inspired by light

lichtwerk

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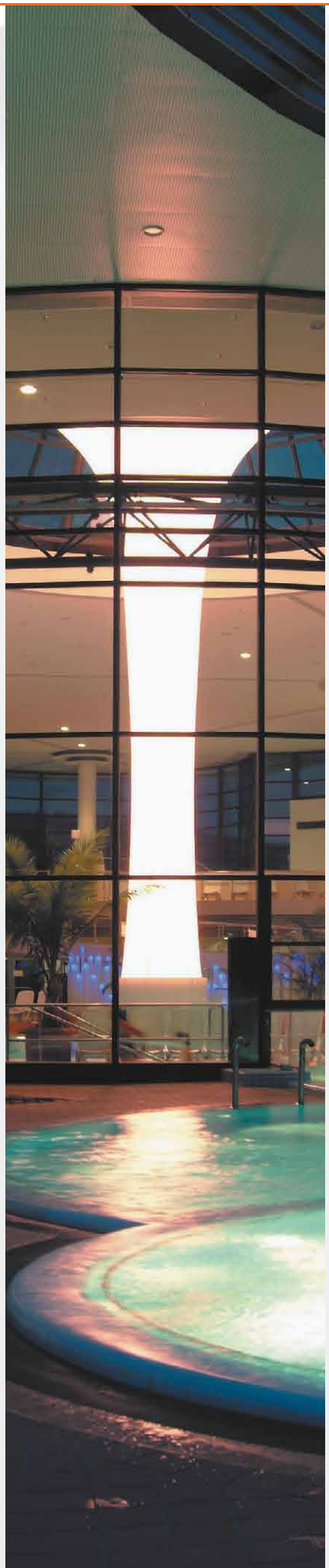
- inspired by light

lichtwerk GmbH is a subsidiary of Regiolux GmbH, and has established itself in the area of architectural lighting as an expert partner for sophisticated lighting tasks.
In addition to standard luminaires, the portfolio of lichtwerk GmbH includes individual project luminaires featuring future-fit technology for innovative lighting solutions.



Flexible

The all-round inclusive package is our standard when it comes to defining our range of services. Lichtwerk reacts flexibly to individual customer requirements. Everything begins with the consultations in the planning phase. Requirements are defined, framework conditions are determined and a selection is made.

Emotional

The effect that was planned is only achieved if everything is perfectly coordinated. Light creates emotions and only when these satisfy the client's requirements does the lighting achieve the enthusiasm, which we set as our goal.
lichtwerk deals with the theme of light in a very emotional manner and treats customer relations the same way.

Creativ

Together, we develop your individual project solution so that the lighting achieves a result that satisfies the architecture, lighting requirement and user alike. Due to the heterogeneous customer structure and changing challenges, lichtwerk is accustomed to always thinking new, innovatively and creatively.

Symbol key

Colour code/Colour

	traffic white (RAL 9016)
wa	white-aluminium also sg (RAL 9006)
	aluminium natural anodized
	stainless steel
cr	chrome
si	silver
sg	silver-grey also wa (RAL 9006)
al	aluminium
tc	translucent
cl	clear
gr	grey
	black
	red
	green
	bue

Control gear

Eb	Electronic ballast
dim	Dimmable
1-10V	Analoge Standard Signal
DALI	Digital Adressable Lighting Interface
ET	Electronic Driver
NL-B	Emergency light single battery
multi	Multiwatt

Ceiling systems

	Ceilings with visible T-rails
	For recessed ceilings

Definition of measurement table variables

L	Length
□L	Length/Width for square luminaires
L2	Additional length
B	Width
H	Height
∅D	Diameter
KE	Cable infeed
KL	Length of luminaire head or ballast box
KB	Width of luminaire head or ballast box
KH	Height of luminaire head or ballast box
A1	Fixing distance in case of single mounting
A2	Fixing distance for the middle luminaires or between the luminaires in case of light run mounting
X	Distance from centre of the luminaire to the electrical feed in (X direction = length)
Y	Distance from centre of the luminaire to the electrical feed in (Y direction = width)
/ SL	Length of cut for recessed luminaires
/ SB	Width of cut for recessed luminaires
/ SD	Diameter of cut for recessed luminaires
e	Minimum necessary depth for luminaire mounting
DS min/max	Min./Max. ceiling thickness in case of suspended ceiling
ML	Modul (axis) Length
MB	Modul (axis) Width

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Information

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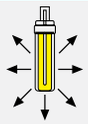
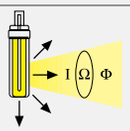
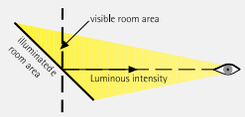
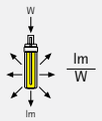
Lighting technology basic concepts

Basic terms	Unit	Symbol	Definition	
1. Luminous flux	Lumen (lm)	Φ	The total quantity of light emitted from the light source.	
2. Luminous intensity	Candela (cd)	$\frac{I = \Phi}{\Omega}$	The luminous intensity I evaluates the light radiated in a definite direction. It depends on the luminous flux Φ in this direction and on the radiated solid angle.	
3. Illuminance	Lux (lx)	$\frac{E = \Phi}{A}$	The illuminance E is the luminous flux Φ, on a defined surface A.	
4. Luminance	Candela pro m^2 (cd/m^2)	$\frac{L = \Phi}{A \cdot \cos \varepsilon}$	The luminance is the luminous intensity per m^2 of visible surface. The luminance L of an illuminated surface is the measure for the luminosity perceived.	
5. Luminous efficiency	Lumen (lm) Watt (W)	$\frac{\eta = \Phi}{P}$	The luminous efficiency is the luminous flux of a bulb related to its electrical power consumption	

Degrees of protection

IP degrees of protection according to the first reference number

Ref-No.	Short description	Short details which foreign bodies cannot ingress the housing
0	Unprotected	No special protection
1	Protected against the ingress of foreign solid bodies with a diameter greater than 50 mm	Great body surface, e.g. a hand (however no protection against intentional contact), foreign solid bodes
2	Protected against the ingress of foreign solid bodies with a diameter greater than 12 mm	Finger or similar up to 80 mm length; foreign solid bodes greater than 12 mm diameter
3	Protected against the ingress of foreign solid bodies with a diameter greater than 2.5 mm	Tools, wires etc. with a diameter or a thickness greater than 2.5 mm; foreign solid bodes greater than 2.5 mm diameter
4	Protected against the ingress of foreign solid bodies with a diameter greater than 1 mm	Wires or strips thicker than 1 mm; foreign solid bodes greater than 1 mm diameter
5	Dustproof	ngress of dust is not completely prevented, however, dust must not penetrate in such quantities that a proper operation of the device is impaired
6	Dust tight	No pnentration of dust

IP degrees of protection according to the second reference number

Ref-No.	Short description	Details of protective measures through the housing
0	Unprotected	No special protection
1	Protected against dripping water	Dripping water (vertically falling drops) shall have no harmful effects
2	Protected against dripping water up to 15°	Vertically falling drops shall have no detrimental effect, if the housing is inclined up to 15 ° from its original operation position
3	Protected against spraying water	Water falling as a spray at an angle of up to 60° from the vertical shall have no detrimental effect against the vertical position
4	Protected against splashing water	Water splashed against the housing from any direction shall have no detrimental effect
5	Protected against water jets	Water projected by a nozzle against the housing from any direction shall have no detrimental effect
6	Protected against heavy seas	Water from heavy seas or water jet under high pressure shall not penetrate the housing in harmful quantities
7	Protected against the effects of immersion	Ingress of water in harmful quantities shall not be possible when the housing is immersed in water under defined conditions with regard to pressure and time
8	Protected against immersion	The devise is suitable for permanent immersion in water; the conditions are to be indicated by the manufacturer Note: In general, this signifies that the device is completely sealed. However, this may signify with specific devices that water penetrates but has no detrimental effects.

