LIGHTING SOLUTIONS

Component Systems for Lighting Applications

STANDARD TECHNOLOGY
HIGH LEVEL STANDARD
HIGH QUALITY

For Discharge Lamps
Ballasts, Ignitors, Power Switches, Capacitors and Lampholders

For Fluorescent Lamps
Ballasts, Capacitors, Lampholders, Starter Lampholders, Terminal Blocks and Accessories

For Incandescent Lamps
Transformers and Lampholders

For Emergency Lighting
Emergency lighting modules, Rechargable Batteries and Supports

[UPDATE!]

Edition 2021

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LIGHT TECHNOLOGY PRODUCTS

Vossloh-Schwabe is not merely a manufacturer of top-quality components for the lighting industry, but above all a competent and innovative partner when it comes to providing the growing lighting market with cost-effective all-round solutions.

Featuring a future-proof component structure that already now satisfies both the requirements of energy-efficient lighting and European standards, VS' unique product range includes magnetic and electronic ballasts, state-of-the-art control systems (Blu2Light and LiCS), LED lighting systems and matching operating devices.

Employing in excess of 500 people in more than 20 countries, Vossloh-Schwabe is represented all over the world. VS can draw on extensive resources for R&D as well as for international expansion activities. A highly motivated workforce, comprehensive market knowledge, profound industry expertise as well as eco-awareness and environmental responsibility show Vossloh-Schwabe to be a reliable partner for the provision of optimum and cost-effective lighting solutions.

Vossloh-Schwabe's dedication to delivering superior quality is reflected in its ISO 9001 certification.

Vossloh-Schwabe is ready to embark on a collaborative journey into an economically illuminated future.

LED components are just as much a part of our product range as light control systems. Our extensive range of powerful LED modules, LED drivers, Blu2Light and LiCS controllers and sensors is presented on our website **www.vossloh-schwabe.com**.

We'll be happy to help you dimension your lighting project. Contact us.

NEW TECHNOLOGY LED HIGH QUALITY

PUMA Headquarters

Porsche Museum

PUMA Headquarters, Herzogenaurach

As the secret "capital of sport", the little German town of Herzogenaurach is home to the headquarters of the sport lifestyle company PUMA. Covering a total surface area of 50,000 square metres, the complex is made up of three buildings that are positioned so as to create a large central square, the PUMA Plaza.

The main aim of the lighting concept developed for the new PUMA corporate headquarters was to deliver optimum quality of light, enable maximum flexibility in using the available space and yield the greatest possible energy savings. No less than 985 electronic DALI ballasts and 4,650 standard electronic ballasts made by Vossloh-Schwabe went into implementing the lighting system.

The inner courtyard features additional red and white effect lighting in the form of ground-level linear markings created using LEDs made by Vossloh-Schwabe. These LEDs enable digital lighting sequences to flow over the square. To complement the clear-cut, rectilinear forms that characterise the entire building complex, a number of slender light columns, made of square aluminium sections, were installed to round off the courtyard's stylish appearance.

Photos: Markus Bollen

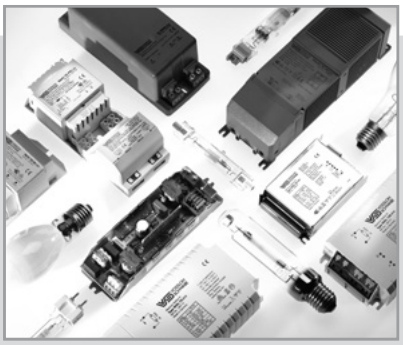
Porsche Museum, Stuttgart

The name "Porsche" both stands for a long tradition of outstanding quality and the excitement of high-octane driving. The Porsche Museum in Stuttgart constitutes a fitting presentation venue that does the brand image every justice. The architectural flagship thus serves to make the "Porsche experience" available to everyone.

The lighting installed in the Porsche Museum forms a crucial element of the exhibition space created for around 80 vehicles. It was important to ensure every detail of these high-end cars was clearly visible. In this regard, direct and reflecting lighting had to be reduced to an absolute minimum so as to neither irritate visitors, nor detract from the brilliant gloss of the bodywork.

This forms another instance in which Vossloh-Schwabe products have helped to add to the enjoyment of each and every visitor. Built-in electronic ballasts and electronic DALI safety converters ensure flicker-free, efficient light.

ELECTRONIC AND ELECTRO-MAGNETIC



ELECTRONIC AND ELECTROMAGNETIC OPERATING DEVICES

For high-pressure sodium lamps (HS), metal halide lamps (HI) and mercury vapour lamps (HM)

Electronic ballasts
Modern discharge lamps operate very efficiently in combination with electronic ballasts. The numerous advantages of using electronic ballasts to operate high-pressure discharge lamps are listed in more detail on the product pages.

With the help of temperature and service-life tests, VS electronic ballasts guarantee a high degree of reliability. The quality of the electronic ballasts is ensured by continuous in-circuit tests and function tests like burn-in tests.

Magnetic ballasts
The electrical specifications of VS' range of ballasts comply with lampspecific requirements. Vossloh-Schwabe attaches great importance to ensuring the impedance value of electromagnetic ballasts is kept within particularly narrow tolerances. This advantage, which is achieved by individual adjustment of the air gap during the automated production and testing process of every ballast, decisively contributes to optimising light output, light colour and service life of discharge lamps.

The range includes ballasts with variable voltage tapping points and varying degrees of inherent heating as well as encapsulated devices.

2 Ballasts for Discharge Lamps

For high-pressure sodium lamps (HS), metal halide lamps (HI) and mercury vapour lamps (HM)

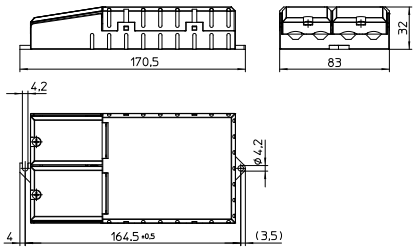
Electronic Ballasts for HI Lamps 35 and 70 W

Shape: M3/K34

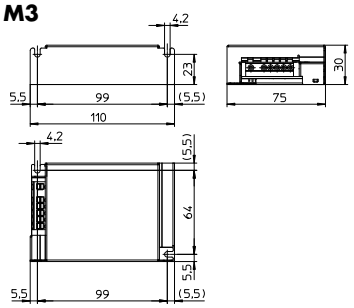
Casing: aluminium (M3),
heat-resistant polycarbonate (K34)
For ceramic discharge tube lamps (C-HI)
Power factor: ≥ 0.95
Ignition voltage: max. 5 kV
Operation frequency: 173 Hz
Push-in terminals with lever opener: 0.75–2.5 mm²
Total harmonic distortion: < 10%
Temperature protection
Constant power consumption
Protection against "no load" operation
For luminaires of protection class I (metal casing)
For luminaires of protection class I and II (plastic casing)
Degree of protection: IP20
Permissible load capacity: 20–120 pF
RFI-suppressed
Fixing brackets for screws M4
for base mounting
No flickering of defective lamps

K34 **M3**

K34 with cord grip



M3



Lamp				Electronic ballast								System
Output W	Type	Base	Power consumption W	Type	**Ref. No.**	Voltage AC 50, 60 Hz V ±10%	Mains current A	Energy efficiency	Ambient temperature t_a (°C)	Casing temperature t_c (°C)	Weight g	Output W
M3 – Electronic built-in ballast (with cap)												
35	HI	GU6.5, G8.5, GU8.5, GX8.5, G12, E27	1 x 39	EHXc 35.325	**183033**	220–240	0.20–0.18	A2	–20 to 65	max. 80	220	43
70	HI	G8.5, GU8.5, GX8.5, G12, PG12-2, E27, RX7s	1 x 73	EHXc 70.326	**183036**	220–240	0.36–0.34	A2	–20 to 55	max. 80	220	80
M3 Built-in PCB – Electronic built-in ballasts (without cap)												
35	HI	GU6.5, G8.5, GU8.5, GX8.5, G12, E27	1 x 39	EHXc 35.325	**183034**	220–240	0.20–0.18	A2	–20 to 65	max. 80	180	43
K34 – Independent electronic ballasts with cord grip												
35	HI	GU6.5, G8.5, GU8.5, GX8.5, G12, E27	1 x 39	EHXc 35.325	**183035**	220–240	0.20–0.18	A2	–20 to 65	max. 75	260	43
70	HI	G8.5, GU8.5, GX8.5, G12, PG12-2, E27, RX7s	1 x 73	EHXc 70.326	**183038**	220–240	0.36–0.34	A2	–20 to 55	max. 75	260	80

Circuit diagrams see page 56

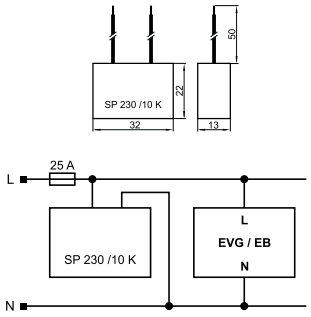
Luminaire Protection Device

For electronic devices
When electronic components form part of lighting systems, it is often necessary to protect such components against power-supply interruptions and electric overloads (power surges).

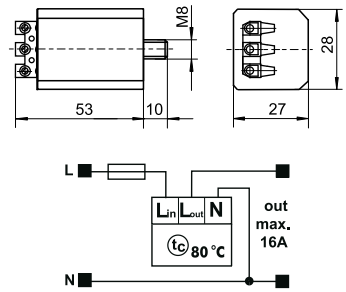
These can be caused by switching inductive loads or by atmospheric discharges such as lightning striking the mains or the ground. A further cause can be induced voltages from neighbouring cables when working with leading-edge phase-cutting controls.

The protection unit reduces over-voltages at the connection terminals of electronic components. The remaining residual voltage is then reduced to a respective protective level, based on the discharge current.

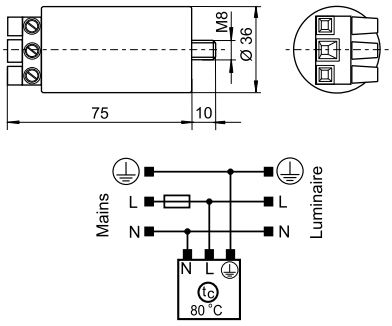
SP 230/10 K
Suitable for luminaires of protection class II
Type 3 product
With integrated thermal fuse
Dimensions (LxWxH): 32x22x13 mm
Weight: 20 g
Connecting: solid wire, length: 50 mm
Ref. No.: 147230



SPC 230/10 K
If the protective luminaire component overloads, the connected lighting circuit will be interrupted. This cut-out function makes it easier to detect the end of life of the protective component, facilitates quick replacement by maintenance staff and provides reliable protection for lighting components.
Suitable for luminaires of protection class II
Type 3 product
Dimensions (LxWxH): 53x28x27 mm
Weight: 50 g
Screw terminals: 0.5–1.5 mm²
Ref. No.: 142736



SP 3/230/10 K
Suitable for luminaires of protection class I
Type 3 product
Dimensions (ØxH): Ø 36x75 mm
Weight: 60 g
Screw terminals: 0.75–4 mm²
Ref. No.: 147233



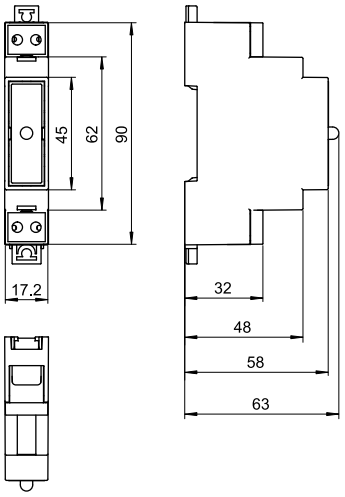
Type	**Ref. No.**	Voltage 50/60 Hz V ± 10 %	Max. load current A	Max. impulse voltage U_{OC} (V)	Discharge current* (8/20 µs) I_N (A)	$I_{max.}$ (A)	Protection level at discharge current of 1000 A	Safety max. A	Max. permitted casing temperature (°C)	Min. permitted ambient temperature (°C)	Fixation
SP 230/10 K	**147230**	220–240	–	10000	5000	10000	≤ 850 V	25	80	–30	–
SPC 230/10 K	**142736**	220–240	16	10000	5000	10000	≤ 850 V	16	80	–30	M8x10
SP 3/230/10 K	**147233**	100–277	–	10000	5000	10000	≤ 1000 V	25	80	–30	M8x10

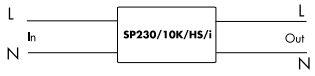
* Discharge current: at 5000 A min. 15 strikes; at 10,000 A min. 1 strike

Luminaire Protection Device – Type 3

For electronic devices
These protective components are fitted with an LED indicator. Once the end of the component's life has been reached, the green LED goes out and the protective component has to be replaced.

SP230/10 K/HS/i
The green LED light will go out if the protective function fails
Dimensions (LxWxH): 90x17.2x63 mm
Weight: 45 g
Screw terminals: 0.5–2.5 mm²
Fixation on DIN installation rail
Ref. No.:147240





Type	**Ref. No.**	Voltage 50/60 Hz V ±10 %	Max. load current (A)	Protection level at discharge current of 1000 A	Max. impulse voltage U_{OC} (V)	Discharge current* (8/20 µs) IN (A)	$I_{max.}$ (A)	Safety max. A	Max. permitted casing temperature °C	Fixation
SP230/10 K/HS/i	**147240**	220–240	16	≤ 1000 V	10000	5000	10000	16	–35 to 80	DIN-rail

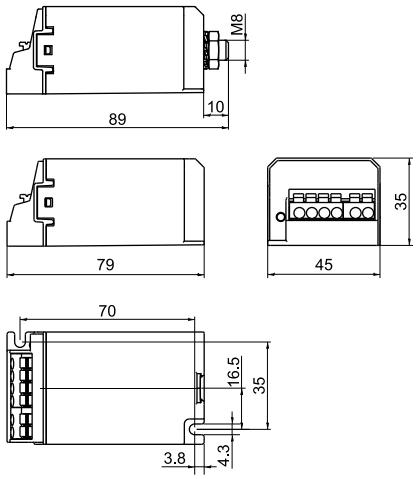
* Discharge current: at 5000 A min. 15 strikes; at 10,000 A min. 1 strike

Luminaire Protection Device – Type 3

For electronic devices

These protective components are fitted with internal thermal fuses. The protective component will be disconnect from the mains at the end of the internal varistors' life or if there is a permanently overvoltage.
In that case the green LED goes out and the protective component has to be replaced.

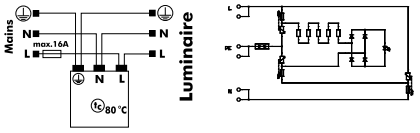
AC-system: TT-TN-IT
Temporary overvoltage
(TOV)-LV: 443 V AC (5 sec.) / 443 V (120 min.)
(TOV)-MV/HV: 1200 V AC (200 msec.)
I_{sccr}: 1000 A
With integrated thermal fuse
Dimensions (LxWxH): 79x45x35 mm



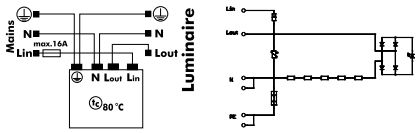
SP3/230/10K/i
Suitable for luminaires of protection class I
Push-in terminals: 0.5–2.5 mm²
Degree of protection: IP20
DEKRA approved acc. to EN 61643-11
Weight: 67/72 g
Ref. No.: 142743 without fixing threaded bolt
Ref. No.: 142744 with fixing threaded bolt

SPC3/230/20K/i
Suitable for luminaires of protection class I
Push-in terminals: 0.75–2.5 mm²
Degree of protection: IP20
Comply with the requirements of EN 61643-11
Weight: 55/60 g
Ref. No.: 142752 without fixing threaded bolt
Ref. No.: 142751 with fixing threaded bolt

SP3 230/10K/i



SPC3/230/20K/i



Type	Ref. No.	Voltage 50/60 Hz V ±10 %	Max. load current A	Protection level L-N (V)	L-PE (V)	N-PE (V)	Ipe µA	Max. impulse voltage U_{OC} (V)	Discharge current* (8/20 µs) I_N (A)	$I_{max.}$ (A)	Safety max. A	Max. permitted casing temp. °C	Fixing threaded bolt
SP3/230/10 K/i	**142743**	100–277	16	< 1500	< 1800	< 1800	1	10000	5000	10000	16	–35 to 80	without
SP3/230/10 K/i	**142744**	100–277	16	< 1500	< 1800	< 1800	1	10000	5000	10000	16	–35 to 80	with
SPC3/230/20 K/i	**142751**	100–277	16	< 1500	< 2200	–	1	20000	10000	20000	16	–35 to 80	with
SPC3/230/20 K/i	**142752**	100–277	16	< 1500	< 2200	–	1	20000	10000	20000	16	–35 to 80	without

* Discharge current: at $I_{N\ min.}$ 15 strikes; at $I_{max.}$ 1 strike

One-phase Luminair Protection Devices – Type 3 with Protection of Control Phase or DALI Interface

For electronic devices
These protective components are fitted with internal thermal fuses. The protective component will be disconnect from the mains at the end of the internal varistors' life or if there is a permanently overvoltage.
In that case the green LED goes out and the protective component has to be replaced.

SPC3/230/10K/i LS
One-phase overvoltage protection for control phase
Comply with the requirements of EN 61643-11
Weight: 69/79 g
Ref. No.: 142755

SPC3/230/10K/i LS DI
With integrated coordination circuit
Ref. No.: 142756

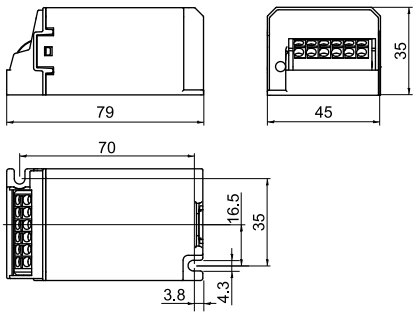
SPC3/230/10K/i DALI
One-phase overvoltage protection for L, N, PE and for protection of DALI signal
Comply with the requirements of EN 61643-11 and EN 61643-21
Weight: 57/67 g
Ref. No.: 142753

SPC3/230/10K/i DALI DI
With integrated coordination circuit
Ref. No.: 142754

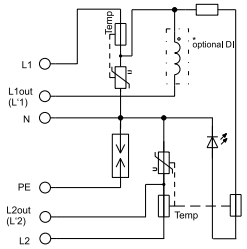
Suitable for luminaires of protection class I
Dimensions (LxWxH): 79x45x35 mm
Fixing threaded bolt on request
Push-in terminals: 0.2–2.5 mm²
Permitted casing temperature: –35 to 80 °C
With integrated thermal fuse
Fuse: max. 16 A
Max. residiual current (I_{PE}): 1 µA
Degree of protection: IP20

AC-system: TT-TN-IT
Temporary overvoltage
- (TOV)-LV: 443 V AC (5 sec.) / 443 V (120 min.)
- (TOV)-MV/HV: 1200 V AC (200 msec.)

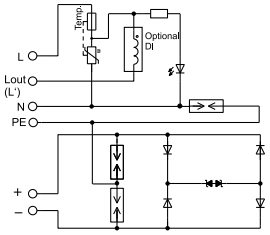
I_{sccr}: 1000 A



SPC3/230/10K/i LS



SPC3/230/10K/i DALI DI



Type	Ref. No.	Voltage 50/60 Hz	Max. load current	Protection level			Max. impulse voltage	Discharge current* (8/20 µs)		Protection voltage DALI d+ to d- Channel 1	d1/d2 to PE Channel 2	Capacity d+ to d-
		V ± 10 %	A	L-N (V)	L-PE (V)	L2-N (V)	U_{OC} (V)	I_N (A)	$I_{max.}$ (A)	0,5 kV/0,25 kA	10 kV/5 kA	pF
SPC3/230/10K/i LS	**142755**	100–277	5	< 1500	< 1900	< 1600	10000	5000	10000	–	–	–
SPC3/230/10K/i LS DI	**142756**	100–277	2.5	< 1500	< 1900	< 1600	10000	5000	10000	–	–	–
SPC3/230/10K/i DALI	**142753**	100–277	5	< 1500	< 1900	–	10000	5000	10000	< 70	< 1000	< 20
SPC3/230/10K/i DALI DI	**142754**	100–277	2.5	< 1500	< 1900	–	10000	5000	10000	< 70	< 1000	< 20

* Discharge current: at $I_{N\ min.}$ 15 strikes; at $I_{max.}$ 1 strike

Integrated Coordination Circuit
In contrast to standard protective components, the SPC3...DI components feature an integrated coordination circuit. Coordination means that the highest share of the energy applied to luminaires in the form of high-voltage pulses is discharged, which in turn ensures the protective components within the LED driver are subjected to only minimal voltage loads. This coordination can be checked by carrying out a high-voltage test on the luminaires.
A decoupling inductor is also available as a separate product, which must be wired in between the protective component and the LED driver.
Type: DI-5A
Ref. No.: 149830

Luminaire Protection Device – Type 2 and 3

For electronic devices
These protective components are fitted with an LED indicator. Once the end of the component's life has been reached, the green LED goes out and the protective component has to be replaced.
If the protective luminaire component overloads, the connected lighting circuit will be interrupted.

This cut-out function makes it easier to detect the end of life of the protective component, facilitates quick replacement by maintenance staff and provides reliable protection for lighting components.
Dimensions (LxWxH): 76x34x27 mm
Weight: 100 g, with integrated thermal fuse
DEKRA approved acc. to EN 61643-11

AC system: TT-TN-IT
Temporary overvoltage
- (TOV)-LV: 443 V AC (5 sec.) / 443 V (120 min.)
- (TOV)-MV/HV: 1200 V AC (200 msec.)

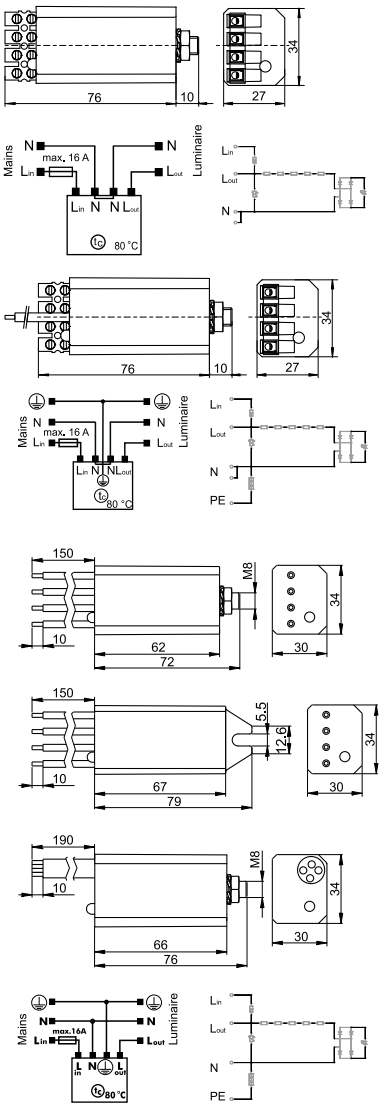
I_{sccr}: 4500 A

KEMA KEUR
Powered by DEKRA

SPC 230/10 K/i
Suitable for luminaires of protection class II
Screw terminals: 0.75–2.5 mm²
Degree of protection: IP20
Ref. No.: 142737

SPC 3/230/10 K/i
Suitable for luminaires of protection class I
Screw terminals: 0.75–2.5 mm²
Lead ground terminal: stranded conductors, 2.5 mm², silicone insulation, length: 150 mm
Degree of protection: IP20
Ref. No.: 142738
Earthing wire with M4 ring-tongue
Ref. No.: 142742

SPC 3/230/10 K/i-IP66
4 leads: stranded conductors, 2.5 mm², silicone insulation, length: 150 mm
Degree of protection: IP66
Ref. No.: 142748
Ref. No.: 142746 casing with fixing lug (no KEMA approval)
Ref. No.: 142747 with isolated cable with outer diameter approx. 12 mm (no KEMA approval)




142737 / 142738, 142742


142748, 142746


142747

Type	Ref. No.	Voltage 50/60 Hz V ±10 %	Max. load current (A)	Protection level L-N (V)	Protection level L-PE (V)	Ipe µA	Max. impulse voltage U_{OC} (V)	Discharge current* (8/20 µs) IN (A)	Discharge current* (8/20 µs) $I_{max.}$ (A)	Safety max. A	Max. permitted casing temp. °C	Fixation
SPC 230/10 K/i	**142737**	100–277	16	< 1500	—	–	10000	5000	10000	16	–35 to 80	M8x10
SPC 3/230/10 K/i	**142738**	100–277	16	< 1500	< 1800	1	10000	5000	10000	16	–35 to 80	M8x10
SPC 3/230/10 K/i	**142742**	100–277	16	< 1500	< 1800	1	10000	5000	10000	16	–35 to 80	M8x10
SPC 3/230/10 K/i-IP66	**142748**	100–277	16	< 1500	< 1800	1	10000	5000	10000	16	–35 to 80	M8x10
SPC 3/230/10 K/i-IP66	**142746**	100–277	16	< 1500	< 1800	1	10000	5000	10000	16	–35 to 80	lug
SPC 3/230/10 K/i-IP66	**142747**	100–277	16	< 1500	< 1800	1	10000	5000	10000	16	–35 to 80	M8x10

* Discharge current: at 5000 A min. 15 strikes; at 10,000 A min. 1 strike

Inrush Current Limiter ESB

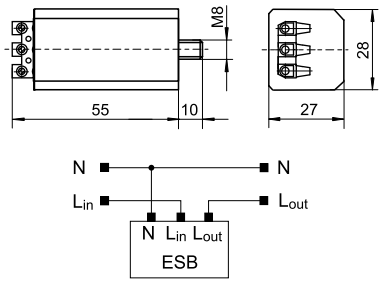
Limits capacitive inrush currents of electronic ballasts and LED drivers and converters

Due to their capacitive nature, electronic operating devices generate high inrush currents. By temporarily activating a limiting resistor, the inrush current is reduced to an uncritical value (see graph below).

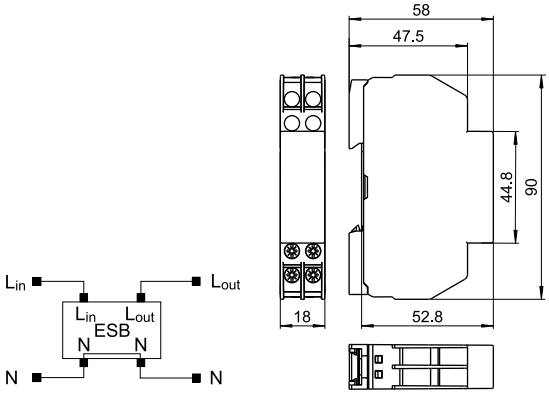
Several electronic devices can be connected downstream under consideration of the maximum permissible continuous current of the inrush current limiter. As a result, the load per circuit breaker (MCB) can be increased by at least 2.5 fold.

The ESB thus prevents any automatic circuit breakers from being triggered or any damage from being caused to upstream relay contacts.
Switching cycles: > 10,000

ESB-6K
Casing: PC
Dimensions (LxWxH): 55x28x27 mm
Weight: 61 g
Screw terminals: 0.5–1.5 mm²
VDE approved
Ref. No.: 149820
Ref. No.: 149822

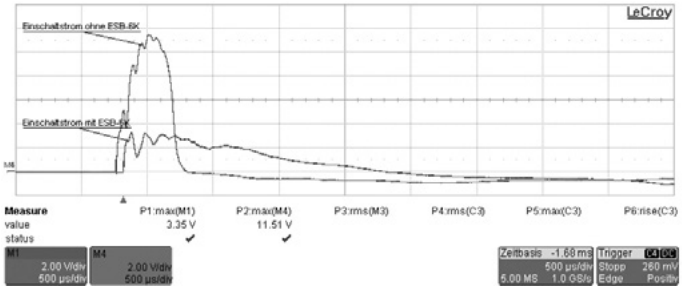


ESB-16HS
Casing: PC
Dimensions (LxWxH): 90x18x58 mm
Weight: 75 g
Screw terminals: 0.5–2.5 mm²
Ref. No.: 149821



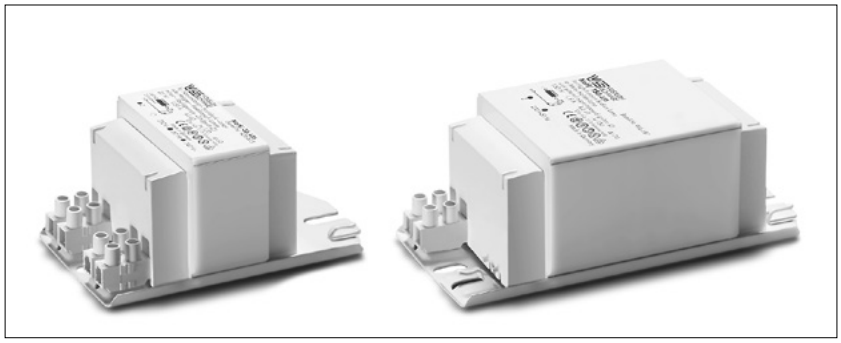
Type	**Ref. No.**	Nominal voltage 50–60 Hz V ± 10 %	Power consumption W	Max. direct current A	Limiting resistor Ω	Period of limitation ms	Max. permitted casing temperature (°C)	Min. permitted ambient temperature (°C)	Fixation
ESB-6K	**149820**	220–240	0.25	6	20	approx. 18	80	–30	M8x10
ESB-16HS	**149821**	220–240	0.6	16	11.2	approx. 18	80	–30	DIN-rail
ESB-6K_1A	**149822**	220–240	0.25	6	440	approx. 160	80	–30	M8x10

Example using a 150 W LED driver
Brown: with ICL (ESB)
Blue: without ICL (ESB)
1 V = 1 A

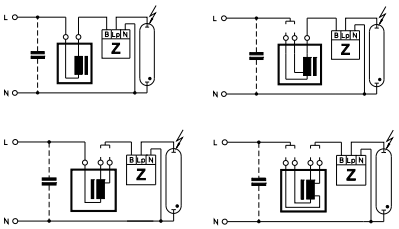


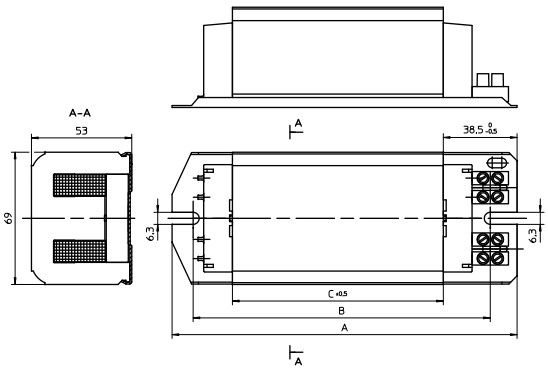
Standard Ballasts for HS and HI Lamps 35 to 250 W

Shape: 53x69 mm



For high pressure sodium lamps (HS),
metal halide lamps (HI) and
ceramic discharge lamps (C-HI)
Vacuum-impregnated with polyester resin
Screw terminals: 0.5–2.5 mm²
Protection class I
tw 130
Ballasts for pulse ignition system on request





