



UV

More than just light

Solutions in ultraviolet and infrared

Lamps and systems

Radium

In today's society, tailor-made UV radiation is state of the art technology. It sterilises water and surfaces, hardens paints, adhesives and plastics, exposes printing plates and helps recognise forgeries, decayed foods and hairline cracks in workpieces. Last, but not least, UV radiation can be used very effectively for advertising purposes and for special effect illumination in theatres, discos and bars.

The Range

- > **Puritec:**
the low pressure UV lamp for sterilisation.
- > **Sanolux:**
the UV lamp with a spectrum close to sunlight
- > **Supratec:**
the powerful UV light source for industrial applications
- > **Ralutec... 71 und ... 78:**
compact low pressure lamps with blue light and UVA radiation
- > **SupraBlack:**
UV high pressure lamp with black glass bulb
- > **UvaBlack:**
UV low pressure lamp with black glass

Radium Puritec Lamps

Radium Puritec lamps are Mercury low pressure lamps which mainly emit shortwave UV radiation. They are the advanced and environment-friendly alternative to chemical methods.

Radium offers a variety of lamps for effective, chemical-free and environment-friendly sterilisation in many important areas. Lamp size and performance vary according to the task at hand.

They are characterised by

- > high UVC radiation output
- > long life

The main lines of the spectrum lie at 254nm and 185nm. UV radiation with wavelength below 240nm transforms oxygen into ozone. The quartz material of the ozone producing lamps also lets pass this highly energetic radiation. If ozone production should not be desired special kinds of glass or quartz are employed. These are still transparent for the sterilising radiation (killing micro-organisms) but absorb the ozone generating radiation.

Lamp Types: Puritec lamps are manufactured undoped up to 55W and doped with amalgam up to 200W. They are available as U-shape compact lamps with bayonet base and as linear lamps with wire, 2-pin or 4-pin base. They are also available as whole systems ready to connect and drive. Undoped lamps reach their optimal bulb wall temperature of 40°C at an ambient temperature of 25°C. Amalgam lamps reach 100°C typically and, therefore, are less sensitive to varying ambient temperatures.



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Fields of Application

Sterilisation of Room Air in:

- > Hospitals
- > Surgeries
- > Clean air rooms
- > Offices with and without air-conditioning
- > Storage spaces
- > Highly frequented service areas
- > Animal stables

Sterilisation and Cleaning of Water in:

- > Private households
- > Municipal waterworks
- > Mobile stations (camping and outdoor)
- > Swimming pools and aquaria
- > Water purification plants
- > Food processing
- > Sewage works

Surface Sterilisation:

Packing of pharmaceuticals and foods, in sterile areas and for sterilising equipment.

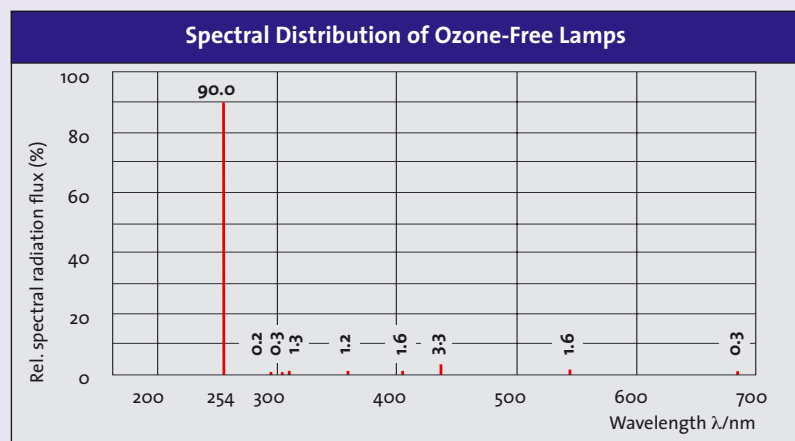
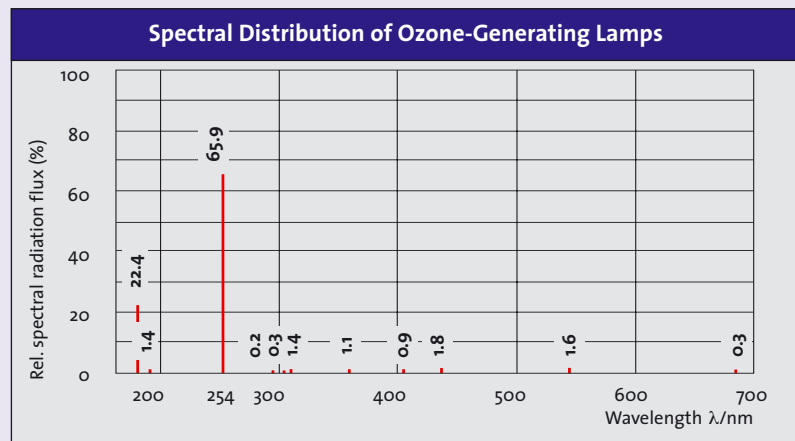
Odour Removal:

Using the ozone-forming version for air-conditioning, storage rooms and extract air.

EPROM erasing:

Using UV-C radiation to erase data from programmable memory chips.

Spectral Radiation Distribution

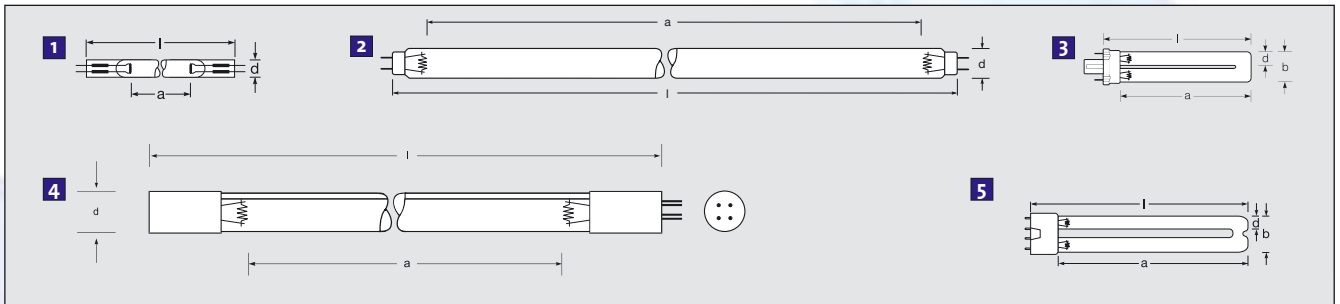


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Specification



Product Number

Order Code

Wattage, W

Dimension l, mm

Dimension a, mm

Dimension b, mm

Dimension d, mm

Figure

Base

Box Quantity, pcs.

Mains Voltage, V

Nominal Current, A

UVC-Radiation Power
254 nm, W

Operating Position

Starter

Economic Lifetime, h

Puritec UV Low Pressure Lamps, Ozone-Free

343 12271	NTE 5-220 ¹⁾	5	116	81	-	11.3	1	none	20	230	0.19	1.5	any	RS11	1000
343 14028	NTE 6-270 G5	6	210.5	154	-	15.5	2	G5	50	230	0.15	1.7	any	RS11	6000
343 14029	NTE 8-270 G5	7.9	287	230	-	15.5	2	G5	50	230	0.17	2.5	any	RS11	6000
343 12195	NTE 15-270 G13	15	436	354	-	25.5	2	G13	20	230	0.34	4.6	any	RS11	8000
343 14030	NTE 25-270 G13	25	436	351	-	25.5	2	G13	10	230	0.60	6.9	any	RS11	8000
343 12196	NTE 30-270 G13	30	893	808	-	25.5	2	G13	10	230	0.37	11.2	any	RS11	8000
343 12197	NTE 55-270 G13	55	893	808	-	25.5	2	G13	10	230	0.77	16.5	any	RS11	8000
343 12865	NSE 7-270 G23	7	115	95	28	13.0	3	G23	10	230	0.18	1.9	any	integr.	8000
343 12864	NSE 9-270 G23	9	145	125	28	13.0	3	G23	10	230	0.18	2.5	any	integr.	8000
343 12863	NSE 11-270 G23	11	215	195	28	13.0	3	G23	10	230	0.16	3.6	any	integr.	8000
343 14031	NSE 18-270 2G11	18	225	195	40	20.0	5	2G11	25	230	0.38	5.5	any	RS11	8000
343 14032	NSE 24-270 2G11	24	320	290	40	20.0	5	2G11	25	230	0.35	8.5	any	RS11	8000
343 14033	NSE 36-270 2G11	36	415	386	40	20.0	5	2G11	25	230	0.44	12.0	any	RS11	8000
343 14034	NSE 16T5-270 4pin	14	287	206	-	15.5	4	4pin	50	230	0.40	3.0	any	RS11	7500
343 14035	NSE 36T5-270 4pin	39	842	762	-	15.5	4	4pin	10	230	0.43	12.0	any	RS11	9000
343 14036	NSE 64T5-270 4pin	65	1554	1474	-	15.5	4	4pin	2	230	0.43	25.0	any	RS11	9000

Puritec UV Low Pressure Lamps, Ozone-Generating

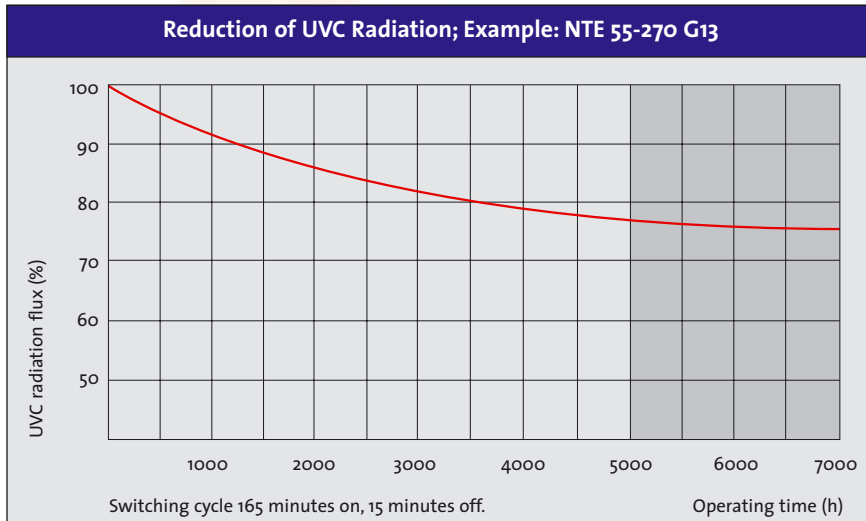
343 12270	NTE 5-210 ¹⁾	5	116	81	-	11.3	1	none	20	230	0.19	1.5	any	RS11	1000
343 12272	NTE 12-210 ¹⁾	12	360	325	-	11.3	1	none	25	230	0.17	4.5	any	RS11	1000
343 13350	NTE 55-210 G13-FR	55	895	835	-	26.0	2	G13	6	230	0.77	18.0	any	RS11	8000