Test symbols

Test symbols, classes and degrees of protection

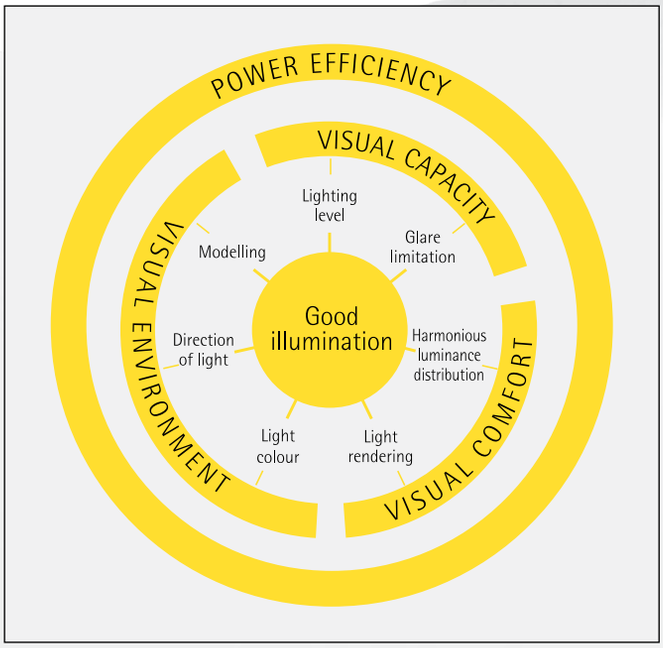
All lichtwerk luminaires are manufactured according to approved technical standards and 100% electrically tested. The luminaires are designed as standard for 230 V, 50 Hz and an ambient temperature of 25° C, and satisfy European norms and directives, including ENEC provisions in relation to safety, electromagnetic compatibility and energy efficiency.

Test symbols	Description
	The -symbol is the European safety symbol for luminaires. The test regulations are determined by the European standard 60 598. The -symbol is issued in combination with the identification number of a European test center (VDE = 10). This documents that the luminaires have been built and tested „in conformity with the standards" as per the Low-voltage Directive 73/23 EEC.
	All luminaires meet the -conditions. In the event of faulty luminaire the fastening surfaces will not be hotter than 180° C. They may be mounted on inflammable building materials as described in DIN 4102 with an ignition point of at least 200 °C (e.g. wood). Observe the installation instructions in order to avoid incorrect installation.
	Identification for thermally insulated ceilings. Luminaires may be directly covered with insulating material.
	New EN-test mark replaces the national -symbol. VDE 0100 Part 720 requires that luminaires with the - or -symbol and at least with degree of protection IP 50 must be installed in areas where dust and/or fibers pose a fire hazard. Observe the installation instructions when installing.
	Luminaires with the -identification are intended for surface mounted installation in furniture. They have been designed so that inflammable materials as defined in DIN 4102 cannot be ignited in the event of a faulty luminaire. Observe the installation instructions in order to avoid incorrect installation.
	Luminaires with the -symbol are intended for surface-mounted and recessed installation in furniture. They are constructed so that in the case of luminaire failure, materials with inflammability characteristics not recognised by VDE 0710 Section 14 cannot be ignited. In order to avoid incorrect installation, installation instructions must be observed.
	Luminaires with impact resistance specifications are tested with impact apparatus according to IEC 60068-2-75; the specified Nm/J value corresponds to mechanical strength according to EN 60598-1-4.13.
	Luminaires with this symbol correspond to EN 60598-1 standard conditions for the temperature specified by this symbol Testing is carried out according to IEC 60695-11-5 (needle-flame test) or IEC 60695-2-10 (glow-wire flammability index).
	The - identification is performed by the manufacturer. The manufacturer, at the manufacturer's own responsibility, hereby confirms conformity with the respective EC or EU directives. Conformity in accordance with the „Low-voltage Directive" and the „EMC directive" (interference immunity, emitted interference) is the precondition for the 1-identification for our products.
	With this symbol, the suitability of luminaires for computer workstations according to DIN EN 12464-1 is specified. The degree number means that the luminance in all luminaire planes beyond that angle does not exceed certain limitation values. Depending on screen quality and screen visualisation, the norm specifies different limitation values.

Protection classes

Protection classes	Description
	Luminaires with the indoor symbol are only suitable and approved for the use in buildings
	Luminaires of protection class I must be connected to a protective conductor.
	Luminaires of protection class II are shock-proof and therefore a PE terminal is not authorized.
	Luminaires of protection class III are intended for operation at safety low voltage < 50V (effective)

Quality criteria for good light

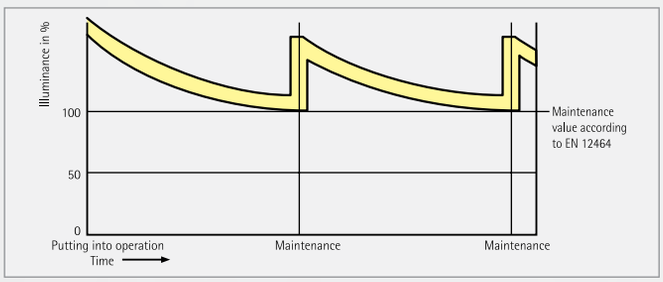


Quality criteria for good light

The function of the interior illumination is to provide human beings with an environment which contributes to their mental and physical well-being and prevents accidents. Moreover, it should influence the mental state of the human being with the aim of achieving a higher degree of performance, combating premature fatigue and reducing errors.

To fullfill these conditions ideally, several quality criteria have to be taken into account at the design stage:

- Lighting level
- Luminance distribution
- Glare limitation
- Directionality of light and modelling
- Light colour and light rendering



Lighting level / Lighting illuminance

The lighting level is essentially determined by the illuminance. In turn, the latter is dependent on the visual task; it is determined by the difficulty in discerning certain contrasts and details and the speed at shich these must be discerned. Standard EN 12464 informs about the required nominal illuminances for the different room types or activities. The nominal illuminances should prevail as an average value in the entire room area intended for a particular type of work. It refers to the average aging condition of the lighting system and in accordance with DIN 5035, is generally measured horizontally 0.85 m above the floor. The illuminance is reduced in every lighting system with progressive aging of the lamps and as a result of dust on the luminaires. In additon, the reflective room surfaces will, as a rule, darken or may also be dusty. For this reason, and in accordance with DIN 5035, the nominal illuminance must be multiplied by a factor of 1.25 for planning with normal aging conditions. As shown in the above graph, however, the illuminance will even drop below the nominal value during the course of time depending on the degree of aging and accumulation of dirt. Maintenance is due when the average illuminance has dropped to 80% of the nominal illuminance. At the same time, the illuminance at no single workplace should ever be less than 0.6 times the value of the nominal illuminance.