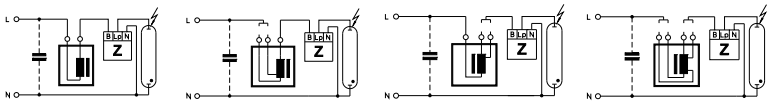
Lamp			Ballast										Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor λ	Energy efficiency	C_P µF	I_N A
35	HS, HI	0.53	NaHJ 35.485*	**571074**	230/240, 50	112	86	31	0.98	60	0.40	EEI=A3	6	0.22/0.21
			NaHJ 35.638	**570961**	220, 60	112	86	31	0.98	50	0.41	EEI=A3	5	0.23
50	HS, HI	0.76	NaH 50.486*	**571077**	230/240, 50	112	86	36	1.07	65	0.37	EEI=A3	8	0.30/0.29
			NaH 50.654	**570958**	220, 60	112	86	31	1.00	60	0.36	EEI=A3	8	0.31
70	HS, HI	0.98	NaHJ 70.300	**570977**	220, 50	112	86	36	1.12	75	0.40	EEI=A3	12	0.40
			NaHJ 70.128*	**571008**	230, 50	112	86	36	1.12	75	0.36	EEI=A3	12	0.38
			NaHJ 70.128*	**571022**	230/240, 50	112	86	36	1.15	75	0.36	EEI=A3	12	0.38/0.37
			NaHJ 70.128	**571018**	240, 50	112	86	36	1.15	75	0.37	EEI=A3	12	0.37
			NaHJ 70.653	**570962**	220, 60	112	86	36	1.05	75	0.42	EEI=A3	10	0.40
100	HS, HI	1.20	NaHJ 100.126	**570997**	220, 50	112	86	36	1.12	75	0.44	EEI=A3	12	0.55
			NaHJ 100.941*	**570964**	230/240, 50	112	86	36	1.15	75	0.42	EEI=A3	12	0.55/0.53
150	HS, HI	1.80	NaHJ 150.159	**571004**	220, 50	145	120	64	1.78	75	0.41	EEI=A3	20	0.80
			NaHJ 150.620*	**571013**	230, 50	145	120	64	1.83	75	0.40	EEI=A3	20	0.77
			NaHJ 150.620	**571019**	240, 50	145	120	64	1.85	75	0.40	EEI=A3	20	0.74
			NaHJ 150.679	**570999**	220, 60	145	120	64	1.72	75	0.44	EEI=A3	16	0.80
250	HS, HI	3.00	NaHJ 250.204	**571006**	220, 50	180	155	94	2.98	75	0.42	EEI=A3	32	1.32
			NaHJ 250.915*	**570963**	230, 50	180	155	110	2.95	80	0.40	EEI=A3	32	1.26
			NaHJ 250.340*	**570982**	230/240, 50	180	155	110	3.10	75	0.39	EEI=A3	32	1.26/1.21
			NaHJ 250.340	**570978**	240, 50	180	155	110	3.10	80	0.39	EEI=A3	32	1.21
			NaHJ 250.163	**571249**	220, 60	180	155	94	2.50	70	0.42	**A2**	25	1.35

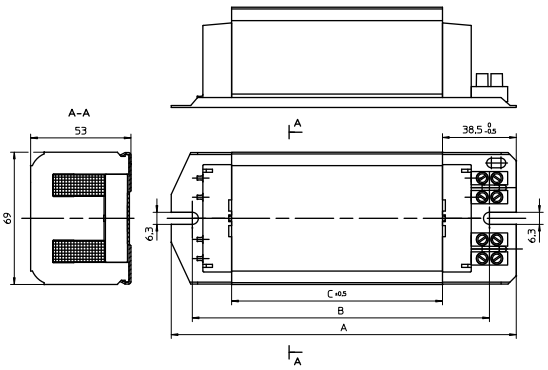
* Ballasts without CE marking for replacements or markets outside of the EU

Ballasts with Thermal Cut-out for HS and HI Lamps 35 to 250 W

Shape: 53x69 mm

For high pressure sodium lamps (HS),
metal halide lamps (HI) and
ceramic discharge lamps (C-HI)
Vacuum-impregnated with polyester resin
With temperature switch with automatic reset
Protection class I
tw 130





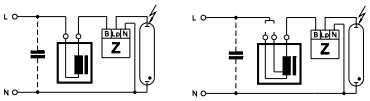
Lamp			Ballast											Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor (λ)	Energy efficiency		C_P µF	I_N A
Push-in terminals: 0.5–1.5 mm²															
35	HS, HI	0.53	NaHJ 35.209	**571076**	230/240, 50	112	86	36	1.10	35	0.36	**A2**		6	0.22
			NaHJ 35.485*	**571075**	230/240, 50	112	86	36	1.07	60	0.40	EEI=A3		6	0.22/0.21
50	HS, HI	0.76	NaHJ 70/50.157*	**571081**	230, 50	112	86	42	1.23	55	0.37	EEI=A3		8	0.30
70	HS, HI	0.98								70	0.37	EEI=A3		12	0.38
70	HS, HI	0.98	NaHJ 70.128*	**571009**	230, 50	112	86	36	1.12	75	0.36	EEI=A3		12	0.38
			NaHJ 70.226	**571011**	230, 50	112	86	41	1.28	60	0.37	**A2**		12	0.38
			NaHJ 70.158*	**570995**	230/240, 50	112	86	36	1.15	70	0.36	EEI=A3		12	0.38/0.37
150	HS, HI	1.80	NaHJ 150.995*	**570994**	230/240, 50	145	120	64	1.84	75	0.40	EEI=A3		20	0.77/0.74
Screw terminals: 0.5–2.5 mm²															
50	HS, HI	0.76	NaH 50.486*	**571078**	230/240, 50	112	86	36	1.07	65	0.37	EEI=A3		8	0.30
50	HS, HI	0.76	NaHJ 70/50.695*	**571085**	230/240, 50	112	86	48	1.23	50	0.37	EEI=A3		8	0.30/0.29
70	HS, HI	0.98								70	0.37	EEI=A3		12	0.38/0.37
70	HS, HI	0.98	NaHJ 70.226	**571012**	230, 50	112	86	41	1.28	60	0.37	**A2**		12	0.38
			NaHJ 70.128*	**571010**	230, 50	112	86	36	1.12	75	0.36	EEI=A3		12	0.38
			NaHJ 70.158*	**570975**	230/240, 50	112	86	36	1.15	70	0.36	EEI=A3		12	0.38/0.37
			NaHJ 70.128*	**571020**	230/240, 50	112	86	36	1.15	70	0.36	EEI=A3		12	0.38/0.37
100	HS, HI	1.20	NaHJ 100.213	**571031**	230/240, 50	112	86	45	1.38	65	0.41	**A2**		12	0.55/0.53
			NaHJ 100.941*	**571028**	230, 50	112	86	36	1.14	75	0.42	EEI=A3		12	0.55
			NaHJ 100.941*	**570980**	230/240, 50	112	86	36	1.15	75	0.42	EEI=A3		12	0.55/0.53
100	HS, HI	1.20	NaHJ 150/100.973*	**571244**	230, 50	145	120	75	2.02	55	0.41	**A2**		12	0.55
150	HS, HI	1.80								75	0.41	EEI=A3		20	0.77
150	HS, HI	1.80	NaHJ 150.166	**571025**	230/240, 50	180	155	110	3.08	50	0.40	**A2**		20	0.77/0.74
			NaHJ 150.620*	**571015**	230, 50	145	120	64	1.83	75	0.40	EEI=A3		20	0.77
			NaHJ 150.995*	**570974**	230/240, 50	145	120	64	1.84	75	0.40	EEI=A3		20	0.77/0.74
			NaHJ 150.620*	**571023**	230/240, 50	145	120	64	1.84	75	0.40	EEI=A3		20	0.77/0.74
250	HS, HI	3.00	NaHJ 250.915*	**570993**	230, 50	180	155	110	2.95	80	0.40	EEI=A3		32	1.26

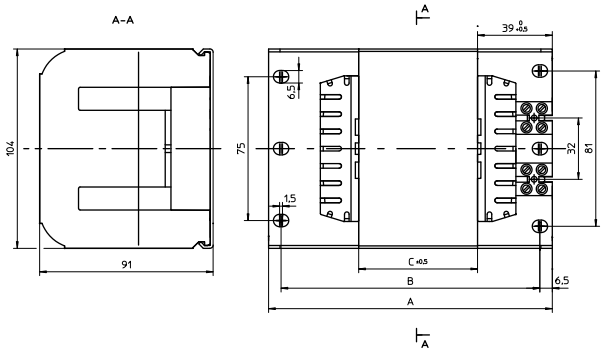
* Ballasts without CE marking for replacements or markets outside of the EU

Ballasts for HS and HI Lamps 250 to 1000 W

Shape: 91x104 mm

For high pressure sodium lamps (HS),
metal halide lamps (HI) and
ceramic discharge lamps (C-HI)
Vacuum-impregnated with polyester resin
Screw terminals: 0.75–2.5 mm²
Protection class I
tw 130





Lamp			Ballast										Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor λ	Energy efficiency	C_P µF	I_N A
250	HS, HI	3.00	NaHJ 250.727*	**571042**	230, 50	133	120	42	3.30	75	0.39	EEI=A3	32	1.26
			NaHJ 250.727	**571049**	240, 50	133	120	42	3.40	75	0.39	EEI=A3	32	1.21
400	HS, HI	4.45	NaHJ 400.006	**571044**	220, 50	148	135	62	4.57	75	0.44	**A2**	45	2.00
			NaHJ 400.006	**571047**	230, 50	148	135	62	4.57	80	0.44	**A2**	45	1.95
			NaHJ 400.737	**571054**	230/240, 50	148	135	62	4.7	75	0.45	**A2**	45	2.00/1.95
			NaHJ 400.737	**571050**	240, 50	148	135	62	4.61	80	0.43	**A2**	45	1.90
			NaHJ 400.012	**571057**	220, 60	148	135	68	4.45	75	0.44	**A2**	40	2.00
600	HS	6.20	NaH 600.010	**571045**	220, 50	173	160	96	6.78	75	0.44	**A2**	65	2.90
			NaH 600.005	**571055**	230/240, 50	173	160	96	6.89	75	0.44	**A2**	65	2.90/2.85
			NaH 600.140	**571058**	220, 60	173	160	96	6.79	75	0.46	**A2**	55	3.00
1000	HS	10.30	NaHJ 1000.089	**571043**	220, 50	248	235	160	11.31	75	0.47	**A2**	100	5.1
	HI	9.50								75	0.51	**A2**	85	5.0
	HS	10.30	NaHJ 1000.089	**571046**	230, 50	248	235	160	11.4	75	0.45	**A2**	100	5.1
	HI	9.50								75	0.49	**A2**	85	5.0
	HS	10.30	NaHJ 1000.089	**571051**	230/240, 50	248	235	160	11.57	75	0.45	**A2**	100	5.1
	HI	9.50								75	0.46	**A2**	85	5.0
	HS	10.30	NaHJ 1000.089	**571048**	240, 50	248	235	160	11.45	75	0.42	**A2**	100	4.8
	HI	9.50								75	0.46	**A2**	85	4.9
	HS	10.30	NaHJ 1000.089	**571056**	220, 60	248	235	160	11.13	75	0.46	**A2**	100	5.1
	HI	9.50								75	0.50	**A2**	85	5.0

* Ballasts without CE marking for replacements or markets outside of the EU

With Thermal Cut-out

Thermal cut-out with automatic reset

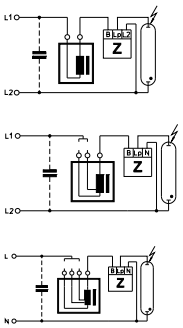
Lamp			Ballast										Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor λ	Energy efficiency	C_P µF	I_N A
250	HS, HI	3.00	NaHJ 250.727*	**571052**	230/240, 50	133	120	42	3.40	75	0.39	EEI=A3	32	1.26/1.21
400	HS, HI	4.45	NaHJ 400.737	**571053**	230/240, 50	148	135	62	4.7	75	0.43	**A2**	45	1.95/1.90

* Ballasts without CE marking for replacements or markets outside of the EU

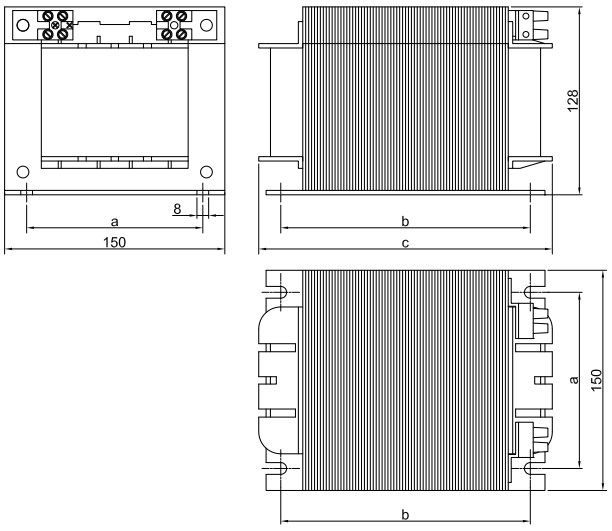
Ballasts for HI Lamps up to 2500 W

Shape: 150x150 mm

For metal halide lamps (HI)
Vacuum impregnated with polyester resin
Screw terminals: 0.75–4 mm²
For luminaires of protection class I
tw 130



For Short Arc Lamps

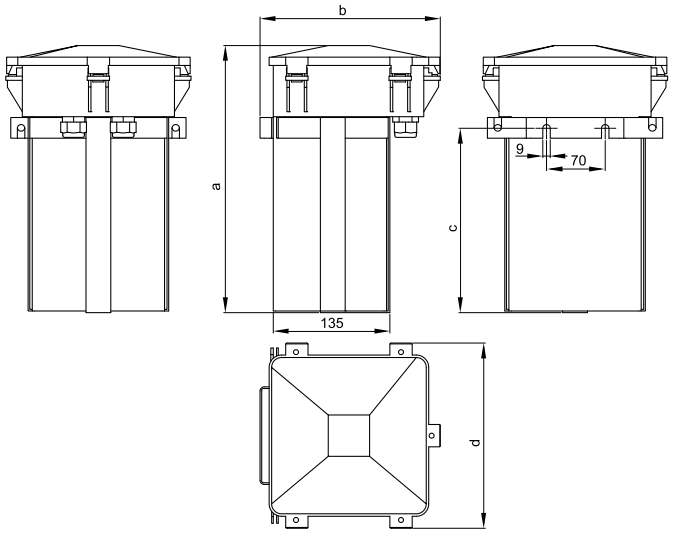


Lamp			Ballast										Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor λ	Energy efficiency	C_P µF	I_N A
2000	HI	8.8	J 2000.71	**554303**	380/400, 50	122	175	200	15	75	0.60	**A2**	37	6
			J 2000.72	**554304**	380/400/415, 50	122	135	160	14	70	0.58	**A2**	37	6
			J 2000.73	**554305**	380, 60	122	175	200	15	75	0.53	**A2**	30	6
2000	HI	10.3/11.3	JD 2000.81	**554270**	380/400, 50	122	175	200	15	80	0.53	**A2**	60	6
			JD 2000.81	**554306**	380/400/415, 50	122	135	160	14	75	0.52	**A2**	60	6
			JD 2000.83	**554283**	380, 60	122	175	200	15	75	0.54	**A2**	50	6
2000	HI	12.2	JD 2000II.91	**554307**	380/400, 50	122	175	200	16	80	0.46	**A2**	70	6
			JD 2000II.92	**554308**	380, 60	122	175	200	16	75	0.45	**A2**	60	6
2000	HI	16.5	JD 2000I.85	**554309**	230/240, 50	122	135	160	14	80	0.57	**A2**	125	10.5
			JD 2000I.86	**554310**	220, 60	122	135	160	14	80	0.57	**A2**	105	10
For Short Arc Lamps 1200 and 2500 W														
2500	HI	25.6	J 2500.96	**554312**	208, 60	122	175	200	16	—	0.44	**A2**	260	12.3
					230/245, 50							**A2**		

Ballast Units for HS and HI Lamps 1000 to 2000 W

Encapsulated in a plastic casing

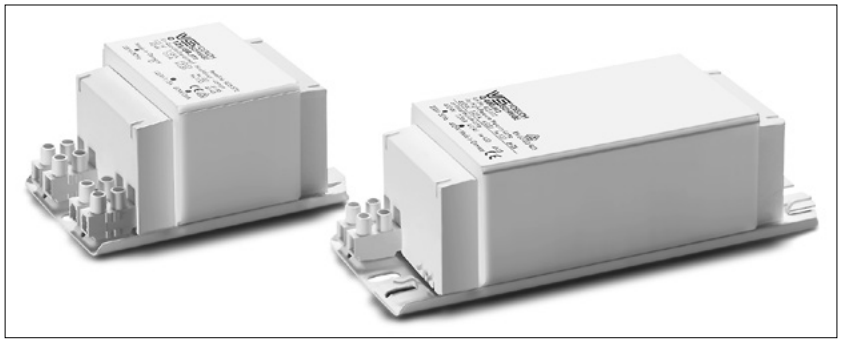
For high-pressure sodium vapour lamps (HS) and metal halide lamps (HI)
Fully encapsulated ballast unit in a self-extinguishing, fibre-glass-reinforced polyamide casing consisting of a ballast, capacitor, fuse and a ready-to-use, pre-wired connection terminal.
Cable feed using a PG thread fitting
Degree of protection: IP65
With double insulation
Screw terminals: 0.75–10 mm²
Protection class II
tw 130



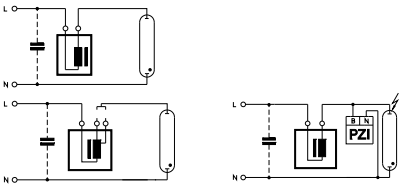
Lamp				Ballast unit									
Output W	Type	Current A	Mains current (A)	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	d mm	Weight kg	Power factor λ	Energy efficiency
230/240 V, 50 Hz and 380/400/415 V, 50 Hz													
1000	HS	10.3/11.3	5.75	VNaHJ 1000.75	**554313**	230/240, 50	288	217	–	220	15	> 0.90	**A2**
	HI	9.5	4.9										**A2**
2000	HI	8.8/9.2	5.7	VJ 2000.76	**554314**	380/400/415, 50	320	217	225	225	21	> 0.90	**A2**
		10.3/11.3	6.0	VJD 2000.77	**554315**	380/400/415, 50	320	220	225	225	23	> 0.90	**A2**
		12.2	6.0	VJD 2000I.78	**554316**	380/400/415, 50	320	220	225	225	25	> 0.90	**A2**
220 V, 60 Hz and 380 V, 60 Hz													
1000	HS	10.3/11.3	5.75	VNaHJ 1000.75	**554904**	220, 60	288	217	–	220	15	> 0.90	**A2**
	HI	9.5	4.9										**A2**
2000	HI	8.8/9.2	5.7	VJ 2000.76	**554905**	380, 60	320	220	225	225	21	> 0.90	**A2**
		10.3/11.3	6.0	VJD 2000.77	**554906**	380, 60	320	220	225	225	23	> 0.90	**A2**
		12.2	6.0	VJD 2000I.78	**554909**	380, 60	320	220	225	225	25	> 0.90	**A2**

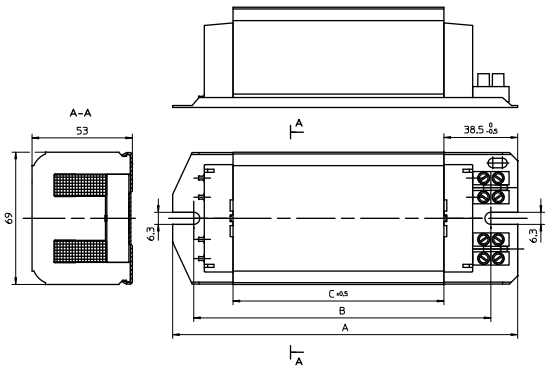
Ballasts for HM and HI Lamps 50 to 400 W

Shape: 53x69 mm



For mercury vapour lamps (HM) and
metal halide lamps (HI) with ignition voltage 1 kV
Vacuum-impregnated with polyester resin
Screw terminals: 0.5–2.5 mm²
Protection class I
tw 130





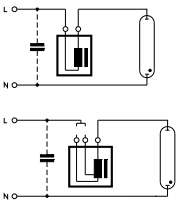
Lamp			Ballast										Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor λ	Energy efficiency	C_P µF	I_N A
50	HM	0.61	Q 80/50.551*	**570968**	230, 50	112	86	31	1.00	55	0.43	EEI=A3	7	0.27
80	HM	0.80								70	0.51	EEI=A3	8	0.41
80	HM	0.80	Q 80.510	**570965**	240, 50	112	86	31	1.00	60	0.48	EEI=A3	8	0.40
			Q 80.584	**570970**	220, 60	112	86	31	0.91	55	0.51	EEI=A3	7	0.43
80	HM	0.80	Q 125/80.611*	**571080**	230, 50	112	86	42	1.22	50	0.49	EEI=A3	8	0.41
125	HM	1.15								70	0.54	EEI=A3	10	0.60
125	HM	1.15	Q 125.549	**570976**	220, 50	112	86	31	0.94	75	0.56	EEI=A3	10	0.63
			Q 125.568*	**570969**	230, 50	112	86	36	1.10	75	0.54	EEI=A3	10	0.60
			Q 125.512	**570966**	240, 50	112	86	36	1.10	75	0.51	EEI=A3	10	0.58
			Q 125.598	**570981**	220, 60	112	86	31	0.94	75	0.57	EEI=A3	10	0.65
250	HM	2.13	Q 250.513	**570967****	220, 50	145	120	64	1.84	75	0.58	**A2**	18	1.26
			Q 250.528	**570972****	230, 50	145	120	64	1.86	75	0.56	**A2**	18	1.20
			Q 250.703	**570996****	240, 50	145	120	64	1.87	75	0.53	**A2**	18	1.15
			Q 250.606	**571003****	220, 60	145	120	64	1.75	75	0.58	**A2**	15	1.30
400	HM	3.25	Q 400.616	**571000****	220, 50	180	155	110	2.94	75	0.60	EEI=A3	25	2.00
			Q 400.612	**570971****	230, 50	180	155	110	3.00	75	0.56	**A2**	25	1.90
			Q 400.669	**570973****	240, 50	180	155	110	3.07	75	0.54	**A2**	25	1.85
			Q 400.613	**570998****	220, 60	180	155	94	2.54	75	0.60	**A2**	25	2.00

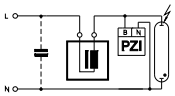
* Ballasts without CE marking for replacements or markets outside of the EU
** Suitable for metal halide lamps (HI) with ignition voltage 1 kV in combination with pulse ignitor PZI 1000/1 K

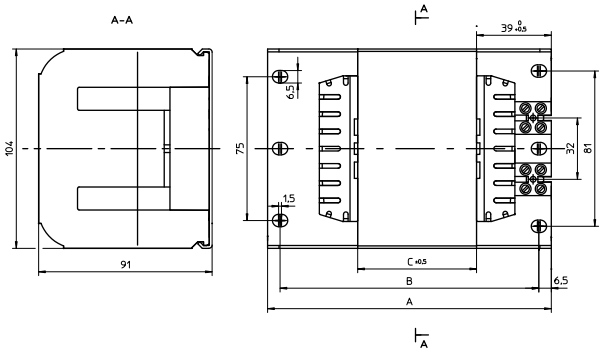
Ballasts for HM and HI Lamps 1000 W

Shape: 91x104 mm

For mercury vapour lamps (HM) and
metal halide lamps (HI) with ignition voltage 1 kV
Vacuum-impregnated with polyester resin
Screw terminals: 0.75–2.5 mm²
Protection class I
tw 130







Lamp			Ballast										Capacitor	
Output W	Type	Current A	Type	**Ref. No.**	Voltage AC V, Hz	a mm	b mm	c mm	Weight kg	Δt K	Power factor λ	Energy efficiency	C_P µF	I_N A
1000	HM	7.50	Q 1000.097	**571257***	220, 50	173	160	96	6.97	75	0.61	**A2**	60	4.80
			Q 1000.096	**571255***	230, 50	173	160	96	6.94	75	0.60	**A2**	60	4.80
			Q 1000.145	**571256***	240, 50	173	160	96	6.90	75	0.58	**A2**	60	4.60
			Q 1000.311	**571254***	220, 60	173	160	96	6.74	75	0.61	**A2**	50	5.00

* Suitable for metal halide lamps (HI) with ignition voltage 1 kV in combination with pulse ignitor PZI 1000/1 K

SUPERIMPOSED AND PULSE IGNITION

ELECTRONIC IGNITORS

Superimposed ignitors
Superimposed ignitors work independently of ballasts and generate defined ignition pulses during every half-wave within the stipulated voltage ranges. As the mains frequency only plays a subordinate role, these systems work equally well at 50 Hz and 60 Hz.

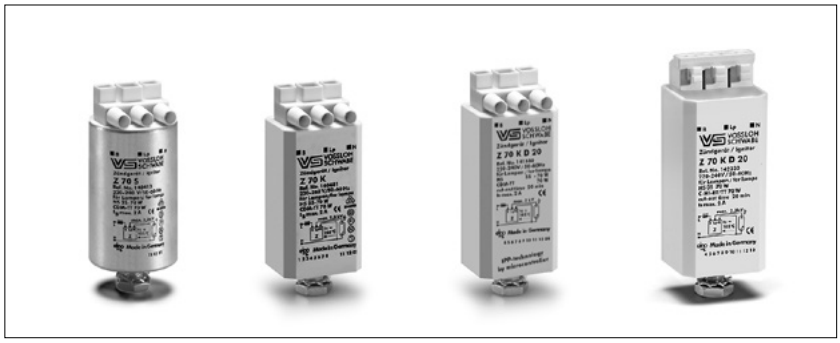
Superimposed ignitors should be mounted near the lampholder. The clearance needed between the ignitor and the lamp is determined by the respective maximum load capacitance, which is specified for each ignitor in the technical details. The capacitive load of the cable is dependent on its physical properties and wiring layout; this value usually ranges between 70–100 pF per metre.

Pulse ignitors
As pulse ignitors use the winding of an inductive ballast to generate the requisite pulse voltage, such ballasts must be designed to withstand these high ignition voltages.

On the following pages, Vossloh-Schwabe presents an extensive range of ignitors for all areas of application.

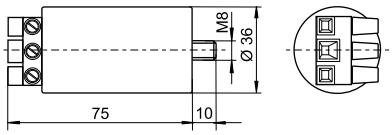
2 Ignitors and Accessories for Discharge Lamps

Electronic Superimposed Ignitors for HS Lamps up to 70 W

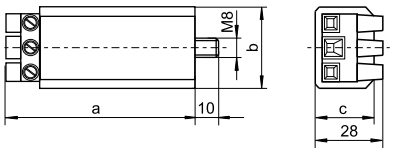


Standard version or with automatic switch-off
For high pressure sodium lamps (HS) and ceramic discharge lamps C-HI-TT/ET with base E27
Phasing of the ignition voltage:
60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II

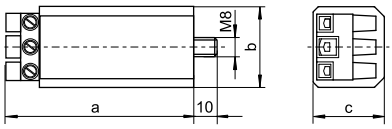
Al casing



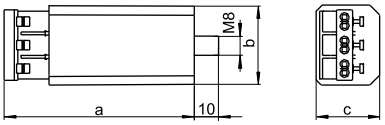
PC casing – K



PC casing – K D20



PC casing – with push-in terminals

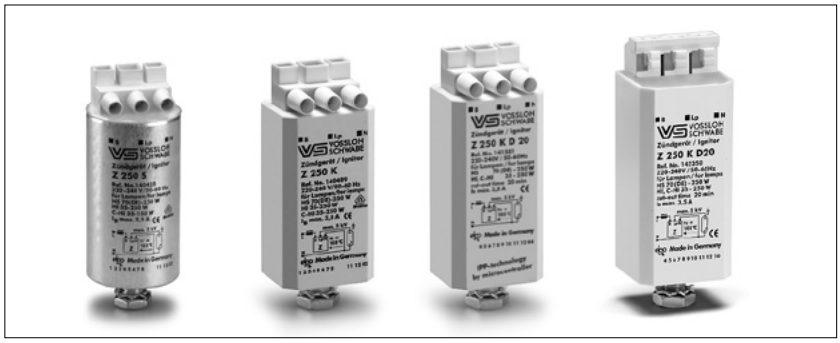


Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al) with screw terminals: 0.75–4 mm²													
Z 70 S	**140413**	220–240	2	< 0.6	< 5	1.8–2.3	20–200	–	35	76	–	–	135
Plastic casing (PC) with screw terminals: 0.75–4 mm²													
Z 70 K	**140481**	220–240	2	< 0.6	< 5	1.8–2.3	20–200	–	–	78	34	27	125
Z 70 K D20	**141580***	220–240	2	< 0.6	< 5	1.8–2.3	20–100	1216/50–60	–	80	34	30	145
Plastic casing (PC) with push-in terminals: 0.5–2.5 mm²													
Z 70 K D20	**142330***	220–240	2	< 0.6	< 5	1.8–2.3	20–100	1216/50–60	–	83	34	30	145

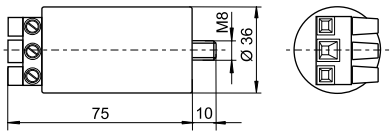
* With IPP technology

Electronic Superimposed Ignitors for HS Lamps 70 (DE) to 250 W and HI Lamps 35 to 250 W

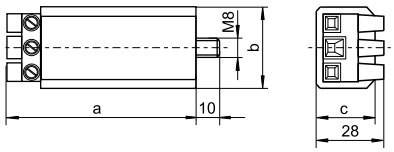
Standard version or with automatic switch-off
For high pressure sodium lamps (HS), metal halide lamps (HI) and ceramic discharge lamps (C-HI)
Phasing of the ignition voltage: 60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II



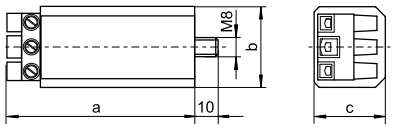
Al casing



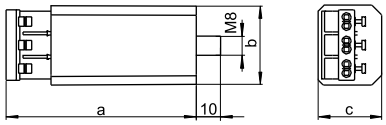
PC casing – K



PC casing – K D20



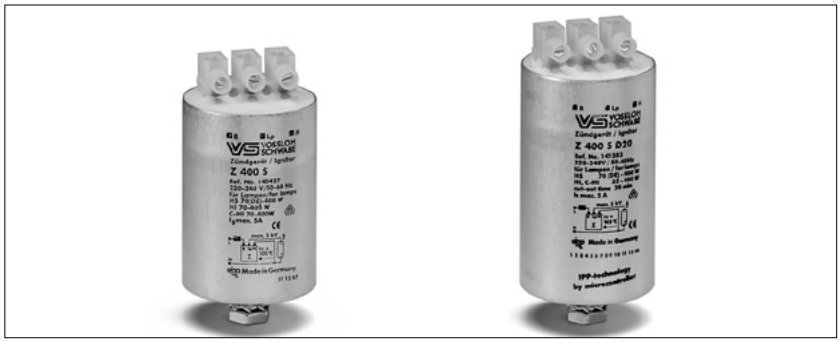
PC casing – with push-in terminals



Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al) with screw terminals: 0.75–4 mm²													
Z 250 S	**140425**	220–240	3.5	< 1.8	< 20	4–5	20–100	–	35	76	–	–	140
Plastic casing (PC) with screw terminals: 0.75–4 mm²													
Z 250 K	**140489**	220–240	3.5	< 1.8	< 20	4–5	20–100	–	–	78	34	27	130
Z 250 K D20	**141581***	220–240	3.5	< 1.8	< 20	4–5	20–100	1216/50–60	–	80	34	30	145
Plastic casing (PC) with push-in terminals: 0.5–2.5 mm²													
Z 250 K D20*	**142350***	220–240	3.5	< 1.8	< 20	4–5	20–100	1216/50–60	–	83	34	30	145

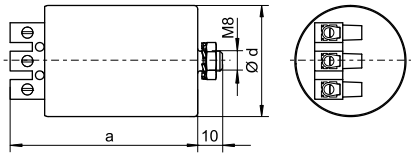
* With IPP technology

Electronic Superimposed Ignitors for HS Lamps 70 (DE) to 400 W and HI Lamps 35 to 400 W



Standard version or with automatic switch-off
For high pressure sodium lamps (HS), metal halide lamps (HI) and ceramic discharge lamps (C-HI)
Phasing of the ignition voltage: 60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Screw terminals: 0.75–4 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II

Al casing

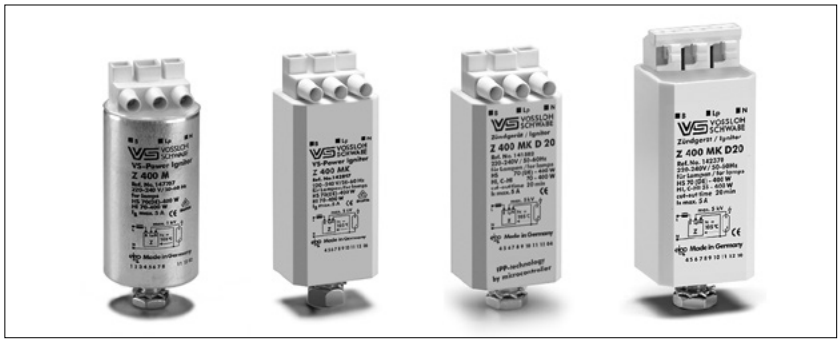


Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)													
Z 400 S	**140427**	220–240	5	< 3	< 25	4–5	20–100	–	45	76	–	–	250
Z 400 S D20	**141583***	220–240	5	< 3	< 25	4–5	20–100	1216/50–60	45	90	–	–	280