Puritec UV Amalgam Lamps, Ozone-Free

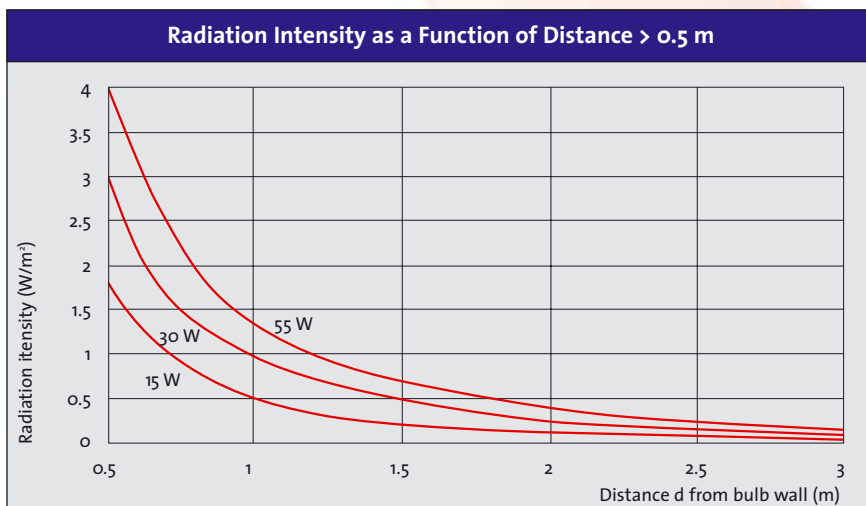
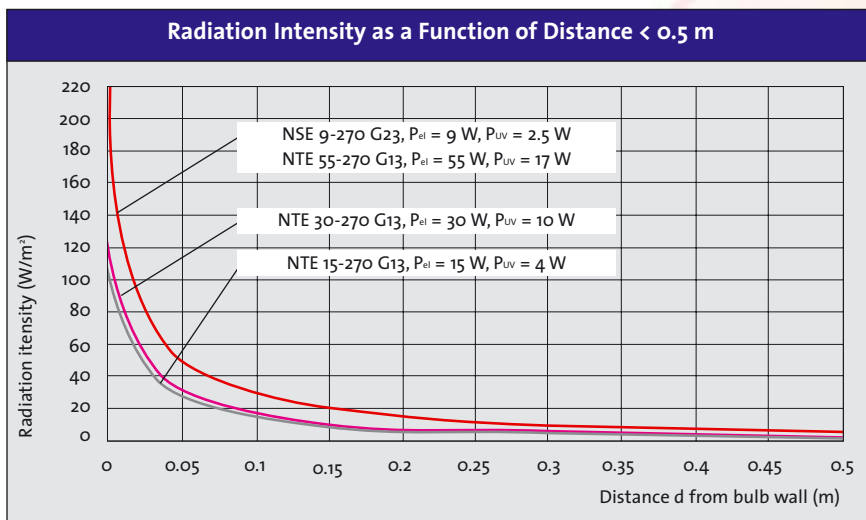
343 12727	ASE 120-221 4pin	120	895	825	-	19.0	4	4pin	5	230	2.15	40.0	any	-	12000
343 12728	ASE 190-221 4pin	190	1280	1210	-	19.0	4	4pin	5	230	2.25	60.0	any	-	12000

Operation with appropriate ballast for fluorescent lamps, apart from¹⁾ with 13 W ballast.
Further types, as well as lamp data sheets, are available on request.

Radiation Characteristics over Lifetime

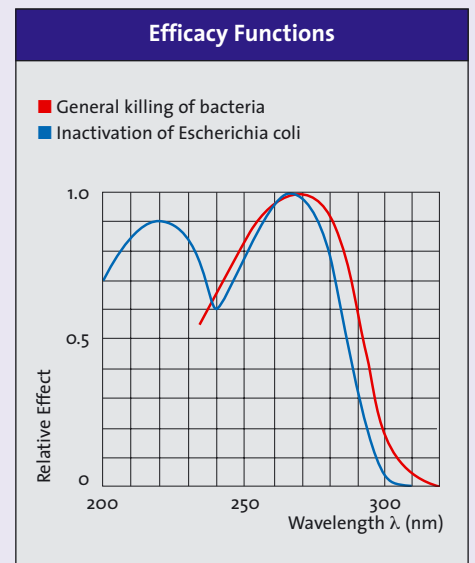


UVC- Radiation Intensity in Linear Puritec Lamps



Biological Effect

Killing of Bacteria: The effective bacterial action of the Puritec lamps is a result of the very good agreement between its maximum radiation at a wavelength of 254 nm and the spectral effectiveness function $s(\lambda)_{ba,rel}$ for killing bacteria. (DIN 5031-10 : 2000-03)



Warning: Radiation from Puritec lamps is a health hazard. After only short exposure it leads to conjunctivitis and erythema. Skin and eyes have to be protected from direct radiation. In rooms which do not offer direct radiation protection, protective clothing is therefore required.

In poorly ventilated rooms, ozone-generating lamps can cause dangerously high levels of ozone. If food storage rooms are irradiated, the relevant regulations about the use of sterilising radiation have to be followed.



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Radiation Doses for Inactivating Various Microorganisms

The following values relate to an inactivation rate of 90% at a wavelength of 254 nm, where UV radiation is particularly effective against bacteria. The radiation dose H is

defined as UV power x time/irradiated area (Ws/m^2). Values in bold are mean values for the respective families of microbes. Values in brackets show the range of values found

in the literature. Additionally, individual examples of the microbe families are listed.

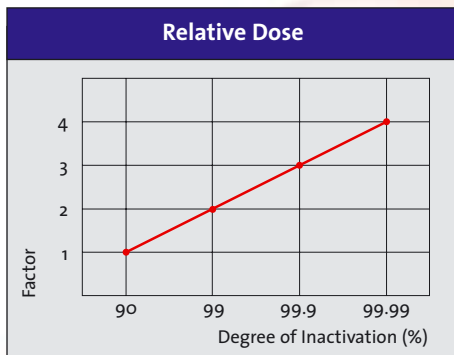
Bacteria			
Bacillus (vegetative)	32 (13-58)		
Bac. anthracis	45		
Bac. Megatherium	13		
Bac. paratyphosus	32		
Bac. subtilis	58		
Bacillus (spore)	118 (11-365)		
Bac. Megatherium	27		
Bac. subtilis	120		
Bac. anthracis	45		
Bac. subtilis (ATCC6633)	365		
Bacillus subtilis	11		
Bac. subt. spore ATCC6633	152		
Campylobacter jejuni	29		
Clostridium tetani	130		
Coryneb. diphtheria	34		
Citrob. freundii (ATCC8090)	42		
Enterob. cloaca (ATCC13047)	64		
Escherichia coli:	45 (7-58)		
Escherichia coli	30		
Escherichia coli (in air)	7		
Escherichia coli (in water)	54		
Escherichia coli ATCC 11229	25		
Escherichia coli ATCC 25922	30		
Escherichia coli K 12 AB 1157	58		
Escherichia coli B/ r ATCC 12407	53		
Klebsi. pneumon. ATCC4352	42		
Legionella	15 (4-26)		
Legionella dumoffi	24		
Legionella gormanii	26		
Legionella micdadei	15		
Legionella longbeachae 1	12		
Legionella longbeachae 2	10		
Legionella oakridgensis	22		
Legionella micdadei	18		
Legionella jordanis	11		
Legionella wadsworthii	4		
Legionella pneumophila	25		
Legionella bozemanii	20		
Leptospira	20 (8-28)		
Leptospira biflexa	23		
Leptospira illini	8		
Leptospira interrogans	28		
Micrococcus	80 (61-100)		
Micrococcus candidus	61		
Microc. sphaeroides	100		
Neisseria catarrhalis	44		
Pseudomonas aerug.	35 (15-55)		
Pseudomonas aeruginosa	55		
Salmonella	43 (21-80)		
Salm. typhimurium	80		
Salm. enteritidis	40		
Salmonella typhi	21		
Serratia marcescens	32 (7-85)		
Shigella paradysenteriae	17		
Staph	44 (18-110)		
Staph. albus	18		
Staph. aureus	26		
Staph. epidermis	110		
Strep.	36 (18-65)		
Strep. haemolyticus	22		
Strep. lactis	62		
Strep. viridans	20		
Strep. faecalis (ATCC29212)	65		
Strep. faecalis	55		
Strep. pyogenes	22		
Strep. salivarius	20		
Strep. albus	18		
Vibrio	24 (8-39)		
Yersinia enterocolitica	15		
DNA-Viruses			
Parvovirus	35 (30-40)		
Bov. parvovirus	40		
Kilham rat virus	30		
HCC (Dog hepat. Adenov)	265		
Herpes virus	57 (15-165)		
Pseudorabies virus	70		
Herpes simplex MP str.	67		
Herpes simplex MP str.	15		
Herpes simplex, type 1	165		
Vaccinia	18		
RNA-Viruses			
Picornavirus	72 (36-186)		
Poliovirus	110		
Poliov type 1 Mahoney	67		
Poliov	133		
Poliov type 1	36		
Poliov Mahoney	45		
ECBO	80		
Coxsackiev	186		
Reovirus	102 (48-163)		
Reovirus type 1	48		
Reov type 1 (Lang str)	163		
Rotav	159		
Rotav SA11	65		
Paramyxovirus	35 (15-55)		
Sindbis virus	55		
Newcastle Disease	15		
Orthomyxovirus	35		
Influenza	35		
HIV (Lentiv)	1438 (600-2400)		
HIV (HTLVIII)	600		
HIV (Sup T1)	1450		
HIV (H9)	2400		
HIV (PHA-stim. PBL)	1300		
Phages			
Bacteriophage	152 (65-310)		
Bac. subt. phage SPO2c12	150		
Bac. subt. phage SPP1	195		
Bac. subt. phage Ø 29	70		
Bacteriophage F specific	292		
Coliphage f2	310		
Staph. phage A994	65		
Yeasts	59 (23-100)		
Oospora lactis	50		
Saccharomyces cerevisiae (baking yeast, brewing yeast)	33-100		
Saccharomyces ellipsoideus	60		
Saccharomyces sp.	80		
Torula sphaerica (in milk and cream)	23		
Fungi	713 (130-3000)		
Aspergillus glaucus	440		
Aspergillus flavus	600		
Aspergillus niger	1320		
Aspergillus niger (pasta)	1500		
Aspergillus amstelodami (meat)	700		
Candida paraposilosis	220		
Cladospor. herbarum (cold stores)	500		
Mucor racemosus	170		
Mucor mucedo (meat, bread, fat)	600		
Oospora lactis	50		
Penicillium chrysogenum (fruit)	500		
Penicillium roquefortii	130		
Penicillium expansum	130		
Penicillium digitatum	440		
Rhizopus nigricans	1100		
Rhizopus nigricans (cheese)	1100		
Scopulariopsis brevicaulis (cheese)	800		
Protozoa	600-1000		
Algae	3000-6000		
Green algae, blue algae, diatoms			

Radiation Doses for Inactivating Various Microorganisms

The above table shows that the dose increases with increasing complexity of the organisms. A higher degree of inactivation requires a higher dose. The total dose required is the product of the value for 90% inactivation given in the table multiplied by the relative dose factor.