Burning-in of fluorescent lamps

New fluorescent lamps, especially T16 (T5) versions, require a burn-in time of approx. 100 hours for basic stabilisation. With operation of lamps with dimmable electronic control gear, burn-in must take place with dimming set at 100%.

Cool Spot

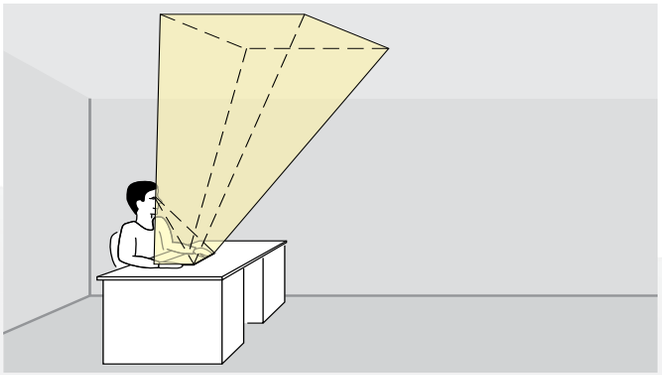
Lamps in T16 (T5) design have a so-called „cool spot", the coolest point on the stamp side of the lamp. With multi-lamp luminaires care must be taken that the stamped ends are on the same side, so that the cool spot does not overheat. If T16 (T5) lamps are arranged vertically, the stamp imprint should be below.

Quality criteria for good light

Glare limitation

Direct glare is caused by excessive luminance in the field of view. It diminishes visual acuity (physiological glare) and may seriously lessen the sense of well-being (psychological glare). Methods of glare evaluation for indoor luminaires evaluate the limitation of luminance within the critical beam angle. As a standard evaluation system the UGR (Unified Glare Rating) method was introduced in Europe as the DIN EN 12464-1 standard. Details concerning the UGR method are described in the CIE 117 publication. The UGR value of a lighting installation, determined according to a table for the position of a standard viewer, is not permitted to exceed the value specified by the standard.

Reflected glare is caused by disturbing reflections upon blank surfaces. As shown in the illustration, no light from the marked area should fall onto the working plane. According to the physical law ‚angle of incidence = angle of reflection',
reflections occurring would lie precisely in the field of view of the person working there. Matt work surfaces help significantly in solving the problem of reflected glare. Reflected glare leads to similar disturbances as direct glare, and impairs mainly contrasts, which are required for disturbance-free seeing. The lighting of computer screen workspaces requires especially careful planning, because strong reflections on the screens often make work impossible.



Reflected glare is caused by disturbing reflections on bright surfaces.

The reflective properties of the screen surfaces, the screen polarity and its curvature in combination with shining surfaces in the room are the decisive factors of influence for the assimilation of information via screens. Disturbing reflections can be lessened with anti-reflection measures for the screen surface. The suitability of luminaires is specified in DIN EN 12464-1. Depending on screen quality and screen polarity, the luminance values of luminaires and shiny surfaces reflected on the screens must not exceed the specified limitation values for mean luminance. Depending on these screen classes and the screen polarity, the luminance values of luminaires and shiny surfaces reflected on the screens must not exceed the specified limitation values for mean luminance. These limitation values are considered for luminaires above an emission angle of 65° all round.

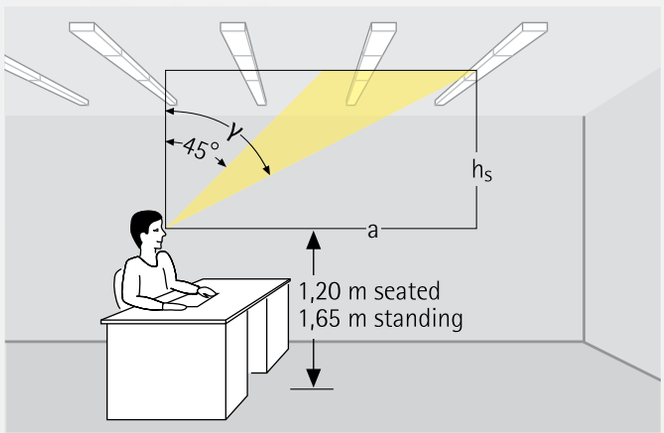
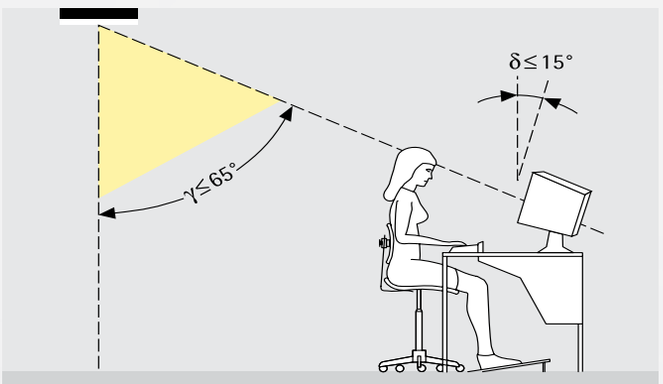


Fig. 1: Arrangement of luminaires at right angles.



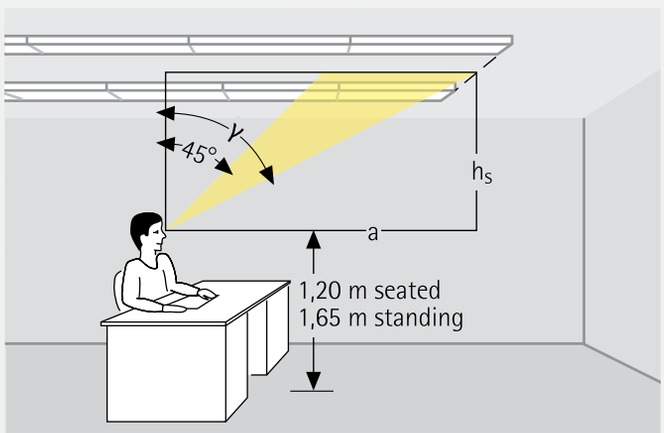


Fig. 2: Arrangement parallel to the line of vision.

„High state"-luminance of the screen	Screens with high luminance L > 200 cd/m²	Screens with mean luminance L ≤ 200 cd/m²
Case A Positive polarity and usual requirements with regard to colour and details of the presented information, e.g. as available in offices, classes, etc.	≤ 3000 cd/m²	≤ 1500 cd/m²
Case B Negative polarity and/or higher requirements with regard to colour and details of the presented information, e.g. as available in case of CAD, colour verification etc.	≤ 1500 cd/m²	≤ 1000 cd/m²
Note „High state"-luminance of the screen (see EN ISO 9241-302) describes the maximum luminance of the white area of the screen. Manufacturers of screens indicate that value.		