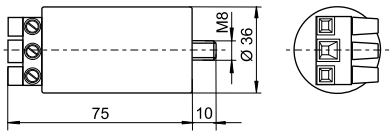
* With IPP technology

Electronic Superimposed Ignitors for HS Lamps 70 (DE) to 400 W and HI Lamps 35 to 400 W

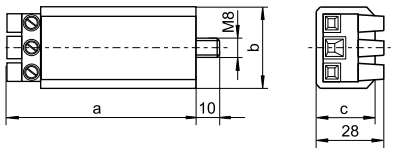
Standard version or with automatic switch-off
Compact shape
For high pressure sodium lamps (HS), metal halide lamps (HI) and ceramic discharge lamps (C-HI)
Ignition voltage: 4–5 kV
Phasing of the ignition voltage: 60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II
For luminaires of protection class I (140594, 147707)



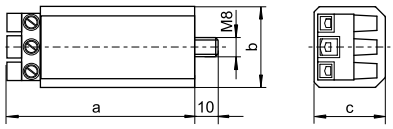
Al casing



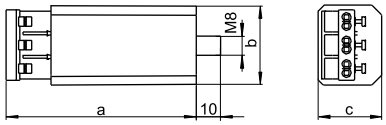
PC casing – K



PC casing – K D20



PC casing – with push-in terminals



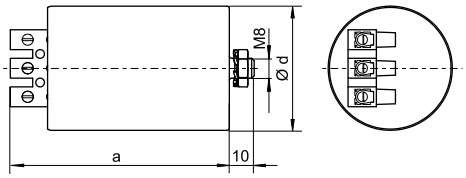
Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al) with screw terminals: 0.75–4 mm²													
Z 400 M	**140594**	220–240	5	< 3	< 35	4–5	20–50	–	35	76	–	–	140
Z 400 M VS-Power	**147707****	220–240	5	< 3	< 35	4–5	20–50	–	35	76	–	–	140
Z 400 M S	**140693**	220–240	5	< 3	< 35	4–5	20–50	–	35	76	–	–	140
Plastic casing (PC) with screw terminals: 0.75–4 mm²													
Z 400 M K	**140597**	220–240	5	< 3	< 35	4–5	20–50	–	–	78	34	27	130
Z 400 M K VS-Power	**142897****	220–240	5	< 3	< 35	4–5	20–50	–	–	78	34	27	130
Z 400 M K D20	**141582***	220–240	5	< 3	< 35	4–5	20–50	1216/50–60	–	80	34	30	145
Plastic casing (PC) with push-in terminals: 0.5–2.5 mm²													
Z 400 M K D20	**142370***	220–240	5	< 3	< 35	4–5	20–50	1216/50–60	–	83	34	30	145

Recommended for outdoor lighting
* With IPP technology
** Not suitable for C-HI lamps

Electronic Superimposed Ignitors for HS Lamps 600 and 750 W

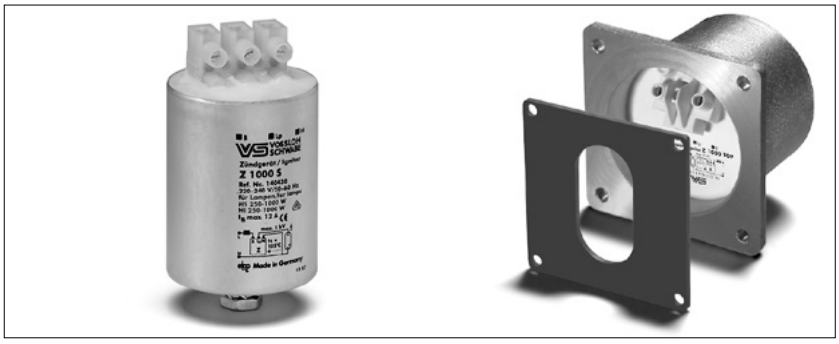
Standard version
For high pressure sodium lamps (HS)
Phasing of the ignition voltage:
60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Screw terminals: 0.75–4 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II

Al casing



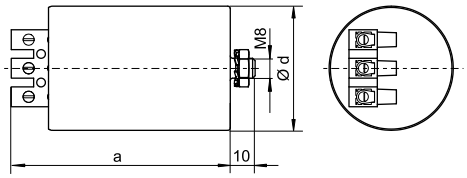
Type	**Ref. No.**	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)													
Z 750 S	**146990**	220–240	8	< 3	< 20	4–5	20–100	–	50	90	–	–	360

Electronic Superimposed Ignitors for HS and HI Lamps 250 to 1000 W

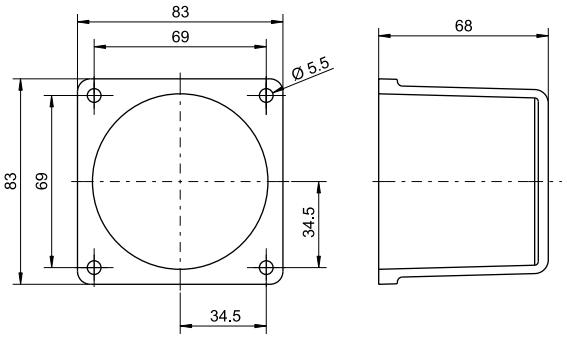


Standard version or with automatic switch-off
For high pressure sodium lamps (HS)
and metal halide lamps (HI)
Phasing of the ignition voltage:
60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Screw terminals: 0.75–2.5 mm²
(Z 1000 S: 0.75–4 mm²)
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II

Al casing



Z 1000 TOP



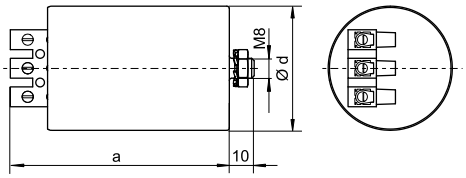
Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)													
Z 1000 S	**140430**	220–240	12	< 6	< 35	4–5	20–100	–	50	80	–	–	340
Z 1000 TOP	**140607****	220–240	12	< 6	< 35	4–5	20–100	–	–	83	83	68	620
Z 1000 S D20	**141584***	220–240	12	< 6	< 35	4–5	20–100	1216/50–60	50	80	–	–	340

* With IPP technology
** For flange-mounting with gasket for degree of protection IP55

Electronic Superimposed Ignitors for HS and HI Lamps up to 1000 W

Standard version
For high pressure sodium lamps (HS)
and metal halide lamps (HI)
For long lead lengths
Max. permitted casing temperature: 105 °C
Screw terminals: 0.75–2.5 mm²
Fastening: male nipple with pre-assembled washer and nut

Al casing



For HS and HI lamps 150 to 1000 W
Phasing of the ignition voltage: 60–90 °el
For luminaires of protection class I

Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)													
Z 1000 L	**140471***	220–240	12	< 6	< 35	4–5	20–2000	—	50	97	—	—	340

* Not suitable for HI lamps types NDL, WDL or for HS lamps types S, de-Luxe, Comfort or similar

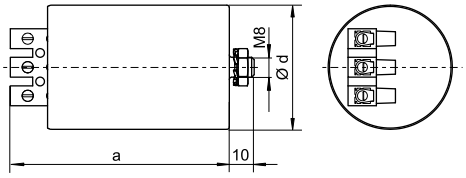
For HS lamps 600 to 1000 W/400 V
and HI lamps 1000 W/400 V
Phasing of the ignition voltage:
60–90 °el and 240–270 °el
For luminaires of protection class I and II

Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)													
Z 1000 S/400 V	**140496**	380–415	6	< 3.3	< 28	4–5	20–2000	—	45	84	—	—	295

Electronic Superimposed Ignitors for Projection Lamps up to 1200 W

Standard version
For high-pressure discharge lamps
Phasing of the ignition voltage:
60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Screw terminals: 0.75–2.5 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I

Al casing



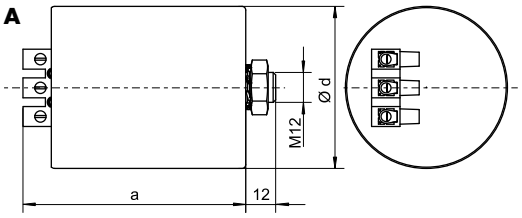
Type	**Ref. No.**	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)													
Z 1200/2.5	**140608***	220–240	15	< 7.5	< 40	2–2.5	20–200	–	50	80	–	–	330
Z 1200/9	**140609****	220–240	15	< 10	< 40	7–8	20–50	–	50	135	–	–	650

* For lamps, e.g. HSR, MSR, SN
** For lamps, e.g. HMI, HTI, CDI, RSI, CSR

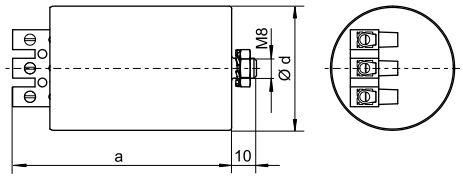
Electronic Superimposed Ignitors for HI Lamps up to 3500 W

Standard version
For metal halide lamps (HI)
Phasing of the ignition voltage:
60–90 °el and 240–270 °el
Max. permitted casing temperature: 105 °C
Screw terminals: 0.75–2.5 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I and II

A



B

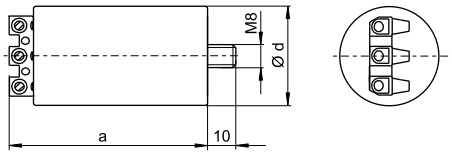


Type	Ref. No.	Voltage AC 50–60 Hz V	Max. lamp current A	Internal loss W	Inherent heating K	Ignition voltage kV	Load capacity pF	Switch-off time sec./Hz	Drawing	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)														
Z 2000 S	**140432**	220–240	20	< 6	< 30	4–5	20–100	–	A	65	96	–	–	640
Z 2000 S/400 V	**140497**	380–415	12.7	< 5	< 32	4–5	20–2000	–	B	50	88	–	–	340
Z 3500 S/400 V	**140499**	380–415	20	< 7	< 35	4–5	20–100	–	A	65	96	–	–	650

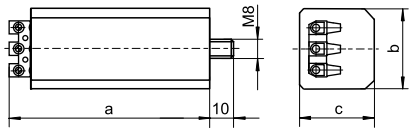
Pulse Ignitors for HS and HI Lamps up to 1000 W

With automatic switch-off
For high pressure sodium lamps (HS), metal halide lamps (HI) and ceramic discharge lamps (C-HI)
Max. permitted casing temperature: 95 °C
Screw terminals: 0.75–2.5 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I
This pulse ignitor is only for use with ballasts that have a dedicated tapping, as this determines the size of the ignition voltage.

Al casing



PC casing



For HS lamps 50 to 1000 W, HI lamps 35 to 1000 W and C-HI lamps 35 to 400 W

Type	Ref. No.	Voltage AC 50–60 Hz V	Number of ignition pulses per mains period	Ignition voltage kV	Load capacity pF	Programmed switch-off time sec./Hz	Casing a mm	b mm	c mm	Weight g
Plastic casing (PC)										
PZ 1000 K D20	**142784***	220–240 ±10%	≥ 2	1.8–2.3/4–5	20–1000	1216/50–60	74	34	27	100

With IPP technology
* Suitable ballasts (type: NaHJ...PZT) are available on request

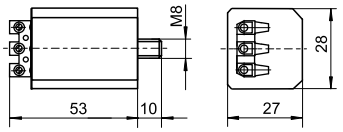
For HS lamps 600 to 1000 W/400 V and HI lamps 1000 W/400 V

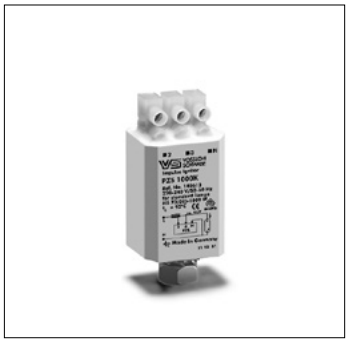
Type	Ref. No.	Voltage AC 50–60 Hz V	Number of ignition pulses per mains period	Ignition voltage kV	Load capacity pF	Programmed switch-off time sec./Hz	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Aluminium casing (Al)											
PZ 1000/400 V A5	**142783***	380–420	≥ 1	4–5	20–800	300/50	40	80	—	—	155

* Suitable ballasts (type: NaHJ...PZT) are available on request

Pulse Ignitors for HS Lamps 50 to 1000 W

Standard version
For standard high pressure sodium lamps (HS)
Max. permitted casing temperature: 95 °C
Screw terminals: 0.5–1.5 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I



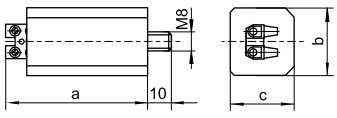


Type	Ref. No.	Voltage AC 50–60 Hz V	Number of ignition pulses per mains period	Ignition voltage kV	Load capacity pF	Programmed switch-off time sec.	Casing d (Ø) mm	a mm	b mm	c mm	Weight g
Plastic casing (PC)											
PZS 1000 K	**140613**	220–240	approx. 1/sec.	approx. 4	20–4000	—	—	50	28	27	50

Not suitable for HS lamps types Plus, Super, XL, HO
Suitable ballasts (type: NaH...P) are available on request

Pulse Ignitors for HI Lamps 250 to 2000 W, Ignition Voltage up to 1 kV

Standard version
For metal halide lamps (HI)
with ignition voltage of 0.9 kV
Max. permitted casing temperature: 95 °C
Screw terminals: 0.5–2.5 mm²
Fastening: male nipple with pre-assembled washer and nut
For luminaires of protection class I



Type	Ref. No.	Voltage AC 50–60 Hz V	Number of ignition pulses per mains period	Ignition voltage kV	Load capacity pF	Programmed switch-off time sec.	Casing a mm	b mm	c mm	Weight g
Plastic casing (PC)										
PZI 1000/1 K	**140617**	220–240	≥ 1	0.7–0.9	max. 10000	—	57	28	27	50

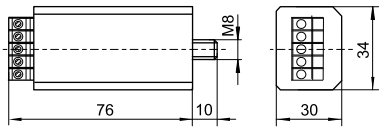
Electronic Power Switches for HS Lamps up to 600 W and HM Lamps up to 700 W

For high pressure sodium lamps (HS)
and mercury vapour lamps (HM)
For power reduction by using ballasts
with multiple voltage tapping and
superimposed ignitors
PR 12 K LC and PR 12 K D are also suitable for
power switching of LED drivers and electronic ballasts.
Casing: PC
Max. permitted casing temperature t_c: 80 °C
Screw terminals: 0.75–2.5 mm²
Fastening: male nipple with pre-assembled
washer and nut
For luminaires of protection class I and II
Circuit diagrams for power reduction
see pages 62–64.

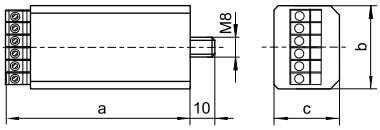
Advantages of PR 12 K LC

- intelligent, auto-adaptive concept
- eliminates the time-consuming task of continually adjusting the times of power-reduced operation to suit constantly changing day-night cycles
- removes the need for making adjustments due to daylight-saving times
- easy programming via dial
- no additional control line necessary
- optimal suitable for the supplementary integration into existing luminaires
- suitable for luminaires of protection class I and II

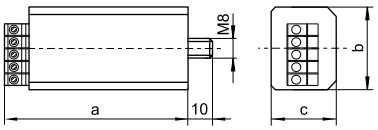
PU 12 K/PR 12 KD/PR 12 K LC



PU 120 K



PU 121 K



Type	Ref. No.	Voltage AC	Max. contact current		Inherent heating	Integrated delay	Control phase for power reduction	Casing			Weight
		V, Hz	A/λ	λA/λ	K	switching	(circuitry logic)	a mm	b mm	c mm	g
Power reduction with control phase											
PU 12 K	**140621**	230, 50 / 220, 60	8/0.5	12/1	< 25	—	disconnect or connect	74	34	27	100
PU 120 K	**140622***	230, 50 / 220, 60	8/0.5	12/1	< 10	327 sec.	disconnect	74	34	27	100
PU 121 K	**140623***	230, 50 / 220, 60	8/0.5	12/1	< 25	327 sec.	connect	74	34	27	100
Power reduction without control phase											
PR 12 K LC****	**142170****	220–230 ±10%, 50 220 ±10%, 60	8/0.5	12/1	< 12	selectable	without control phase	76	34	31	100
PR 12 K D****	**142150*****	220–230 ±10%, 50 220 ±10%, 60	8/0.5	12/1	< 12	selectable	without control phase	76	34	31	100

* For full-load lamp start
** Time of power-reduced operation selectable, starting point of switching-time changes automatically to suit constantly changing day-night cycles
*** Power reduction after a constant switching-time (delay switching); swichting-time selectable: 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 hrs at 50 Hz
**** 120–240 V ±10% on request

Switch Units for Electronic Operating Devices with 1–10 V Interface

Vossloh-Schwabe's switch units are designed to enable one-step power reduction of lamps (FL, CFL, LED, HS, HI and C-HI) with the help of the respective electronic ballast or converter.

To this end, the switch units utilises the 1–10 V interface of the control gear unit. The switch unit is mainly intended for outdoor luminaires in systems with or without a control phase.

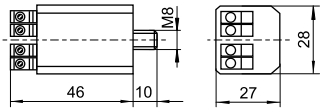
Shape: 56x28x27 mm
Casing: PC
Screw terminals: 0.75–2.5 mm²
Max. permissible casing temperature t_c: 80 °C
Min. permissible ambient temperature t_a: –30 °C
Fastening: plastic male nipple with pre-assembled washer and nut

Power reduction SU 1–10 V K for lighting systems featuring an L_{ST} control phase

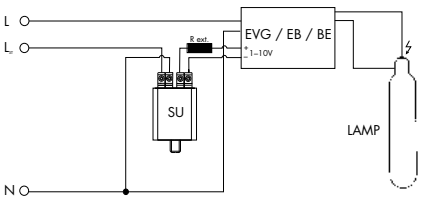
The switch unit employs a positive switching to reduce power, i.e. power is reduced when the control phase is switched off (L_{ST} = 0 V).
The 1–10 V interface of the electronic ballast is addressed at the moment that power reduction is effected.

Power reduction PR 1–10 V K LC for lighting systems without a control phase

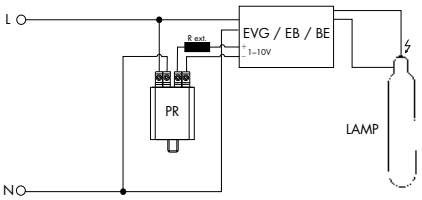
This switch unit can be used to effect power reduction in lighting systems that do not feature a control phase.
The 1–10 V interface is addressed on the basis of the fundamental operating principle used by Vossloh-Schwabe's PR 12 K LC power switch (details of which can be made available on request). This power switch is capable of determining the starting time of reduced-power operation over the measured operating time of a lighting system. As a result, it is no longer necessary to spend valuable time modifying the power-reduction unit to suit the continually changing day-night cycle; changing the clocks in line with daylight saving measures in the summer and winter is equally unnecessary. The 1–10 V interface of the electronic ballast is addressed as soon as the system is switched to reduced power.



Circuit diagram SU 1–10 V K



Circuit diagram PR 1–10 V K LC



Type	Ref. No.	Control voltage L_{ST} V, 50/60 Hz	Externally (on site) connected resistor ($R_{ext.}$) kΩ (min. 0.1 W)	Self-heating K	Weight g
For lighting systems with control phase					
SU 1–10 V K	**149992**	220–240 V ±10%	1–70	< 10	50
For lighting systems without control phase					
PR 1–10 V K LC	**149993**	–	1–70	< 10	50

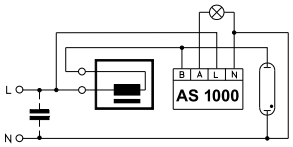
Start-up Switches for HS and HI Lamps 35 to 1000 W and HM Lamps 50 to 700 W

To bridge a phase of darkness during the starting-up period of high-pressure discharge lamps and also after a brief interruption of the power supply until the high-pressure discharge lamps are restarted

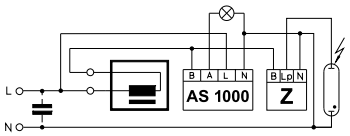
For mercury vapour lamps (HM),
high-pressure sodium lamps (HS),
metal halide lamps (HI) and
ceramic discharge lamps (C-HI)
For HS, HI and C-HI lamps only if used together with a superimposed ignitor
Nominal voltage/frequency:
220–230 V ± 10%/50–60 Hz
240 V ± 10%/50 Hz
Max. permitted casing temperature t_c: 85 °C
Screw terminals: 0.75–2.5 mm²
Fastening: male nipple with pre-assembled washer and nut
Max. wattage of incandescent lamp: 1000 W
Automatic switch-off at 60% of the discharge lamp's luminous flux

During the ignition and start-up period, the start-up switch activates an incandescent lamp to provide a basic level of lighting. After a brief interruption in the supply voltage during the re-ignition of the discharge lamp, the integrated control electronics also bridges the phase of darkness by switching on the auxilliary lighting. The incandescent lamp is automatically switched off when the discharge lamp has achieved a sufficient luminous flux (approx. 60%).

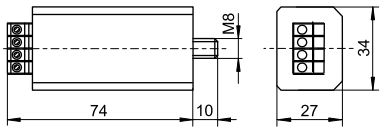
Circuit for HM lamps



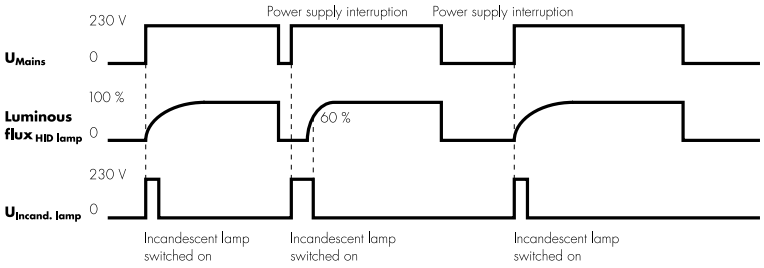
Circuit for HS and HI lamps



AS 1000 K
Casing: PC
Weight: 100 g
Internal loss: < 0.8 W
Inherent heating: < 10 K
Type: AS 1000 K
Ref. No.: 140627



The time diagram shows some typical switching examples of a luminaire equipped with a high-pressure discharge lamp, incandescent lamp and start-up switch AS 1000 K.



Electronic Discharge Units for Parallel Connected Capacitors 0.1 to 100 µF

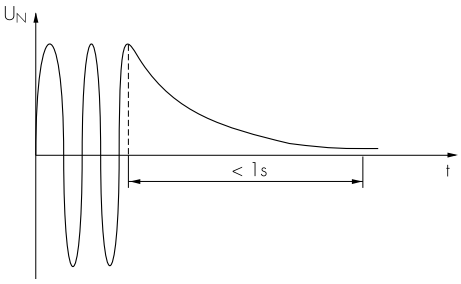
On luminaires with parallel compensation and designed for plug connection to the mains supply, the plugs retain their charge for a relatively long time after disconnection from the power supply. The discharge resistors built into the compensation capacitor are designed for stationary lamps and when disconnected from the mains permit a voltage reduction to 50 V after 1 minute at the earliest.

According to European standard EN 60598-1, the compensation capacitor on mobile lamps must be discharged to 34 V within 1 second. Until now so-called discharge chokes built like conventional ballasts have been used for this purpose. These conventional discharge chokes are connected in parallel to the compensation capacitor and after disconnection from the power supply rapidly discharge the capacitor owing to their low ohmic resistance.

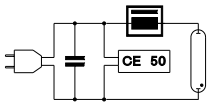
In their rated operating conditions, conventional discharge chokes exhibit a considerable inductive reactance which diminishes the effect of the compensation capacitor particularly if it has a low capacitance.

Furthermore, conventional discharge chokes cause considerable losses and feature high weight.

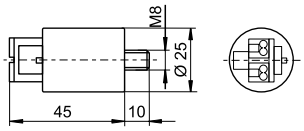
With the aid of the electronic discharge unit CE 50, it is possible to discharge a capacitor with a capacitance of up to 100 µF to 34 V within 1 second, i.e. within the time specified in EN 60598-1.



Thanks to its high reliability, low inherent losses, small dimensions and low weight, the CE 50 represents an inexpensive solution to the problem of capacitor discharge.



CE 50
All electronic, wear resistant switching element
Casing: aluminium
Nominal voltage: 34–264 V
Nominal frequency: 50–60 Hz
Internal loss: < 0.5 W
Inherent heating: < 6 K
Max. permitted casing temperature: 95 °C
Push-in terminals: 1 mm²
Fastening: male nipple with pre-assembled washer and nut
Weight: 40 g
Type: CE 50
Ref. No.: 140537



THERMOPLASTICS AND PORCELAIN

THE RIGHT MATERIAL MIX SPELLS A DECISIVE ADVANTAGE

The lampholders presented in this chapter are designed for high-pressure discharge lamps, for which high ignition voltages and high starting currents are characteristic. High temperatures can also occur with higher lamp outputs.

Vossloh-Schwabe therefore attaches great importance to ensuring casings, contacts and cables are made of high-grade materials.

Owing to the high ignition voltages, these lampholders are also governed by stricter requirements regarding creepage and air clearance distances.

When operating high-pressure discharge lamps with E27 and E40 Edison bases, care must be taken to ensure that the respective lampholders are approved for use with discharge lamps. Lampholders that are suitable in this respect are marked with "5 kV".

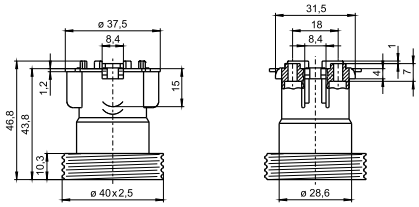
Lampholders with E26 and E39 bases and UL-approved wiring can be found under **www.unvlt.com/products/legacy/lampholders**.

2 Lampholders for Discharge Lamps

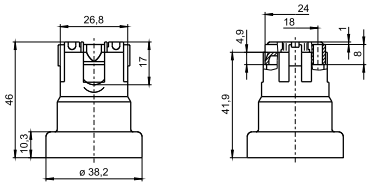
E27 Lampholders

For discharge lamps with base E27

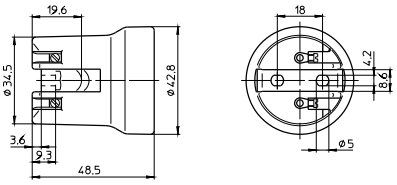
E27 lampholder, for cover caps (see p. 186–188)
Profiled shape, external thread 40x2.5 IEC 60399
Nominal rating: 4/250/5 kV
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 15/16.5 g, unit: 500 pcs.
Type: 64719
Ref. No.: 505720 LCP, black, T270



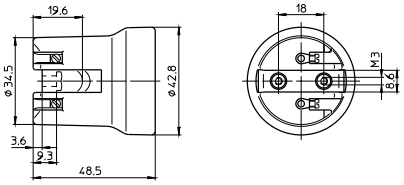
E27 lampholder, for cover caps (see p. 186–188)
Profiled shape, plain
Nominal rating: 4/250/5 kV
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 15 g, unit: 500 pcs.
Type: 64770
Ref. No.: 505014 LCP, black, T270



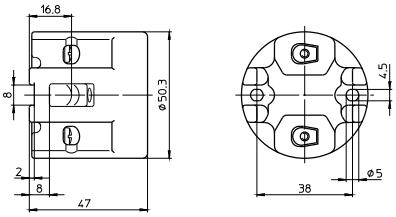
E27 lampholders
Casing: porcelain, white, T210
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Oblong holes for screws M4
Weight: 65/67.7 g, unit: 200 pcs.
Type: 62600
Ref. No.: 102635
Type: 62601 with lamp safety catch
Ref. No.: 102637

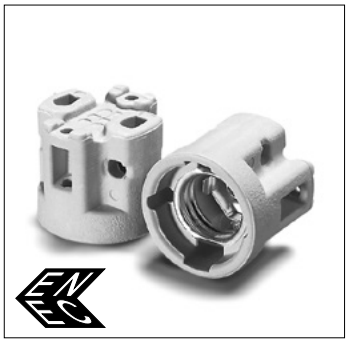


E27 lampholder
Casing: porcelain, white, T210
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Threaded bushes for screws M3
Weight: 69.3 g, unit: 200 pcs.
Type: 62622
Ref. No.: 108416

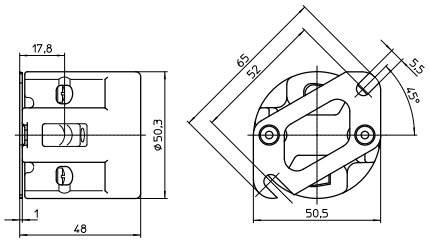


E27 lampholders
Casing: porcelain, white, T210
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Oblong holes for screws M4, length max. 15 mm
Weight: 106.8/103.9 g, unit: 100 pcs.
Type: 62104
Ref. No.: 102615
Type: 62105 with lamp safety catch
Ref. No.: 102617

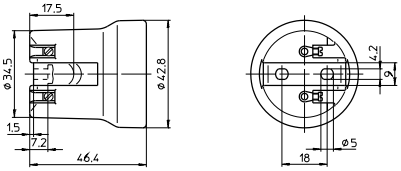




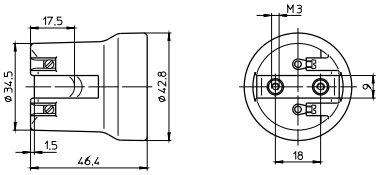
E27 lampholders
Casing: porcelain, white, T210
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing bracket with slot for screws M5
Weight: 113 g, unit: 100 pcs.
Type: 62110
Ref. No.: 106585
Type: 62111 with lamp safety catch
Ref. No.: 109568



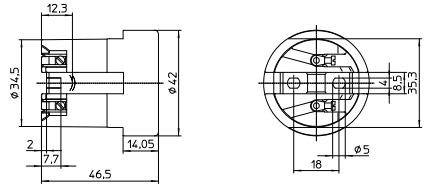
E27 lampholders
Casing: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screws M4
Weight: 60.6 g, unit: 200 pcs.
Type: 62050
Ref. No.: 102599
Type: 62010 with lamp safety catch (with spring)
Ref. No.: 102577
Type: 62009 with lamp safety catch (with crushing)
Ref. No.: 544605



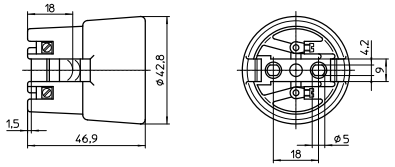
E27 lampholder
Casing: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fastening bushes for screws M3
Weight: 66.3 g, unit: 200 pcs.
Type: 62015
Ref. No.: 102582



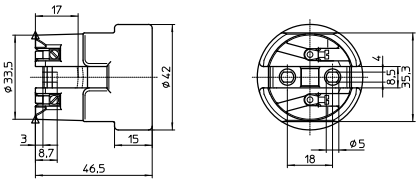
E27 lampholder, one-piece
Material: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screws M4
Weight: 60.5 g, unit: 200 pcs.
Type: 62070
Ref. No.: 543304



E27 lampholder, for cover caps (see page 186–188)
Casing: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screws M4
Weight: 66.5 g, unit: 150 pcs.
Type: 62310
Ref. No.: 102624



E27 lampholder
Casing: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screw M4
Weight: 66.5 g, unit: 200 pcs.
Type: 62370
Ref. No.: 543303

