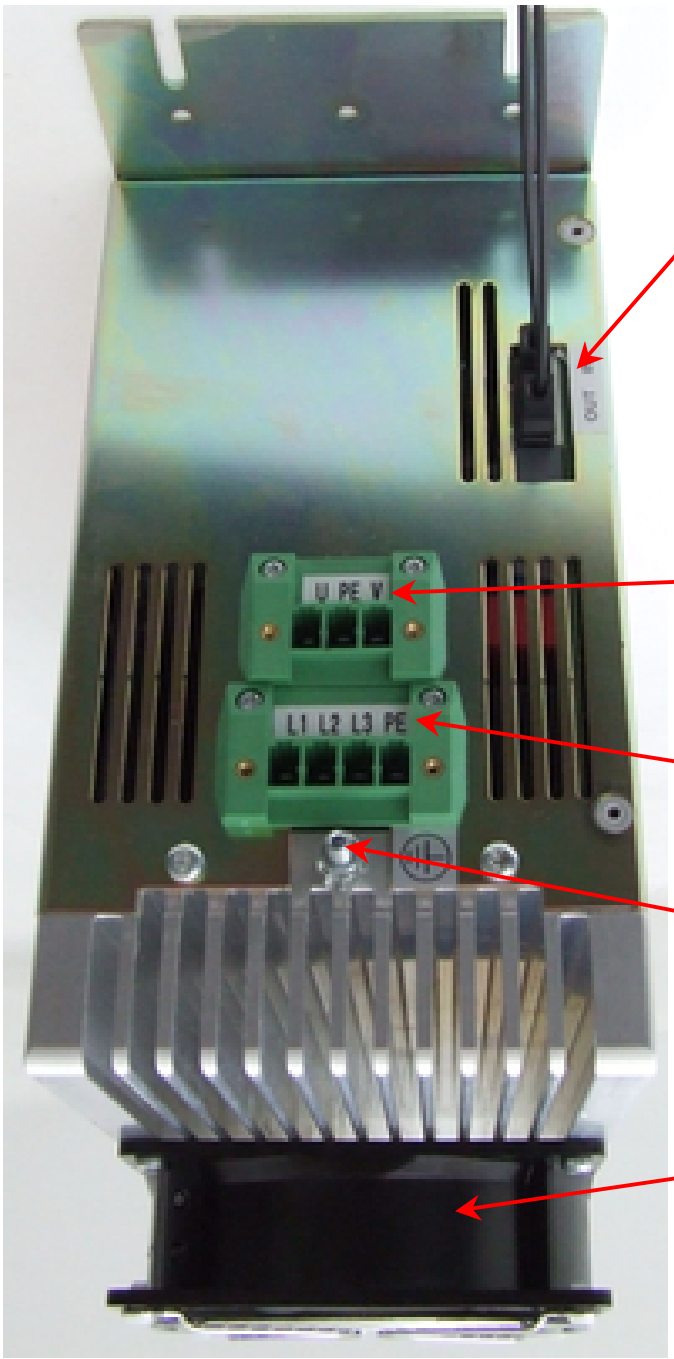
6.2 Electrical connections BLP 60-LC



control connections:

IN
OUT

lamp connections:

U uv-lamp
V uv-lamp
PE ground / cable shielding

mains connections

L1 L2 L3 PE

Additional PE-connection
see paragraph 7.1

cooling fan (internal supplied)

Connectors for cable side (included):

- lamp connector (3 pole):	PC4HV/3-STF-7,62	Phoenix 1882382
- mains connector (4 pole)	PC4HV/4-STF-7,62	Phoenix 1882395