Chemical substance

Resistenz-Table

Chemical substance	Polyester	Acrylic glass (PMMA)	Polycarbonat (Housing PC)
Acetone	not resistent	not resistent	not resistent
Aliphat. hydrocarbons	partially resistent	partially resistent	resistent
Alcohol up to 30%	resistent	resistent	resistent
Alkohol concentrated	partially resistent	not resistent	not resistent
Amoniac 25 %	not resistent	resistent	not resistent
Accumulatore acid	resistent	resistent	resistent
Aniline	not resistent	not resistent	not resistent
Aromat. hydrocarbons	partially resistent	not resistent	not resistent
Ether	partially resistent	not resistent	not resistent
Ethyl acetate	not resistent	not resistent	not resistent
Benzine	resistent	resistent	resistent
Benzole	not resistent	not resistent	not resistent
Beer	resistent	resistent	resistent
Blood	resistent	resistent	resistent
Bromine acid	not resistent	not resistent	not resistent
Chloroform	not resistent	not resistent	not resistent
Chlorophenol	not resistent	not resistent	not resistent
Diesel oil, crude oil	resistent	resistent	partially resistent
Dioxane	resistent	not resistent	not resistent
Acetic acid up to 5 %	resistent	partially resistent	resistent
Acetic acid up to 30 %	resistent	not resistent	partially resistent
Glycerine	resistent	resistent	partially resistent
Glycol	resistent	resistent	resistent
Glysantine	resistent	resistent	resistent
Carbon dioxide	resistent	resistent	resistent
Carbon monoxide	resistent	resistent	resistent
Lime water	resistent	resistent	partially resistent
Saline	resistent	resistent	resistent
Ketone	not resistent	not resistent	not resistent
Lysol	not resistent	not resistent	not resistent
Sea water	resistent	resistent	resistent
Methylene chloride	not resistent	not resistent	not resistent
Methyl alcohol	not resistent	not resistent	not resistent
Metal salts and their watery solutions	resistent	resistent	resistent
Sodium hydroxide 2 %	partially resistent	resistent	not resistent
Sodium hydroxide 10 %	not resistent	resistent	not resistent
Petroleum ether	resistent	resistent	partially resistent
Pyridine	not resistent	not resistent	not resistent
Phenol	not resistent	not resistent	not resistent
Nitric acid up to 10 %	resistent	resistent	resistent
Nitric acid 10 - 20 %	partially resistent	partially resistent	partially resistent
Nitric acid over 20 %	not resistent	not resistent	not resistent
Hydrochlorit acid up to 20 %	resistent	resistent	resistent
Hydrochlorit acid over 20 %	resistent	resistent	partially resistent
Sulfuric acid up to 50 %	resistent	resistent	resistent
Sulfuric acid up to 70 %	resistent	partially resistent	partially resistent
Sulfuric acid over 70 %	not resistent	not resistent	not resistent
Solfurous acid up to 5 %	partially resistent	partially resistent	not resistent
Hydrogen sulphide	resistent	resistent	resistent
Soapsuds	resistent	resistent	resistent
Soda	resistent	resistent	resistent
Synth. suds	resistent	resistent	partially resistent
Oil of turpentine	resistent	partially resistent	partially resistent
Carbon tetrachloride	resistent	not resistent	not resistent
Water up to 60° C	resistent	resistent	resistent
Hydrogene peroxide up to 40 %	not resistent	not resistent	partially resistent
Hydrogene peroxide over 40 %	not resistent	partially resistent	partially resistent
Xylene	not resistent	not resistent	not resistent