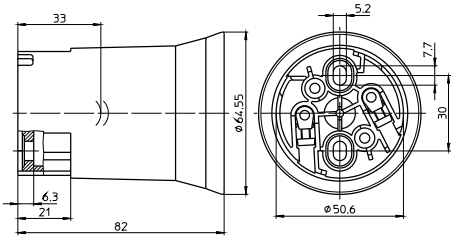


E40 Lampholders

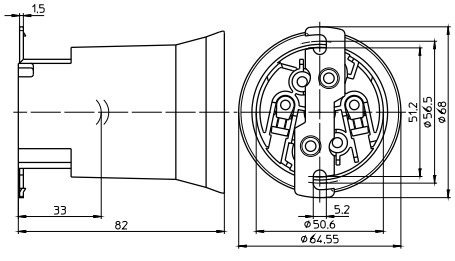
For discharge lamps with base E40

Nominal rating: 18/500/5 kV
Screw terminals: 1.5–4 mm²
Spring loaded central contact

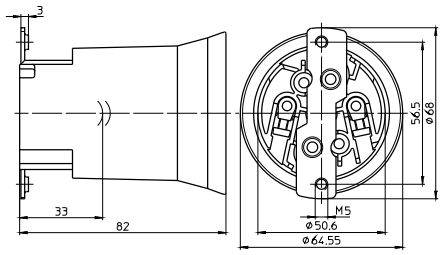
E40 lampholders
Casing: PPS, black, T240
Oblong holes for screws M5
Weight: 111.7/112.1 g, unit: 40 pcs.
Type: 12600/12601
Ref. No.: 400913
Ref. No.: 400914 with lamp safety catch
With steel thread
Ref. No.: 533428
Ref. No.: 533429 with lamp safety catch



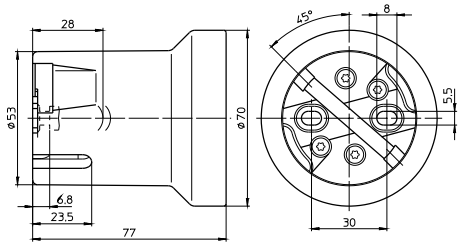
E40 lampholders
Casing: PPS, black, T240
Fixing bracket with slots for screws M5
Weight: 122.3/122.7 g, unit: 40 pcs.
Type: 12610/12611
Ref. No.: 400915
Ref. No.: 400916 with lamp safety catch
With steel thread
Ref. No.: 533430
Ref. No.: 533431 with lamp safety catch



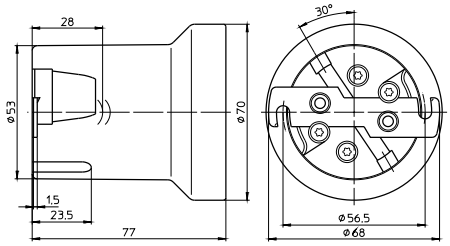
E40 lampholders
Casing: PPS, black, T240
Fixing bracket with tapped fixing holes M5
Weight: 122.9/123.3 g, unit: 40 pcs.
Type: 12614/12612
Ref. No.: 400917
Ref. No.: 400918 with lamp safety catch
With steel thread
Ref. No.: 536220
Ref. No.: 533432 with lamp safety catch



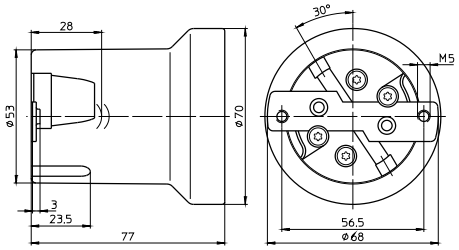
E40 lampholders
Casing: porcelain, white, T270
Oblong holes for screws M5
Weight: 224/229.3 g, unit: 48 pcs.
Type: 12800/12801
Ref. No.: 108208
Ref. No.: 107780 with lamp safety catch
With steel thread
Ref. No.: 532602
Ref. No.: 532603 with lamp safety catch

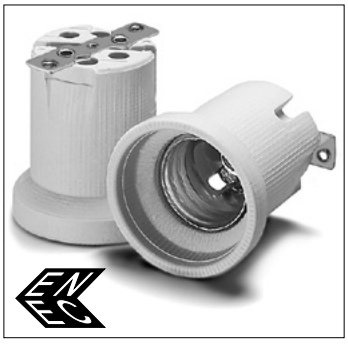


E40 lampholders
Casing: porcelain, white, T270
Fixing bracket with slots for screws M5
Weight: 252.3/243 g, unit: 48 pcs.
Type: 12810/12811
Ref. No.: 108374
Ref. No.: 108375 with lamp safety catch
With steel thread
Ref. No.: 532604
Ref. No.: 532605 with lamp safety catch

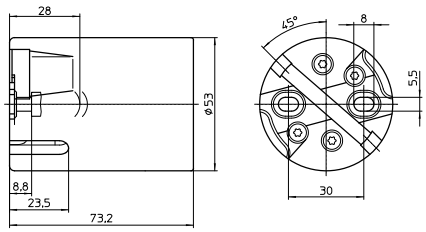


E40 lampholders
Casing: porcelain, white, T270
Fixing bracket with tapped fixing holes M5
With lamp safety catch
Weight: 252.8 g, unit: 48 pcs.
Type: 12812
Ref. No.: 108373
With steel thread
Ref. No.: 532606

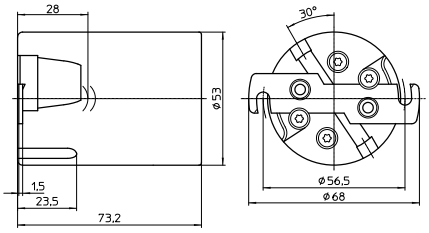




E40 lampholders
Only for lamps with base E40/E45
Casing: porcelain, white, T270
Oblong holes for screws M5
Weight: 206 g, unit: 50 pcs.
Type: 12900/12901
Ref. No.: 528252
Ref. No.: 528958 with lamp safety catch



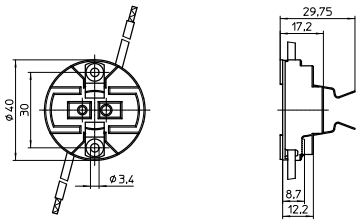
E40 lampholders
Only for lamps with base E40/E45
Casing: porcelain, white, T270
Fixing bracket with slots for screws M5
Weight: 217 g, unit: 50 pcs.
Type: 12910/12911
Ref. No.: 528253
Ref. No.: 528254 with lamp safety catch



GY9.5 Lampholders

For discharge lamps with base GY9.5

GY9.5 lampholder
Casing: ceramic, cover plate: PPS, black
T240, nominal rating: 10/500/5 kV, contacts: Ni
Leads: Cu tinned, stranded conductors
5 kV: 1 mm², Si-insulation max. Ø 3.6 mm, length: 300 mm and Cu tinned, stranded conductors 0.75 mm², Si-insulation, length: 300 mm
Fixing holes for screws M3
Weight: 48 g, unit: 150 pcs.
Type: 37001
Ref. No.: 533663

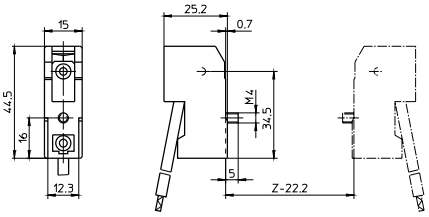


RX7s Lampholders

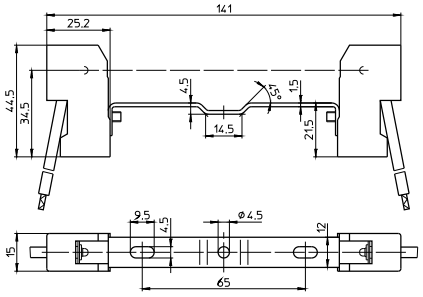
If the central hole on the bracket is used for fixing it has to be ensured by an additional support within the luminaire that the bracket cannot be deformed. If the lampholders are used for lamps with ignition voltage max. 20 kV the luminaire manufacturer is responsible for sufficient creepage distances and clearances.

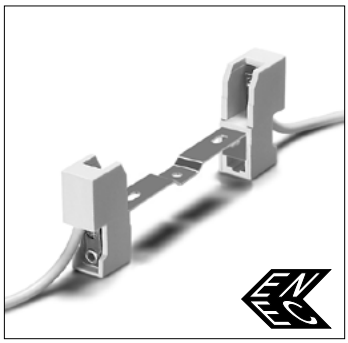
Remark on lampholders type 323:
The luminaire design must ensure protection from electric shock as well as sufficient creepage distances and clearances from live parts on the back of lampholder.

Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Lead: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Fixing screw M4
Weight: 26.2 g, unit: 300 pcs.
Type: 32301
Ref. No.: 100913

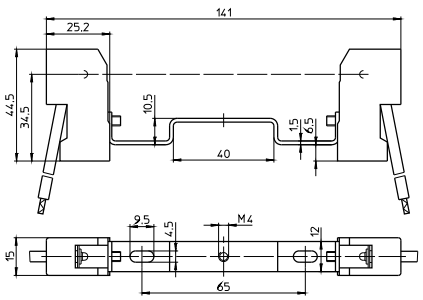


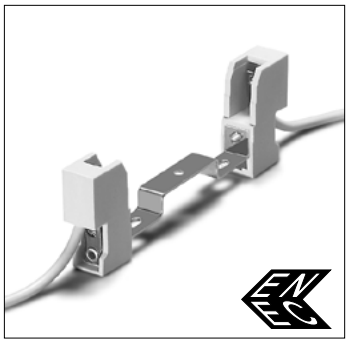
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central hole for screw M4
Weight: 74.8 g, unit: 200 pcs.
Type: 32311 contact distance: 114.2 mm
Ref. No.: 100921



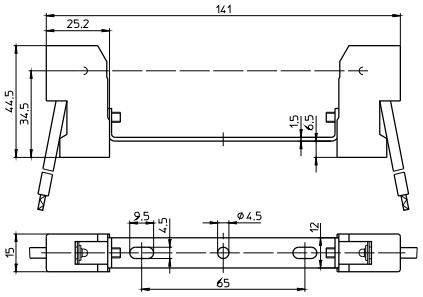


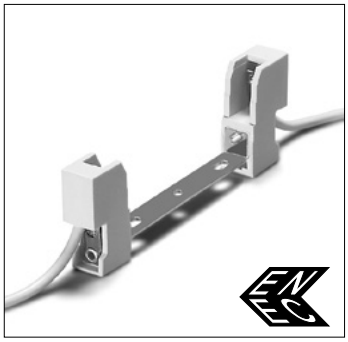
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central tapped holes M4
Weight: 76 g, unit: 200 pcs.
Type: 32321 contact distance: 114.2 mm
Ref. No.: 100922



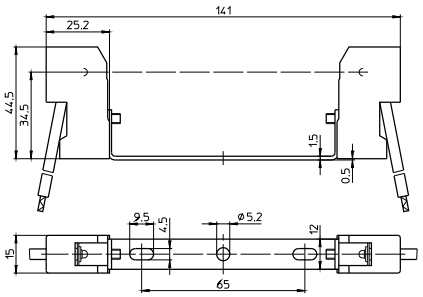


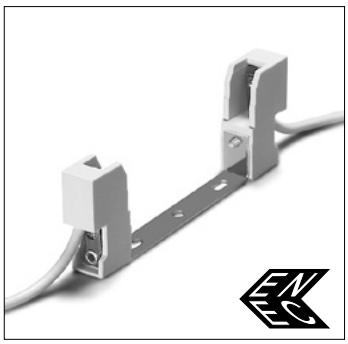
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central hole for screw M4
Weight: 74 g, unit: 200 pcs.
Type: 32341 contact distance: 114.2 mm
Ref. No.: 100932



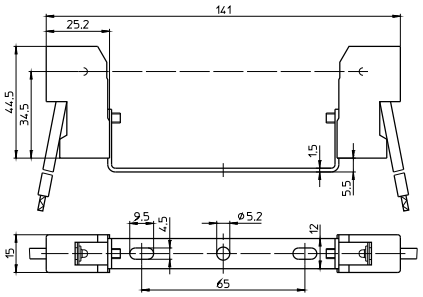


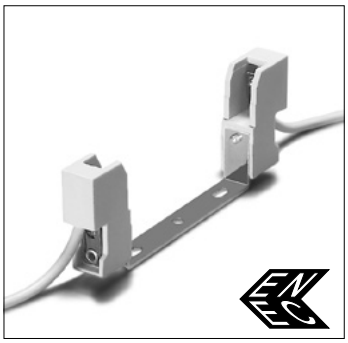
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central hole for screw M5
Weight: 75.5 g, unit: 200 pcs.
Type: 32361 contact distance: 114.2 mm
Ref. No.: 100934



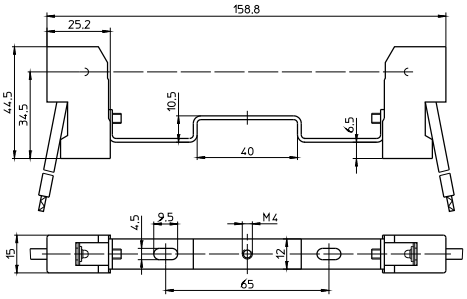


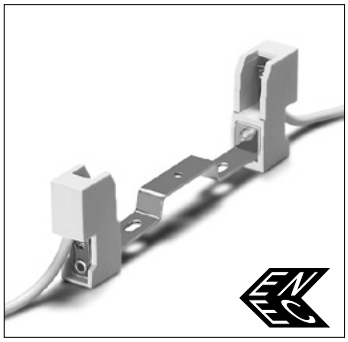
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central hole for screw M5
Weight: 76.4 g, unit: 200 pcs.
Type: 32381 contact distance: 114.2 mm
Ref. No.: 100937



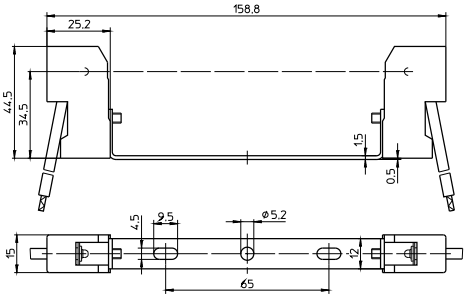


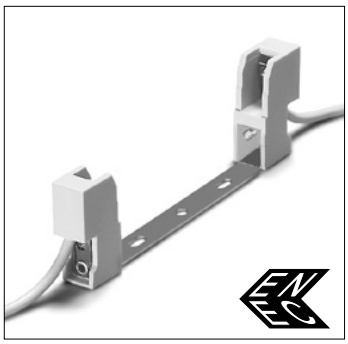
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central tapped hole M4
Weight: 78.3 g, unit: 200 pcs.
Type: 32326 contact distance: 132 mm
Ref. No.: 100925



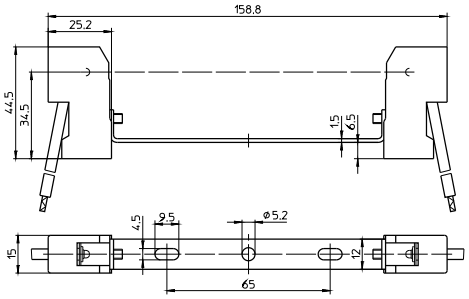


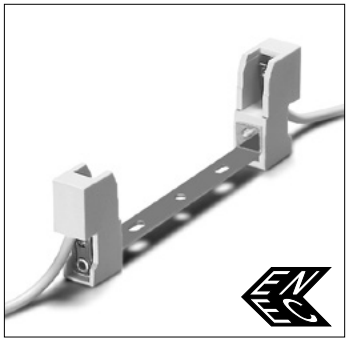
Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central hole for screw M5
Weight: 77.6 g, unit: 200 pcs.
Type: 32330 contact distance: 132 mm
Ref. No.: 100928





Partly enclosed RX7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 4/500/5 kV
Leads: Cu tinned, stranded conductors 1 mm², Si-insulation max. Ø 3.6 mm, length: 200 mm
Oblong holes for screws M4
Central hole for screw M5
Weight: 75.7 g, unit: 200 pcs.
Type: 32336 contact distance: 132 mm
Ref. No.: 100931

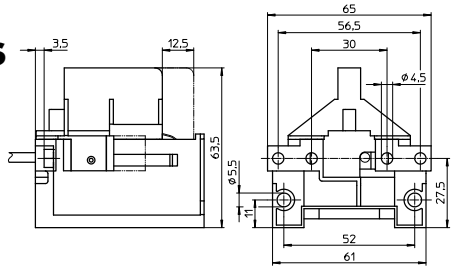


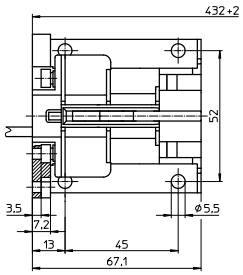


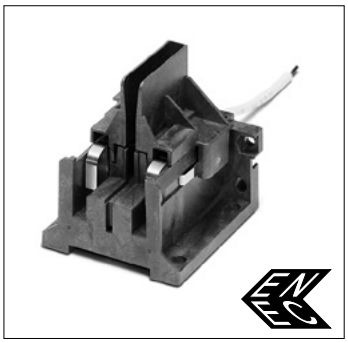
K12x30s Lampholders

For discharge lamps with base K12x30s

K12x30s lampholders
Suitable for luminaires of protection class II
Casing: LCP, black, T150
Nominal rating: 4/500/3 kV
Contacts: CuSn6, silver plated
Leads: Cu tinned, stranded conductors 1 mm² Si-insulation, doubled insulated
Rear recess M4, wrench size 7
Rear and bottom fixing holes for screws M5
Weight: 75.9/61.5 g, unit: 100 pcs.
Type: 13010
Ref. No.: 532430 lead length: 705 mm
Ref. No.: 532431 lead length: 155 mm





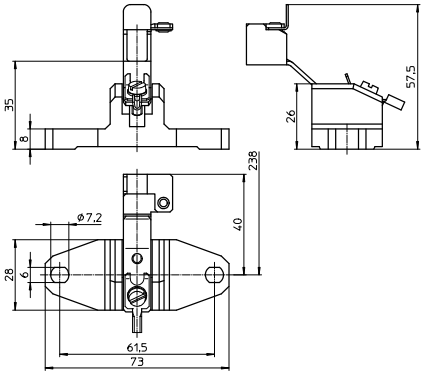


K12s-7 Support

For metal halide lamps 1000 and 2000 W
Type Osram HQI TS and Radium HRI TS

The luminaire design must ensure protection from electric shock as well as sufficient creepage and clearance distances.

K12s-7 support
Cable connection on cable lug for lead 0.75–2.5 mm²
Casing: ceramic, T300
Support: stainless steel, heat-resistant
Oblong holes for screws M5
Weight: 70 g, unit: 25 pcs.
Type: 21100
Ref. No.: 107677



2 Components for Discharge Lamps

If the electrical current through a discharge lamp is increased, a discharge channel with very high luminous efficiency is created in the discharge chamber. Luminous flux and light output increase substantially. The internal pressure of the discharge chamber rises and attains between 1 and 10 bar – these are so-called high-pressure discharge lamps or simply discharge lamps. The light output and colour rendition of high-pressure lamps vary considerably depending on the lamp family.

Discharge lamps can only be operated with ballasts. Ignitors are additionally required for sodium lamps and metal halide lamps. Furthermore, to compensate blind current when using magnetic ballasts, compensation capacitors must be fitted. The lampholders enable the lamp to be fixed in the luminaire and ensure simple exchange of lamps at the end of their service life.

As well as stabilising the lamp's operating point, ballasts also influence the lamp's output and luminous flux, the system's light output, the service life of the lamps as well as the colour temperature of the light.

The following chapters provide technical information regarding VS components for
- High-pressure sodium lamps (HS lamps)
- Metal halide lamps (HI lamps)
- Metal halide lamps with a ceramic discharge tube (C-HI lamps)
- Mercury vapour lamps (HM lamps)
- Low-pressure sodium lamps (LS lamps)

Electromagnetic or electronic ballasts can be used for high-pressure discharge lamps. Unlike with fluorescent lamps, lamp efficiency is not decisively altered by the use of electronic ballasts. In contrast, electronic ballasts lead to a reduction of the inherent losses and thus to an increase in system efficiency. In addition, electronic ballasts ensure gentle lamp operation, which increases the lamp's service life.

Independent electronic and electromagnetic ballasts have also been developed, which in the form of control gear units then provide special advantages during application.

Electronic Ballasts for HI and C-HI Lamps

Electronic ballasts are fitted with all the components required to operate discharge lamps. Furthermore, they safely shut down lamps at the end of their service life to prevent high temperatures from being generated within the luminaires that could influence the service life of the luminaires and components.

By adding a strain-relief module, VS electronic built-in ballasts turn into independent operating devices that can, for instance, be used as a power unit and can also be installed in intermediate ceilings in this form.

Assembly Instructions for Electronic Ballasts

Assembly instructions for mounting and installing electronic ballasts for high-pressure discharge lamps

Mandatory regulations

DIN VDE 0100	Erection of low voltage installations
EN 60598-1	Luminaires – part 1: general requirements and tests
EN 61347-1	Operating devices for lamps – part 1: general and safety requirements
EN 61347-2-12	Control gear for lamps; part 2-12: Particular requirements for d.c. or a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)
EN 55015	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
EN 61000-3-2	Electromagnetic Compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (device input current up to and including 16 A per conductor)
EN 61547	Installations for general lighting purposes – EMC immunity requirements

Descriptions of VS EBs for discharge lamps

The type designations for VS HID ballasts all follow the same pattern, as follows:

EHXc	70	.326
Electronic ballast for HID lamps	Wattage	Serial number

Mechanical mounting

Surface	Firm, flat surface required to ensure good heat transfer. Avoid mounting on protruding surfaces.
Mounting location	Electronic ballasts must be protected against moisture and heat. Installation in outdoor luminaires: water protection rate of > 4 (e.g. IP54 required).
Fastening	Using M4 screws in the designated holes
Heat transfer	If the ballast is destined for installation in a luminaire, sufficient heat transfer must be ensured between the electronic ballast and the luminaire casing. Electronic ballasts should be mounted with the greatest possible clearance to heat sources or lamps. During operation, the temperature measure at the ballast's t_c point must not exceed the specified maximum value.

Supplement for independent electronic ballasts

Mounting position	Any position using the mounting tabs
Clearance	Min. of 0.10 m from walls, ceilings and insulation Min. of 0.10 m from further electronic ballasts Min. of 0.25 m from sources of heat (lamp)
Surface	Solid; EB must not be allowed to sink into insulation materials

Technical specifications

Type	Operating voltage range AC: 220 V...240 V	Protective conductor mA	Mean service life*** hrs.	Power factor λ	Temperature protection*	Possible no. of VS devices/automatic cut-out type B (10A)	B (16A)	C (10A)	C (16A)
Standard EB									
EHXc 35.325 (183033;183034)	±10%	≤ 0.5	32,000 (t_c 85 °C)	0.95	yes**	7	12	12	20
			40,000 (t_c 80 °C)						
			50,000 (t_c 75 °C)						
EHXc 35.325 (183035)	±10%	≤ 0.5	32,000 (t_c 80 °C)	0.95	yes	7	12	12	20
			40,000 (t_c 75 °C)						
			50,000 (t_c 70 °C)						
EHXc 70.326 (183036)	±10%	≤ 0.5	32,000 (t_c 80 °C)	0.95	yes**	7	12	12	20
			40,000 (t_c 75 °C)						
			50,000 (t_c 70 °C)						
EHXc 70.326 (183038)	±10%	≤ 0.5	26,000 (t_c 75 °C)	0.95	yes	7	12	12	20
			40,000 (t_c 65 °C)						
			50,000 (t_c 60 °C)						

* The devices are fitted with a temperature switch to protect against impermissible overheating.
Once the device has cooled down, it is switched on again. It may prove necessary to briefly dis- and then reconnect the device to the mains voltage.
** The temperature protection inside the luminaire must be checked when using devices without a cap.
*** To achieve the mean service life, the max. temperature ($t_{c\ max.}$) at the t_c point must not be exceeded; failure rate = 0.2% per 1000 hrs

Product features

Shutdown of defective lamps

In the event of a lamp failing to ignite or of a lamp with an increased operating voltage (end of the lamp's service life), the electronic ballast will switch off after a defined period of time (< 20 minutes). The ballast will also shut down if the lamp fails to attain its specified rated output. The ballast can be reset by disconnecting and then reconnecting the mains voltage. The ballast must always be disconnected from the mains prior to changing a lamp.

EOL Effect

In high-pressure discharge lamps, the EOL effect manifests itself in a change of the lamp's voltage. These changes can, for instance, occur due to unsealed parts of the burner or the rectifier effect. An automatic EOL cut-out prevents safety risks at the end of the service life of high-pressure discharge lamps. EOL tests are conducted to check the behaviour of electronic ballasts at the end of a lamp's service life. The EOL cut-out stops the lamp base overheating at the end of a lamp's service life.

Short-circuit resistance

The ballast outputs (to the lamp) are short-circuit-proof. Short-circuits between the lamp connection and the casing (earth conductor) will destroy the ballast.

Temperature protection

To prevent excess temperatures, some ballasts are fitted with temperature protection. A ballast will restart after it has cooled down. It might be necessary to briefly interrupt the supply voltage. The above table contains a list of temperature-protected devices.

Transient mains peak protection

Values are in compliance with EN 61547 (interference immunity).

Electrical installation

Wiring

- The wiring between the mains, electronic ballast and lamp must comply with the respective circuit diagram. Note: the luminaire casing (metal) must be connected to the earth conductor.
- The electronic ballast must be earthed using a toothed washer or similar (protection class I, compliance with RFI/BCI standards).
- To ensure compliance with RFI suppression limits, mains conductors should not be wired parallel to lamp conductors and maximum clearance should be ensured.
- After the installation of electronic ballasts, luminaires must be tested to ensure compliance with maximum values laid down in EN 55015.

It is permissible to connect the protective conductor of the ballast by attaching the ballast to metal conductors that are connected to the protective conductor. In doing so, care must be taken to ensure the protective conductor is contacted in accordance with EN 60598. If, however, a ballast is fitted with a connection terminal for a protective conductor without through-wiring and if this is to be used to connect the protective conductor, this connection terminal may only be used for the ballast itself.

Push-in terminals

The used terminals can be connected using rigid or flexible conductors with a section of 0.75–2.5 mm². The stripped conductor length is 10–11 mm for terminal grid 3.5 mm. Conductors must not be tin-plated.

Error current

Impulse-resistant leak-current protection must be installed. Distribute the luminaires to phases L1, L2 and L3; install tri-phase FI switches. If permissible, install FI switches with 30 mA leak current; connect no more than 15 luminaires as FI switches can be triggered at half the leak current value.

Tri-phase connection of luminaires with EB

- Prior to operating newly installed lighting systems: check the mains voltage is appropriate to the electronic ballast's mains voltage range (AC, DC).
- The N-type conductor must be properly connected to all luminaires or ballasts.
- Conductors can only be connected or disconnected if the ballast is disconnected from the mains. Attention: N-type conductors must never be disconnected individually or as the first element.
- Insulation resistance test: from L to PE (L and N must not be connected)
- The neutral conductor must be reconnected after completion of the test.

Electromagnetic Compatibility (EMC)

Vossloh-Schwabe's electronic ballast range was developed in accordance with valid EMC standards (interference, interference immunity and mains harmonics) and specially designed to ensure safe compliance with the limiting values. It is assumed that any remarks regarding conductor wiring and conductor length in the instructions for installing electronic ballasts in luminaires or for independent ballasts will be observed.

Compensation

Luminaires with electronic ballasts do not need compensation (power factor ≥ 0.95).

Selection of automatic cut-outs

Dimensioning automatic cut-outs

High transient currents occur when an EB is switched on because the capacitors have to load. Lamp ignition occurs almost simultaneously.This also causes a simultaneous high demand for power. These high currents when the system is switched on put a strain on the automatic conductor cut-outs, which must be selected and dimensioned to suit.

Release reaction

The release reaction of the automatic conductor cut-outs comply with VDE 0641, part 11, for B, C characteristics.

No. of electronic ballasts (see table on page 53)

The maximum number of VS ballasts applies to cases where the devices are switched on simultaneously. Specifications apply to single-pole fuses. The number of permissible ballasts must be reduced by 20% for multi-pole fuses. The considered circuit impedance equals 400 mΩ (approx. 20 m [2.5 mm²] of conductor from the power supply to the distributor and a further 15 m to the luminaire). Doubling circuit impedance to 800 mΩ increases the possible number of ballasts by 10%.

Additional information

Information on the installation of electronic ballasts for optimising EMC. To ensure good radio interference suppression and the greatest possible operating safety, the following points should be observed when installing electronic ballasts:

- Conductors between the EB and the lamp (HF conductors) must be kept short (reduction of electromagnetic interference).
- Mains and lamp conductors must be kept separate and if possible should not be laid in parallel to one another. The distance between HF and mains conductors should be as large as possible, ideally > 5 cm. (This prevents the induction of interference between the mains and lamp conductors.)
- The mains conductor within the luminaire must be kept short (to reduce the induction of interference).
- Devices must be properly earthed. EBs require secure contacts to the luminaire casing or must be earthed using a PE connection. This PE connection should be effected using an independent conductor to achieve better dissipation of the leak current. EMC improves at frequencies greater than 30 MHz.
- The mains conductor must not be laid too close to the EB or the lamp (this is especially important in the event of through-wiring).
- Mains and lamp conductors must not be crossed. Should this be impossible to avoid, conductors should be crossed at right angles to one another if at all possible.
- Should conductors be wired through metal parts, such conductors must always be additionally shielded (e.g. with an insulating sleeve or grommet).

Temperature

Reference point temperature t_c

The safe operation of electronic ballasts is dependent on the maximum permissible temperature not being exceeded at the measuring point. Vossloh-Schwabe has determined a casing temperature measuring point – $t_{c\ max.}$ – on all EB casings. To avoid shortening the service life or diminishing operating safety, the stipulated maximum temperature must not be exceeded at this t_c point. This point is determined by testing the converter during normal, IEC-standardised operation at the specified ambient temperature (t_a), which is also indicated on the type plate. As both the design-related ambient temperature and the ballast's inherent heat, as determined by the installed load, are subject to great variation, the casing temperature should be tested at the t_c point under real installation conditions.

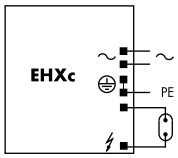
Ambient temperature t_a

The ambient temperature – as specified on every EB – denotes the permissible temperature range within the luminaire.

Reliability and service life

If the max. temperature at the t_c reference point (as specified on the type plate and the technical documentation of the ballast) is not exceeded, the defined service life can be expected to be achieved, assuming a switching cycle of 165 minutes on and 15 minutes off. See table on page 53 for service life details.

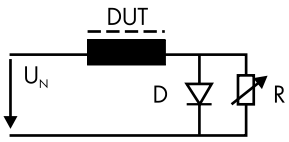
Circuit diagrams for metal halide lamps (HI) and high-pressure sodium lamps (HS) with electronic ballasts (EB)



EHXc 35.325, EHXc 70.326

Electromagnetic Ballasts for Discharge Lamps

Test circuit for thermally protected ballasts



DUT	Device under Test
D	Diode, 100A, 600V
R	Resistor, 0...200 (1/2 lamp output)
U_N	110% of rated supply voltage

Electromagnetic ballasts for HI and HS Lamps

As the lamp manufacturer's reference values regarding lamp current and voltage are generally identical for metal halide (HI) and high-pressure sodium lamps (HS) of the same lamp wattage and the impedance values required for the ballast are also identical, the same ballasts can frequently be used for both lamp types. It should be remembered that HI lamps react sensitively to impedance deviations from the rated value with appreciable colour changes. Vossloh-Schwabe ballasts therefore comply with the lamp's narrower tolerances. Moreover, ballasts remain below the maximum peak DC value for HI lamps. This value is not specified for HS lamps; instead, the maximum stated start-up current must not be exceeded.

In order to keep the temperature of the luminaires and the electrical values of the lamps within tolerable limits, the impedance of the ballasts must remain constant over the entire service life. A so-called service life test (test of thermal durability) provides proof of this requirement having been met.

HI and HS lamps constitute a special case in terms of thermal testing. In rare cases, a safety risk can occur at the end of the service life of lamps fitted with external bulbs. The safety risk is caused by the so-called lamp rectifier effect, which can lead to overheating of ballasts, ignitors, lampholders and conductors and can therefore destroy the luminaire. Against this background, the luminaire standard EN 60598-1 "luminaires; part 1: general requirements and tests" has been supplemented by tests concerning this safety risk. As a result, since 1 September 2002, it has been illegal to market luminaires that do not comply with the new regulations. This means luminaires need to be fitted with thermal protection that prevents a luminaire from overheating in the event of this malfunction.