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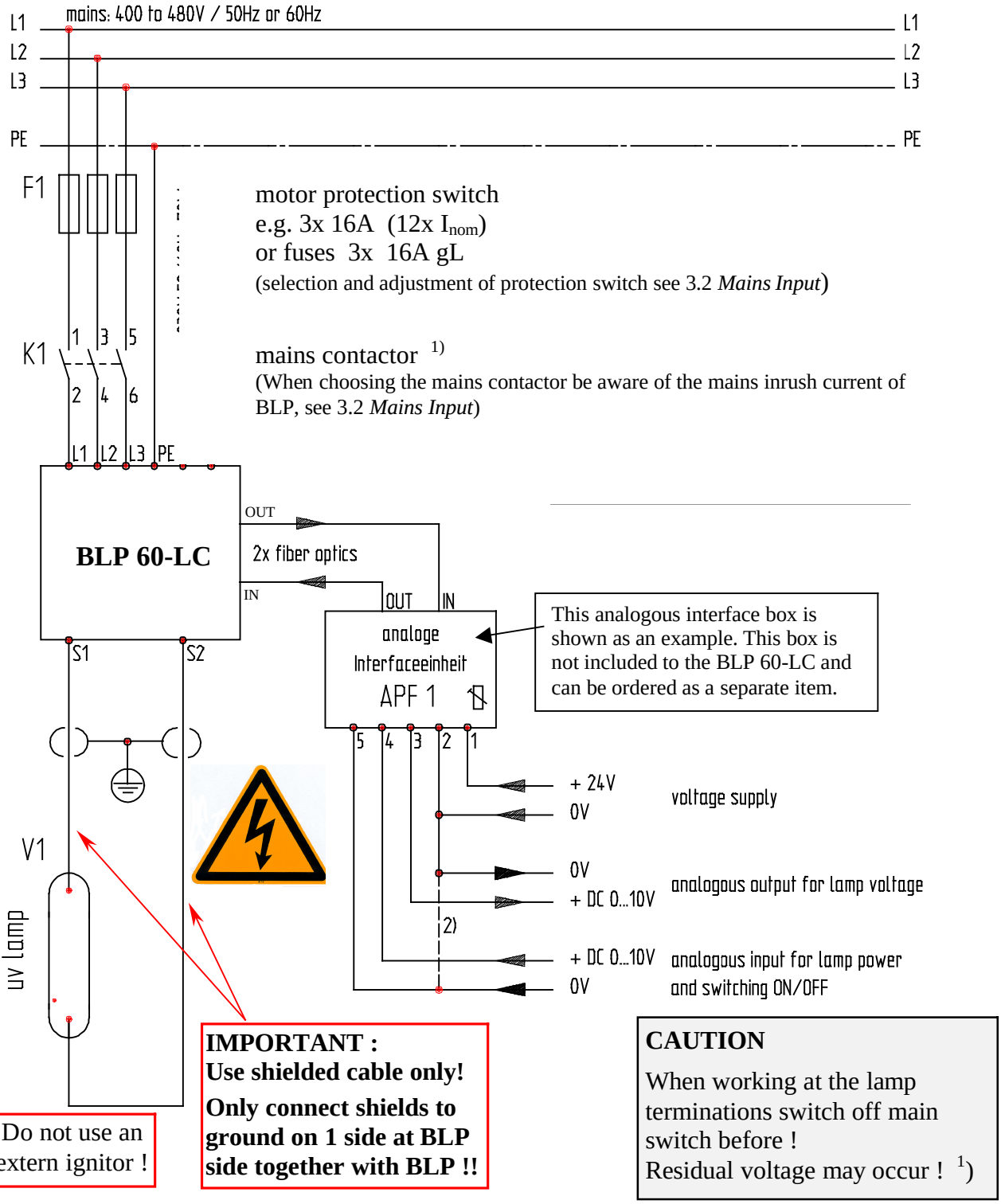
6.3 Electrical wiring diagram BLP 60-LC



1) Main contactor recommended to have reliable switch OFF and no residual voltages at the output t the lamp.
Otherwise electric shock may occur while working at the uv-lamp etc. e.g. for service !

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7 Protective Grounding

7.1 Instructions for Instrument Safety concerning Protective Earth Conductor Connection

7.1.1 General:

For noise elimination, there are installed three-phase current line filters in the electronic power supplies. For these line filters, which are necessary in these power categories, it is impossible to manage with discharge currents, which are smaller than 3.5 mA. Therefore, in accordance to the current Standards, appropriate precautionary measures have to be carried out.
We start the following contemplations from the assumption that our instruments operate in plants, which are solid connected with mains.
In accordance to EN 50176 (VDE0160) April 1998 Section 5.3.2.1 "Discharge Current via the Protective Earth Conductor" one of the following measures has to be taken:

a) Cross section of the protective earth conductor has to be at least 10 mm^2 Cu.
   NOTE: This minimum cross section was established out of consideration for its mechanical strength.
b) Monitoring of protective earth conductor by a facility, which leads to independent switching-off of the electronic equipment in case of failure.
c) Wiring of a second conductor, electrical parallel to the protective earth conductor, via separate terminals. This conductor by itself has to comply with the demands for the protective conductor.

7.1.2 Fault-Current Circuit Breaker

Above mentioned “b)” is complied with this. Additionally the following should be taken into consideration: Our electronic equipment can carry a DC leakage in case of failure. Therefore a special fault-current circuit breaker has to be used, which releases at DC fault.
Also attention has to be paid to a peculiarity of the three-phase line filter:
In normal case, when all three phases are applied to, the discharge current is typically under 30 mA.
In case of missing phase or phases or in the moment of switching on or off, there can occur asymmetries, in consequence of which the current values can be up to 180 mA.
If several power supplies are installed in the machine, it is impossible to use a fault-current circuit breaker. The Standard speaks here about incompatibility of protective measures.