Example: 99.9% inactivation of *escherichia coli*

90% value from table:	30 Ws/m ²
Factor:	3
Total dose:	90 Ws/m ²



Room Air Sterilisation

Puritec lamps efficiently destroy harmful microorganisms in room air, such as bacteria, viruses, spores, yeasts, algae, protozoa and fungi. Depending on the requirements for personnel protection, sterilisation occurs either directly or indirectly.

Indirect Sterilisation: The sterilising effect is achieved by bringing microorganisms in the room air within reach of the radiation through convection, thereby inactivating them. Indirect sterilisation requires an aluminium reflector under the sterilisation lamp to ensure that the area beneath the lamp is screened from the emitted radiation which is, in turn, reflected towards the ceiling. This requires UV-absorbent ceiling and wall paint. Indirect sterilisation eliminates danger and potential hazards to people. Ventilating the room air may in hands sterilisation. Indirect sterilisation is also used in air exchange, air conditioning and humidification equipment.

In air ducts, the lamps are usually positioned after the dust filter in the flow direction. The installation of radiation chambers is advisable for air conditioning and humidification plants.

Direct Sterilisation: Direct sterilisation is possible in rooms which are not occupied by persons without adequate protective clothing or animals. Additional reflectors are not necessary. It is recommended that the walls are highly reflective.

UV Reflectivities of Some Materials

Material	Reflectivity %
AL: untreated surface	40-60
AL: polished surface	60-89
AL: vapour coated on glass	75-85
Anodised aluminium	65-75
Stainless steel	25-30
Tinplate	25-30
Chrome plate	35-40
White oil paint	3-10
White watercolour	10-35
Aluminium paint	40-75
Zinc oxide paint	4-5
Black enamel	5
White enamel	5-10
White gypsum, lime	40-60
Magnesium oxide	75-88
Calcium Carbonate	70-80
Canvas	15-20
Ivory wallpaper, glossy	30
White wallpaper	20-30



Water Sterilisation

Puritec sterilisation lamps are the chemical-free alternative to private and public water treatment. They can be used both in stationary large-scale applications, e.g. in water works, or in mobile applications, e.g. for camping. Other applications include sterilisation of pools and sewage.

The lamps should be installed in the flowing water. The compact U-shaped Puritec lamp is particularly suited for low water flow rates and volumes. The linear Puritec lamp is used for higher water flow rates.

The sterilisation efficiency depends on the composition of the fluids. Salts, organic substances and other components restrict the penetration depth of the UV radiation. This has to be taken into account in the design of water sterilisation plants.

For information: in distilled water, the UV radiation intensity falls to 10% of the initial value after about 3 m. Radium provides help for project calculation.

Project Example

By answering the following four questions, the required number of NTE lamps can be determined:

- > Which microorganism?
- > What degree of inactivation?
- > What flow rate?
- > What container dimension?

Calculation Steps:

> The radiation dose H in Ws/m^2 can be calculated from the first two questions and the relative dose from the graph on page 7.



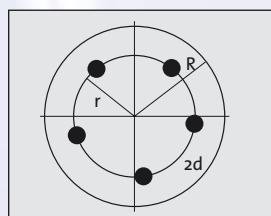
> The required minimum radiation intensity E can be calculated using the equation $E = H \times \Phi / (3.14 \times R^2 \times L)$ where Φ is the flow rate in m^3/s , R the radius and L the length of the irradiation space in m (for cylindrical volumes).

> The maximum distance d of the material to be irradiated from the nearest lamp follows from the graph of 'UVC Radiation Intensity' on page 5.

> The lamps are positioned around a circle with radius $r = R - d$.

> The distance between two neighbouring lamps on the circle is $2d$.

> The number of lamps, n , on the circle is given by $n = 3.14 \times (R - d) / d$.



Calculation Example for Water Sterilisation

Microorganisms:

Escherichia coli in water
Degree of inactivation: 99.9%

Radiation dose:

$$H = 3 \times 54 \text{ Ws/m}^2 = 162 \text{ Ws/m}^2$$

Flow rate:

$$F = 270 \text{ m}^3/\text{h} = 0.075 \text{ m}^3/\text{s}$$

Dimension of the irradiation space:

$$R = 0.5 \text{ m}; L = 0.9 \text{ m}$$

Minimum radiation intensity:

$$E = H \times \Phi / (3.14 \times R^2 \times L)$$

$$E = 17 \text{ W/m}^2$$

The distance is given by the radiation intensity diagram (page 5):

$$d = 0.12 \text{ m (NTE 30W)}$$

Number of lamps:

$$n = 3.14 \times (0.5 - 0.12) / 0.12$$

$n = 10$ (NTE 30W), to be arranged equidistant along a circle with radius

$$r = R - d = 0.38 \text{ m.}$$



Surface Sterilisation

During packaging of drugs and food, in sterile areas in hospitals and for sterilising equipment surfaces, contaminated objects are directly exposed to UV radiation. The radiation efficiency can be significantly increased through the use of reflectors (white teflon or polished aluminium).

In assembly lines, linear Puritec lamps are predominantly used, whereas in closed pieces of apparatus or sterilisation equipment the compact U-shaped Puritec lamps are normally used.

Project Example Assembly Line Application Questions:

- > Which microorganism?
- > What degree of inactivation?
- > What distance between lamp and product?
- > What length and speed of conveyorbelt?

Calculation Steps:

- > The radiation dose H in Ws/m^2 can be calculated from the first two questions and the relative dose from the graph on page 7.
- > From the distance between the product and the Puritec lamps, the graphs on page 5 provide the radiation intensity, E , which is achievable with one lamp.
- > The length and speed of the assembly line determine the exposure time for each lamp segment. The required number of segments is the length of the assembly line divided by the length of the lamp (about 1 m for Puritec 30 W and 55 W).
- > The radiation dose per lamp segment, H_{seg} , is the radiation dose divided by the number of lamp segments.
- > The required radiation intensity per segment, H_{seg} , is the required radiation dose, E_{seg} , per segment divided by the radiation time per segment.
- > The required radiation intensity divided by the radiation intensity of one lamp, E , is the required number of lamps per segment. This number of lamps multiplied by the number of segments is the total number of lamps required.

Calculation Example for Surface Sterilisation

Microorganisms:

Penicillium chrysogenum (fungus),
degree of inactivation: 99%

Radiation dose:

$$H = 2 \times 500 \text{ Ws/m}^2 = 1000 \text{ Ws/m}^2$$

Planned distance between lamps and product is 0.2 m

Radiation intensity:

(NTE 55 W, page 5)

$$E = 17 \text{ W/m}^2$$

Through the use of suitable reflectors, it is possible to approximately double the radiation intensity in the direction of the product, i.e. about 35 W/m^2 .

Length of conveyorbelt to be irradiated:

4 m (lamp length about 1 m, therefore 4 lamp segments.)

Speed of conveyor belt:

$$0.5 \text{ m/s}$$

Exposure time of the product per lamp segment:

$$2 \text{ s}$$

Radiation dose per lamp segment:

$$H_{seg} = 1000 \text{ Ws/m}^2 / 4 = 250 \text{ Ws/m}^2$$

Radiation dose per segment:

$$E_{seg} = 250 \text{ Ws/m}^2 / 2 \text{ s} = 125 \text{ W/m}^2$$

Number of lamps:

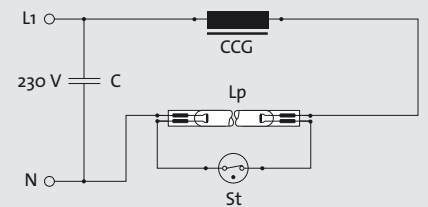
$$n = 125 \text{ Ws/m}^2 / 35 \text{ W/m}^2$$

$$n = 4 \text{ lamps per segment}$$

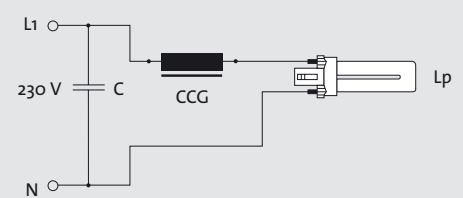
For 4 segments, a total number of 16 Puritec NTE 55 W lamps are required.

Wiring Notes

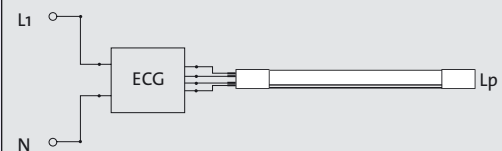
Puritec NTE...



Puritec NSE...G23



Amalgam Lamp with ECG



CCG: Conventional controlled gear;

ECG: Electronic controlled gear;

Lp: Lamp;

N: Neutral;

L1: Phase;

St: Starter;

C: Capacitor

Operating notes: In the Puritec NSE G23, the mains voltage ignition starter is integrated in the base. Operation with ECG is recommended.

Note: These calculations only serve as examples.

Each individual project has to be calculated and tested separately.

Sanolux

The light from this special lamp is similar in its composition to the complete radiation mixture of natural alpine sunlight. It is generated by a tungsten filament and a high pressure lamp. The special glass bulb of the Sanolux lamp is fitted with an internal reflector which focuses the radiation. Special doping of the glass ensures that the lamp only emits the UVA and UVB radiation contained in sunlight.

A significant advantage of this lamp is its easy handling. It has an E 27 base which allows it to be used without additional equipment wherever there is a 230V mains voltage supply.

Due to its sun-like radiation spectrum, the Sanolux lamp is particularly well suited to simulating the sun in industrial material testing. In many production fields, this testing of materials and equipment is an important part of quality assurance.