In this respect, it is recommended to use VS ballasts with temperature switches that have already been tested using this circuit.

Electromagnetic ballasts for HM lamps

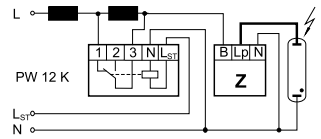
Even in the event of major mains fluctuations (92–106% of the rated voltage), the ballast must not fall short of the no-load voltage specified by the lamp manufacturer nor exceed a fixed short-circuit current. The start-up current must be high enough to ensure that at least 90% of the lamp's operating voltage is achieved within 15 minutes.

Power reduction with HS and HM lamps

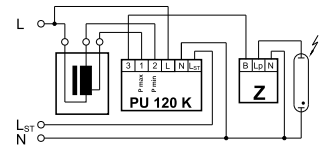
The lamp wattage can be reduced by operating the ballast at a higher impedance value, higher than the rated value. The lamp manufacturer's specifications must be observed in doing so to avoid shortening the lamp's service life. The lamps should be started at the ballast's rated impedance and only switched down to reduced operation after a period of at least five minutes.
The impedance value can be altered by using an additional ballast (high-effort option) or by using a switch-able ballast (low-cost option). These ballast models can be switched using either a modern, time-controlled electronic power reduction switch, which is equipped with an additional control conductor (230 V), or a power reduction switch with a constant incentive rate setting (no control conductor).

The construction of power reduction switches with control conductors differs according to the selected increase in impedance.

Switching to reduced power using additional impedance (second ballast)



Switching to reduced power using a switchable ballast (ballast with tapping points)



Start-up switches

As high-pressure lamps operate with a start-up phase, the lamp's full luminous flux will only be reached after completion of this start-up period. In the event of disconnection from the mains, this start-up phase is dependent on the lamp's temperature. If an additional source of light is desired or required for this start-up period for safety-relevant applications, it is possible to switch on an auxiliary lamp with the help of a start-up switch.

- AS 1000 K for superimposed ignition systems. This switch monitors the lamp's operating voltage. If this is below a defined value (approx. 60% of the lamp's luminous flux), an auxiliary lamp is switched on.

Lamp family	Typical start-up time	Typical restart time (mains interruption at lamp operating temperature)
HS	3 min.	5 min.
HI / C-HI	3 min.	10 min.
HM	4–5 min.	4–5 min.
LS	10 min.	5 min.

Assembly Instructions for Electromagnetic Ballasts

For mounting and installing electromagnetic ballasts for high-pressure discharge lamps

Mandatory regulations

DIN VDE 0100	Erection of low voltage installations
EN 60598-1	Luminaires – part 1: general requirements and tests
EN 61347-1	Operating devices for lamps – part 1: general and safety requirements
EN 61347-2-9	Operating devices for lamps; part 2-9: special requirements for ballasts for discharge lamps (except fluorescent lamps)
EN 60923	Ballasts for discharge lamps – performance requirements
EN 55015	Maximum values and methods of measurement for RFI suppression in electrical lighting installations and similar electrical appliances
EN 61000-3-2	Electromagnetic Compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (device input current up to and including 16 A per conductor)
EN 61547	Installations for general lighting purposes – EMC immunity requirements

Technical specifications

Operating voltage range
The ballasts can be operated at the specified mains voltage within a tolerance range of ±10% for HS/HI and HM lamps and ±3% for C-HI lamps.

Leak current ≤ 0.1 mA

Compensation/power factor
Inductive ballasts: $\lambda \leq 0.5$
Parallel-compensated ballasts: $\lambda \geq 0.85$

Mechanical mounting

Mounting position
Any

Mounting location
Ballasts are designed for installation in luminaires or comparable devices. Independent ballasts do not need to be installed in a casing.

Fastening Preferably using M4 to M6 screws, depending on the size of the ballast. Encapsulated ballasts may only be used with flat-headed screws (M5), underlaid with a washer (DIN 9021). (Tightening torque ≈ 2 Nm)

Temperature
The winding temperature tw must be checked during operation and must not exceed the specified maximum value. It must be tested by using the standardised method of measuring resistance. The Δt marking on the type plate is a measure of the ballast's inherent heating and thus of its power loss. The lower this value is the lower the power loss of the ballast. This value is determined using standardised measuring regulations and constitutes a benchmark for comparing ballasts of the same design for selection purposes.

Electromagnetic compatibility (EMC)

Interference
Interference voltage measurements have to be taken at the connection terminals for luminaires with electromagnetic ballasts as these are systems that operate with lamp voltages of under 100 Hz. These low-frequency interference voltages are generally not critical with high-pressure discharge lamps with electromagnetic ballasts.

Interference immunity
Thanks to the robust design and choice of materials, electromagnetic ballasts provide a high degree of interference immunity and are not impaired by normal mains power interference.

Mains Harmonics
After every zero crossing of the lamp current, discharge lamps experience a re-ignition peak as the lamps go out for a brief (imperceptible) moment. These re-ignition peaks of discharge lamps generate mains harmonics that are smoothed by the ballast's impedance. VS electromagnetic ballasts all comply with the stipulated maximum values.

Selection of automatic cut-outs for VS electromagnetic ballasts

Dimensioning automatic cut-outs
When a ballast is switched on, high transient current peaks occur due to parasite capacitances that can accumulate with the number of luminaires. These high system switch-on currents put a strain on the automatic conductor cut-outs. For this reason, only surge-current-proof automatic cut-outs should be used for lighting systems.

Release reaction
The release reaction of the automatic conductor cut-outs comply with VDE 0641, part 11,
for B and C characteristics.

No. of ballasts
The following values are meant as guidelines only and may vary depending on the respective lighting system. The maximum number of VS ballasts applies to cases where the devices are switched on simultaneously. Specifications apply to singlepole fuses. The number of permissible ballasts must be reduced by 20% for multi-pole fuses. The considered circuit impedance equals 400 mΩ (approx. 20 m of [2.5 m²] conductor from the power supply to the distributor and a further 15 m to the luminaire). Doubling circuit impedance to 800 mΩ increases the possible number of ballasts by 10%. The values quoted in the following tables are guidelines and can be affected by system-specific factors.

Possible number of ballasts connected to automatic cut-outs with or without compensation

Lamp data		C_P	Max. number of ballasts connected to automatic cut-outs – without compensation / with compensation																			
			C10		C13		C16		C20		C25		B10		B13		B16		B20		B25	
W	V	µF	without	with	without	with	without	with	without	with	without	with	without	with	without	with	without	with	without	with	without	with
Mercury vapour lamps (HM)																						
50	230	7	10	19	13	25	15	31	18	39	23	49	8	10	11	12	13	15	16	18	20	23
80	230	8	6	12	7	15	9	19	11	24	14	30	6	6	8	7	10	9	12	11	15	14
125	230	10	4	7	5	9	7	12	7	15	9	19	4	4	5	5	7	6	9	7	10	9
250	230	18	2	4	3	5	3	6	3	7	4	9	2	2	3	2	3	3	4	3	5	4
400	230	25	1	2	1	3	2	4	2	5	2	6	1	1	1	1	2	22	3	2	3	2
700	230	40	–	1	–	1	1	2	1	2	1	3	1	–	1	–	1	1	1	1	2	1
1000	230	60	–	1	–	1	–	1	1	2	1	2	–	–	–	–	1	–	1	1	1	1
Metal halide lamps (HI)																						
35	230	6	11	22	14	29	18	36	23	45	29	50	9	11	12	14	15	18	18	23	23	27
70	230	12	7	12	9	15	11	18	14	23	17	29	5	8	6	10	8	13	9	16	12	20
100	230	12	6	10	7	13	9	16	11	20	14	25	4	7	5	9	6	11	8	14	10	17
150	230	20	4	7	5	9	6	11	7	14	9	17	2	5	3	6	4	8	5	10	6	12
250	230	32	2	5	2	6	3	7	4	9	5	11	1	3	1	4	2	5	3	6	4	8
400	230	35	2	3	2	4	3	5	4	7	5	8	1	2	1	3	2	4	2	5	3	6
1000	230	85	–	1	–	1	1	1	1	3	1	3	–	–	–	–	–	1	1	1	1	2
2000	380	60	–	1	–	1	–	2	–	2	–	3	–	–	–	–	–	1	–	1	–	2
2000	380	37	–	–	–	–	–	1	–	1	–	2	–	–	–	–	–	–	–	1	–	1
3500	380	100	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
High pressure sodium vapour lamps (HS)																						
35	230	6	11	22	14	29	18	36	23	45	29	50	9	11	12	14	15	18	18	23	23	27
50	230	10	9	16	11	20	14	24	18	31	22	38	6	11	8	14	10	17	13	22	16	27
70	230	12	7	12	9	15	11	18	14	23	17	29	5	8	6	10	8	13	10	16	12	20
100	230	12	6	10	7	13	9	16	11	20	14	25	4	7	5	9	6	11	8	14	10	17
150	230	20	4	7	5	9	6	11	7	14	9	17	2	5	3	6	4	8	5	10	7	12
250	230	36	2	5	2	6	3	7	4	9	5	11	1	3	1	4	2	5	3	6	4	8
400	230	45	1	3	1	3	2	4	3	5	4	7	1	2	1	2	1	3	2	4	2	5
600	230	60	1	2	1	2	1	2	2	3	2	4	–	1	–	1	1	2	2	2	2	3
1000	230	100	1	1	1	1	1	1	1	2	2	3	–	–	–	–	–	1	1	1	1	2

Safety functions

The VS range includes ballasts with an integrated temperature switch that safely disconnects the lamp from the power supply if the lamp should develop the rectifier effect towards the end of its service life. The cut-out behaviour of the temperature switch is influenced by the luminaire construction. The luminaire manufacturer is responsible for checking the factory settings of the temperature switch in accordance with EN 60598-1 Section 12.5. VS can adjust the temperature switch to the appropriate cut-out temperature to suit requirements.

Reliability and service life

Provided the maximum winding temperature is not exceeded, the ballasts can be expected to yield a service life of 100,000 operating hours.Failure rate < 0.025%/1,000 hrs

Electrical installation

Push-in terminals — Terminals can be contacted with rigid conductors up to a maximum of 1.5 mm².

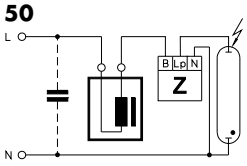
Screw terminals
- Terminals can be contacted with rigid or flexible conductors with ferrules on bare end of core
- Conductor cross-sections are determined by the terminals and can vary according to type 0.5–1.5 mm² / 0.75–2.5 mm² / 1.5–2.5 mm²
- Stripped lead length: 8–9 mm
- Conductors must not be tin-plated
- Max. tightening torque 0.5 Nm

Wiring — The wiring between the power supply, ballast and lamp must be in accordance with the respective circuit diagram (see pages 62–64).

Components — High-pressure discharge lamps must only be fitted with components that are rated to withstand the respective ignition voltage.

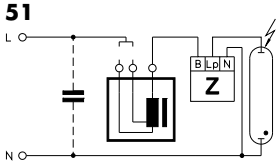
Circuit diagrams for high-pressure sodium lamps (HS) and metal halide lamps (HI)

50



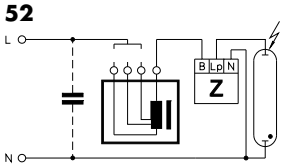
Superimposed ignition of HS and HI lamps

51



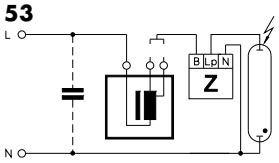
Superimposed ignition of HS and HI lamps
(ballasts with two alternative voltage tapping points)

52



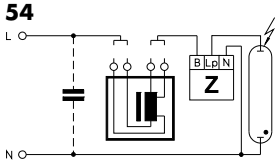
Superimposed ignition of HS and HI lamps
(ballasts with three alternative voltage tapping points)

53



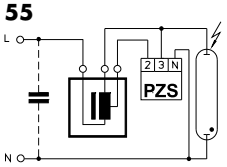
Superimposed ignition of HS and HI lamps
(ballasts with two alternative power tapping points)

54



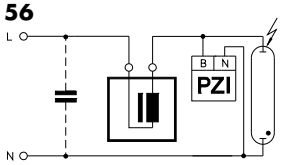
Superimposed ignition of HS and HI lamps
(ballasts with two alternative voltage and
power tapping points)

55



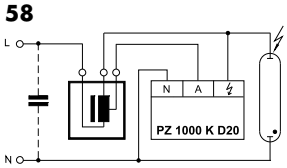
Pulse ignition of standard HS lamps

56



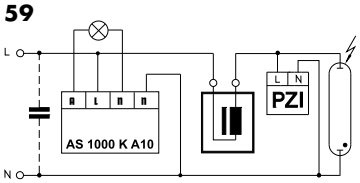
Pulse ignition of HI lamps, ignition voltage 0.9 kV

58



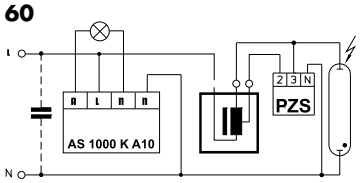
Pulse ignition for HS and HI lamps

59



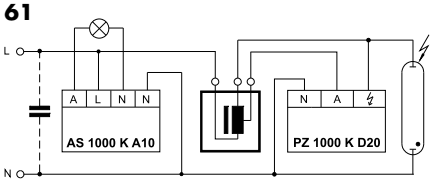
Start-up switch for HI lamps, ignition voltage 0.9 kV

60



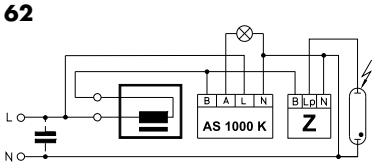
Start-up switch for standard HS lamps

61



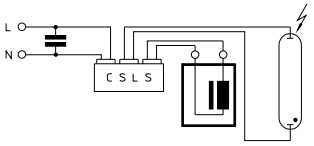
Start-up switch for HS and HI lamp

62



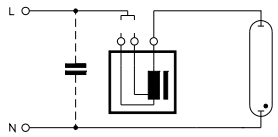
Start-up switch for HS and HI lamps

63



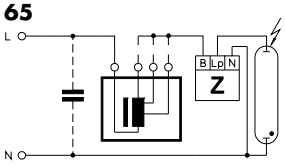
SDW-T lamps

64



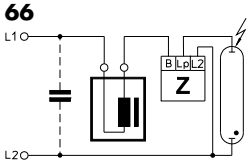
HS lamps with internal ignitor (ballasts with
two alternative voltage tapping points)

65



Superimposed ignition of HS and HI lamps
with three alternative power tapping points

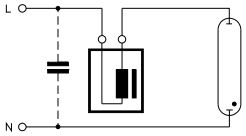
66



Superimposed ignition of HS and HI lamps
with polyphase power systems

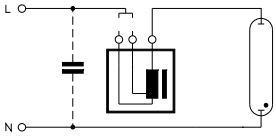
Circuit diagrams for mercury vapour lamps (HM)

67



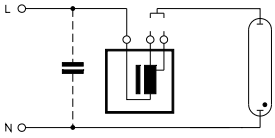
HM lamps

68



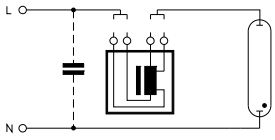
HM lamps (ballasts with
two alternative voltage tapping points)

69



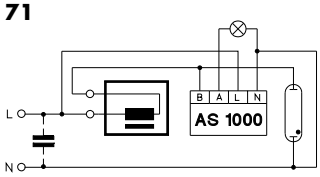
HM lamps (ballasts with
two alternative power tapping points)

70



HM lamps (ballasts with two alternative voltage
and power tapping points apiece)

71

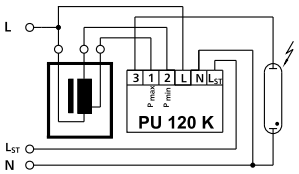


Start-up switch for HM lamps with auxiliary lamp

Power reduction of mercury vapour lamps (HM lamps)

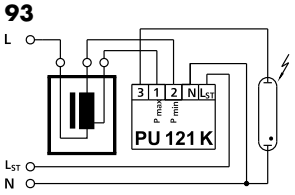
L_{ST} connectable to L1, L2 and L3

92



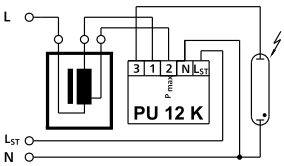
Disconnected control phase (L_{ST} = 0 V)
with ballasts with two tapping points

93



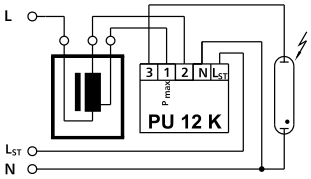
Connected control phase (L_{ST} = 230 V)
with ballasts with two tapping points

94



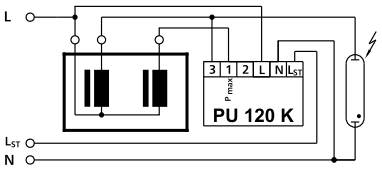
Disconnected control phase (L_{ST} = 0 V)
with ballasts with two tapping points

95



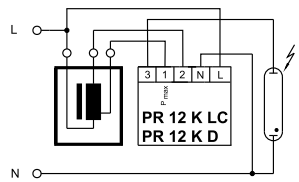
Connected control phase (L_{ST} = 230 V)
with ballasts with two tapping points

96



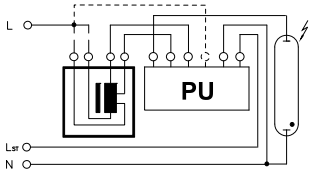
Disconnected control phase (L_{ST} = 0 V)
with two ballasts connected in parallel

97



Electronic power reduction without control phase

98

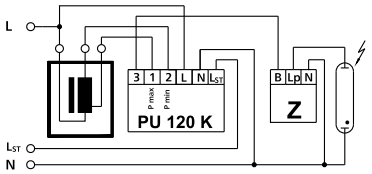


Ballasts with two tapping points and
two voltage tapping points (L_{ST} = 0 V or L_{ST} > 0 V)

Power reduction of high-pressure sodium lamps (HS lamps) – superimposed ignition system

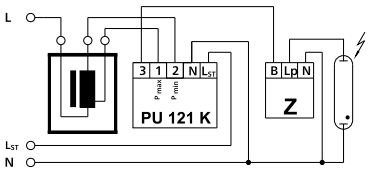
L_{ST} connectable to L1, L2 or L3

80



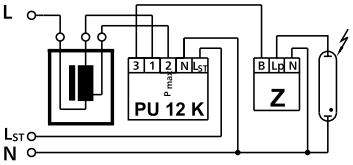
Disconnected control phase (L_{ST} = 0 V)
with ballasts with two tapping point

81



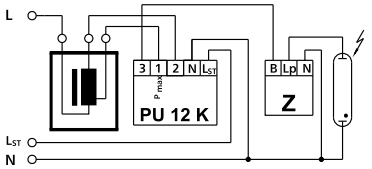
Connected control phase (L_{ST} = 230 V)
with ballasts with two tapping points

82



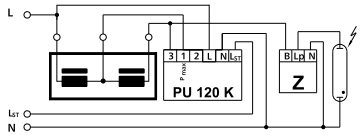
Disconnected control phase (L_{ST} = 0 V)
with ballasts with two tapping points

83



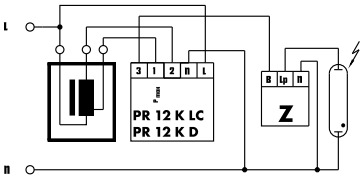
Connected control phase (L_{ST} = 230 V)
with ballasts with two tapping points

84



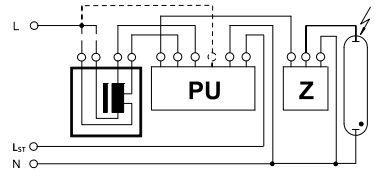
Disconnected control phase (L_{ST} = 0 V)
with main ballast and additional inductance

85



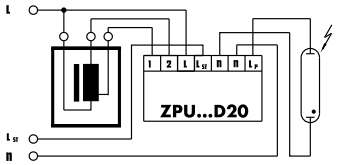
Electronic power reduction without control phase

86



Ballast with two tapping points and two
voltage tapping points (L_{ST} = 0 V or L_{ST} > 0 V)

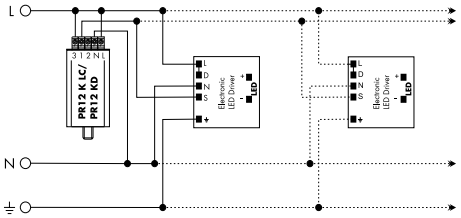
89



Disconnected control phase (L_{ST} = 0 V)
with ballasts with two tapping points

Power switching of LED drivers and electronic ballasts

100



Lampholders for High-pressure Discharge Lamps

Metal halide and high-pressure sodium lamps feature extremely different bases, which include RX7s, Fc2, G8.5, GX8.5, GU8.5, GX10, G12, GX12, PG12, PGJ5, GU6.5, E27 and E40, depending on whether the lamp is single- or double-ended. All lampholders are subject to the same typical conditions found with discharge lamps: high ignition voltages and temperatures. The high start-up currents deserve particular attention in lampholder design. This is also reflected by the insulation materials, which are usually solid ceramics or heat-resistant plastic (e.g. PPS – polyphenylene sulphide). Depending on the lamp's requirements (voltage, current, temperature, etc.), silver, nickel and copper alloys with thick nickel coatings are used as conductors. The luminaire regulation EN 60598-1 (VDE 0711 part 1), defines the safety requirements with regard to ignition voltages in connection with creepage and air clearance distances. Special care must be taken to ensure that lampholders are approved for discharge lamps when using high-pressure lamps with E27 and E40 Edison bases. Lampholders that are suitable for this purpose are marked with a maximum value of "5 kV" and comply with the increased creepage and air clearance distances specified by the lampholder requirements in EN 60238 (VDE 0616 part 1). The lampholder regulations governing special lampholders, EN 60838-1 (VDE 0616 part 5), apply analogously to all other base systems. The high ignition voltage pulses also place special demands on the conductors. In practice, silicone-insulated conductors with an outer diameter of 3.6 mm have proved to be suitable for discharge lamps. Silicone-insulated conductors with a glass-silk lining with a diameter of 7 mm should be used for lamps with an instant hot restart (20 kV) function.

VS lampholders for the UL market and UL approved leads are available for all common lamp types.

Further information can be found at www.unvlt.com/products/legacy/lampholders.

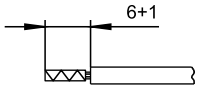
When connecting lampholders to push-in terminals of ballasts, the diameter of the conductor and the length of the stripped cables must be taken into account to ensure correct operation of the installed components. To this end, Vossloh-Schwabe can make additional versions available with compacted cable ends as further options.

When using compacted cable ends, the reduction of the cable diameter at the end of the cable must be taken into account, which means that the respective ballast push-in terminal has to be capable of taking the next-smaller cable diameter (see table with examples).

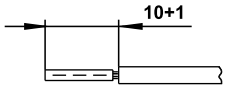
When using screw terminals to connect a ballast, it is recommended to use a ferrules on the bare end of core.

Cable cross-section mm²	Push-in terminal range on the ballast when using compacted cable ends mm²
0.75	≥ 0.5
1	≥ 0.75

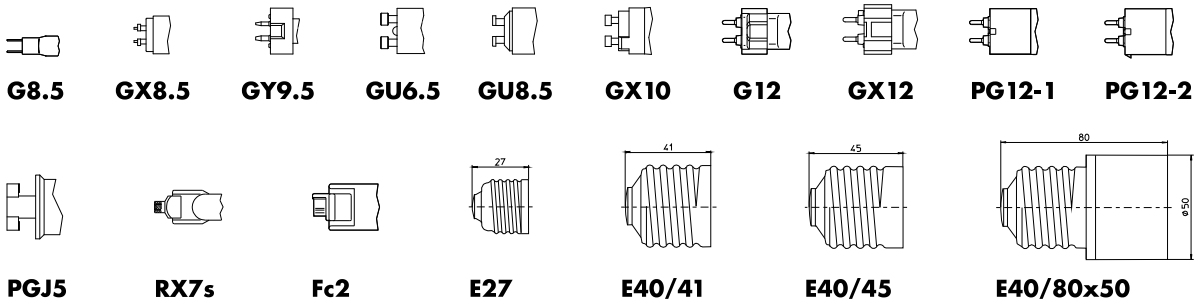
Ferrule on bare end of core



Compacted cable ends

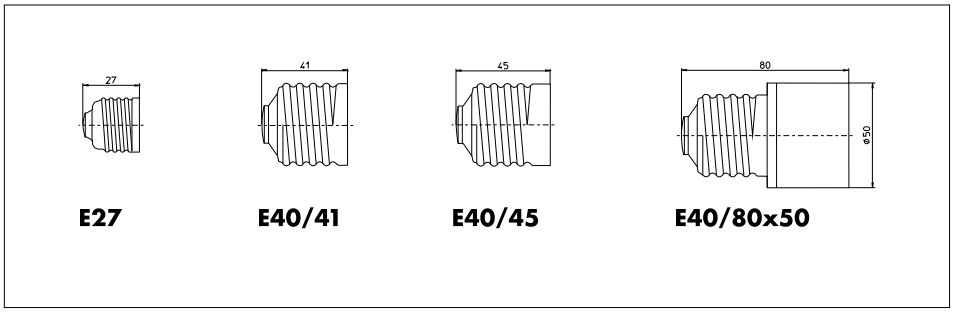


Bases for the most commonly used HI and HS lamps



Bases for the most commonly used HM lamps

Edison bases are predominantly used for mercury vapour lamps (HM)



Ignitors

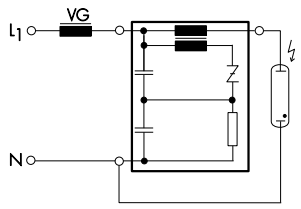
Ignition voltages for high-pressure sodium lamps (HS) and metal halide lamps (HI)

The ignition voltage of HS and HI lamps is determined by the respective lamp technology as well as the creepage and air clearance distances of the base-lampholder system. High-pressure sodium lamps of 35, 50 and 70 W with an E27 base are ignited with a voltage of between 1.8 and 2.3 kV. All other high-pressure lamps of the sodium and metal halide families require an ignition voltage of between 4 and 5 kV (except for special lamps and lamps with base PGJ5).

Superimposed ignitors

Superimposed ignitors work independently of ballasts and generate defined ignition pulses within the voltage ranges of 220–240 V ±10% and 380–415 V ±10%. As the mains frequency only plays a minor role, these systems work equally well at 50 Hz and 60 Hz. In accordance with the lamp manufacturer's specifications, pulses or clusters of pulses of defined width and height are generated in every half wave. Although lamp current flows through superimposed ignitors, they only cause low losses in relation to the system's power consumption. The maximum ambient temperature can be calculated by subtracting the ignitor's self-heating, which is caused by the inherent losses, from the specified maximum casing temperature (t_c).

Circuit principle of a superimposed ignitor

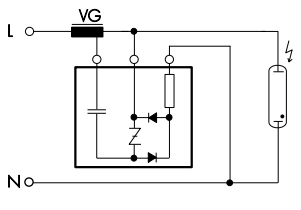


Superimposed ignitors should be mounted near the lampholder. The clearance needed between the ignitor and the lamp is determined by the respective maximum load capacitance, which is specified for each ignitor in the technical specifications. The capacitive load of the cable is dependent on its physical properties and wiring layout; this value usually ranges between 70 pF and 100 pF per metre. The casing temperature must not fall below –30 °C and must not exceed the maximum value specified on the device.

Pulse ignitors

Pulse ignitors use the winding of an inductive ballast to generate the pulse voltage needed to ignite high-pressure discharge lamps. For that reason, ballasts must be designed to withstand these high ignition voltages. In this respect, special attention is paid to the insulation as well as the creepage and air clearance distances. As pulse ignition systems generate high-energy pulses, they are also suitable in the event of longer conductor distances between ignitor and lamp. State-of-the-art ignitors feature electronic circuitry. Depending on their design and the technical requirements, the simplest solution is to connect pulse ignitors in parallel with the lamp. Further models make partial use of the winding of a ballast, which will either feature multiple tapping points for voltage selection or special tapping points for pulse operation.

Circuit principle of a pulse ignitor



VS ignitors provide the following advantages:

- fully electronic construction
- compact design
- large nominal voltage range
- large output range
- low self-heating
- minimal power loss
- low noise
- long service life
- high electrical safety due to high-quality components (e.g. approved capacitors)
- highly heat-resistant (max. permissible casing temperature t_c: 105 °C for superimposed ignitors and 95 °C for pulse ignitors)
- highly fire-resistant potting compound (certified according to EN 60926 and UL 94-V0)
- environmentally compatible potting compound (waste key No. 57110)

Product range

Vossloh-Schwabe's product range covers superimposed and pulse ignitors in standard models and with automatic cut-outs. Superimposed ignitors with automatic cut-outs are available with various cut-out times and ignition voltage pulse mechanisms (A and D). In this respect, D-series ignitors featuring the intelligent pulse-pause mode (IPP) are the best solution in terms of ignition reliability and switching off defective lamps.

Electronic ignitors with integrated cut-outs capture data on ignition behaviour during the ignition process. These data, e.g. regarding ignition frequency or failure, serve to identify ageing lamps and to ensure the ignition process is reliably switched off after a defined period of time at the end of the lamp's service life or in the event of defective lamps. This reduces the negative consequences associated with defective lamps.

Superimposed and Pulse Ignitors with Automatic Cut-out

Ignitors with IPP technology and extended cut-out – D series

After connection to mains voltage, D series ignitors generate ignition voltage pulses that are controlled and if necessary switched off by the ignitor in accordance with the lamp's operating state, lamp recognition and the safe burning time. If the safe burning time is not attained after three consecutive ignition attempts, pulse generation will cease.

Appropriately programmed microprocessors enable these performance features of ignitors with IPP technology (Intelligent Pulse-Pause Mode) and extended cut-outs.

Z ... D20/
PZ ... D20 for HS, HI and C-HI lamps
programmed cut-out time: 1,216 seconds

Ignitors with IPP technology and extended cut-outs are available up to an output of 1,000 W.

Programmed cut-out function of VS ignitors

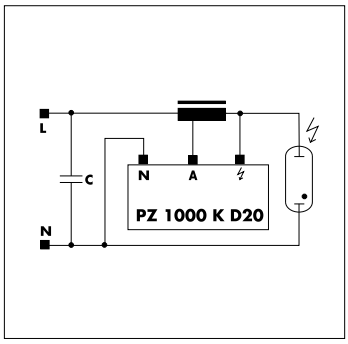
Ignitors with automatic cut-out – A series

After connection to mains voltage, A series ignitors supply a continuous stream of ignition voltage pulses until the lamp has ignited or the predefined cut-out time (sum of all ignition periods) has been reached if the lamp fails to ignite.

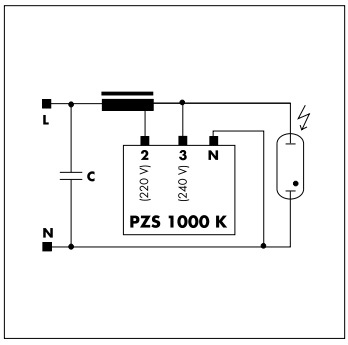
PZ ... A5 for HSI lamps
programmed cut-out time: ca. 300 seconds

Pulse ignition systems – overview of technical specifications

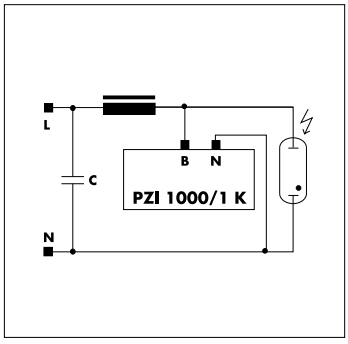
For HS, HI and C-HI lamps – PZ 1000 K D20
for high-pressure sodium lamps (HS) 50–1000 W,
metal halide lamps (HI) 35–1000 W and
for ceramic discharge tube lamps (C-HI) 35–400 W
Ignition voltage: 1.8–2.3 kV or 4–5 kV
No. of pulses: 2 per mains period
Load capacitance: 20–1000 pF
Ignitors with automatic cut-out and IPP technology
Suitable ballast types: NaHJ ... PZT with special winding tapping point,
whose position is determined by the magnitude of the ignition voltage



For HS lamps – PZS 1000 K
for standard high-pressure sodium lamps (HS) 50–1000 W
Not suitable for discharge lamp models SUPER, PLUS, XL, etc.
Ignition voltage: approx. 4 kV
No. of pulses: 1 per second
Load capacitance: 20–4000 pF
Suitable ballast types:
NaH ... P with winding tapping point
(20 V voltage difference)



For HI lamps – PZI 1000/1 K
for metal halide lamps (HI)
with an ignition voltage up to 0.9 kV
No. of pulses: 1 per mains period
Load capacitance: max. 10,000 pF
Suitable ballast models: Q...