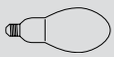
Lamp index

Category	Designation (LBS)	Power (W)	Socket	Colour rendering	Colour temperatur	Luminous flux (lm)	OSRAM	Philips	Sylvania	GE
Fluorescent Lamps	T 16 (T5)	14	G 5	1B	ww, nw, tw	1200	FH 14 W/8..	TL5 14 W HE/8..	FHE 14 W/8..	F14 W/8..
	T 16 (T5)	21	G 5	1B	ww, nw, tw	1900	FH 21 W/8..	TL5 21 W HE/8..	FHE 21 W/8..	F21 W/8..
	T 16 (T5)	28	G 5	1B	ww, nw, tw	2600	FH 28 W/8..	TL5 28 W HE/8..	FHE 28 W/8..	F28 W/8..
	T 16 (T5)	35	G 5	1B	ww, nw, tw	3300	FH 35 W/8..	TL5 35 W HE/8..	FHE 35 W/8..	F35 W/8..
	T 16 (T5)	24	G 5	1B	ww, nw, tw	1750	FQ 24 W/8..	TL5 24 W HO/8..	FHO 24 W/8..	F24 W/8..
	T 16 (T5)	39	G 5	1B	ww, nw, tw	3100	FQ 39 W/8..	TL5 39 W HO/8..	FHO 39 W/8..	F39 W/8..
	T 16 (T5)	49	G 5	1B	ww, nw, tw	4300	FQ 49 W/8.	TL5 49 W HO/8..	FHO 49 W/8..	F49 W/8..
	T 16 (T5)	54	G 5	1B	ww, nw, tw	4450	FQ 54 W/8..	TL5 54 W HO/8..	FHO 54 W/8..	F54 W/8..
	T 16 (T5)	80	G 5	1B	ww, nw, tw	6150	FQ 80 W/8..	TL5 80 W HQ/8..	FHO 80 W/8..	F80 W/8..
	T 26 (T8)	18	G 13	1A	ww, nw, tw	1000	L 18 W/..	TL-D 18 W/9..	F18 W/9..	F18 W/9..
	T 26 (T8)	18	G 13	1B	ww, nw, tw	1350	L 18 W/..	TL-D 18 W/8..	F18 W/8..	F18 W/8..
	T 26 (T8)	36	G 13	1A	ww, nw, tw	2300	L 36 W/..	TL-D 36 W/9..	F36 W/9..	F36 W/9..
	T 26 (T8)	36	G 13	1B	ww, nw, tw	3350	L 36 W/..	TL-D 36 W/8..	F36 W/8..	F36 W/8..
	T 26 (T8)	38	G 13	1B	ww, nw, tw	3300	L 38 W/..	TL-D 38 W/8..	F38 W/8..	F38 W/8..
	T 26 (T8)	58	G 13	1A	ww, nw, tw	3700	L 58 W/..	TL-D 58 W/9..	F58 W/9..	F58 W/9..
	T 26 (T8)	58	G 13	1B	ww, nw, tw	5200	L 58 W/..	TL-D 58 W/8..	F58 W/8..	F58 W/8..
Compact-Fluorescent Lamps	TC-S	5	G 23	1B	ww, nw	250	Dulux S 5 W/...	PL-S 5 W/.../2P	CF-S 5 W/...	F5BX/...
	TC-S	7	G 23	1B	ww, nw	400	Dulux S 7 W/...	PL-S 7 W/.../2P	CF-S 7 W/...	F7BX/...
	TC-S	9	G 23	1B	ww, nw	600	Dulux S 9 W/...	PL-S 9 W/.../2P	CF-S 9 W/...	F9BX/...
	TC-S	11	G 23	1B	ww, nw	900	Dulux S 11 W/...	PL-S 11 W/.../2P	CF-S 11 W/...	F11BX/...
	TC-SEL	5	2 G7	1B	ww, nw	250	Dulux S/E 5 W/...	PL-S 5 W/.../4p	CF-SE 5 W/...	F5BX/.../4p
	TC-SEL	7	2 G7	1B	ww, nw	400	Dulux S/E 7 W/...	PL-S 7 W/.../4p	CF-SE 7 W/...	F7BX/.../4p
	TC-SEL	9	2 G7	1B	ww, nw	600	Dulux S/E 9 W/...	PL-S 9 W/.../4p	CF-SE 9 W/...	F9BX/.../4p
	TC-SEL	11	2 G7	1B	ww, nw	900	Dulux S/E 11 W/...	PL-S 11 W/.../4p	CF-SE 11 W/...	F11BX/.../4p
	TC-D	10	G24 d-1	1B	ww, nw	600	Dulux D 10 W/...	PL-C 10 W/.../2P	CF-D 10 W/...	F10DBX/...
	TC-D	13	G24 d-1	1B	ww, nw	900	Dulux D 13 W/...	PL-C 13 W/.../2P	CF-D 13 W/...	F13DBX/...
	TC-D	18	G24 d-2	1B	ww, nw	1200	Dulux D 18 W/...	PL-C 18 W/.../2P	CF-D 18 W/...	F18DBX/...
	TC-D	26	G24 d-3	1B	ww, nw	1800	Dulux D 26 W/...	PL-C 26 W/.../2P	CF-D 26 W/...	F26DBX/...
	TC-DEL	10	G24 q-1	1B	ww, nw	600	Dulux D/E 10 W/...	PL-C 10 W/.../4p	CF-DE 10 W/...	F10DBX/.../4p
	TC-DEL	13	G24 q-1	1B	ww, nw	900	Dulux D/E 13 W/...	PL-C 13 W/.../4p	CF-DE 13 W/...	F13DBX/.../4p
	TC-DEL	18	G24 q-2	1B	ww, nw	1200	Dulux D/E 18 W/...	PL-C 18 W/.../4p	CF-DE 18 W/...	F18DBX/.../4p
	TC-DEL	26	G24 q-3	1B	ww, nw	1800	Dulux D/E 26 W/...	PL-C 26 W/.../4p	CF-DE 26 W/...	F26DBX/.../4p
	TC-T	13	GX 24 d-1	1B	ww, nw	900	Dulux T 13 W/...	–	–	F13TBX/...
	TC-T	18	GX 24 d-2	1B	ww, nw	1200	Dulux T 18 W/... (IN)	PL-T 18 W/.../2P	CF-T 18 W/...	F18TBX/...
	TC-T	26	GX 24 d-3	1B	ww, nw	1800	Dulux T 26 W/... (IN)	PL-T 26 W/.../2P	CF-T 26 W/...	F26TBX/...
	TC-TEL	13	GX 24 q-1	1B	ww, nw	900	Dulux T/E 13W/...	–	–	F13TBN/.../A/4p
	TC-TEL	18	GX 24 q-2	1B	ww, nw	1200	Dulux T/E 18 W/... (IN)	PL-T 18 W/.../4p	CF-TE 18 W/...	T18TBX/.../A/4p
	TC-TEL	26	GX 24 q-3	1B	ww, nw	1800	Dulux T/E 26 W/... (IN)	PL-T 26 W/.../4p	CF-TE 26 W/...	T26TBX/.../A/4p
	TC-TEL	32	GX 24 q-3	1B	ww, nw	2400	Dulux T/E 32 W/... (IN)	PL-T 32 W/.../4p	CF-TE 32 W/...	T32TBX/.../A/4p
	TC-TEL	42	GX 24 q-4	1B	ww, nw	3200	Dulux T/E 42 W/... (IN)	PL-T 42 W/.../4p	–	–
	TC-TEL	57	GX 24 q-5	1B	ww, nw	4300	Dulux T/E 57 W/... (IN)			
	TC-TEL	60	2 G 8	1B	ww, nw	4000	–	PL-H 60 W/.../4p	–	–
	TC-TEL	85	2 G 8	1B	ww, nw	6000	–	PL-H 85 W/.../4p	–	–
	TC-LEL	18	2 G 11	1B	ww, nw	1200	Dulux L 18 W/...	PL-L 18 W/.../4p	CF-L 18 W/...	F18BX/...
	TC-LEL	18	2 G 11	1A	ww, nw, tw	750	Dulux L 18 W/...	PL-L 18 W/.../4p	CF-L 18 W/...	F18BX/...
	TC-LEL	24	2 G 11	1B	ww, nw	1800	Dulux L 24 W/...	PL-L 24 W/.../4p	CF-L 24 W/...	F24BX/...
	TC-LEL	24	2 G 11	1A	ww, nw, tw	1200	Dulux L 24 W/...	PL-L 24 W/.../4p	CF-L 24 W/...	F24BX/...
	TC-LEL	36	2 G 11	1B	ww, nw	2900	Dulux L 36 W/...	PL-L 36 W/.../4p	CF-L 36 W/...	F36BX/...
	TC-LEL	36	2 G 11	1A	ww, nw, tw	1900	Dulux L 36 W/...	PL-L 36 W/.../4p	CF-L 36 W/...	F36BX/...
	TC-LEL	40	2 G 11	1B	ww, nw	3500	Dulux L 40 W/...	PL-L 40 W/.../4p	CF-LE 40 W/...	F40BX/...
	TC-LEL	55	2 G 11	1B	ww, nw	4800	Dulux L 55 W/...	PL-L 55 W/.../4p	CF-LE 55 W/...	F55BX/...
	TC-LEL	55	2 G 11	1A	ww, nw	3000	Dulux L 55 W/...	PL-L 55 W/.../4p	–	F55BX/...
	TC-LEL	80	2G11	1B	ww, nw	6000	Dulux L 80 W/...	PL-L 80 W/.../4p		