In many fields of production, testing of materials and equipment is important for ensuring high quality standards. Laboratory tests can provide valuable quick-motion insights in the following areas: fitness for service in the tropics, artificial ageing and weathering, determination of changes in material properties, or functionality and durability under unusual climatic conditions.

The total irradiation of natural sunlight on the earth's surface with the sun in zenith position is approximately 1 kW/m^2 . This average is achieved by evenly arranging 16 lamps per square metre of the area to be treated (distance between bulb and material to be irradiated about 50 cm). The yearly average of solar irradiation at a latitude of 50° North is about 200 W/m^2 .

The high proportion of UV radiation in the spectrum of this lamp also makes it a useful accessory for hardening plastics (polymerisation). The application of UV lamps has greatly simplified the handling of plastics and adhesives.

Dosing and mixing of different components, and working under time pressure due to limited pot life are largely a thing of the past. Under normal room illumination the plastic material can be handled and processed for almost any length of time. It can then quickly be hardened under UV irradiation.

Because of its advantages - simple handling and low costs - Sanolux is now used extensively for this application in workshops, in mobile equipment for repair work and for hobby activities.

Sanolux has also found entry into the electronics industry. Because of its high UV yield and its simple handling, the lamp is frequently used for exposing UV-sensitive photo-resist in the production of circuit boards.

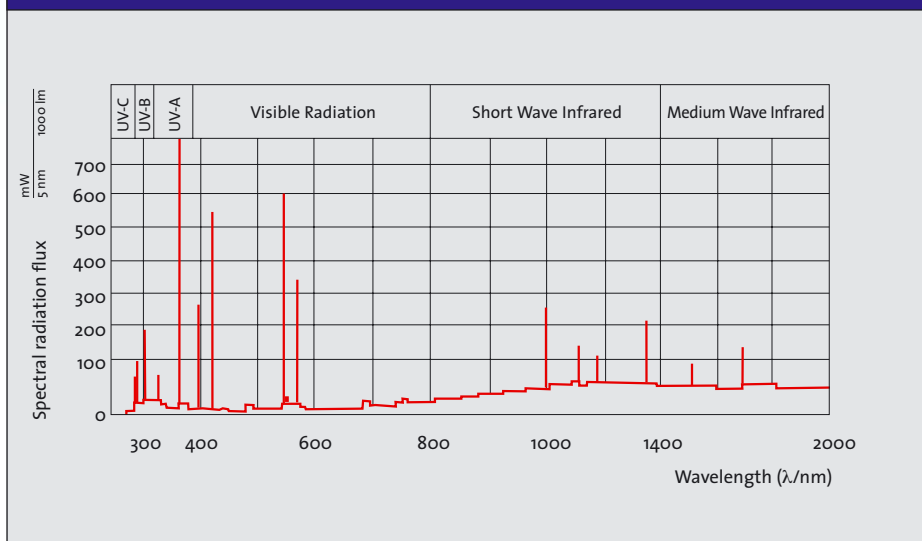


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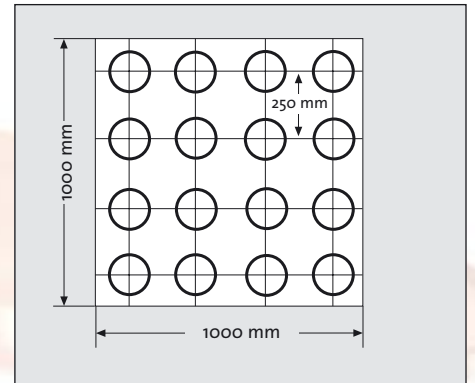
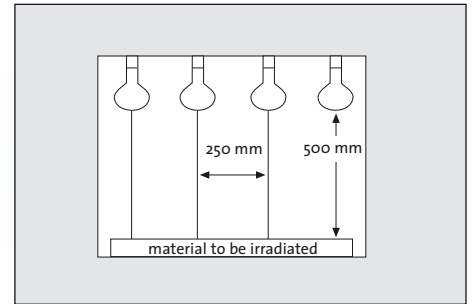
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Specification

Spectral Radiation Distribution



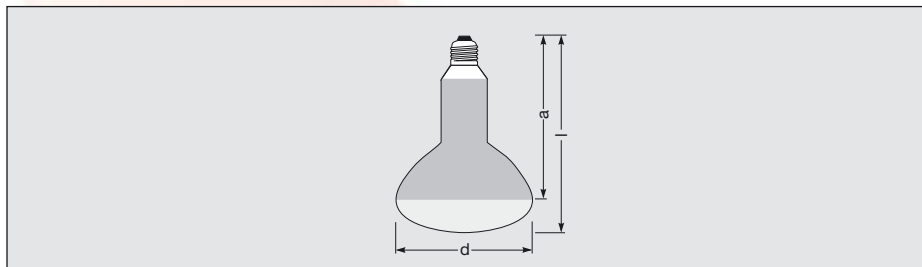
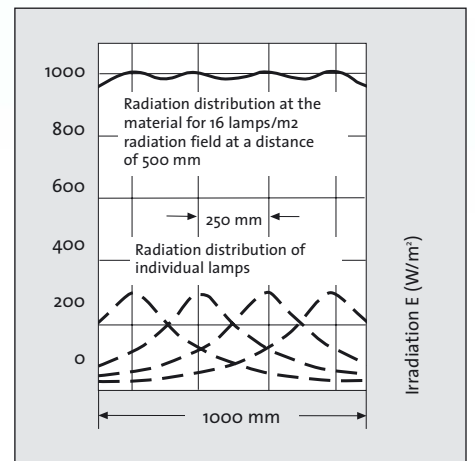
Test Field with 16 Sanolux Lamps



Illuminance and Irradiance of the Sanolux Lamp

(Distance = 0.5 m)

Operating Time	Illuminance	UVB	UVA	Visible
h	lx	280-315 nm W/m ²	315-400 nm W/m ²	380-780 nm W/m ²
1	14400	3.0	13.6	41.4
500	13700	1.8	11.0	39.0
1000	10800	1.1	7.3	29.7



- Product Number
- Order Code
- Base
- Wattage, W
- Angle of Radiation
- Dimension l, mm
- Installed Length a, mm
- Diameter d, mm
- Box Quantity, pcs.
- Mains Voltage, V
- Operating Position
- Ignitor
- Economic Lifetime, h

Sanolux UV high pressure lamp

323 12198	HRC 300-280 E27	E27	300	30°	185	150	127	6	230	any	not required	1000
-----------	-----------------	-----	-----	-----	-----	-----	-----	---	-----	-----	--------------	------

The lamp specification sheet is available on request.

ULTRAVIOLET

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Supratec

This high performance halogen metal vapour lamp was developed specifically for industrial applications.

A particular combination of metal halides generates strong radiation in the UVB range (280-315 nm) and especially in the UVA range (315-380 nm). The quartz bulb absorbs UV radiation below 250 nm. This means that no ozone is generated.

Applications

- > Large-scale hardening of plastic parts, e.g. deep drawn components or plastic veneers
- > Hardening of lacquers and paints
- > Exposure of diazo film material and print layouts
- > Modern adhesive technology
- > Artificial material ageing

The spectral radiation profile of the lamp corresponds almost exactly with the reaction profile of photo-sensitive plastics. This offers the plastics industry a powerful, emission free, and ecologically benign hardening method.

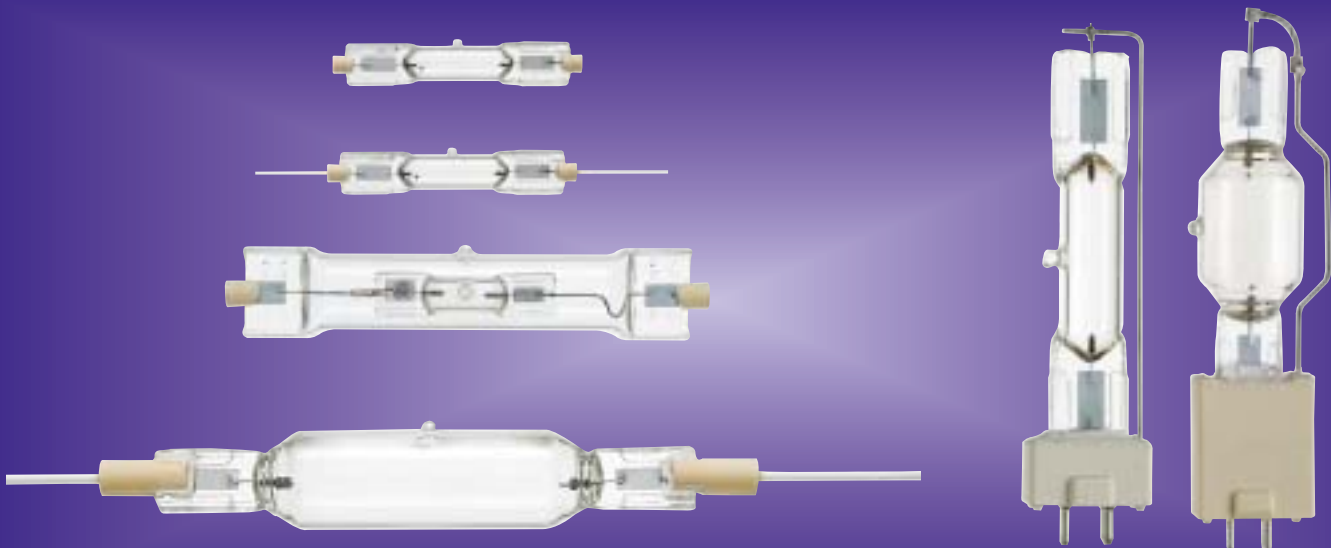
Advantages

- > Labour and time consuming task of mixing different substances becomes obsolete.
- > No restriction on handling times prior to irradiation.
- > Irradiation causes immediate hardening; increasing productivity.
- > No material loss through premature hardening.
- > Simplified production processes.
- > Low energy consumption.

Other applications of the powerful UV sources include exposure of film material and printing plates in the printing industry, as well as artificial weathering and ageing of materials in test laboratories.

Intensive UV radiation has significant advantages for material tests using fluorescent excitation.