Assembly Instructions for Ignitors

For mounting and installing ignitors

Mandatory regulations

DIN VDE 0100	Erection of low voltage installations
EN 60598-1	Luminaires – part 1: general requirements and tests
EN 61347-1	Operating devices for lamps – part 1: general and safety requirements
EN 61347-2-1	Control gear for lamps; part 2-1: special requirements for ignitors (other than glow starters)
EN 60927	Control gear for lamps; ignitors (other than glow starters); performance requirements
EN 55015	Maximum values and methods of measurement for RFI suppression in electrical lighting installations and similar electrical appliances
EN 61000-3-2	Electromagnetic Compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (device input current up to and including 16 A per conductor)
EN 61547	Installations for general lighting purposes – EMC immunity requirements

Technical specifications

Operating voltage range

Ignitors can be operated at the specified mains voltage within a tolerance range of ±10%.

Max. casing temperature t_c

A maximum casing temperature t_c of 105 °C or 95 °C is specified for superimposed ignitors and pulse ignitors, respectively. Tests carried out during operation must ensure this maximum value is not exceeded. Selecting an ignitor for higher lamp currents can reduce self-heating and thus also the temperature at the t_c measuring point. Details regarding self-heating can be found in the following table. The temperature structure in the luminaires is negatively influenced by ageing lamps.

Minimum ambient temperature t_a

The minimum ambient temperature ta for all superimposed and pulse ignitors is –30 °C. Ignitors for use in applications with special requirements to the ambient temperature (for example –40 °C) are available on request.

Superimposed ignitors – Technical specifications

Voltage V/Hz	**Ignitor type**	Max. lamp current A	Power loss W	Inherent heating K	Ignition voltage kV	Max. load capacity pF	Max. conductor length between ignitor and lamp* m	Connection terminals (mm²) Screw	Push-in	Casing material	Dimensions (dia. x L or L x W x H) length without threaded stud mm
220–240/ 50–60	**Z 70 S**	2	< 0.6	< 5	1.8–2.3	200	2	0.75–4	—	Al	Ø35 x 76
	Z 70 K	2	< 0.6	< 5	1.8–2.3	200	2	0.75–4	—	PC	78 x 34 x 27
								—	0.5–2.5		81 x 34 x 27
	Z 70 K D20	2	< 0.6	< 5	1.8–2.3	100	2	0.75–4	—	PC	80 x 34 x 30
								—	0.5–2.5		83 x 34 x 30
	Z 250 S	3.5	< 1.8	< 20	4.0–5.0	100	1	0.75–4	—	Al	Ø35 x 76
	Z 250 K	3.5	< 1.8	< 20	4.0–5.0	100	1	0.75–4	—	PC	78 x 34 x 27
								—	0.5–2.5		81 x 34 x 27
	Z 250 K D20	3.5	< 1.8	< 20	4.0–5.0	100	1	0.75–4	—	PC	80 x 34 x 30
								—	0.5–2.5		83 x 34 x 30
	Z 400 S	5	< 3.0	< 25	4.0–5.0	100	1	0.75–4	—	Al	Ø45 x 76
	Z 400 S D20	5	< 3.0	< 25	4.0–5.0	100	1	0.75–4	—	Al	Ø45 x 90
	Z 400 M **Z 400 M VS-Power** **Z 400 M S**	5	< 3.0	< 35	4.0–5.0	50	0.5	0.75–4	—	Al	Ø35 x 76
	Z 400 M K	5	< 3.0	< 35	4.0–5.0	50	0.5	0.75–4	—	PC	78 x 34 x 27
								—	0.5–2.5		81 x 34 x 27
	Z 400 M K VS-Power	5	< 3.0	< 35	4.0–5.0	50	0.5	0.75–4	—	PC	78 x 34 x 27
								—	0.5–2.5		81 x 34 x 27
	Z 400 M K D20	5	< 3.0	< 35	4.0–5.0	50	0.5	0.75–4	—	PC	80 x 34 x 30
								—	0.5–2.5		83 x 34 x 30
	Z 750 S	8	< 3.0	< 20	4.0–5.0	100	1	0.75–2.5	—	Al	Ø50 x 90
	Z 1000 S	12	< 6.0	< 35	4.0–5.0	100	1	0.75–2.5	—	Al	Ø50 x 80
	Z 1000 TOP										83 x 83 x 68
	Z 1000 S D20	12	< 6.0	< 35	4.0–5.0	100	1	0.75–2.5	—	Al	Ø50 x 89
	Z 1000 L	12	< 6.0	< 35	4.0–5.0	2000	20	0.75–2.5	—	Al	Ø50 x 97
	Z 1200/2,5	15	< 7.5	< 40	2.0–2.5	200	2	0.75–2.5	—	Al	Ø50 x 80
	Z 1200/9	15	< 10.0	< 40	7.0–8.0	50	0.5	0.75–2.5	—	Al	Ø50 x 135
	Z 2000 S	20	< 6.0	< 30	4.0–5.0	100	1	0.75–2.5	—	Al	Ø65 x 96
380–420/ 50–60	**Z 1000 S/400V**	6	< 3.3	< 28	4.0–5.0	2000	20	0.75–2.5	—	Al	Ø45 x 84
	Z 2000 S/400V	12	< 5.0	< 32	4.0–5.0	2000	20	0.75–2.5	—	Al	Ø50 x 88
	Z 3500 S/400V	20	< 7.0	< 35	4.0–5.0	100	1	0.75–2.5	—	Al	Ø65 x 96

* With a conductor of, for instance, 100 pF per m (3x2.5 mm²)

Pulse ignitors – Technical specifications

Nominal voltage/ frequency V/Hz	**Pulse ignitor type**	Casing temperature t_c °C	Ignition voltage kV	Max. load capacity pF	Max. conductor length between ignitor and lamp* m	Connection screw terminals mm²	Casing material	Dimensions (dia. x L or L x W x H) length without threaded stud mm
220–240/50–60	**PZS 1000 K**	95	approx. 4	4000	40	0.5–1.5	PC	50 x 28 x 27
	PZ 1000 K D20	95	1.8–2.3/ 4.0–5.0	1000	10	0.75–2.5	PC	74 x 34 x 27
	PZI 1000/1 K	95	0.7–0.9	10000	100	0.5–2.5	PC	57 x 28 x 27
380–420/50–60	**PZ 1000/400 V A5**	95	4.0–5.0	800	8	0.75–2.5	Al	Ø40 x 80

* With a conductor of, for instance, 100 pF per m (3x2.5 mm²) – wiring must be taken into consideration

Mechanical mounting

Mounting position
Any

Mounting location
Ignitors are designed for installation in luminaires or comparable constructions. Ignitors must be protected against radiation of direct lamp heat by appropriate installation.

Clearance from lamp
The clearance needed between ignitor and lamp is determined by the load capacitance of the conductors and by the type of ignitor pulses. The table on page 70 gives details of the clearance needed for a typical 3-phase lead with a cross-section of 2.5 mm² per conductor.

Casing materials Unmarked in the type description: aluminium; marked "K": polycarbonate

Fastening Via threaded stud M8x10 (Z 2000 S, Z 3500 S/400 V: M12x12)

Dimensions The table on page 70 provides details of ignitor dimensions.

Electromagnetic compatibility (EMC)

Interference Ignitors only generate interference due to the high ignition voltages during lamp ignition. This is classified as click interference and is not evaluated in lighting technology. However, as this interference occurs continuously in the event of old lamps that fail to ignite, operators of lighting systems are legally obliged to exchange such lamps.

Interference immunity
Owing to their design and the materials used, VS ignitors are characterised by high interference immunity and comply with the specified maximum values.

Mains harmonics
Are not observed during lamp ignition. VS ignitors meet the requirements.

Reliability and service life

The service life of an ignitor is dependent on strict compliance with the casing temperature t_c during operation. As the ignitors are only subjected to loads during high-voltage lamp ignition, a service life of 10 years can be expected provided the t_c values are not exceeded. Failure rate: < 0.04%/1,000 hrs.

Electrical installation

Connection terminals
Ignitors feature screw or push-in terminals. For screw terminals a maximum torque value of 0.8 Nm must not be exceeded when connecting the conductor. Push-in terminals are for rigid conductors with a cross section of 0.5–2.5 mm² or respective flexible conductors with ferrule bare end of cores. Stripped lead ends of 8–9 mm are required. Tinned lead ends are not permitted. The permissible conductor cross-sections can be seen in the table on page 70.

Wiring The ignitors must be wired between ballast and lamp in accordance with the circuit diagrams on pages 62–64. The load capacitances of the wiring must also be taken into account. Distances to lamps should be kept as short as possible.

Power switches for street lighting

In view of the drive to cut public spending on energy and also in the light of environmental policies to protect resources, reducing the power consumption of high-pressure discharge lamps is becoming increasingly important.

Power reduction is possible on high-pressure sodium vapour and mercury vapour lamps and is realised with the aid of electronic actuators or by switching the inductance in the luminaire itself with the aid of power switches.

Provided that the lamp still emits an acceptable minimum of light output and uniformity, these lamps can be used to reduce the lighting level of outdoor lighting systems during off-peak traffic periods (e.g. in accordance with DIN 5044 for street lighting).In conjunction with the appropriate ballasts, the VS power switches constitute a perfect all-round solution for power switching purposes. This VS system has been approved by leading lamp manufacturers.

Power switch PR 12 K LC – Power reduction without control line

The new VS PR 12 K LC power switch is capable of setting the period of power-reduced operation based on the measured burning time of a lighting system. This eliminates the time-consuming task of continually adjusting the times of power-reduced operation to suit constantly changing day-night cycles; it also removes the need for making adjustments due to daylight-saving times and is thus suitable for use worldwide (regionally independent).

Function

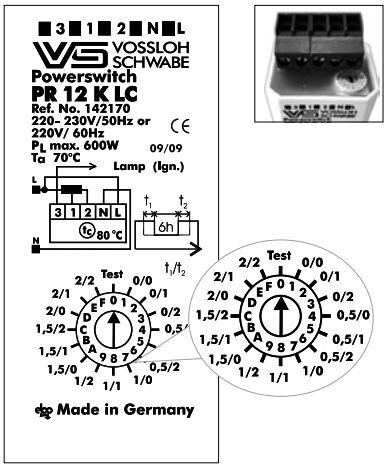
The intelligent PR 12 K LC power switch does not require a control line to reduce lamp output; it uses the tapping of the ballast. Thanks to an integrated microprocessor, the PR 12 K LC power switch can measure the burning time of the luminaire. This value is then compared to data stored on the chip and used to set the time at which the luminaire will switch over to power-reduced operation. The luminaire will be operated at reduced power for a minimum of six hours (reduced by approx. 40% of the lamp's nominal rating at 50% of luminous flux). This period of power reduction can be extended to a maximum of 10 hours.

Setting periods of power-reduced operation

The power switch is delivered in its default setting – i.e. the dial is set to 'Test (Code 0)'. After the luminaire has been installed, the desired power reduction time must be set using the dial on the power switch. The power-reduction period can be set to a minimum of six hours and can be extended by up to two hours in both directions (i.e. earlier or later). This results in a maximum power-reduction period of 10 hours.

The dial enables the following settings:

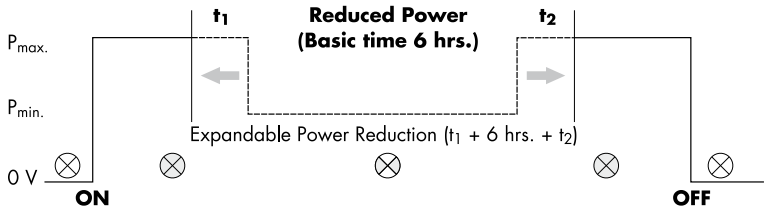
Dial settings		t_1	Basic power	t_2	Total power
Position	Timings	Hours	reduction period (hrs)	Hours	reduction time (hrs)
0	Test	Factory setting: 5 seconds on full load, followed by power reduction			
1	0/0	0	6	0	6
2	0/1	0	6	1	7
3	0/2	0	6	2	8
4	0.5/0	0.5	6	0	6.5
5	0.5/1	0.5	6	1	7.5
6	0.5/2	0.5	6	2	8.5
7	1/0	1	6	0	7
8	1/1	1	6	1	8
9	1/2	1	6	2	9
A	1.5/0	1.5	6	0	7.5
B	1.5/1	1.5	6	1	8.5
C	1.5/2	1.5	6	2	9.5
D	2/0	2	6	0	8
E	2/1	2	6	1	9
F	2/2	2	6	2	10



Determining operating/power reduction periods

- The dial is set to the desired period of power reduction, e.g. to position 1 (0/0), which corresponds to a power-reduction period of six hours.
- In the first night, the luminaire is activated by the twilight switch (e.g. at 20:30 hours) and will operate at its nominal rating. After four hours (default setting), the luminaire will be switched down by 40% of the lamp output by the power switch and will then remain in power-reduced operation until the twilight switch turns the system off (e.g. at 06:30 hours).
- During this time, the power switch will measure the entire burning time of the lamp (10 hours in our example).
- The power switch then compares the measured burning period with values stored on the microprocessor. The integrated comparative values of the power switch form the basis for the starting point of power-reduced operation for the following night. The "new" starting time will then be stored by the power switch until the following night.
- In the second night, the lighting system – controlled by the twilight switch and thus dependent on the day/night cycle of the respective region and the time of year – will be activated (and deactivated) at a slightly different time as compared to the first night (either earlier or later, depending on the season)
- With the dial set to position 1, the power switch will thus activate the six-hour period of power-reduced operation after two hours, as per our example, and will then revert to nominal operation before the twilight switch finally sends the signal to switch the lighting system off.
- During the night, the power switch will again measure the entire burning time, compare this value with the stored values and then reset the starting time for power-reduced operation.
- The period of power-reduced operation can be adjusted by changing the dial setting. This period can be extended in both directions (i.e. earlier or later) as detailed in the table on page 72.
- If the dial is, for instance, set to 9 (1/2) this will produce a total period of power-reduced operation of 9 hours (1+6+2). As a result, power-reduced operation will begin one hour earlier than the value determined the night before would ordinarily prescribe and will then extend the minimum period of power-reduced operation by two hours.
- If, in very rare cases, the total burning period of the lighting system should remain under six hours per night, the power switch will activate power-reduced operation after 15 minutes of nominal operation and stay in power-reduced mode until the lighting system is switched off. Switching diagram for power reduced operation.

Switching diagram for power reduced operation



Deactivating reduced-power operation for the night

The functional scope of the PR 12 K LC power switch has been extended with an extra function that permits the operator to deactivate reduced-power operation of the lighting system for a single night. The function can be useful for local festivities or events (e.g. town fêtes) during which it would not be appropriate to operate the local street lighting system at reduced power for safety reasons.

The power switch can be easily programmed to operate the lighting system at normal (i.e. 100%) power for the immediately following night cycle. The power switch is programmed by briefly switching the lighting system on for a period of min. 60 and max. 90 seconds during the day of the event and then switching it off again. The intelligent power switch recognises this command and sets the usual reduced-power operation to zero. The power switch can be successively programmed in this manner as many days in a row as necessary. For every night the lighting system is to be operated at normal (100%) power, the lighting system will have to be switched on for a period of min. 60 and max. 90 seconds during the day. The lighting system will be operated at normal (100%) power in the respective night following day-time activation of the extra function.

The power switch does not need to be reprogrammed to return to power-reduced operation of the lighting system. The power switch will automatically return to its original (power-reducing) program if the lighting system is not switched on during the day for a period of min. 60 and max. 90 seconds.

Before testing the extra function, it is important to ensure that the power switch has been in operation for at least one night cycle. Only then will the "learning cycle" start that is required to perform the basic function. After that, the extra function can be activated as described above.

Luminaire testing

The 'Test (Code 0)' dial setting on the power switch is used for luminaire testing during production as well as for direct function tests for "subsequent" installation in the lighting system. After the luminaire is switched on, the lamp is first operated at its nominal rating. After only five seconds, the system will be switched over to power-reduced operation, which will produce a visible change even though the lamp will not yet have attained its full output.

Maintenance work on the lighting system

Maintenance work that requires the lighting system to be switched on for a period of less than two hours will not influence the settings of power switch PR 12 K LC.
Should the lighting system need to be switched on for more than two hours during maintenance work, the PR 12 K LC power switch will activate power-reduced operation after 15 minutes of nominal operation in the following night and will then start to re-measure the total burning time of the lighting system. To determine the starting time of power-reduced operation for subsequent nights, the power switch will again use the stored comparative values.

Switch Units

For power reduction using electronic ballasts with a 1–10 V interface

Suitable for a broad range of lamps

Vossloh-Schwabe's switch units are designed to enable one-step power reduction of lamps (FL, CFL, LED, HS, HI and C-HI) with the help of the respective electronic ballast or converter. To this end, the switch units utilises the 1–10 V interface of the control gear unit. The switch unit is mainly intended for outdoor luminaires in systems with or without a control phase.

Discharge lamps may only be operated at reduced power if they have been expressly approved for this purpose by the manufacturer. In addition, the unit can also be used to dim tubular and compact fluorescent lamps as well as LEDs.

The 1–10 V interface is addressed via an external circuit at the output of the switch unit using a suitably dimensioned resistor. The type of resistor and circuitry are selected by the luminaire manufacturer to suit the desired degree of power reduction.
The switch unit satisfies the provisions of DIN EN 61347 and is suitable for use in outdoor luminaires of protection classes I and II.

Function PR 1–10 V K LC

The intelligent PR 1–10 V K LC switch unit does not require a control line to reduce lamp output.

Thanks to an integrated microprocessor, the PR 1–10 V K LC switch unit can measure the burning time of the luminaire. This value is then compared to data stored on the chip and used to set the time at which the luminaire will switch over to power-reduced operation.

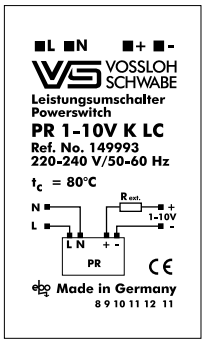
The luminaire will be operated at reduced power for a minimum of six hours (reduced by approx. 40% of the lamp's nominal rating at 50% of luminous flux). This period of power reduction can be extended to a maximum of 10 hours.

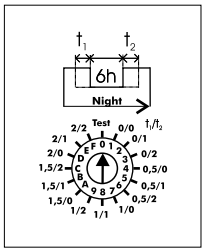
Setting periods of power-reduced operation for PR 1–10 V K LC

The PR 1–10 V K LC switch unit is delivered in its default setting – i.e. the dial is set to 'Test (Code 0)'.
After the luminaire has been installed, the desired power reduction time must be set using the dial on the switch unit. The power-reduction period can be set to a minimum of six hours and can be extended by up to two hours in both directions (i.e. earlier or later). This results in a maximum power-reduction period of 10 hours.

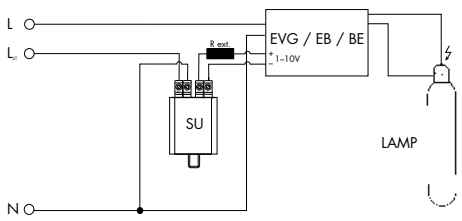
The dial enables the following settings:

Dial Settings Position	Timings	t_1 Hours	Basic power reduction period (hrs)	t_2 Hours	Total power reduction time (hrs)
0	Test	Factory setting: 5 seconds on full load, followed by power reduction			
1	0/0	0	6	0	6
2	0/1	0	6	1	7
3	0/2	0	6	2	8
4	0.5/0	0.5	6	0	6.5
5	0.5/1	0.5	6	1	7.5
6	0.5/2	0.5	6	2	8.5
7	1/0	1	6	0	7
8	1/1	1	6	1	8
9	1/2	1	6	2	9
A	1.5/0	1.5	6	0	7.5
B	1.5/1	1.5	6	1	8.5
C	1.5/2	1.5	6	2	9.5
D	2/0	2	6	0	8
E	2/1	2	6	1	9
F	2/2	2	6	2	10

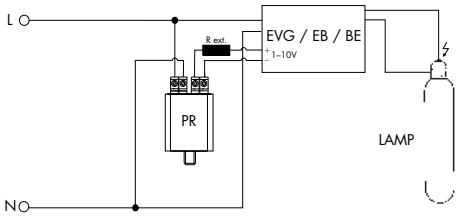




Circuit diagrams for switch units



SU 1–10 V K



PR 1–10 V K LC

Energy efficiency classification

Based on Directive 2009/125/EC, the European Commission has revised and redefined the limit values from Regulations (EC) 244/2009, (EC) 245/2009 and (EU) 1194/2012 in the third stage with Regulation (EU) 2019/2020 laying down ecodesign requirements for light sources and separate control gear. This regulation will enter into force on 1 September 2021. In the process, the scope was extended to LED light sources and separate control gear of any kind. In addition, limit values for losses in the so-called standby mode, no-load mode and the standby mode in network operation were added. The energy classes for separate control gears are no longer applicable and the limit values of the former class A2 apply. This means that within the EU, only control gears of energy class A2 and better are permitted.

Furthermore, regulation (EU) 2019/2020 sets higher efficiency requirements for the most common T8 lamps from 1 September 2023, which de facto prohibits the placing of T8 lamps on the EU market. In addition, most types of halogen lamps will be banned.

The following table summarises the minimum energy efficiency requirements for separate control gears that will apply in the EU from 1 September 2021.

Minimum efficiency ηmin.	**Control gears for high-pressure discharge lamps**
0.78	$P_{LS} \leq 30$ W
0.85	30 W < $P_{LS} \leq 75$ W
0.87	75 W < $P_{LS} \leq 105$ W
0.90	105 W < $P_{LS} \leq 405$ W
0.92	$P_{LS} > 405$ W

P_{LS} = measured light source power

Directive EU 245/2009 stipulates limit values governing the energy consumption of LED light sources and separate control gears, regardless of the technology, and applies to both electromagnetic and electronic control gear. Luminaires as so-called surrounding products are not covered by this regulation if both light source and control gear can be removed for inspection without destroying them. If a luminaire cannot be dismantled in the above sense, the luminaire is considered a light source and is subject to the regulation. The area of application is the Member States of the European Union.

However, **outside of the EU** it will continue to be possible to market products of all energy classes, as before, in compliance with local laws and directives.

ELECTRONIC BALLASTS

ELECTRONIC BALLASTS

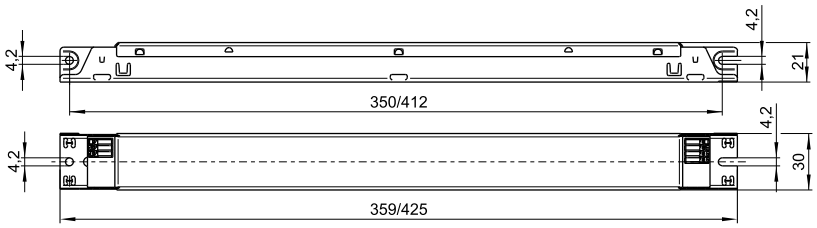
Operating fluorescent lamps with electronic ballasts yields numerous advantages with regard to efficiency and convenience. Further details are provided on the respective product pages and the technical appendix.

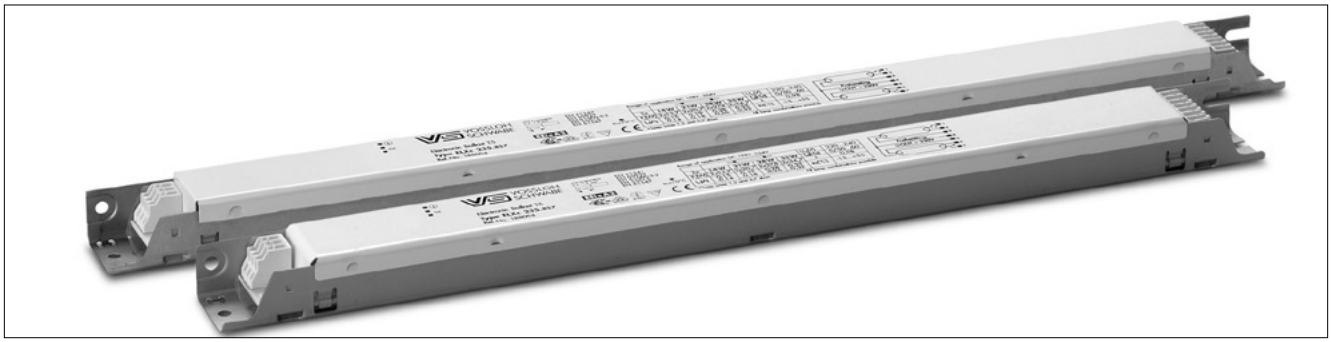
3 Electronic Ballasts for TC and T Lamps

ELXc – Warm Start for TC-F, TC-L Lamps

Electronic built-in ballasts
Casing: metal
Power factor: > 0.96
DC voltage
for operation: 176–264 V
for ignition: 198–264 V
(ELXc 180.866, 280.538: DC voltage cannot be reduced to 176 V)
Push-in terminals: 0.5–1 mm²
For the automatic luminaire wiring:
IDC terminals for leads H05V-U 0.5
RFI-suppressed
For luminaires of protection class I
Degree of protection: IP20
For lighting systems with
high switching frequency (> 5/day)
EOL shut down approved acc. to EN 61347 Test 2

M10/M11





T5 **TC** **BUILT-IN** **1–10 V**
T8 **INDEPENDENT** **DALI/PUSH**

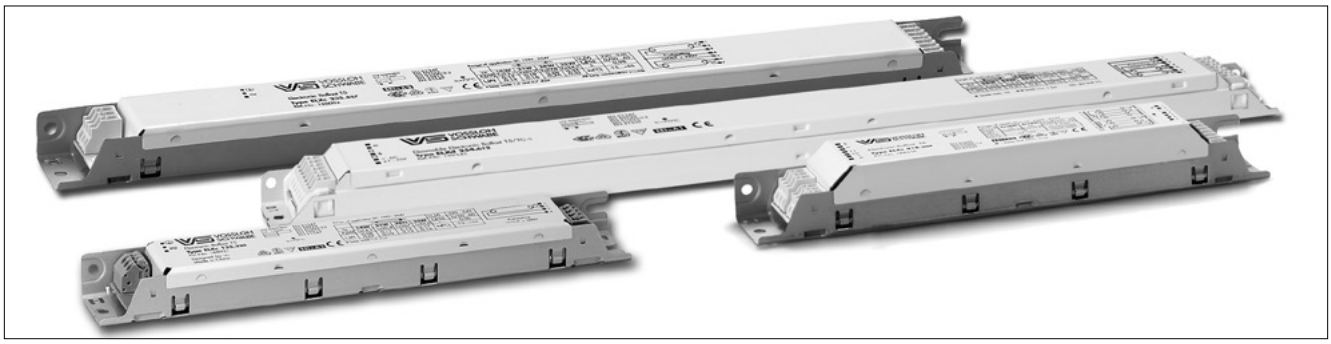
Lamp				Electronic ballast							System	
Output W	Type	Base	Power consumption W	Type	**Ref. No.**	Voltage AC 50, 60 Hz V±10%	Energy efficiency	Ambient temperature t_a (°C)	Casing temperature t_c (°C)	Casing	Output W	Luminous factor %
18	TC-F/-L	2G10/2G11	1 x 16.0	ELXc 140.862	**188140**	220–240	A2	–15 to 55	max. 70	M10	19.0	109.0
2x18	TC-F/-L	2G10/2G11	2 x 16.0	ELXc 240.863	**188616**	220–240	A2 BAT	–15 to 55	max. 70	M10	35.0	105.3
24	TC-F/-L	2G10/2G11	1 x 22.0	ELXc 140.862	**188140**	220–240	A2	–15 to 55	max. 70	M10	27.0	109.0
2x24	TC-F/-L	2G10/2G11	2 x 22.0	ELXc 240.863	**188616**	220–240	A2 BAT	–15 to 55	max. 70	M10	51.0	106.8
36	TC-F/-L	2G10/2G11	1 x 32.0	ELXc 140.862	**188140**	220–240	A2	–15 to 55	max. 70	M10	35.0	101.0
2x36	TC-F/-L	2G10/2G11	2 x 32.0	ELXc 240.863	**188616**	220–240	A2 BAT	–15 to 55	max. 70	M10	71.0	98.7
40	TC-L	2G11	1 x 40.0	ELXc 140.862	**188140**	220–240	A2	–15 to 55	max. 70	M10	46.0	104.0
2x40	TC-L	2G11	2 x 40.0	ELXc 240.863	**188616**	220–240	A2 BAT	–15 to 55	max. 70	M10	89.0	103.6
55	TC-L	2G11	1 x 55.0	ELXc 180.866	**188144**	220–240	A2 BAT	–15 to 55	max. 70	M10	62.0	107.3
2x55	TC-L	2G11	2 x 50.0	ELXc 254.865	**188618**	220–240	A2 BAT	–15 to 50	max. 70	M10	112.0	92.9
			2 x 55.0	ELXc 280.538	**188619**	220–240	A2 BAT	–15 to 50	max. 70	M11	120.0	100.0
80	TC-L	2G11	1 x 80.0	ELXc 180.866	**188144**	220–240	A2 BAT	–15 to 55	max. 70	M10	87.0	97.6
2x80	TC-L	2G11	2 x 80.0	ELXc 280.538	**188619**	220–240	A2 BAT	–15 to 50	max. 70	M11	175.0	100.0

Circuit diagrams see page 131

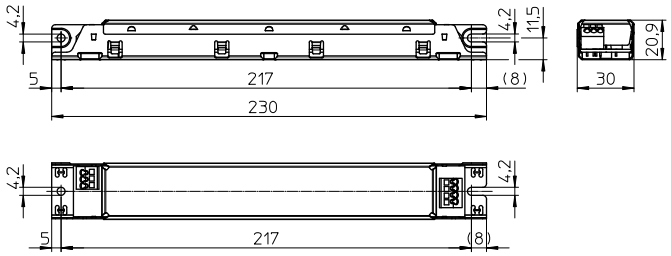
ELXc – Warm Start for T5 and T8 Lamps

Electronic built-in ballasts
Casing: metal
Power factor: ≥ 0.95
RFI-suppressed
For luminaires of protection class I

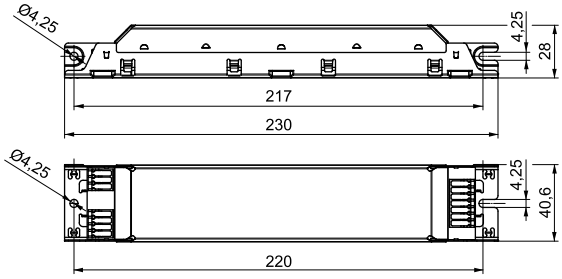
Degree of protection: IP20
For lighting systems with
high switching frequency (> 5/day)



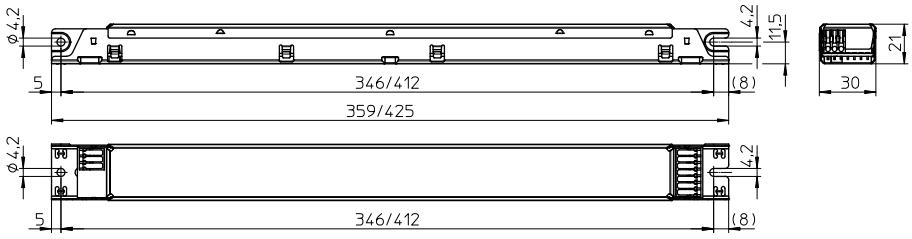
M6



M8



M10/M11



ELXc – Warm Start for T5 Lamps

DC voltage
for operation: 176–264 V
for ignition: 198–264 V
(ELXc 149.858, 154.864, 180.866, 280.538:
DC voltage cannot be reduced to 176 V)
Push-in terminals: 0.5–1 mm²