Lamp index

Category	Designation (LBS)	Power (W)	Socket	Colour rendering	Colour temperatur	Luminous flux (lm)	OSRAM	Philips	Sylvania	GE
Low-voltage Halogen Lamps with closed dichroic reflector	QR-CBC 35/10°-38°	20	GU 4	1A	ww	ca. 320	12300/12314	12300/12314	FTB/FTD 12V/20W	Precise MR 11
	QR-CBC 35/10°-38°	35	GU 4	1A	ww	ca. 600	12312	12312	FTE/FTH 12V/35W	Precise MR 11
	QR-CBC 51/8°-60°	20	GU 5,3	1A	ww	ca. 320	6642/6643/6644	6642/6643/6644	ESX/BAB 12V/20W	Precise MR 16
	QR-CBC 51/8°-60°	35	GU 5,3	1A	ww	ca. 600	6645/6646/6647	6645/6646/6647	FMT/FMW 12V/35W	Precise MR 16
	QR-CBC 51/8°-60°	50	GU 5,3	1A	ww	ca. 930	6648/6649/6650/6685	6648/6649/6650/6685	EXT/EXZ/EXN/FNV	Precise MR 16
									12V/30W	
Low-voltage Halogen Lamps with open dichroic reflector	QR-CB 51/10°-38°	20	GU 5,3	1A	ww	ca. 320	41860 SP/FL	-	-	33071..
	QR-CB 51/10°-38°	35	GU 5,3	1A	ww	ca. 600	41865 SP/FL	-	-	33071..
	QR-CB 51/10°-38°	50	GU 5,3	1A	ww	ca. 930	41870 SP/FL	-	-	33071..
Low-voltage Halogen Lamps with aluminium reflector	QR-LP 111 (AR111)	35	G 53	1A	ww	ca. 600	41832 SP/FL	-	-	-
	QR-LP 111 (AR111)	50	G 53	1A	ww	ca. 930	41835 SP/FL	-	-	-
	QR 111 (AR111)	75	G 53	1A	ww	ca. 1450	41840 SP/FL/WFL	-	-	-
	QR 111 (AR111)	100	G 53	1A	ww	ca. 2200	41850 SP/FL/WFL	-	-	-
High-voltage (230V) Halogen Lamps	QT 18	60	B 15d	1A	ww	820	64469 KL/AM	-	-	-
	QT 18	75	B 15d	1A	ww	1100	64473 KL/AM	12123/12120	-	-
	QT 18	100	B 15d	1A	ww	1500	64475 KL/AM	12122/12119	-	-
	QT 18	150	B 15d	1A	ww	2500	64471 KL/AM	12121/12118	-	-
	QT 26	25	E 14	1A	ww	250	64860T	-	-	-
	QT 26	40	E 14	1A	ww	490	64861T/TIM	14001	-	-
	QT 26	60	E 14	1A	ww	820	64862T/TIM	14005	-	-
	QT 32	60	E 27	1A	ww	840	64472 KL/IM	13656	60 W DLX/BTT Klar/Satin	Halo BTT 60 ES 230 CL
	QT 32	75	E 27	1A	ww	1050	64474 KL/IM	-	-	-
	QT 32	100	E 27	1A	ww	1400	64476 KL/IM	13662	100 W DLX/BTT Klar/Satin	Halo BTT 100 ES 230 CL
	QT 32	150	E 27	1A	ww	2500	64478 KL/IM	13946	150 W DLX/BTT Klar/Satin	-
	QT 32	250	E 27	1A	ww	4200	64480 KL/IM	-	-	-
	QT-DE 12	60	R7s	1A	ww	840	64688	60 T3Q/CL/P	Halogenstab 60 W	-
	QT-DE 12	100	R7s	1A	ww	1650	64690	100 T3Q/CL/P	Halogenstab 100 W	29112
	QT-DE 12	150	R7s	1A	ww	2600	64695	150 T3Q/CL/P	Halogenstab 150 W	29123
	QT-DE 12	200	R7s	1A	ww	3200	64698	200 T3Q/CL/P	Halogenstab 200 W	29134
	QT-DE 12	250	R7s	1A	ww	5500	63467 IRC	-	-	-
	QT-DE 12	300	R7s	1A	ww	5000	64701	300 T3Q/CL/P	Halogenstab 300 W	291159
	QT-DE 12	400	R7s	1A	ww	9500	63469 IRC	-	-	-
	QT-DE 12	500	R7s	1A	ww	9500	64702	500 T3Q/CL/P	Halogenstab 500 W	29165
Circular Fluorescent Lamps	T-R 16 (T-R 5)	22	2 GX 13	1B	ww, nw, tw	1800	FC 22	TL 5 C 22W	–	–
	T-R 16 (T-R 5)	40	2 GX 13	1B	ww, nw, tw	3200	FC 40	TL 5 C 40W	–	–
	T-R 16 (T-R 5)	55	2 GX 13	1B	ww, nw, tw	4000	FC 55	TL 5 C 55W	–	–

Lamp index

Category	Designation (LBS)	Power (W)	Socket	Colour rendering	Colour temperatur	Luminous flux (lm)	OSRAM	Philips	Sylvania	GE
High-pressure Metal-halide vapour Lamps	HIE	70	E 27	1B	ww, nw	4500	HQI E 70/...	–	HSI-MP 75 W/...	–
	HIE	100	E 27	1B	ww, nw	8200	HQI E 100/...	–	HSI-MP 100 W/...	–
	HIE	150	E 27	1B	nw	11400	HQI E 150/...	–	HSI-MP 150 W/CL U	–
	HIE	250	E 40	2B	nw	19000	HQI E 250/D	HPI Plus 250 W BU	–	ARC 250/D/H/VBU/960
	HIE	400	E 40	2B	ww, nw	43000	HQI E 400/N	HPI Plus 400 W BU.....	HSI-MP 400 W/C/BU	–
	HIT	70	G 12	1B	ww, nw	5500	HQI-T 70/...	–	HSI-T 70 W/WDL	ARC 70/T/U/...
	HIT	150	G 12	1B	ww, nw	13000	HQI-T 150/...	–	HSI-T 150 W/WDL	ARC 150/T/U/...
	HIT	70	PG 12-2	1B	nw	5300	–	MHN-T 70 W	–	–
	HIT	250	E 40	1A	nw, tw	20000	HQI-T 250/D	HPI-T 250W	HSI-T 250 W/D	ARC 250/T..
	HIT	400	E 40	2B	nw	42000	HQI-T 400/N	HPI-T 4000W	HSI-T 400 W/D	ARC 4000/T..
	HIT-CRI	35	G 12	1B	ww	3400	HCI-T 35/WDL	CDMT/TC35W/830	–	–
	HIT-CRI	70	G 12	1B	ww, nw	6400	HCI-T 70/WDL	CDM-T 70 W	–	CMH 70/T/...
	HIT-CRI	150	G 12	1B	ww, nw	13000	HCI-T 150	CDM-T 150 W	–	CMH 150/T/...
	HIT-CRI	70	E 27	1B	ww	6300	–	CDM-TT 70 W	–	–
	HIT-CRI	150	E 40	1B	ww	13500	–	CDM-TT 150 W	–	–
	HIT-DE	70	RX 7s	1B	ww, nw, tw	5000	HQI-TS 70/...	MHN-TD 70 W	HSI-TD 70 W/...	ARC 70/TD/...
	HIT-DE	150	RX 7s-24	1B	ww, nw, tw	11000	HQI-TS 150/...	MHN-TD 150 W	HSI-TD 150 W/...	ARC 150/TD/...
	HIT-DE	250	Fc 2	1B	ww, nw, tw	20000	HQI-TS 250/...	MHN-TD 250 W	HSI-TD 250 W/...	ARC 250/TD/...
	HIT-DE	400	Fc 2	1B	ww, nw, tw	35000	HQI-TS/NDL	–	–	-
	HIT-DE-CRI	70	RX 7s	1B	ww, nw	6300	HCI-TS 70	CDM-TD 70 W	–	CMH 70/TD/...
	HIT-DE-CRI	150	RX 7s	1B	ww, nw	13500	HCI-TS 150	CDM-TD 150 W	–	CMH 150/TD/...
	HIR	35	GX 10	1B	ww	2275	–	–	BriteSpot ES 50	–
High-pressure sodium-vapour Lamps	HSE-E	50	E 27	4	ww	3500	NAV-E 50/E	SON 50 W-E	SHP 50 W/CO/E	LU 50/90/D/I
	HSE-E	70	E 27	4	ww	5600	NAV-E 70/E	SON 70 W-E	SHP 70 W/CO/E	LU 70/90/D/I
	HSE	150	E 40	4	ww	14000	NAV-E 150	SON 150 W	SHP 150 W	LU 150/100/D
	HSE	250	E 40	4	ww	25000	NAV-E 250	SON 250 W	SHP 250 W	LU 250/D
	HSE	400	E 40	4	ww	47000	NAV-E 400	SON 400 W	SHP 400 W	LU 400/D
	HST	70	E 27	4	ww	5900	NAV-T 70	SON-T 70W	SHP-TS 70W	LU 70/90/T
	HST	150	E 40	4	ww	14500	NAV-T 150	SON-T 150W	SHP-TS 150W	LU 150/100/T
	HST	250	E 40	4	ww	27000	NAV-T 250	SON-T 250W	SHP-TS 250W	LU 250/T
	HST	400	E 40	4	ww	48000	NAV-T 400	SON-T 400W	SHP-TS 400W	LU 400/T
	HST-DE	70	RX 7s	4	ww	6800	NAV-TS 70 SUPER	–	–	–
	HST-DE	150	RX 7s-24	4	ww	15000	NAV-TS 150 SUPER	–	–	–
	HST-DE	250	Fc 2	4	ww	25500	NAV-TS 250	–	–	–
	HST-DE	400	Fc 2	4	ww	48000	NAV-TS 400	–	–	–