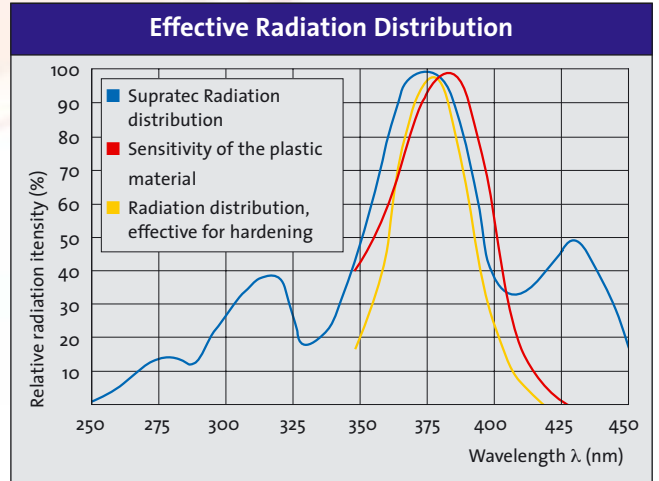
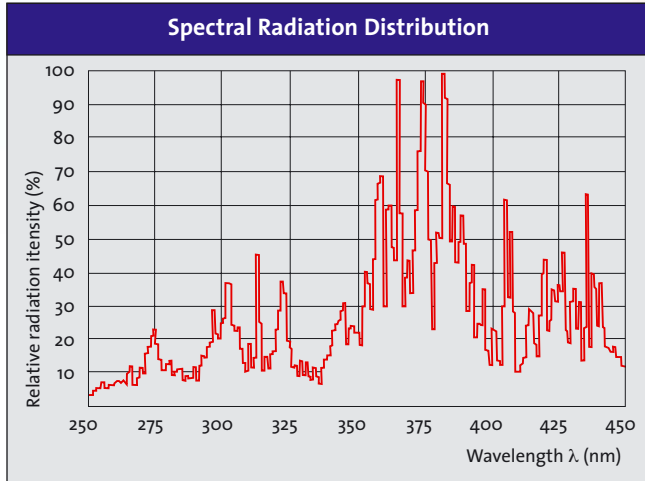
Supratec lamps are particularly well suited for integration into production processes and mass production. The standard range comprises 150 W, 400 W, 500 W, 600 W, 800 W, 1000 W and 2000 W lamps.



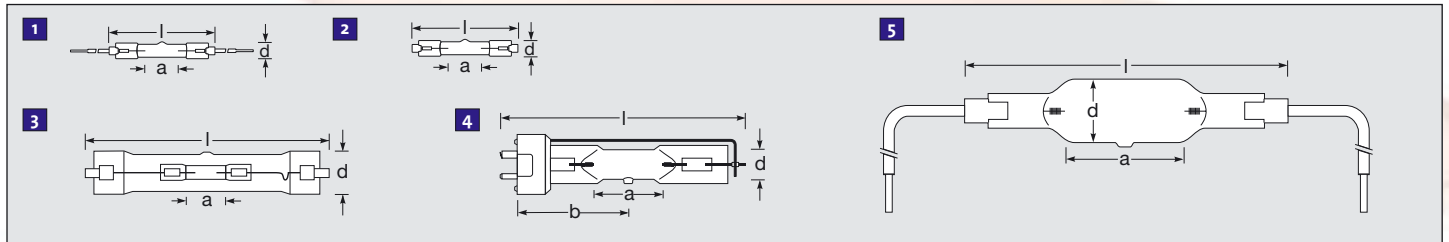
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Spectral Radiation Distribution



Specification



Product Number	Order Code	Base	Wattage, W	Dimension l, mm	Dimension a, mm	Dimension b, mm	Dimension d, mm	Figure	Box Quantity, pcs.	Mains Voltage	UVA Radiation Power, 315 - 400nm, W	UVB Radiation Power, 280 - 315 nm, W	Lamp Current, A	Operating Position	Ignitor, kV	Economic Lifetime, h
----------------	------------	------	------------	-----------------	-----------------	-----------------	-----------------	--------	--------------------	---------------	-------------------------------------	--------------------------------------	-----------------	--------------------	-------------	----------------------

Supratec UV High Pressure Lamp, Dual Base

323 12273	HTT 150-211	wire	165	59.5	10	-	10	1	25	230	22	6	1.5	p30	4.0	1000
323 12345	HTT 150-211	R75	165	57.6	10	-	10	2	25	230	22	6	1.5	p30	4.0	1000
323 12230	HAT 150-221	R75-24	170	132	10	-	23	3	12	230	22	5	1.5	any	4.0	1000
323 14621	HTC 400-221	R75	460	104	33	-	14	2	25	230	95	25	4.0	any	4.0	1000
323 13855	HTC 600-221	KU10s	580	106	45	-	14	1	25	230	110	28	5.0	any	4.0	1000
323 12298	HTC 800-221	R75	870	111	35	-	18	2	25	230	180	35	7.0	any	4.0	1000
323 14718	HTC 1000-221	KY10s	1000	141	48	-	28	5	25	230	230	55	9.0	any	4.0	800
323 11585	HTC 2000-327	KX10s	2000	174	72	-	28	5	25	400	480	110	9.0	any	4.0	800
323 11586	HTC 2000-347	KX10s	2000	174	72	-	28	5	25	400	490	60	9.0	any	4.0	800
323 12356	HTC 2000-349	KX10s	2000	210	104	-	28	5	25	400	490	70	9.0	any	4.0	800

Supratec UV High Pressure Lamp, Single Base

323 12077	HSC 400-221	GY9.5	460	114	33	51	14	4	25	230	90	22	4.0	any	4.0	1000
323 13856	HSC 500-221	GY9.5	570	116	32	53	16	4	25	230	110	28	5.0	any	4.0	1000
323 12078	HSC 1000-221	GYX9.5	1000	139	30	74	25	4	25	230	210	40	9.0	any	4.0	800

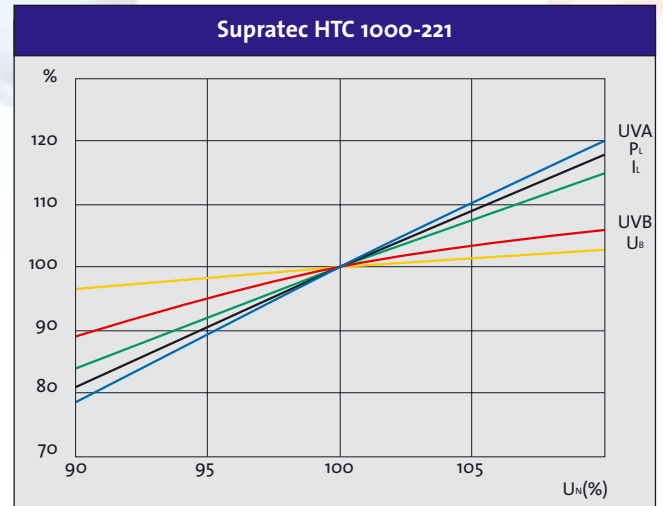
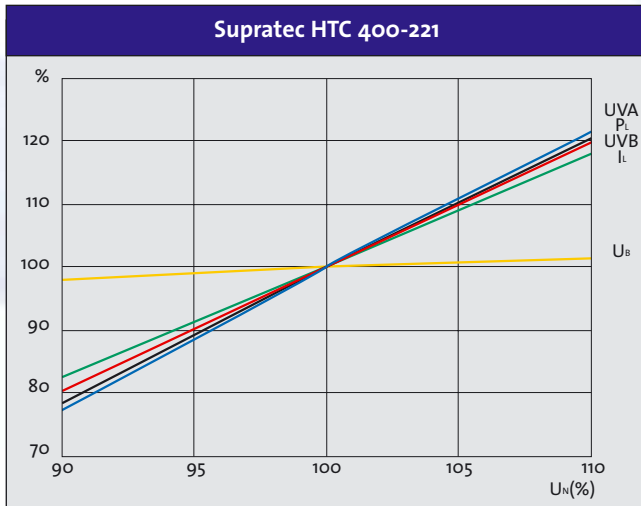
Additional types and individual lamp specification sheets are available on request.

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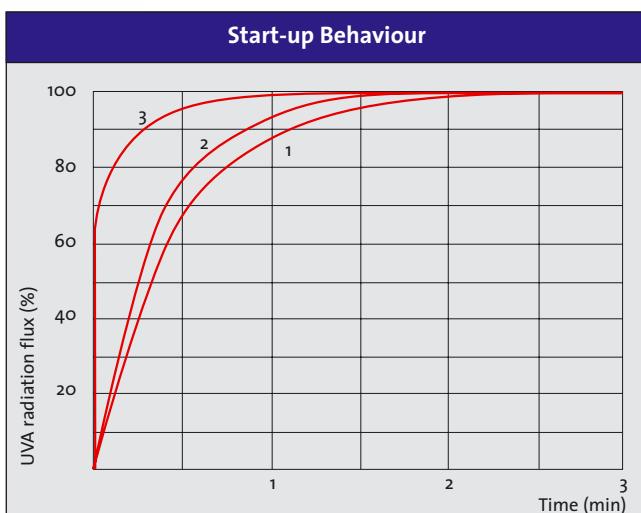
Operating Characteristics



These relationships are valid for an ambient temperature of 40°C. Radiation flux: UVA 315-400 nm; UVB 280-315 nm; PL: Lamp power, IL: Lamp current, UB: Operating voltage, U_M : Mains voltage



Operating Notes



- 1: cold lamp (1000 W)
- 2: cold lamp (400 W)
- 3: increased from half load (400 W and 1000 W)

Operating Temperatures:

The following limit operating temperatures must be observed for Supratec lamps:

- Pinched seal temperature: 350°C
- Bulb temperature: minimum 650°C, maximum 950°C

The electrical and radiation data vary with the bulb temperature. The highest UV radiation flux is reached at a bulb temperature of 850°C.

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Warning:

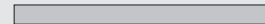
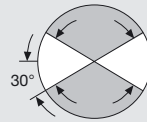
Supratec lamps emit UV radiation of high intensity which can cause sunburn and conjunctivitis. Direct or reflected **unfiltered** radiation must not fall on the skin or eyes! Operating in closed fixtures only.

Supratec lamps do not generate ozone. Special safety measures are therefore not required. The Supratec quartz bulb must not be touched with bare fingers. Any fingerprints must be removed with alcohol prior to initial operation.

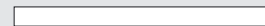
Installation Notes:

Observe permissible installation position! The lamps become very hot during operation and are pressurised. Therefore, the lamps must only be operated in enclosed equipment which is licensed for the purpose. This prevents the discharge of hot glass splinters if a bulb breaks.