For the automatic luminaire wiring:
IDC terminals for leads H05V-U 0.5
EOL shut down approved
acc. to EN 61347 Test 2 (for T5)

◉ **T5** ○ **T8** ○ **TC** ◉ **BUILT-IN** ○ **INDEPENDENT** ○ **1–10 V** ○ **DALI/PUSH**

Lamp				Electronic ballast							System	
Output W	Type	Base	Power consumption W	Type	**Ref. No.**	Voltage AC 50, 60 Hz V±10%	Energy efficiency	Ambient temperature t_a (°C)	Casing temperature t_c (°C)	Casing	Output W	Luminous factor %
For T5 lamps – Casing: M10 and M11												
24	T5	G5	1 x 22.5	ELXc 140.862	**188140**	220–240	A2 BAT	–15 to 55	max. 70	M10	27.0	114.0
2x24	T5	G5	2 x 22.5	ELXc 240.863	**188616**	220–240	A2 BAT	–15 to 55	max. 70	M10	51.0	107.4
39	T5	G5	1 x 38.0	ELXc 140.862	**188140**	220–240	A2 BAT	–15 to 55	max. 70	M10	43.0	107.0
2x39	T5	G5	2 x 38.0	ELXc 240.863	**188616**	220–240	A2 BAT	–15 to 55	max. 70	M10	82.0	97.9
49	T5	G5	1 x 49.0	ELXc 149.858	**188095**	220–240	A2 BAT	–15 to 55	max. 70	M10	54.0	102.5
2x49	T5	G5	2 x 49.0	ELXc 249.859	**188617**	220–240	A2 BAT	–15 to 50	max. 70	M10	113.0	106.6
54	T5	G5	1 x 54.0	ELXc 154.864	**188142**	220–240	A2 BAT	–15 to 55	max. 65	M10	59.0	101.1
2x54	T5	G5	2 x 54.0	ELXc 254.865	**188618**	220–240	A2 BAT	–15 to 50	max. 70	M10	119.0	106.0
80	T5	G5	1 x 80.0	ELXc 180.866	**188144**	220–240	A2 BAT	–15 to 55	max. 70	M10	87.0	97.6
2x80	T5	G5	2 x 80.0	ELXc 280.538	**188619**	220–240	A2 BAT	–15 to 50	max. 70	M11	175.0	97.2

Circuit diagrams see page 131

ELXc EffectLine – Warm start

Warm start for T5 and T8 lamps – Casing: M6, M8 and M10

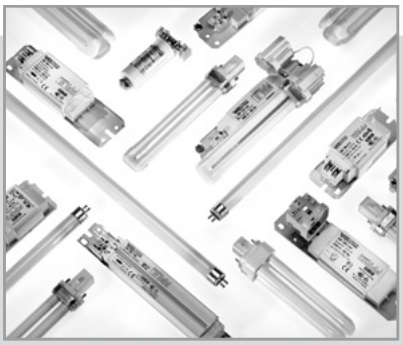
DC voltage
for operation: 176–264 V
for ignition: 198–264 V
(not possible for T8)
Push-in terminals with lever opener: 0.5–1.5 mm²
EOL shut down approved
acc. to EN 61347 Test 2 (for T5)
EOL shut down (for T8)

◉ **T5** ○ **TC** ◉ **BUILT-IN** ○ **1–10 V**
◉ **T8** ○ **INDEPENDENT** ○ **DALI/PUSH**

Lamp				Electronic ballast							System	
Output W	Type	Base	Power consumption W	Type	**Ref. No.**	Voltage AC 50, 60 Hz V±10%	Energy efficiency	Ambient temperature t_a (°C)	Casing temperature t_c (°C)	Casing	Output W	Luminous factor %
For T5 lamps – Casing: M6 and M10												
14	T5	G5	1 x 14.3	ELXc 135.220	**188921**	220–240	A2 BAT	–15 to 55	max. 70	M6	17.0	104.8
2x14	T5	G5	2 x 14.3	ELXc 235.221	**188922**	220–240	A2 BAT	–15 to 55	max. 70	M10	34.5	101.9
21	T5	G5	1 x 20.4	ELXc 135.220	**188921**	220–240	A2 BAT	–15 to 55	max. 70	M6	23.3	106.9
2x21	T5	G5	2 x 21.4	ELXc 235.221	**188922**	220–240	A2 BAT	–15 to 55	max. 70	M10	48.3	104.9
28	T5	G5	1 x 26.7	ELXc 135.220	**188921**	220–240	A2 BAT	–15 to 55	max. 70	M6	29.9	107.5
2x28	T5	G5	2 x 28.7	ELXc 235.221	**188922**	220–240	A2 BAT	–15 to 55	max. 70	M10	62.1	109.0
35	T5	G5	1 x 32.6	ELXc 135.220	**188921**	220–240	A2 BAT	–15 to 55	max. 70	M6	36.5	103.0
2x35	T5	G5	2 x 35.6	ELXc 235.221	**188922**	220–240	A2 BAT	–15 to 55	max. 70	M10	78.2	100.8
For T8 lamps – Casing: M8												
18	T8	G13	1 x 16.0	ELXc 136.207	**188704**	220–240	A2 BAT	–20 to 55	max. 60	M8	18.4	105.0
2x18	T8	G13	2 x 16.0	ELXc 236.208	**188705**	220–240	A2 BAT	–20 to 50	max. 60	M8	35.2	106.0
36	T8	G13	1 x 32.0	ELXc 136.207	**188704**	220–240	A2 BAT	–20 to 55	max. 60	M8	35.4	97.0
2x36	T8	G13	2 x 32.0	ELXc 236.208	**188705**	220–240	A2 BAT	–20 to 50	max. 60	M8	69.7	98.0
2x58	T8	G13	2 x 50.0	ELXc 258.210	**188707**	220–240	A2	–20 to 50	max. 65	M8	109.9	105.0

Circuit diagrams see page 131

RELIABLE AND DURABLE



ELECTROMAGNETIC BALLASTS

The following chapter presents Vossloh-Schwabe's broad range of electromagnetic ballasts for compact fluorescent lamps and tubular fluorescent lamps. The variety of available performance properties and shapes satisfies the most diverse design requirements.

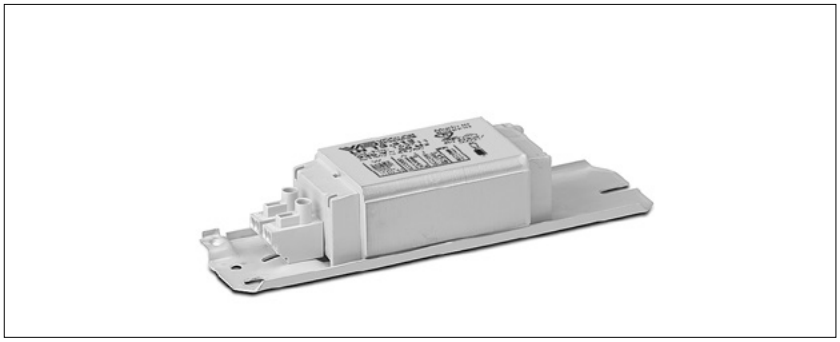
Vossloh-Schwabe's electromagnetic ballasts are characterized by extremely tight impedance-value tolerances, which are achieved by individual adjustment of the air gap during the automated production and testing process of the ballasts. This optimises both light output as well as the service life of fluorescent lamps.

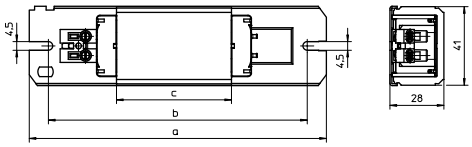
3 Electromagnetic Ballasts for TC and T Lamps

Standard Ballasts 4–16 W, 230/240 V

For fluorescent lamps
Shape: 28x41 mm

Vacuum-impregnated with polyester resin
Push-in terminals: 0.5–1.5 mm²
Protection class I
tw 130



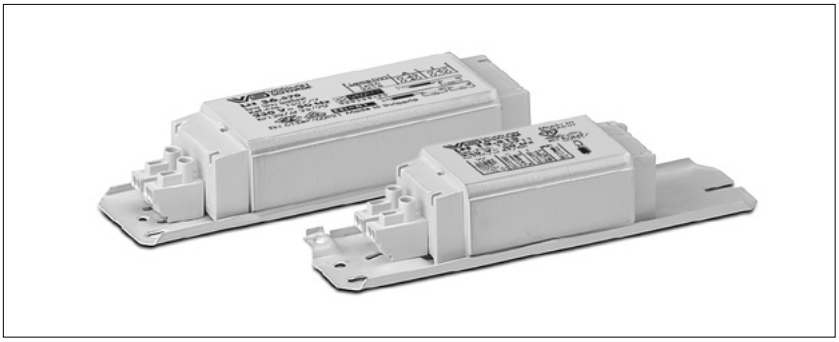


Lamp				Ballast									Capacitor	
Output	Type	Base	Current	Type	**Ref. No.**	Voltage	a	b	c	Weight	$\Delta t/\Delta t_{an.}$	Energy efficiency	C_P	Current
W			mA			V, Hz	mm	mm	mm	kg	K		µF	mA
230 V, 50 Hz														
4	T5 (T16)	G5	170	L 4/6/8.304*	**163683**	230, 50	105	87.5	34	0.32	55/85	B2	2.0	40
2x4	T5 (T16)	G5	155	L 4/6/8.304*	**163683**	230, 50	105	87.5	34	0.32	55/85	B1	2.0	50
5	TC-S	G23	180	L 7/9/11.307*	**163694**	230, 50	105	87.5	34	0.32	60/85	B2	2.0	50
2x5	TC-S	G23	180	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B2	2.0	70
6	T5 (T16)	G5	160	L 4/6/8.304*	**163683**	230, 50	105	87.5	34	0.32	55/85	B1	2.0	50
2x6	T5 (T16)	G5	175	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B1	2.0	65
7	TC-S	G23	175	L 7/9/11.307*	**163694**	230, 50	105	87.5	34	0.32	60/85	B2	2.0	50
2x7	TC-S	G23	160	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B2	2.0	70
8	T5 (T16)	G5	145	L 4/6/8.304*	**163683**	230, 50	105	87.5	34	0.32	55/85	B1	2.0	60
2x8	T5 (T16)	G5	155	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B1	2.0	85
9	TC-S	G23	170	L 7/9/11.307*	**163694**	230, 50	105	87.5	34	0.32	60/85	B1	2.0	60
2x9	TC-S	G23	140	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B2	2.0	80
10	TC-D	G24d-1	190	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B2	2.0	70
	TC-DD	GR10q	180	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B2	2.0	70
11	TC-S	G23	155	L 7/9/11.307*	**163694**	230, 50	105	87.5	34	0.32	60/85	B1	2.0	80
13	TC-D/TC-T	G24d-1/GX24d-1	175	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B2	2.0	80
	T5 (T16)	G5	165	LN 13.313*	**163711**	230, 50	105	87.5	34	0.32	55/80	B1	2.0	80
16	TC-DD	GR8/GR10q	195	LN 16.316*	**163730**	230, 50	105	87.5	34	0.32	60/125	B1	2.0	100
240 V, 50 Hz														
5	TC-S	G23	180	L 7/9/11.411	**164335**	240, 50	105	87.5	34	0.32	60/85	B2	2.0	50
2x5	TC-S	G23	180	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B2	2.0	70
2x6	T5 (T16)	G5	175	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B1	2.0	65
7	TC-S	G23	175	L 7/9/11.411	**164335**	240, 50	105	87.5	34	0.32	60/85	B2	2.0	50
2x7	TC-S	G23	160	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B2	2.0	70
2x8	T5 (T16)	G5	155	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B1	2.0	85
9	TC-S	G23	170	L 7/9/11.411	**164335**	240, 50	105	87.5	34	0.32	60/85	B1	2.0	60
2x9	TC-S	G23	140	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B2	2.0	80
10	TC-D	G24d-1	190	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B2	2.0	70
	TC-DD	GR10q	180	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B2	2.0	70
11	TC-S	G23	155	L 7/9/11.411	**164335**	240, 50	105	87.5	34	0.32	60/85	B1	2.0	80
13	TC-D/TC-T	G24d-1/GX24d-1	175	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B1	2.0	80
	T5 (T16)	G5	165	LN 13.413	**164342**	240, 50	105	87.5	34	0.32	60/90	B1	2.0	80

* Ballasts without CE marking for replacements or markets outside of the EU

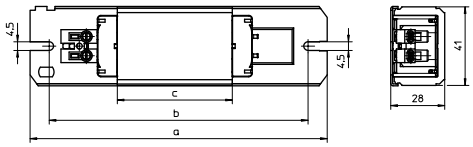
Standard Ballasts 14–65 W 230/240/220 V

For fluorescent lamps
Shape: 28x41 mm



Vacuum-impregnated with polyester resin
Push-in terminals: 0.5–1.5 mm²
(for 534584 screw terminals: 1–4 mm²)
Protection class I
tw 130

A



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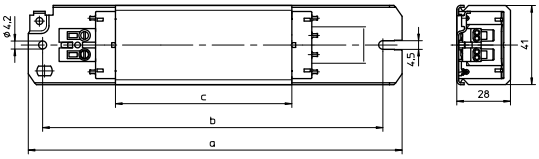

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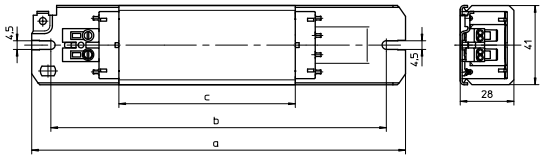
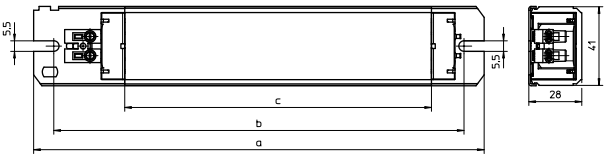
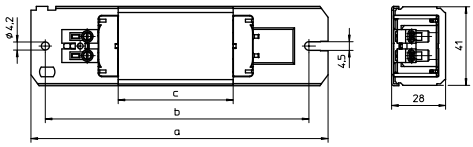


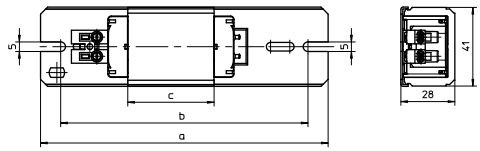
D



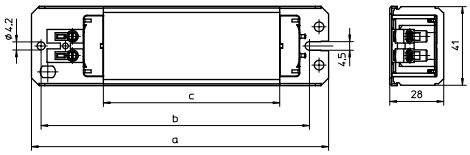
E



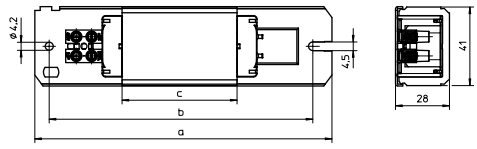
F



G



H



Standard Ballasts 14–65 W, 230/240/220 V

Lamp				Ballast										Capacitor	
Output	Type	Base	Current	Type	**Ref. No.**	Voltage	Drawing	a	b	c	Weight	$\Delta t/\Delta t_{an.}$	Energy efficiency	C_P	Current
W			mA			V, Hz		mm	mm	mm	kg	K		µF	mA
230 V, 50 Hz															
14	T8 (T26)	G13	395	LN 18.510*	**164572**	230, 50	G	155	140	92	0.80	40/65	B2	4.5	150
15	T8 (T26)	G13	310	LN 15.329*	**163861**	230, 50	E	155	138	60	0.55	50/80	B2	3.5	120
2x15	T8 (T26)	G13	340	LN 30.801*	**169645**	230, 50	E	155	138	60	0.55	55/110	B2	4.0	185
16	T8 (T26)	G13	200	LN 16.316*	**163730**	230, 50	A	105	87.5	34	0.32	60/125	B1	2.0	90
18	TC-D/TC-T	G24d-2/GX24d-2	220	LN 18I.319*	**163763**	230, 50	A	105	87.5	34	0.32	60/140	B1	2.0	110
	TC-F/TC-L	2G10/2G11	370	LN 18.510*	**164572**	230, 50	G	155	140	92	0.80	40/65	B1	4.5	120
				LN 18.131*	**530941**	230, 50	E	155	138	60	0.55	55/95	B2	4.5	120
	T-U	2G13	370	LN 18.131*	**530941**	230, 50	E	155	138	60	0.55	55/95	B2	4.5	120
18/20	T8 (T26)/T12 (T38)	G13	370	LN 18.510*	**164572**	230, 50	G	155	140	92	0.80	40/65	B1	4.5	120
				LN 18.131*	**530941**	230, 50	E	155	138	60	0.55	55/95	B2	4.5	120
22	T-R	G10q	400	LN 30.530*	**164680**	230, 50	G	155	140	92	0.80	45/65	B2	4.5	200
25	T12 (T38)	G13	290	L 25.346*	**164013**	230, 50	E	155	138	60	0.55	45/80	B1	3.5	130
26	TC-D/TC-T	G24d-3/GX24d-3	325	LN 18.131*	**530941**	230, 50	E	155	138	60	0.55	55/95	B1	3.5	140
				LN 26.813*	**509502**	230, 50	A	110	100	45	0.41	55/145	B2	3.5	140
28	TC-DD	GR8/GR10q	320	LN 18.510*	**164572**	230, 50	G	155	140	92	0.80	40/65	B1	3.5	150
				LN 18.131*	**530941**	230, 50	E	155	138	60	0.55	55/95	B1	3.5	150
30	T8 (T26)	G13	365	LN 30.801*	**169645**	230, 50	E	155	138	60	0.55	55/110	B2	4.5	180
32	T-R	G10q	450	LN 36.570*	**169779**	230, 50	G	155	140	92	0.80	35/90	B2	4.0	220
36	TC-F/TC-L	2G10/2G11	430	LN 36.570*	**169779**	230, 50	G	155	140	92	0.80	35/90	B1	4.5	210
				LN 36.511*	**164590**	230, 50	G	155	140	92	0.80	35/95	B1	4.5	210
				LN 36.149*	**529029**	230, 50	E	155	138	60	0.55	55/150	B2	4.5	210
				L 36.132*	**535977**	230, 50	F	155	129	45	0.43	65	—	4.5	210
36-1	T8 (T26)	G13	556	L 36I.342*	**538072**	230, 50	B	195	180	110	0.87	50/120	B2	6.5	250
36/40	T-U/T-R	2G13/G10q	430	LN 36.570*	**169779**	230, 50	G	155	140	92	0.80	35/90	B1	4.5	210
				LN 36.149*	**529029**	230, 50	E	155	138	60	0.55	55/150	B2	4.5	210
				L 36.132*	**535977**	230, 50	F	155	129	45	0.43	65	—	4.5	210
	T8 (T26)/T12 (T38)	G13	430	LN 36.570*	**169779**	230, 50	G	155	140	92	0.80	35/90	B1	4.5	210
				LN 36.149*	**529029**	230, 50	E	155	138	60	0.55	55/150	B2	4.5	210
				L 36.132*	**535977**	230, 50	F	155	129	45	0.43	65	—	4.5	210
38	TC-DD	GR10q	430	LN 36.570*	**169779**	230, 50	G	155	140	92	0.80	35/90	B1	4.5	210
				LN 36.149*	**529029**	230, 50	E	155	138	60	0.55	55/150	B2	4.5	210
				L 36.132*	**535977**	230, 50	F	155	129	45	0.43	65	—	4.5	210
	T8 (T26)	G13	430	LN 36.570*	**169779**	230, 50	G	155	140	92	0.80	35/90	B1	4.5	210
				LN 36.149*	**529029**	230, 50	E	155	138	60	0.55	55/150	B2	4.5	210
				L 36.132*	**535977**	230, 50	F	155	129	45	0.43	65	—	4.5	210
58	T-U	2G13	670	LN 58.568*	**169389**	230, 50	D	235	220	160	1.31	35/95	B1	7.0	320
				LN 58.116*	**508186**	230, 50	C	195	180	92	0.80	55/160	B2	7.0	320
58/65	T8 (T26)/T12 (T38)	G13	670	LN 58.568*	**169389**	230, 50	D	235	220	160	1.31	35/95	B1	7.0	320

* Ballasts without CE marking for replacements or markets outside of the EU

Standard Ballasts 14–65 W, 230/240/220 V

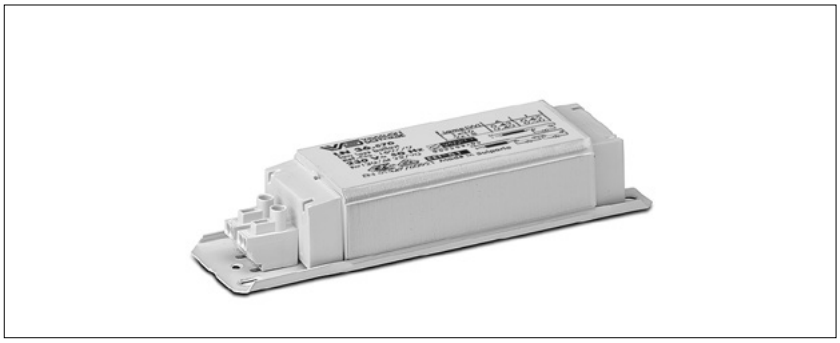
Lamp				Ballast										Capacitor	
Output	Type	Base	Current	Type	**Ref. No.**	Voltage	Drawing	a	b	c	Weight	$\Delta t/\Delta t_{an.}$	Energy efficiency	C_P	Current
W			mA			V, Hz		mm	mm	mm	kg	K		µF	mA
240 V, 50 Hz															
18	TC-F/TC-L	2G10/2G11	370	L 18.936*	**534627**	240, 50	F	155	129	45	0.43	70/140	–	4.5	120
	T-U	2G13	370	L 18.936*	**534627**	240, 50	F	155	129	45	0.43	70/140	–	4.5	120
18/20	T8 (T26)/T12 (T38)	G13	370	L 18.936*	**534627**	240, 50	F	155	129	45	0.43	70/140	–	4.5	120
24	TC-F/TC-L	2G10/2G11	345	L 18.936*	**534627**	240, 50	F	155	129	45	0.43	70/140	–	4.5	150
28	TC-DD	GR8/GR10q	320	L 18.936*	**534627**	240, 50	F	155	129	45	0.43	70/140	–	3.5	150
36/40	T8 (T26)/T12 (T38)	G13	430	L 36.124	**534584**	240, 50	H	155	140	45	0.43	70/150	–	4.5	210
58	T-U	2G13	670	LN 58.722	**534252**	240, 50	C	195	180	92	0.80	60/180	B2	7.0	320
58/65	T8 (T26)/T12 (T38)	G13	670	LN 58.722	**534252**	240, 50	C	195	180	92	0.80	60/180	B2	7.0	320
220 V, 50 Hz															
18	TC-F/TC-L	2G10/2G11	370	L 18.933	**534624**	220, 50	F	155	129	45	0.43	70/160	–	4.5	120
	T-U	2G13	370	L 18.933	**534624**	220, 50	F	155	129	45	0.43	70/160	–	4.5	120
2x18	TC-F/TC-L	2G10/2G11	400	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.0	210
18/20	T8 (T26)/T12 (T38)	G13	370	L 18.933	**534624**	220, 50	F	155	129	45	0.43	70/160	–	4.5	120
2x18/20	T8 (T26)/T12 (T38)	G13	430	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.0	210
24	TC-F/TC-L	2G10/2G11	345	L 18.933	**534624**	220, 50	F	155	129	45	0.43	70/160	–	4.5	150
26	TC-D/TC-T	G24d-3/GX24d-3	325	L 18.933	**534624**	220, 50	F	155	129	45	0.43	70/160	–	3.5	140
28	TC-DD	GR8/GR10q	320	L 18.933	**534624**	220, 50	F	155	129	45	0.43	70/160	–	3.5	150
36	TC-F/TC-L	2G10/2G11	430	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.5	210
36/40	T-U/T-R	2G13/G10q	430	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.5	210
	T8 (T26)/T12 (T38)	G13	430	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.5	210
38	TC-DD	GR10q	430	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.5	210
	T8 (T26)	G13	430	L 36.158	**530252**	220, 50	F	155	129	45	0.43	65	–	4.5	210
58	T-U	2G13	670	L 58.625	**164828**	220, 50	C	195	180	92	0.80	55/155	–	7.0	320
58/65	T8 (T26)/T12 (T38)	G13	670	L 58.625	**164828**	220, 50	C	195	180	92	0.80	55/155	–	7.0	320
220 V, 60 Hz															
18	TC-F/TC-L	2G10/2G11	370	L 18.121	**528582**	220, 60	F	155	129	45	0.43	65/145	–	4.0	150
	T-U	2G13	370	L 18.121	**528582**	220, 60	F	155	129	45	0.43	65/145	–	4.0	150
2x18	TC-F/TC-L	2G10/2G11	400	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	210
18/20	T8 (T26)/T12 (T38)	G13	370	L 18.121	**528582**	220, 60	F	155	129	45	0.43	65/145	–	4.0	190
2x18/20	T8 (T26)/T12 (T38)	G13	430	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	220
24	TC-F/TC-L	2G10/2G11	345	L 18.121	**528582**	220, 60	F	155	129	45	0.43	65/145	–	4.0	190
26	TC-D/TC-T	G24d-3/GX24d-3	325	L 18.121	**528582**	220, 60	F	155	129	45	0.43	65/145	–	3.0	160
36	TC-F/TC-L	2G10/2G11	430	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	210
36/40	T-U/T-R	2G13/G10q	430	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	220
	T8 (T26)/T12 (T38)	G13	430	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	220
38	TC-DD	GR10q	430	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	220
	T8 (T26)	G13	430	L 36.120	**509373**	220, 60	F	155	129	45	0.43	60/170	–	4.0	230
58	T-U	2G13	670	L 58.657	**164870**	220, 60	C	195	180	92	0.80	55/140	–	6.0	320
58/65	T8 (T26)/T12 (T38)	G13	670	L 58.657	**164870**	220, 60	C	195	180	92	0.80	55/140	–	6.0	320

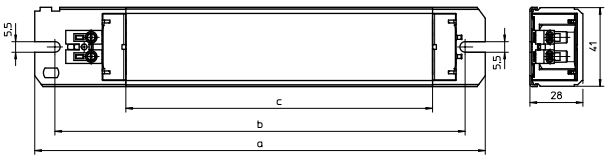
* Ballasts without CE marking for replacements or markets outside of the EU

Super Low-loss Ballasts 18–65 W, 230 V

For fluorescent lamps
Shape: 28x41 mm

Vacuum-impregnated with polyester resin
Push-in terminals: 0.5–1.5 mm²
Protection class I
tw 130
Energy efficiency: A2, minimum EU energy efficiency requirements as of 2017





Lamp				Ballast									Capacitor	
Output	Type	Base	Current	Type	**Ref. No.**	Voltage	a	b	c	Weight	$\Delta t/\Delta t_{an.}$	Energy efficiency	C_P	Current
W			mA			V, Hz	mm	mm	mm	kg	K		µF	mA
230 V, 50 Hz														
2x18/20	T8 (T26)/T12 (T38)	G13	400	LNN 36.648	**560664**	230, 50	235	220	160	1.35	25/40	**A2**	4.5	210
36/40	T8 (T26)/T12 (T38)	G13	430	LNN 36.648	**560664**	230, 50	235	220	160	1.35	25/40	**A2**	4.5	210
58/65	T8 (T26)/T12 (T38)	G13	670	LNN 58.960	**569031**	230, 50	235	220	160	1.35	50/80	**A2**	7.0	320

COMPACT AND VERSATILE

VS LAMPHOLDERS FOR COMPACT FLUORESCENT LAMPS

Vossloh-Schwabe provides a broad range of lampholders for single-ended compact fluorescent lamps, with regard to which the numerous fixing methods make just about any luminaire design possible.

As compact fluorescent lamps generate considerably less heat in comparison to incandescent lamps, the advantages provided by thermoplastics can be fully utilized for lampholder design.

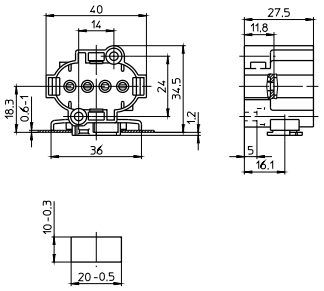
Almost all VS lampholders for compact fluorescent lamps are made of thermoplastic PBT and therefore bear the T marking T140, which refers to the maximum base temperature in accordance with EN 61199 (VDE 0715 T9). The use of this highly heat-resistant material was born of close cooperation between Vossloh-Schwabe and the world's leading lamp manufacturers that also use PBT for producing lamp bases. In connection with fatigue-resistant, stainless steel lamp mounting springs, harmonizing the casing material ensures a permanent and secure lamp fit.

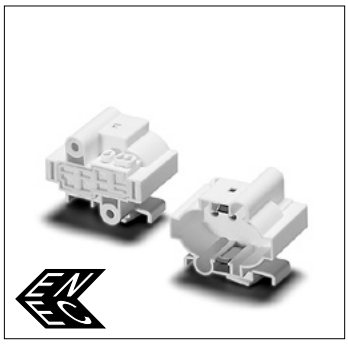
3 Lampholders and Accessories for TC Lamps

2G7 Lampholders

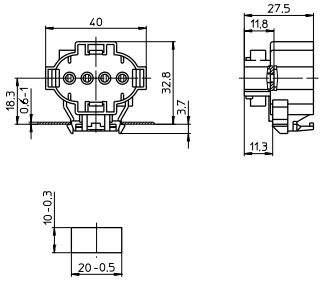
For single-ended compact fluorescent lamps TC-SEL

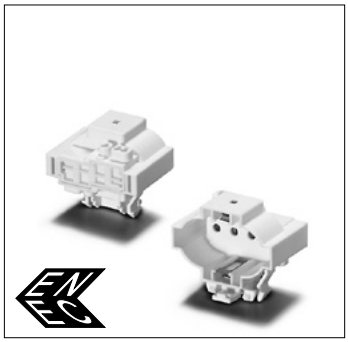
2G7 push-fit lampholder
Casing: PBT GF, white, T140, nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Rear fixing hole for self-tapping screw
acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Locking of the lampholder by a 15° turn
Weight: 13.7 g, unit: 500 pcs.
Type: 35610
Ref. No.: 109235



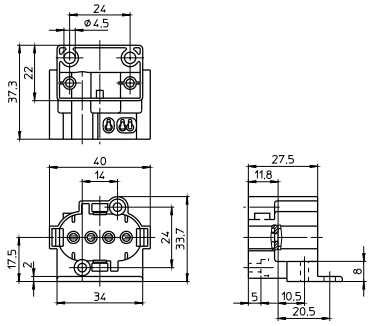


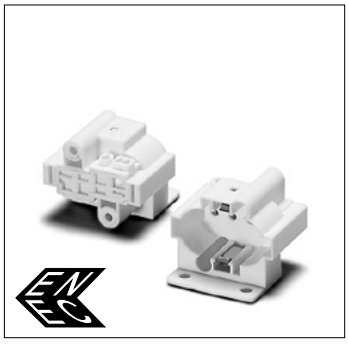
2G7 push-fit lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Push-fit foot for cut-out 10x20 mm
for wall thickness 0.6–1 mm
Weight: 18 g, unit: 500 pcs.
Type: 35613
Ref. No.: 500574



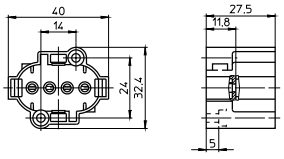


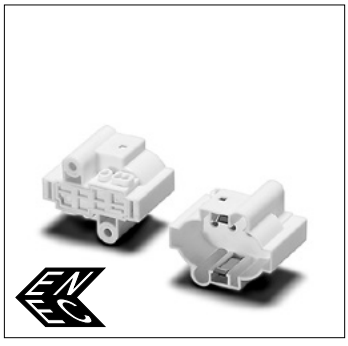
2G7 surface-mounted lampholder
Casing: PBT GF, white, T140, nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Fixing holes for screws M4
Lateral and rear fixing holes for self-tapping
screws acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Weight: 18.1 g, unit: 500 pcs.
Type: 35611
Ref. No.: 109238





2G7 surface-mounted lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Weight: 14 g, unit: 500 pcs.
Type: 35612
Ref. No.: 109240



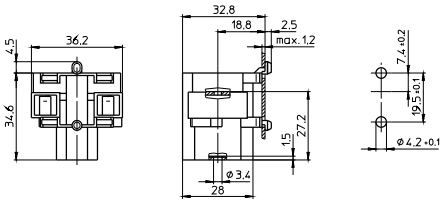


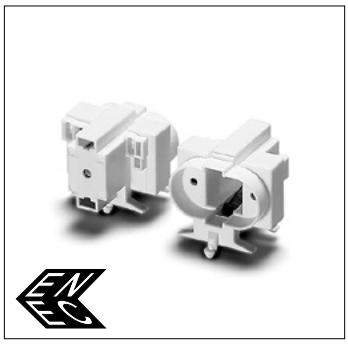
G23 Lampholders

For single-ended compact fluorescent lamps TC-S

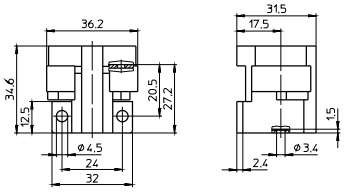
If the central hole is used for mounting,
make sure there is no risk of rotation.