lichtwerk

Sales and delivery conditions

1. General
1.1 These conditions of sale apply exclusively to companies, legal persons under public law or public law special assets in the sense of § 310 paragraph 1 BGB (German Civil Code). The following conditions of sale apply exclusively for all offers and contracts regarding the delivery of goods by Lichtwerk GmbH. They also apply for all future transactions with the Orderer when dealing with legal transactions of the related kind. The Orderer recognises the conditions as binding for him for all of the business relations. Modifications and amendments must be in written form. Conflicting or deviating terms and conditions of the Orderer are not terms of the contract, even if we do not expressly object to them. This will only be content of the respective contract in cases where we expressly approve the conflicting or deviating terms and conditions in writing.
1.2 We reserve our own rights of ownership, copyright and other intellectual property rights for all cost estimates, drawings and documents that are handed over to the Orderer during the contract negotiations. They may only be disclosed to third parties with our prior written permission. If an order is not issued, all transferred documents shall be returned immediately at our request. The Orderer does not have the right to use, retain or disseminate these documents.

2. Conclusion of the contract and scope of services
2.1 Our offers are not-binding and without obligation. In terms of the nature and scope of delivery, they will first be binding upon our written order confirmation. If an order is to be regarded as an offer according to § 145 BGB, we can accept this within two weeks by sending an order confirmation.
2.2 Verbal agreements, in particular supplementary agreements and commitments made by our employees, require our written confirmation to be effective.
2.3 For the delivery, we reserve the right to deviations of goods compared to the documents belonging to the offers, such as catalogues, illustrations, descriptions, drawings as well as weight and dimension information, provided they are commercial and reasonable for the Orderer and in particular do not impair quality and function.

3. Prices, deliveries and terms of payment
3.1 Prices and delivery
3.1.1 The prices are calculated in Euro exclusive of the legal VAT, which is invoiced separately according to the rate valid rate. The prices are calculated according to the prices valid at date of contract conclusion;if the delivery is made more than 4 months after contract conclusion, the prices valid at date of delivery can be invoiced.
3.1.2 Principally, prices shall be ex works excluding VAT, packaging, freight costs and insurance.
3.1.3 For a net order value of €1,500.00 or more, we deliver to the delivery location free of charge within Germany, whereby we provide the goods at the delivery location ready for unloading. Starting at € 750.00, we charge half of the transportation charges for a delivery location within Germany. For a net order value below € 250.00, we charge an additional small-volume surcharge of €25.00.
3.2 Terms of payment
3.2.1 Our invoices are to be paid within 30 days from the date of the invoice. For payment within eight days from the invoice date, we grant a 2 % discount. A payment is considered effected if we are able to access the funds. In the case of payment by cheque, payment is only considered effected when the cheque is redeemed by us.
3.2.2 The acceptance of cheques shall only be accepted on account of performance.
3.2.3 The Orderer's right of retention, as far as it is not based on the same contractual relationship, and the offsetting with contested or not legally determined claims is excluded.
3.2.4 If the Orderer is in default of payment as a whole or a part, he is bound - notwithstanding all other rights of the supplier - to pay from that point of time on default interests to the amount of 8 % annually above the base lending rate.
3.2.5 If the Orderer ceases payments or if bancruptcy is filed or mature checks or bills of exchange are not redeemed, all claims made by the supplier are immediately due.

4. Delivery times and acceptance obligations
4.1 The delivery period begins with the date of written agreement about the order between Orderer and supplier.
4.2 Hindrances beyond our responsibility, in particular acts of God, war, insurrection, strikes, transport disruptions, business disruptions, lack of material, official orders and other inevitable events that delay the delivery in whole or in part automatically lengthen the delivery period by the duration of such conditions. In such cases the parties have the right to withdraw from the contract in whole or in part.
4.3 In the event of a delayed delivery for which we are responsible, the Orderer can only assert his rights arising from the delay if the grace period he granted us has passed without result. If the Orderer proves in this case that he has incurred damages caused by the delay, he can claim a delay compensation for each completed week of the delay in the amount of 0.5% for the entire duration of the delay, but not to exceed 5% of the value of the goods not delivered on time. The right of the Orderer for exercising the right of withdrawal shall remain unaffected. Further-reaching claims shall only apply in cases of intend or gross negligence where liability is mandatory.
4.4 We are entitled to make reasonable installment deliveries.
4.5 If the Orderer causes a delay of dispatch or delivery of the goods or if the Orderer is otherwise in default in accepting the delivery of goods or should the Orderer intentionally violate other obligations to co-operate, we then have the right to claim compensation for any incurred damages in this respect, including any possible additional expenditure. Rights remain reserved for more extensive claims. Insofar as such aforesaid conditions apply, the risk of accidental loss or accidental detoriation of the purchased gods passes over to the Orderer at the precise point of time in which he is in default of acceptance or payment.