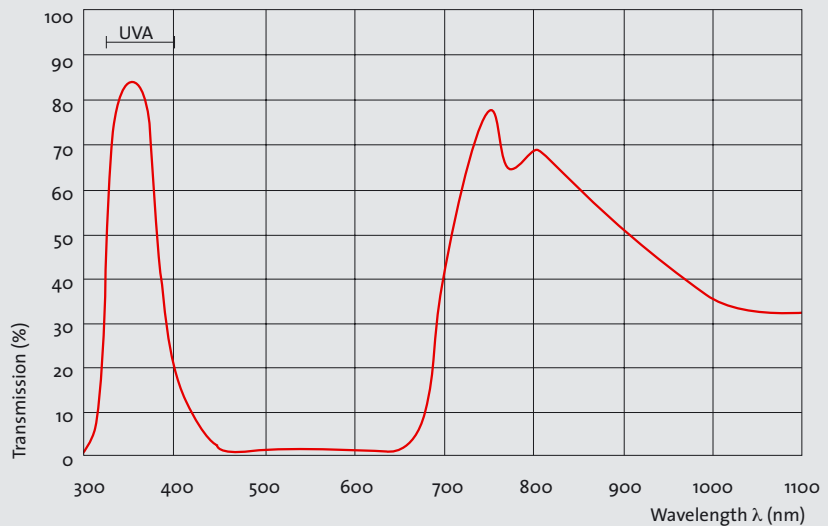
Explanation Operating Position p30



not permitted



permitted

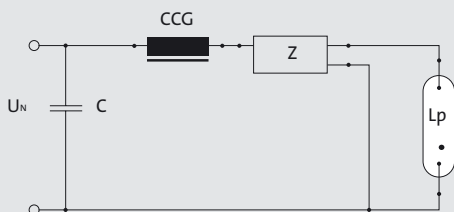


Example: spectral transmission curve of a frequently used filter (DESAG UVISOL '95)
Other DESAG filters for UV applications are, for example, M-UG 2 and Type 322.

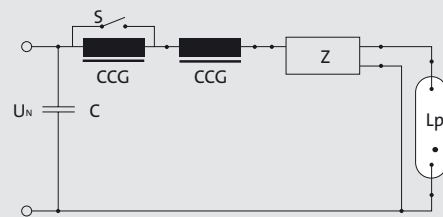
Control Notes

Supratec 150 W – 2000 W

Standard connection



Half-load Connection



CCG: Conventional controlled gear, Z: Ignitor,
C: Power factor correction capacitor, Lp: Lamp,
U_N: Mains voltage, S: Switch

Switch open: half-load operation,
Switch closed: full-load operation

Ralutec Kompakt Low Pressure Lamps in Light Colours 71 and 78

Ralutec Kompakt lamps are low pressure mercury discharge lamps. An electric field between electrodes stimulates the emission of energy intensive UV radiation from mercury vapour in a glass tube. A fluorescent material on the inside of the glass converts this UV radiation into light with the desired spectrum.

The difference between Ralutec Kompakt low pressure lamps in special light colours and conventional compact fluorescent lamps lies in the application of special fluorescent materials. The energy intensive UV radiation is effectively converted into blue radiation or into long wave UV radiation.

Ralutec... 71

This lamp emits light in the visible, blue spectral range of 400-550 nm. Because there are no health risks associated with this lamp, even during professional use over a whole day, and due to its ease of operation, it is an ideal tool for the polymerisation of blue-sensitive plastics, adhesives, lacquers and paints, even for layer thicknesses of more than 1 mm.

Example applications for Ralutec... 71 are torches or mobile plastic hardening equipment for car or boat repairs.

Ralutec... 78

This lamp very effectively emits long wave UVA radiation in the range 350-400 nm. The spectral radiation profile is close to the reaction profile of photo-sensitive plastics. Ralutec... 78 is therefore particularly well suited for hardening modern plastics, adhesives and lacquers - emission-free and environment-friendly.

It is a simple, compact and user friendly solution with low energy consumption.

In addition to its application for the polymerisation of plastics, the convincing properties of the Ralutec... 78 lamp also make it applicable in other modern technology areas. It has, for example, become a common tool for stimulating fluorescence in scientific investigations or as a source of UV light in the production of circuit boards.

The stimulation of fluorescence is also used to recognise bank note and credit card forgeries. Here, black glass filters are applied for increased contrast (for example MUG 2 from DESAG-Schott).

Further Applications

Light Colour 71 and 78:

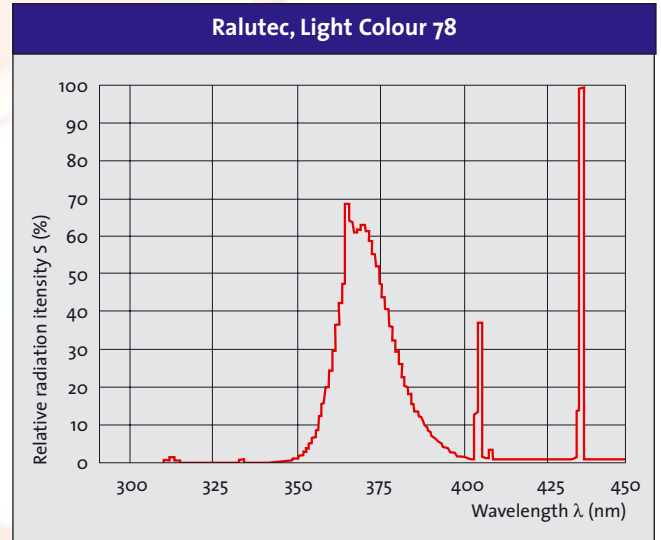
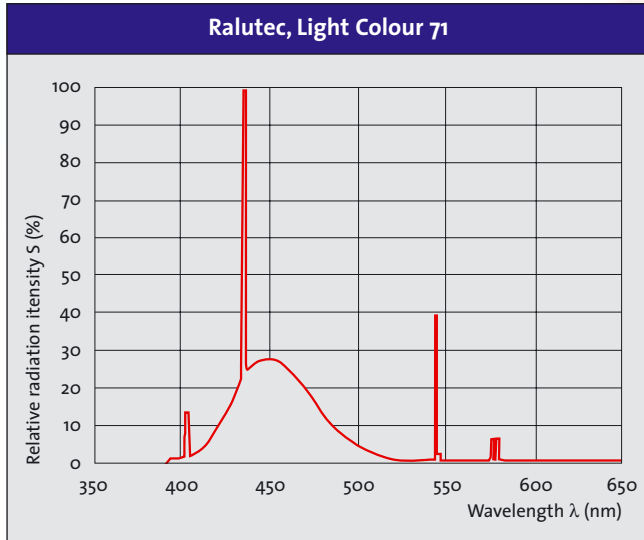
- > dissociation of bilirubin
- > hardening of plastic dental fillings
- > surface sealing in the production of dental spares
- > cosmetic nail shaping
- > insects pitfalls



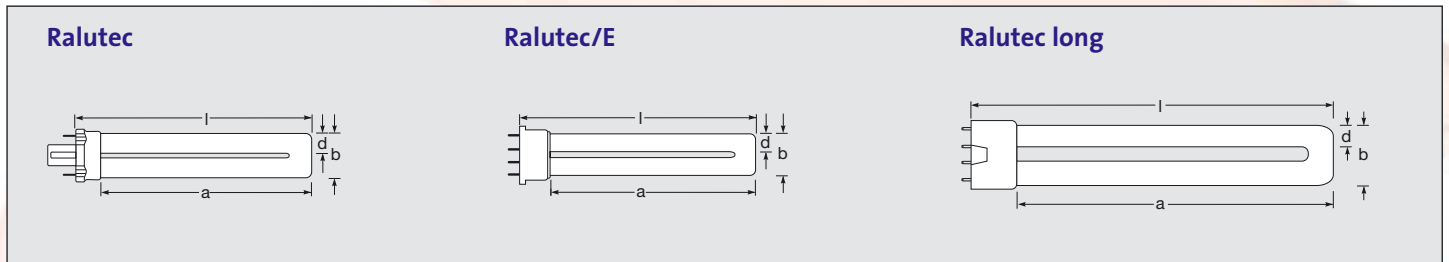
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Spectral Radiation Distribution



Specification



Product Number

Order code

Base

Wattage, W

Dimension l, mm

Dimension a, mm

Dimension b, mm

Dimension d, mm

Box Quantity, pcs.

Nominal Current, A

UV Radiation Power
350 – 400 nm, W

Radiation Power
400 – 550 nm, W

Operating Position

Economic Lifetime, h

Ralutec, Base G23

Product Number	Order code	Base	Wattage, W	Dimension l, mm	Dimension a, mm	Dimension b, mm	Dimension d, mm	Box Quantity, pcs.	Nominal Current, A	UV Radiation Power 350 – 400 nm, W	Radiation Power 400 – 550 nm, W	Operating Position	Economic Lifetime, h
313 12179	Ralutec 7 W/78	G23	7	115	97	27	12	50	0.175	1.4	–	any	1000
313 12180	Ralutec 9 W/71	G23	9	145	127	27	12	50	0.170	–	2.3	any	1000
313 12181	Ralutec 9 W/78	G23	9	145	127	27	12	50	0.170	1.7	–	any	1000
313 12180	Ralutec 11 W/78	G23	11	215	197	27	12	50	0.155	2.3	–	any	1000

Ralutec/E, Base 2G7

313 12184	Ralutec/E 9 W/78	2G7	9	145	126	27	12	50	0.170	1.7	–	any	1000
313 12682	Ralutec/E 11 W/78	2G7	11	215	197	27	12	50	0.155	2.3	–	any	1000

Ralutec long, Base 2G11

313 12185	Ralutec long 18 W/71	2G11	18	225	197	38	12	10	0.370	–	4.2	any	1000
313 12186	Ralutec long 18 W/78	2G11	18	225	197	38	12	10	0.370	2.8	–	any	1000