Therefore one of the following measures has to be applied:

7.1.3 Connection of Protective Earth Conductor with at least 10 mm^2 Cu

Our units BLP 60-LC have a separate M5-screw at their case for connection of protective earth conductor. Via this screw the demanded 10 mm^2 Cu-wire has to be contacted safely with the unit and has to be routed to the electric distribution.
With the above mentioned notes we want to give support to the user. In the end the user himself is responsible for the compliance with the relevant Standards and their realization.

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8 Installation according to EMC rules

8.1 Protection against voltage strikes on mains (lightning strike protection)

Practice has shown, that electrical providing installations worldwide often are not or not sufficient protected against disturbances on mains resulting of e.g. lightning strikes. This sometimes leads to flash-overs and following destruction inside the power supplies, because those strikes are more energy intensive, than Standard strikes, the units are designed to.

Problem is less with strikes between phases, but more with strikes between phases and earth (PE). These strikes overload mostly the EMC filter and the main current components in the BLP.
While further development and upgrading of the BLP, the EMC-filter are changed to reach lower currents to earth in regard to use GFI (ground fault interrupter) with lower setting currents.
Therefore impedance between PE and phases is higher. This is an advantage for using GFI, but at same time a disadvantage against strikes.
Purpose of the so called Y-capacitors inside the EMC filter, which influence the effect of protection incidentally, is not to protect against lightning strikes, but to fulfill RFI rules.

We therefore recommend, if the protection grade at customers installation is unknown or bad, to add to the BLP installation (e.g. inside the electrical cabinet) components for strike suppression.

Useful professional components may be found e.g. at PHOENIX CONTACT (www.phoenixcontact.com). Their brochure "TRABTECH" includes a lot of technical hints, as well as data for the needed components.

8.2 Shielding of lamp cables

Due to the rectangular current, the lamps are driven (approx. 255Hz), harmonics occur. According to EMC rules, those cables have to be shielded between BLP 60-LC and lamp housing.

IMPORTANT: connection of shield to ground:

1. Shield have to be grounded to the central grounding point (PE) of the cabinet by a 4, better 6 mm² lead, as well as the BLP have to be grounded to that point. Use 6, better 10 mm² lead in this case.

2. **<u>Shielding must be grounded only on 1 side of cable !!</u>**
   Otherwise the Ground Fault Protection of BLP 60-LC detects a fault.
   The shield MUST NOT connected on the lamp side additionally and it MUST NOT used as PE for grounding the lamp housing.

   Using connectors between BLP and lamp housing, the shield of the first part of the cable (= between BLP und connector) have to be grounded as usual to the BLP or to the central PE point in the cabinet.
   Do NOT connect shield on the other cable side to the connectors PE terminal.

   The second cable section (from connector to the lamp) also have to be grounded only on 1 side, primarily at the connectors side. Connectors PE should not only be grounded to the eventually surrounding metal sheets it is mounted on, but additionally connected by a 4, better 6 mm² lead to the central PE point in the cabinet!
   For grounding the lamp housing (PE) a separate 2,5 mm² lead from connectors PE to the lamp head
   is ok.

   If using terminals (e.g. ceramic terminals) at the edge of the cabinet for connection of lamp heads, it is proven to ground shield of both cables (one to BLP, one to lamp) together near the terminal with special shield connection clamps (e.g. clamping on a common copper rail). Do NOT ground the shield on the other side of both cables.
   It is important, that this copper rail AND the BLP is additional grounded by a 6, better 10 mm² lead to the central PE point of the cabinet.

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3. Grounding of shield should be done by special shield connection clamps, to realize a good connection all over the surrounding surface of the shield.
4. If an Ampere meter is used, it is proven to NOT cut the shield of the wire to and from the meter. Ground the shield as described above.

8.3 Laying cables

As usual with laying cables according to EMC rules, the lamp cables should not be laid in parallel to cables for analogous or other low level signals, to avoid disturbances to these signals.
If it should not be possible to avoid parallel laying, all concerned cables have to be shielded carefully. Additionally an intensive test of all functions of these low level and analogous signals have to be taken out in several conditions, the lamp could run, e.g. while ignition (disturbance by the igniting pulses), while full power running, etc.

For connect Protective Earth (PE) see more in paragraph 7.1

8.4 Measuring devices

To measure with separate devices, e.g. for service with a clamp ampere meter or a multi meter, lamp voltage or currents use **TrueRMS** devices with a **frequency range of up to 10kHz** as minimum. Other devices may show serious deviations from the true values or show hardly differing values.

CAUTION: if measuring lamp voltage, do NOT connect the volt meter while a lamp is not operated (open circuit). If there is no lamp current, the ignitor impulses are applied to the output and may destroy your measuring device!

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