5. Dispatch, transfer of risk, returns
5.1 The risk is passed on to the Orderer when the goods leave the factory or a warehouse. Shipping takes place uninsured at the Orderer's risk. This also applies even if free delivery is agreed and also for deliveries by our transport staff. If the shipment is delayed as a result of circumstances for which the Orderer is responsible, the risk is transferred with our notification of readiness for shipment. If the shipment is delayed at the Orderer's request or at the fault of the Orderer, then we will store the goods at the Orderer's expense. The Orderer is required to check without delay whether the goods have been damaged during transportation and to immediately inform the carrier and deliverer of any damage or loss. Shipping takes place on behalf of the Orderer.
5.2 If the supplier has no statutory obligation to accept returned goods, the Orderer may only return goods with our express written consent and provided that they are undamaged and returned in the original packaging. 30% of the invoiced amount will be deducted from the credit note to cover processing costs. All reprocessing, freight, insurance and packaging costs are charged to the Orderer. Principally, it is not possible to return custom-made products.

6. Retention of Title
6.1 The goods remain our property until the fulfilment of all our entitled claims against the Orderer (goods subject to retention of title), even if the individual goods have been paid for. A pledge or chattel mortgage of the reserved goods is not permissible.
6.2 In the case of the permissible resale of the reserved goods within the ordinary course of business, the Orderer assigns us already now, until payment of all our claims, as collateral for its future claims towards his customers resulting of such resale without requiring any specific further explanations. This assignment also covers balance claims resulting from existing current account relationships or at their termination of the Orderer with his customers. If the reserved goods are sold together with other goods without agreeing upon an individual price for the reserved goods, the Orderer assigns us the priority over the other claims for such part of the total price claimed which corresponds to the value invoiced by us. Until revoked, the Orderer is authorized to collect the assigned demands from the resale, he is not entitled to dispose of them otherwise, e.g. by assignment. Upon our request, the Orderer must inform his customer about the assignment and to furnish us the necessary documents for the assertion of his rights towards the customer, e.g. to deliver invoices and to provide the required details.
6.3 If the purchasor does not meet all or a part of his payment obligations within 10 days after due date, if he does not cash due checks or if an application for insolvency is filed, we have the right to withdraw from the contract and to require the return of the goods. The purchasor is obliged to procure us with the possession of the goods. The Orderer grants us or any of our authorized representatives the access to all business premises during business hours. We are entitled to use the reserved goods with the diligence of a prudent businessman and to satisfy ourselves with the offsetting of open claims with their proceeds.
6.4 As long as the ownership has not been transferred, the Orderer is to inform us in writing immediately if the supplied item is seized or is exposed to other interventions by third parties. If the third party is unable to indemnify us for the costs of legal or out-of-court costs of a claim according to par. 771 ZPO (German Code of Civil Procedure), the Orderer is liable for our amount outstanding.

7. Warranty
7.1 We are liable for the defects of the goods (in the first instance under the exclusion of the Orderer's rights to back out of the contract or to reduce the purchase price) through rectification of the defect or replacement delivery at our choice. The Orderer shall grant us a reasonable time period to provide the rectification. If the supplementary performance does not work, the Orderer may basically according to his choice demand a cut of the compensation (decrease) or a cancellation of the contract. The improvement is considered failed after the second unsuccessful attempt, provided further improvement attempts are not appropriate due to the subject matter of the contract and are not reasonable to the Orderer. In case of a minor breach of contract, especially minor defects, the Orderer, however, does not have a right of cancellation.
7.2 Warranty rights of the Orderer require that the Orderer's obligations to make inspection and give notice of defects according to par. 377 HGB (German Commercial Code) have been properly fulfilled.
7.3 The Orderer must notify us concerning obvious defects within a period of 10 days after receipt of goods, otherwise the assertion of the warranty claim is excluded. Non-obvious defects must be claimed immediately when they are discovered or determined, otherwise they are deemed to be approved. For all presuppositions for claims he full burden of proof forlies with the Orderer, especially for the deficit itself, for the time period of the determination of the defect, and for the timeliness of the notice of defect.
7.4 If the Orderer, due to a deficiency in title or a material defect after failed subsequent performance, chooses to cancel the contract, he shall not be entitled to additional claims for damages due to the defect.
7.5 The warranty period amounts to one year from date of delivery of our goods to the Orderer.
7.6 The warranty obligation is void if the goods have suffered from improper handling or storage or if improper changes were made to them without the supplier's approval. We are not liable for subsequent changes to the lights, their internal circuitry, equipment or the lamps.
7.7 The condition of the goods only the product description of the manufacturer applies as agreed upon. Additional public statements or advertisements of the manufacturer do not represent a contractual statement on the nature of the goods.
7.8 In the event that the article of sale cannot be used by the Orderer as stipulated in the contract of sale as a result of negligent violation of collateral contractual duties, especially with regard to operating and maintenance instructions, we shall also be liable in accordance with paragraph 7.6. In case of consulting we can only be held responsible if special payment was agreed in writing.
7.9 Claims made by the Customer against the Supplier for installation and disassembly costs, unless they serve to detect errors, costs of disposal and costs for hoisting devices and scaffolding shall be excluded. The Customer shall bear the costs of the necessary recommissioning, software reinstallations or software updates. Where the Supplier meets its cost absorption obligation pursuant to Article 478 of the German Civil Code with respect to other expenses necessary for supplementary performance, the Supplier shall be entitled to pay such expenses by means of a credit note for goods. A right to compensation for damages to the goods themselves shall be excluded. This does not apply, as far as compelling liability is given in cases of intent, gross negligence, lack of guaranteed product properties or the Product Liability Act.

8. Limitation on Liability
8.1 As far as it is not expressly stipulated otherwise in these conditions, the claims against us, our legal representatives and any person employed by us in the performance of our obligation and any vicarious agent resulting from damages, including consequential damages, which occur to the Orderer or a third party, in particular such damages resulting from fault at contract conclusion, culpable breach of an obligation and negligent and impermissible actions are excluded.
8.2 The aforesaid limitations of liability shall not affect the Orderer's product liability claims. In addition, we are liable for loss of life, physical injury and damage to health (regardless of existing limitation of liability according to the statutory provisions) that are caused by a negligent or wilful breach of duty on our part, our legal representatives or our assistants. We are liable under statutory provisions for damages that are not covered by clause 1 and that are based on fraudulent intent by us, our legal representatives or our assistants.
8.3 The Orderer's claim for damages for defect becomes time-barred after one year from date of delivery of the goods to the Orderer. This shall not apply if we can be accused of malice. In these cases, the statutory provisions apply.

9. Data protection
According to § 33 of the German Data Protection Act, we point out that the Orderer's personal data is stored and processed by computer for the purpose of a proper business transaction.

10. Applicable law, place of jurisdiction
For these business relationships and all legal relationships between us and the Orderer, - including export contracts - the governing law of the Federal Republic of Germany applies exclusively. The application of the UN jurisdiction, concerning sales and purchase procedure, is excluded. If legally permissible, the place of jurisdiction for all disputes directly or indirectly resulting from a contractual relationship is, by our choosing, either Haßfurt or the court responsible for the Orderer's registered office. The place of fulfilment for deliveries and payments is also Haßfurt.
If individual conditions of the contract including these GTC are partially ineffective or will be, the validity of the other conditions are not affected by it. The whole or partial ineffective condition should be replaced by conditions, whose economic purpose comes as close as possible to the ineffective one.

Königsberg, September 2012

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