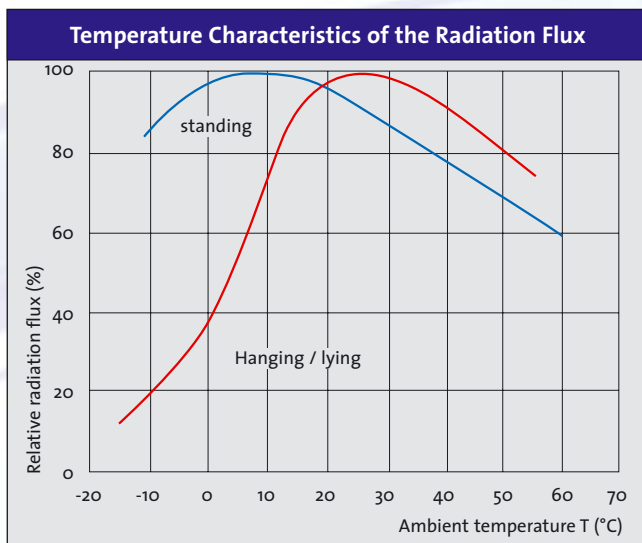
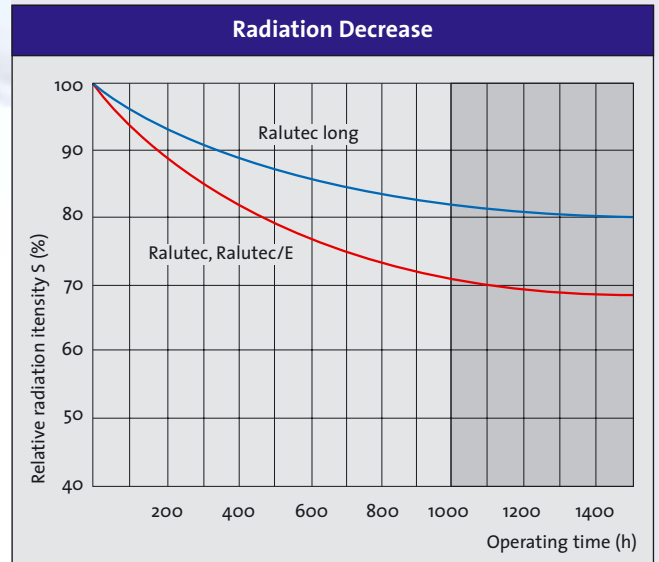
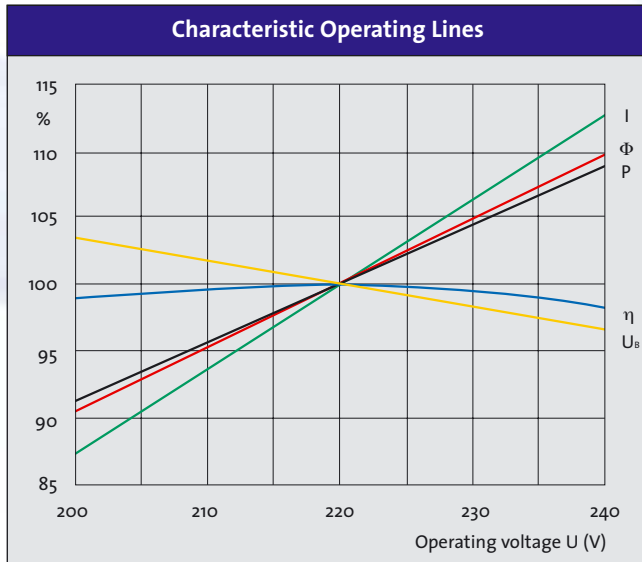
Individual lamp specification sheets are available on request.

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Radium

Specification



Graph top left:

I: lamp current;
Φ: luminous flux;
P: lamp power;
η: luminous efficacy;
U_B: operating voltage

The **top right graph** shows the radiation decrease based on a switching frequency of 165 minutes on, 15 minutes off.

The operating life of Ralutec lamps in light colours 71 and 78 is 1000 hours.

Graph left:

The curves are for a freely burning lamp in still air.

Biological Effects

Ultraviolet radiation has various biological effects on humans. Some of the most important ones are listed below.

- > Direct pigmentation
- > Long-term pigmentation
- > UV erythema (sunburn)
- > Conjunctivitis

The various photo-biological effects on humans depend on the spectral composition and the radiation dose.

The threshold values for different radiation effects are given below. The photo-biologically active radiation dose, H_{biol}, which just causes a noticeable reaction, is called the threshold radiation dose or the threshold value, H_{S,biol}.

The following values are taken from DIN 5031-10 : 2000-03. The NIOSH (US National Institute for Occupational Safety and Health) threshold value is also given for comparison.

> H _{S,Pigmentation} :	100,000 J/m ²
> H _{S,CIE Erythema} :	200-450 J/m ²
> H _{S,Conjunctivitis} :	50 J/m ²
> H _{S,NIOSH} :	30 J/m ²

Biological Effects of UV Radiation

Additional regulations exist for maximum permissible radiation doses in the workplace in the UVA range (320-400 nm).

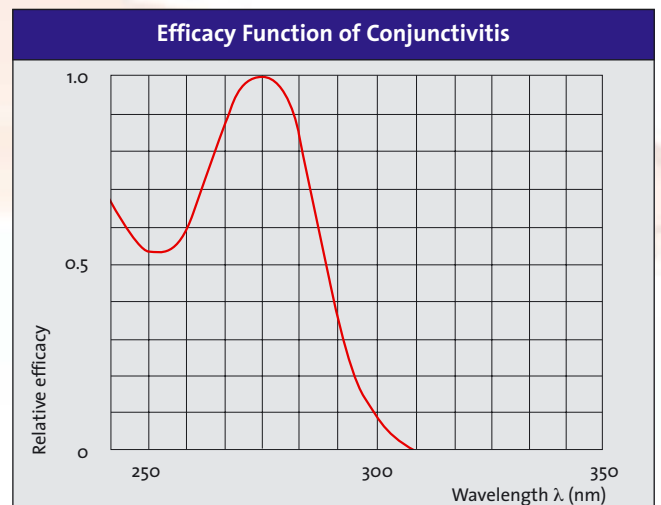
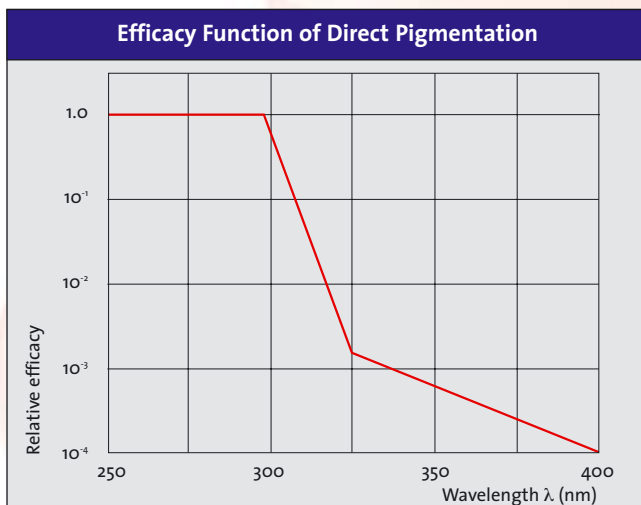
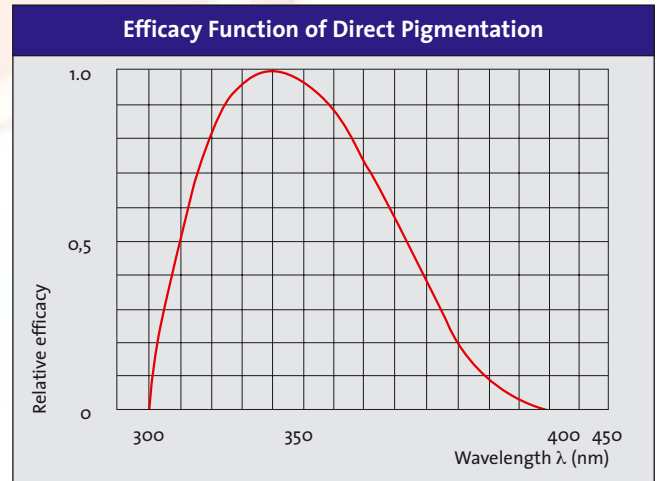
The following applies in Germany:

The radiation dose must not exceed 1 J/cm².

$$H < 1 \text{ J/cm}^2 = 1 \text{ Ws/cm}^2$$

This means that the maximum permissible irradiance in the workplace for exposure times of up to 1000 seconds must be less than 1 mW/cm².

For comparison: The irradiance at a maximum sun altitude of 60° is 4 mW/cm² in the UVA range.



The following table shows the irradiance values and threshold times for Ralutec lamps. The values are based on a distance of 0.5 m from the lamp. The values in brackets show the threshold value for direct skin contact.

	Ralutec 9W/71	Ralutec 9W/78	Ralutec long 18W/78
UVA Irradiance in mW/cm²			
Range 315–380 nm	0.0004 (0.09)	0.06 (12)	0.14 (15)
Range 315–400 nm	0.0007 (0.15)	0.07 (14)	0.16 (18)
Threshold Time in Hours			
Direct Pigmentation	> 2000 (18)	60 (0.28)	24 (0.20)
CIE UV-Erythema, Action Curve	> 2000 (4)	300 (1.40)	125 (1.10)
Konjunktivitis	> 2000 (87)	> 2000 (280)	> 2000 (100)
NIOSH	> 2000 (2)	130 (0.60)	55 (0.50)

Biological Effect

Conclusion:

Threshold times are never exceeded with light colour 71. For light colour 78, the threshold values are not exceeded for irradiation times of up to 15 minutes. The threshold value for erythema is reached only after more than one hour, even with direct skin contact. At distances of more than about 50 cm the operation of Ralutec lamps is absolutely harmless, even over a complete 8 hour working day.

Connection Notes

As with all discharge lamps, the operation of Ralutec Kompakt low pressure lamps requires suitable ballasts. Ralutec lamps with the 2-pin base G23 come with an integrated starter and an interference suppression capacitor. Two lamps can be connected in series if a suitable ballast is used.

Ralutec/E and Ralutec long have a 4-pin base 2G7 or 2G11. They are suitable for operation with both conventional controlled gears and electronic controlled gears, e.g. Quicktronic and Accutronic (for 12 and 24V operation) from Osram or Radium. Conventional operation requires an additional starter RS51 for series connection.

CCG: conventional controlled gear

ECG: electronic controlled gear

C: power factor correction capacitor

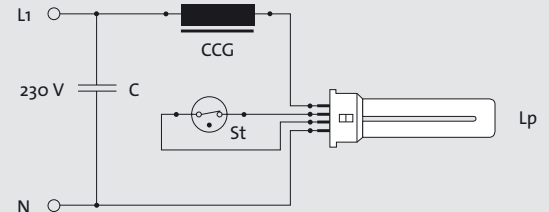
Lp: lamp

N: neutral

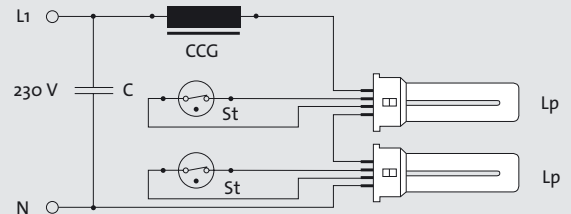
L1: phase

St: starter

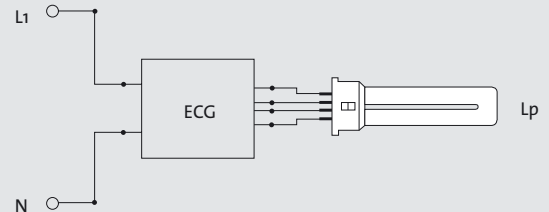
Single Connection 1 lamp with CCG and starter



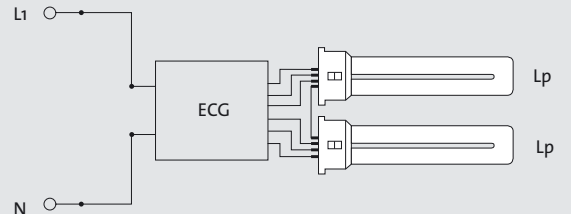
Series Connection 2 lamps with CCG and starter



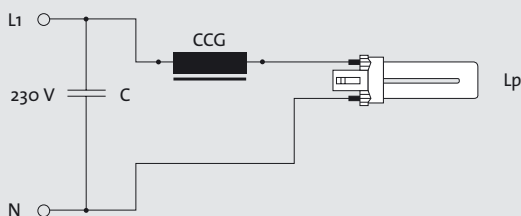
Single Connection 1 lamp with ECG



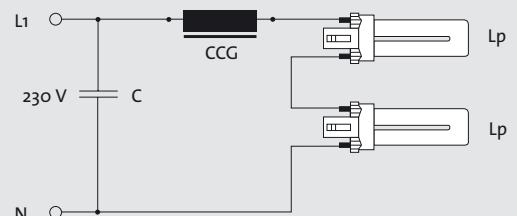
Series Connection 2 lamps with ECG



Single Connection 1 lamp with CCG



Series Connection 2 lamps with CCG



Operating Notes

Lamp Type	Base	Controllable	Single Connection	Series Connection	ECG
Ralutec 7,9 W	G23	no	yes	yes	no
Ralutec/E 9 W	2G7	yes	yes + RS11	yes + RS51	yes
Ralutec long 18 W	2G11	yes	yes + RS11 o. RS73	yes + RS51 o. RS72	yes

The use of electronic controlled gears offers a number of advantages, including energy savings, flicker-free ignition, flicker-free operation, and the option of 12V or 24V operation. Only the 4-pin lamps Ralutec/E and Ralutec long are suitable for operation with electronic controlled gear (ECG).

SupraBlack und UvaBlack Black Light Lamps

Black light lamps have come to be indispensable helpers of optical enrichment in many fields of application. UV lamps with black glass bulbs are used to stimulate fluorescence. Different materials convert invisible UV radiation into visible light.

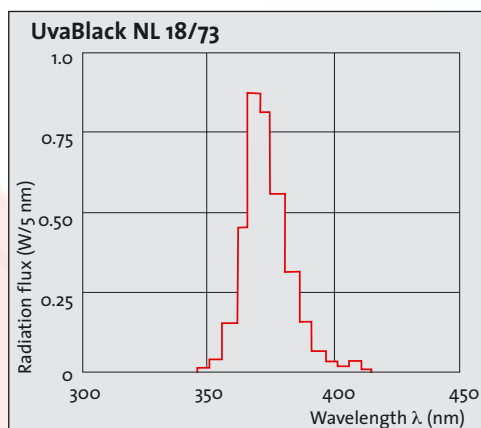
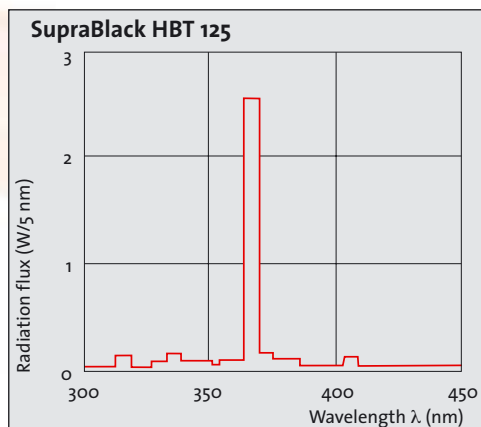
Both the high pressure lamp SupraBlack and the low pressure lamp UvaBlack in light colour 73 generate long wave UV radiation in the range 320-400 nm, which is invisible to the human eye. The black glass bulb absorbs the remaining small portion of visible radiation, which further enhances the contrast.

The irradiance values of the two lamps are quite different. At a distance of 1 m from the centre of the lamp they are:

- > SupraBlack about 0.3 W/m²
- > UvaBlack NL 18W/73 about 0.5 W/m²
- > UvaBlack NL 36W/73 about 1 W/m².

Black light lamps have become invaluable accessories for many applications or for optical enhancements.

Spectral Radiation Distribution



Applications

> Materials technology:

Material testing with fluorescent solutions (e.g. hairline cracks in engine shafts)

> Textile industry:

Analysis of materials, e.g. composition and type of wool admixtures

> Food industry:

Recognition of quality deviations in foods, partial decay of fruits (particularly oranges), meat, fish, seeds etc.

> Criminology:

Recognition of forged or amended documents, forged bank notes, cheques or paintings; recognition of blood traces

> Postal service:

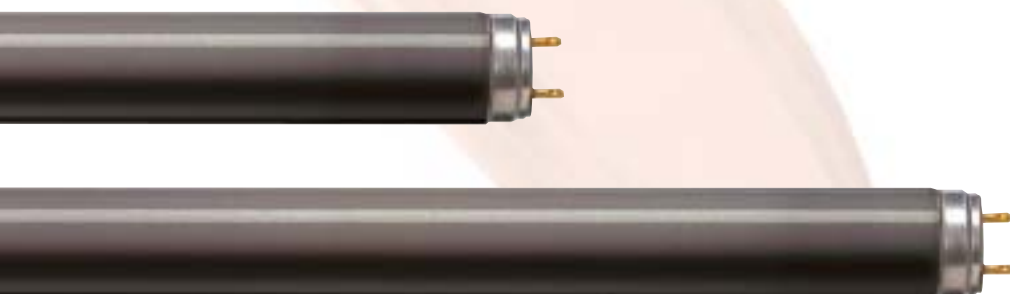
Efficient operation of letter stamping machines; authenticity of stamps

> Illumination:

Special illumination effects for theatre and opera stages, cabarets, variety theatre, discos and bars

> Other applications:

Advertising, design of shop windows, agriculture, mineralogy, testing of precious stones, art history, palaeography, diagnostics etc.

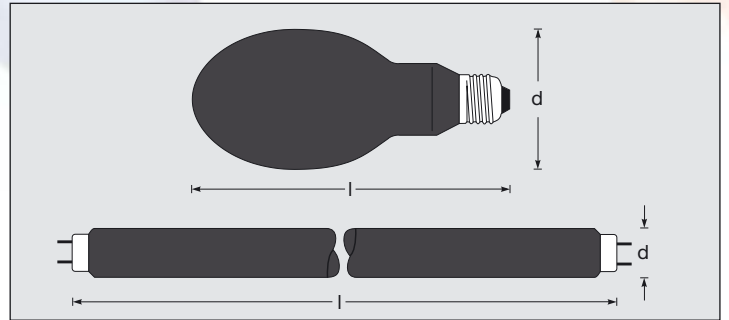


ULTRAVIOLET

Radium Lampenwerk · Sales UV/IR
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Specification



Product Number

Order Code

Base Wattage, W

Dimension l, mm

Dimension d, mm

Base

Box Quantity, pcs.

Mains Voltage, V

Nominal Current, A

UVA Radiation Power, W

Operating Position

Starter

Economic Lifetime

SupraBlack UV High Pressure Lamp

323 12199	HBT 125-281 E27	125	170	75	E27	12	230	1.15	3.0	any	-	2000
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UvaBlack Black Light Fluorescent Lamp

311 12187	UvaBlack 18W/73	18	590	26	G13	25	230	0.37	3.5	any	RS11	2000
311 12188	UvaBlack 36W/73	36	1200	26	G13	25	230	0.44	8.0	any	RS11	2000

Individual lamp specification sheets are available on request.

Biological Effect

Permissible irradiation times per day for a freely burning UvaBlack NL 36W/73 black light lamp according to ACGIH and DIN 5031-10 : 2000-03 at certain distances from the lamp:

Threshold Time	at a distance of 10 cm	at a distance of 100 cm
skin and eyes (ACGIH)	3 h	44 h
CIE UV erythema effect	8 h	115 h
conjunktivitis	45 h	583 h

Conclusion: According to current standards and state of the art, UV exposure limits are not exceeded for the freely burning lamp under normal operation conditions, i.e. there is no known health risk.

The same applies for the SupraBlack high pressure lamp HBT 125-281 E27, except that the operation of a SupraBlack lamp with a damaged or missing outer bulb is dangerous and therefore not allowed.

The limit according to ACGIH (American Conference of Governmental Industrial Hygienists) is based on a total effect curve. This is a model describing all UV effects on the skin and eyes, and is therefore a very restrictive limit.

Connection Notes

The SupraBlack lamp is operated with 230V AC current, with a conventional controlled gear for a 125 W mercury high pressure lamp (nominal current 1.15A). Starters and normal fluorescent lamp ballasts are required for the operation of UvaBlack fluorescent lamps.

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Quality as a permanent process

To converse the thought of quality into action, this is for Radium the motor for its success. Very important factors for reaching the high quality standards - parts of our lamps are being manufactured here, the know-how of the development of production processes up to the construction of the machinery - are provided in our enterprise and are always being held up to date.

Thus Radium is able to manufacture products of high guaranteed quality, which starts with the individual fabrication of small quantities up to the fabrication of big series.

The quality management is on an excellent level. The aim of the staff is to maintain this level by acting consciously every day. The certification according to DIN ISO 9001 is at the same time a confirmation as well as a further motivation.- Radium is a guarantor for quality.

Radium Environment

Quality and environmental protection belong together! Active protection of the environment is a basis in our society for securing the future and apart of our responsibility for the following generations - well as in the private field as in the business field.

Radium see themselves responsible for protecting the environment by saving and carefully using natural resources. Already in 1991, this corporate policy was laid down in the guiding principles for environmental protection. In its core statement, the company committed themselves to the protection of the environment. In 1997, this type of ecological management was inspected in accordance with the EG Eco Audit Regulation and certified in accordance with DIN EN 14001.



General Statements

The technical design data are in accordance with DIN and IEC.

The producer does not take any responsibility for damage to persons or property in case of unsuitable operation or handling of the product.

Operating data and dimensions are valid within the usual tolerances.

On request, models not specified herein, in addition to different bases and voltages, are available.

Sale and delivery are effected in accordance with the Radium Terms of Delivery and Payment valid on the day of conclusion of contract.

Packing units offer economical advantages to the purchase and logistic department. Please match your quantity volume accordingly.

Technical changes and terms of delivery are reserved.



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Accessories

Please contact us for addresses of suppliers. They are available on demand.

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