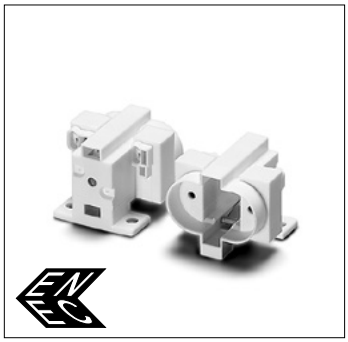
G23 push-fit lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Split pins for wall thickness up to 1.2 mm
Central fixing hole for screw M3
Weight: 12 g, unit: 500 pcs.
Type: 35004
Ref. No.: 101298



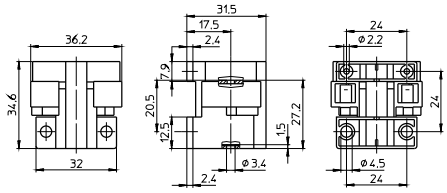


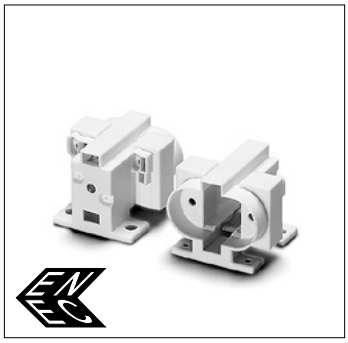
G23 surface-mounted lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Fixing holes for screws M4
Central fixing hole for screw M3
Weight: 12.4 g, unit: 500 pcs.
Type: 35006
Ref. No.: 101306



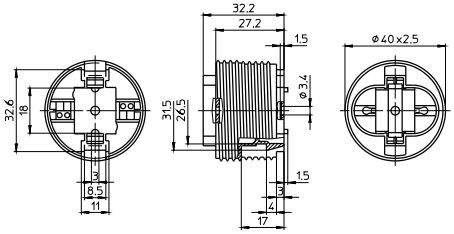


G23 lampholder
For push-fit on track
Casing: PBT GF, white, T140, nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Lateral fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST2.9-C/F
Fixing holes for screws M4
Central fixing hole for screw M3
Weight: 14 g, unit: 500 pcs.
Type: 35007
Ref. No.: 101310

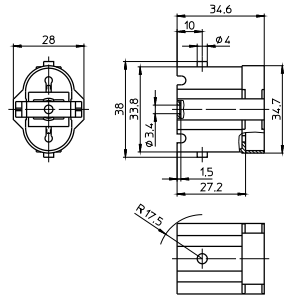


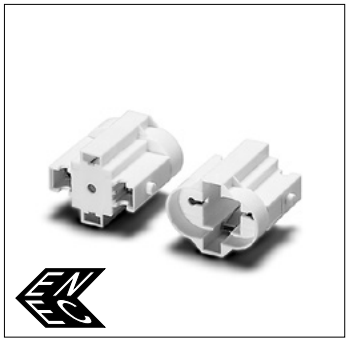


G23 lampholder, for cover caps (see p. 186–188)
External thread 40x2.5 IEC 60399
Casing: PBT GF, white, T140, nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Central fixing hole for screw M3
When using the central hole for mounting
additional depressions for anti-rotation pips
have to be provided.
For screw rings (see p. 200)
Weight: 16.3 g, unit: 500 pcs.
Type: 35010
Ref. No.: 101320

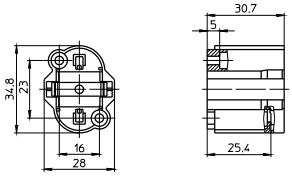


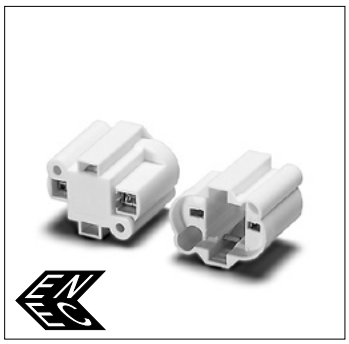
G23 lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Lateral pivots for bracket 105820
Central fixing hole for screw M3
Weight: 11 g, unit: 500 pcs.
Type: 35011
Ref. No.: 101324



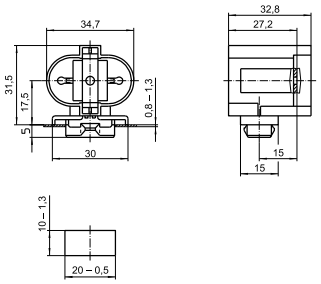


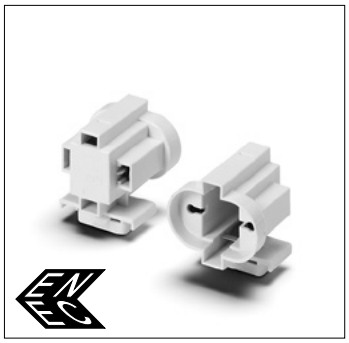
G23 surface-mounted lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Front fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST4.2-C/F
Weight: 11.9 g, unit: 500 pcs.
Type: 35012
Ref. No.: 108898



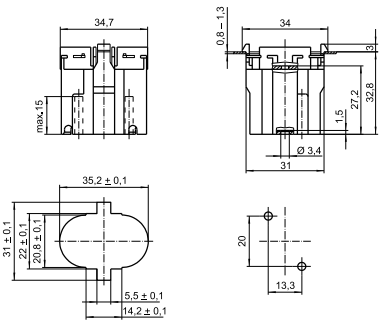


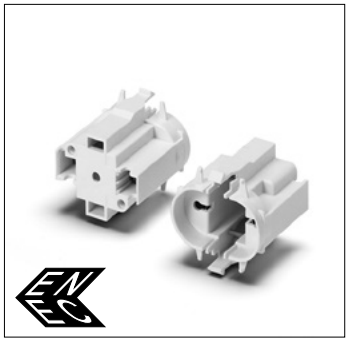
G23 push-fit lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Push-fit foot for wall thickness 0.8–1.3 mm
Central fixing hole for screw M3
Weight: 11 g, unit: 500 pcs.
Type: 35051
Ref. No.: 101344





G23 push-fit lampholder
Casing: PBT GF, white, T140
Nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Front split pins for wall thickness 0.8–1.3 mm
Central fixing hole for screw M3
Weight: 12 g, unit: 500 pcs.
Type: 35052
Ref. No.: 101346

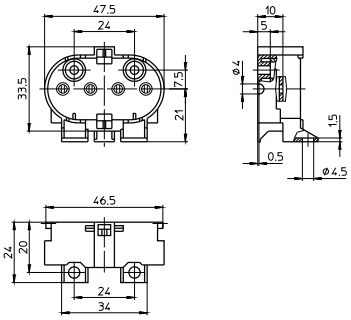


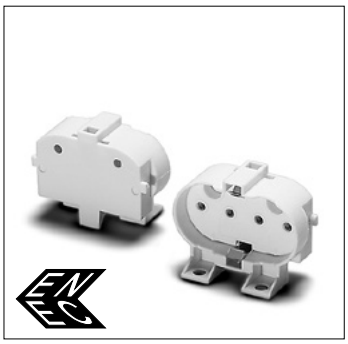


2G11 Lampholders

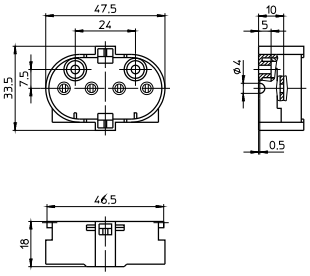
For single-ended compact fluorescent lamps TC-L

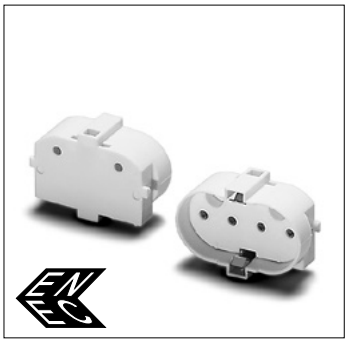
2G11 surface-mounted lampholder
Casing: PBT GF, white, T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Base fixing holes for screws M4
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Weight: 13.7 g, unit: 500 pcs.
Type: 36050
Ref. No.: 101485



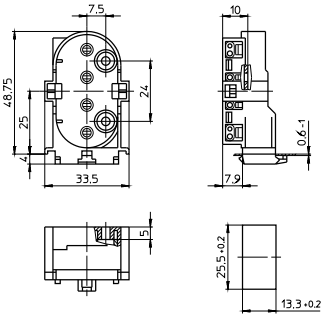


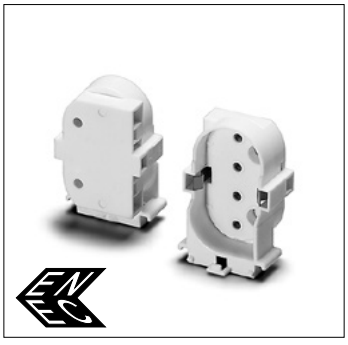
2G11 surface-mounted lampholder
Casing: PBT GF, white, T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Weight: 12.7 g, unit: 500 pcs.
Type: 36051
Ref. No.: 101489



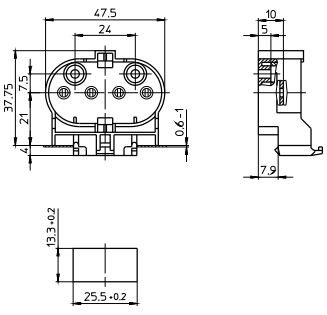


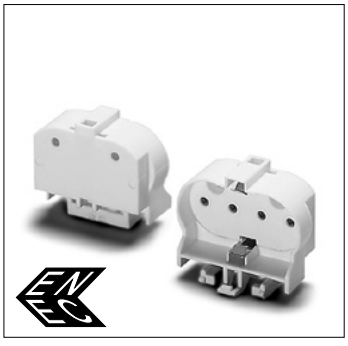
2G11 push-fit lampholder
Casing: PBT GF, white, T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Lamp position: vertical
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Weight: 14.3 g, unit: 500 pcs.
Type: 36052
Ref. No.: 101491





2G11 push-fit lampholder
Casing: PBT GF, white, T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm² (lamp circuit)
Push-in terminals: 0.5–1 mm² (starter circuit)
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST4.2-C/F
Front fixing holes for screws M3
Option for base wiring
Weight: 14.1 g, unit: 500 pcs.
Type: 36053
Ref. No.: 101493



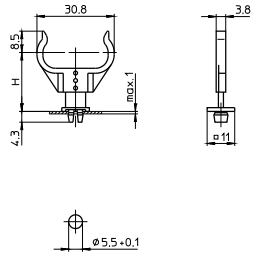


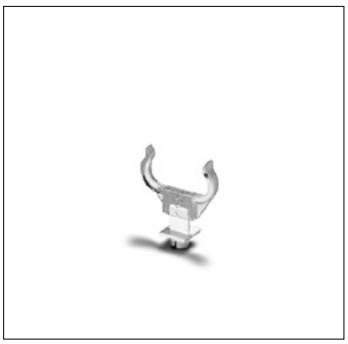
Accessories

For single-ended compact fluorescent lamps

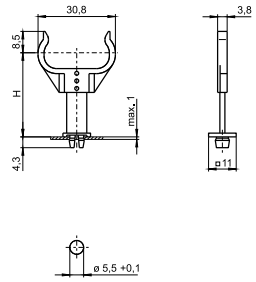
The luminaire manufacturer is responsible
for the right choice of accessories.

Lamp supports for TC-S, TC-SEL lamps
Height adjustable H: 17.5/20.5/23.5 mm
Push-fit foot for cut-out Ø 5.5 mm
for wall thickness up to 1 mm
Weight: 0.4/0.8/0.8 g, unit: 500 pcs.
Type: 35060
Ref. No.: 105775 foot, PC, white
Ref. No.: 105776 bracket, PC, crystal-clear, UV-stabilised

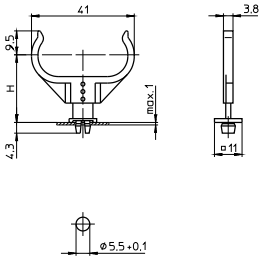




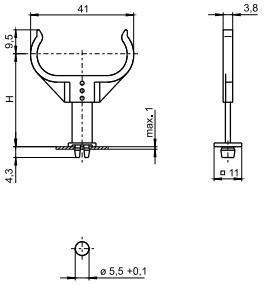
Lamp supports for TC-S, TC-SEL lamps
Height adjustable H: 27.5/30.5/33.5 mm
Push-fit foot for cut-out Ø 5.5 mm
for wall thickness up to 1 mm
Weight: 0.7/0.8/0.8 g, unit: 500 pcs.
Type: 35061
Ref. No.: 105931 foot, PC, white
Ref. No.: 105776 bracket, PC, crystal-clear, UV-stabilised



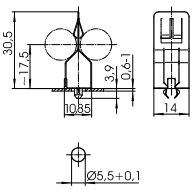
Lamp supports for TC-L lamps
Height adjustable H: 21/24/27 mm
Push-fit foot for cut-out Ø 5.5 mm
for wall thickness up to 1 mm
Weight: 0.4/1.3/1.1 g, unit: 500 pcs.
Type: 35760
Ref. No.: 105775 foot, PC, white
Ref. No.: 105777 bracket, PC, crystal-clear, UV-stabilised
Ref. No.: 106417 bracket, PC, white, UV-stabilised



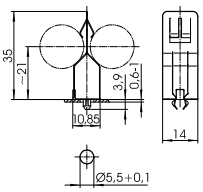
Lamp supports for TC-L lamps
Height adjustable H: 31/34/37 mm
Push-fit foot for cut-out Ø 5.5 mm
for wall thickness up to 1 mm
Weight: 0.7/1.3/1.1 g, unit: 500 pcs.
Type: 35761
Ref. No.: 105931 foot, PC, white
Ref. No.: 105777 bracket, PC, crystal-clear, UV-stabilised
Ref. No.: 106417 bracket, PC, white, UV-stabilised



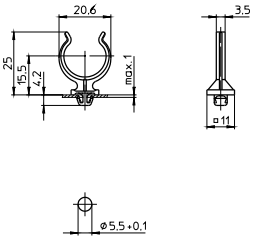
Lamp supports for TC-S, TC-SEL lamps
Material: stainless steel
Weight: 1.3 g, unit: 500 pcs.
Type: 93056 push-fit foot for Ø 5.5 mm
Ref. No.: 509522



Lamp supports for TC-F, TC-L lamps
Material: stainless steel
Weight: 1.5 g, unit: 500 pcs.
Type: 93058 push-fit foot for Ø 5.5 mm
Ref. No.: 509520



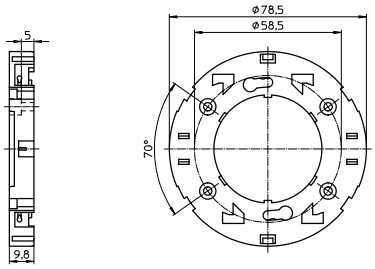
Lamp support for TC-L lamps
Material: PC, white, UV-stabilised
Push-fit foot for cut-out Ø 5.5 mm
for wall thickness up to 1 mm
Weight: 0.7 g, unit: 500 pcs.
Type: 36060
Ref. No.: 108878



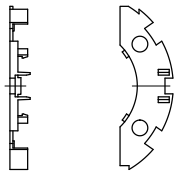
GX53-1 Lampholders, Accessories

For single-ended compact fluorescent lamps with integrated ballasts

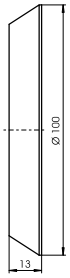
GX53-1 lampholder
Casing: PC, white, T100, nominal rating: 2/250
Push-in terminals for through-wiring
for single-core leads: 0.5–1 mm²
for stranded leads:
0.75 mm², tinned lead ends
Fixing holes for screws M3
Weight: 12.8 g, unit: 200 pcs.
Type: 11000
Ref. No.: 530878



Cord grip/cover plate for GX53-1 lampholders
For leads H03VVH2-F 2X0.75, tinned lead ends
For luminaires of protection class II
Material: PC, white
Weight: 1.6 g, unit: 200 pcs.
Type: 97278
Ref. No.: 504939



Surface-mounted installation ring
For wood or furniture panels
Material: PC, white
Weight: 10.4 g, unit: 100 pcs.
Type: 97277
Ref. No.: 504938



LAMPHOLDERS FOR T5, T8 AND T12 LAMPS

VS LAMPHOLDERS FOR DOUBLE-ENDED FLUORESCENT LAMPS

Vossloh-Schwabe's comprehensive range of lampholders for double-ended fluorescent lamps covers all major fixing methods. Push-through, push-fit and built-in lampholders with split pins or catches are available just as models with screw and push fittings.

High-grade materials for the contacts and thermoplastics for the casings guarantee reliable contacts and a long service life of the components.

Special G13 lampholders for the USA and Canada can be found under **www.unvlt.com/products/legacy/lampholders**.

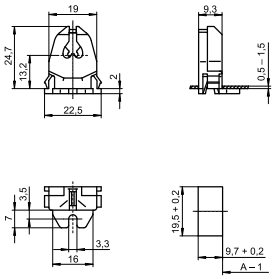
3 Lampholders and Accessories for T Lamps

G5 Lampholders, Accessories

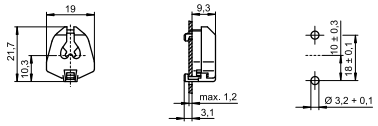
For fluorescent lamps T5 (T16)

Max. permitted temperature T_m
on the rear side of the lampholder: 110 °C

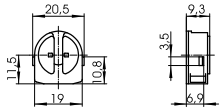
G5 push-through/surface-mounted lampholder
Lamp axis push-through lampholder: 13.2 mm
Lamp axis surface-mounted lampholder: 15.2 mm
Casing: PC, white, T110
Nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.5–1.5 mm
Fixing slot for screw M3
Weight: 3.2 g, packaging unit: 1000 pcs.
Type: 09105
Ref. No.: 100305



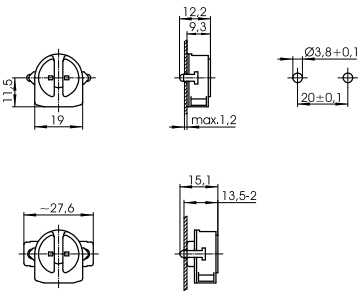
G5 built-in lampholder
Casing: PC, white, T110
Nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Rear split pins for wall thickness up to 1.2 mm
Weight: 2.6 g, packaging unit: 1000 pcs.
Type: 09205
Ref. No.: 100310



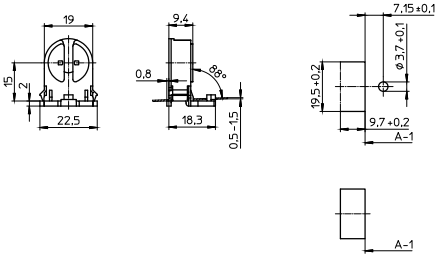
G5 built-in lampholder
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Lateral fixing clips
Weight: 2.8 g, packaging unit: 1000 pcs.
Type: 09404
Ref. No.: 505732



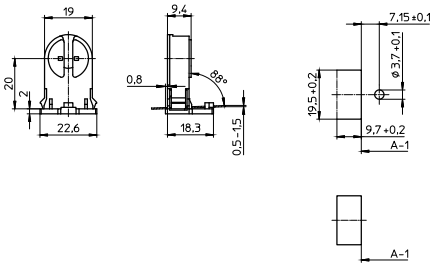
G5 built-in lampholders
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Rear split pins for wall thickness up to 1.2 mm
Weight: 2.9/3.3 g, packaging unit: 1000 pcs.
Type: 09405/09406
Ref. No.: 505733
Ref. No.: 505734 with spring adjustment



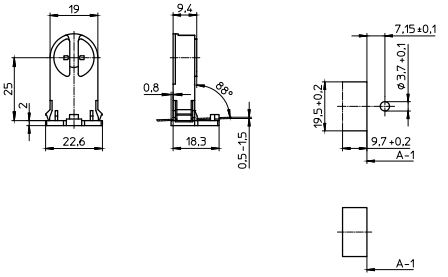
G5 push-through lampholders
Lamp axis: 15 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.5–1.5 mm
Weight: 3.5/3.4 g, packaging unit: 1000 pcs.
Type: 09420/09421
Ref. No.: 505737 with stop
Ref. No.: 505739 without stop



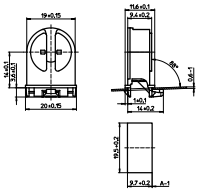
G5 push-through lampholders
Lamp axis: 20 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.5–1.5 mm
Weight: 4.1 g, packaging unit: 1000 pcs.
Type: 09432/09433
Ref. No.: 545933 with stop
Ref. No.: 545935 without stop



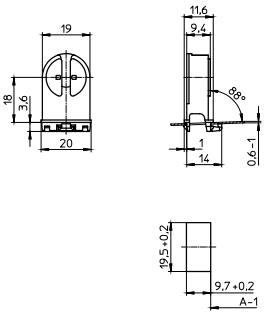
G5 push-through lampholders
Lamp axis: 25 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.5–1.5 mm
Weight: 4.5 g, packaging unit: 1000 pcs.
Type: 09434/09435
Ref. No.: 545937 with stop
Ref. No.: 545939 without stop



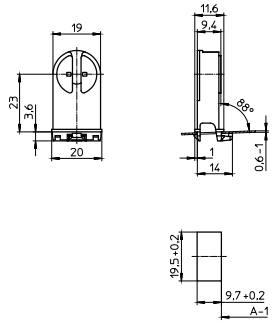
G5 push-fit lampholder
Lamp axis: 14 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Rear fixing clips for wall thickness 0.6–1 mm
Base or lateral wiring
Weight: 3.3 g, packaging unit: 1000 pcs.
Type: 09440
Ref. No.: 505747



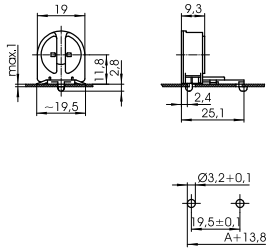
G5 push-fit lampholder
Lamp axis: 18 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Rear fixing clips for wall thickness 0.6–1 mm
Base or lateral wiring
Weight: 3.9 g, packaging unit: 1000 pcs.
Type: 09446
Ref. No.: 545894



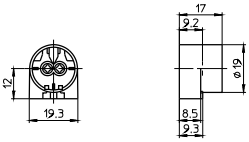
G5 push-fit lampholder
Lamp axis: 23 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Rear fixing clips for wall thickness 0.6–1 mm
Base or lateral wiring
Weight: 4.2 g, packaging unit: 1000 pcs.
Type: 09447
Ref. No.: 545896



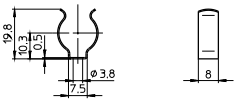
G5 push-fit lampholder
Lamp axis: 11.8 mm
Casing: PBT GF, white, rotor: PBT GF, white
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Base split pins for wall thickness up to 1 mm
Lateral wiring
Weight: 3.1 g, packaging unit: 1000 pcs.
Type: 09460
Ref. No.: 505751



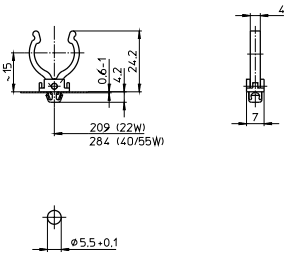
G5 lampholder
For push-fit onto the lamp
Casing: PBT GF, white, T130
Nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Pin support for reliable contact
Lamp support 109685 (see below)
Weight: 3.7 g, packaging unit: 1000 pcs.
Type: 09170
Ref. No.: 109686



Lamp support for lamps Ø 16 mm
Material: zinc-coated polished steel
Fixing hole for screw M3.5
Weight: 1.3 g, packaging unit: 1000 pcs.
Type: 94088
Ref. No.: 109685



Lamp support for lamps Ø 16 mm
Material: PC, white, UV-stabilised
Push-fit foot for cut-out Ø 5.5 mm
Weight: 1 g, packaging unit: 500 pcs.
Type: 84001
Ref. No.: 500757



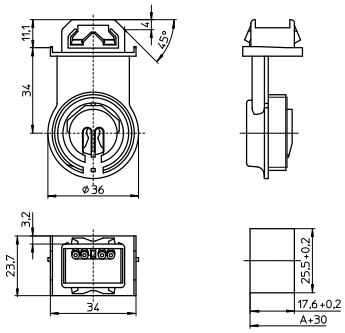
G5 Lampholders, Degree of Protection IP65/IP67

For fluorescent lamps T5 (T16)
For luminaires of protection class I and II

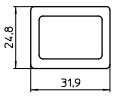
Lampholders protected against dust and jet of water (IP65)
Dust and watertight lampholders (IP67)
Pin support for reliable contact
With spring adjustment

Max. permitted temperature T_m on the rear side of the lampholder: 110 °C

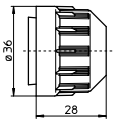
G5 push-fit lampholder
Casing: PC, white, interior part: PBT GF
T140, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Push-fit foot for wall thickness: 1.4–2 mm
Weight: 12.7 g, packaging unit: 250 pcs.
Type: 84108 system 151
Ref. No.: 534073



Foot gaskets for system 151
Weight: 1/1.1 g
Unit: 1000 pcs.
Type: 98004 degree of protection IP65
Ref. No.: 108267 material: cellular rubber, black
Type: 98011 degree of protection IP67
Ref. No.: 504078 material: silicone, transparent



Screw ring for systems 151
Ring: PBT GF, white, gasket: silicone
Weight: 11.8 g, packaging unit: 250 pcs.
Type: 84103
Ref. No.: 529836

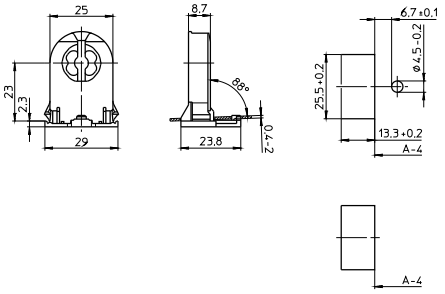


G13 Push-through Lampholders

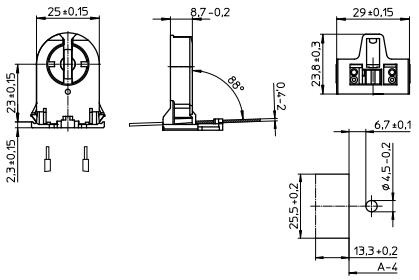
For fluorescent lamps T8 (T26), T12 (T38)

Lampholders with integrated starter holder have
push-in twin terminals for the lamp circuit and
push-in terminals for the the starter circuit.
Pin support for reliable contact
Max. permitted temperature T_m
on the rear side of the lampholder: 110 °C

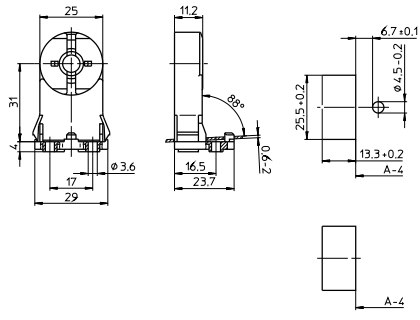
G13 push-through lampholders for lamps T8 and T12
Lamp axis: 23 mm
Casing: PC, white, frontplate: PBT GF, white
T140, nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.4–2 mm
Weight: 6 g, packaging unit: 1000 pcs.
Type: 27700/27701
Ref. No.: 109330 with stop
Ref. No.: 109331 without stop



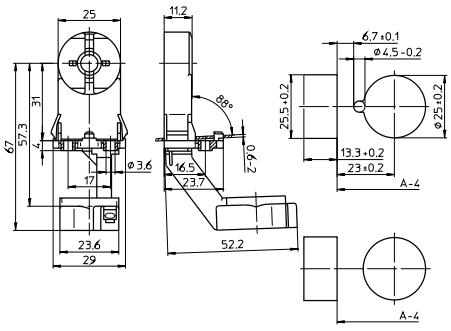
G13 Rotoclic push-through lampholders
for lamps T8 and T12
Lamp axis: 23 mm
Casing: PC, white, frontplate: PBT GF, white
T140, nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.4–2 mm
Weight: 6.8 g, packaging unit: 1000 pcs.
Type: 27700/27701
Ref. No.: 546641 with stop
Ref. No.: 546642 without stop

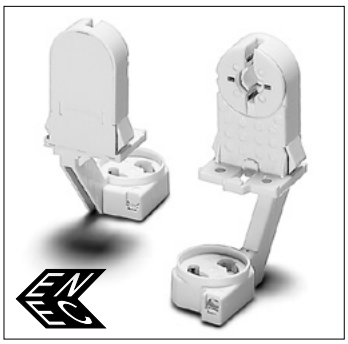


G13 push-through lampholders for lamps T8 and T12
Lamp axis: 31 mm
Casing: PC, white, rotor: PBT, white
T130, nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.6–2 mm
Weight: 9.9 g, packaging unit: 1000 pcs.
Type: 28500/28501
Ref. No.: 100591 with stop
Ref. No.: 100593 without stop



G13 push-through lampholders for lamps T8 and T12
With starter attachment, lamp axis: 31 mm
Casing: PC, white, rotor: PBT, white
T130, nominal rating: 2/250
Push-in terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.6–2 mm
Weight: 16 g, packaging unit: 500 pcs.
Type: 28600/28601
Ref. No.: 100596 with stop
Ref. No.: 100598 without stop





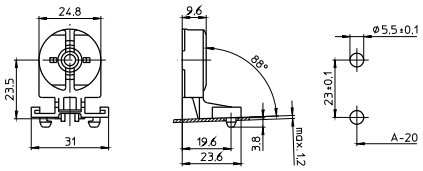
G13 Push-fit Lampholders

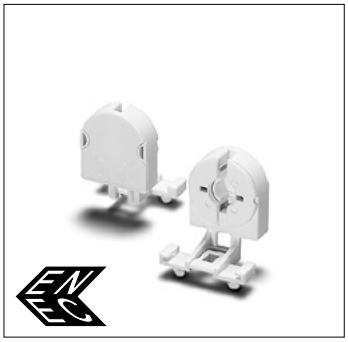
For fluorescent lamps T8 (T26), T12 (T38)

Lampholders with integrated starter holder
are equipped with big rotor and have
push-in twin terminals for the lamp circuit and
push-in terminals for the the starter circuit.
Pin support for reliable contact

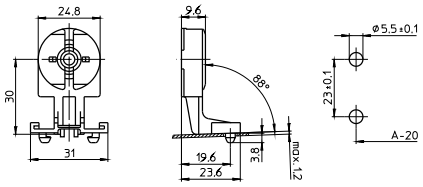
Max. permitted temperature T_m
on the rear side of the lampholder: 110 °C
T-Marking acc. to IEC
IP50 version: push-fit foot with gasket

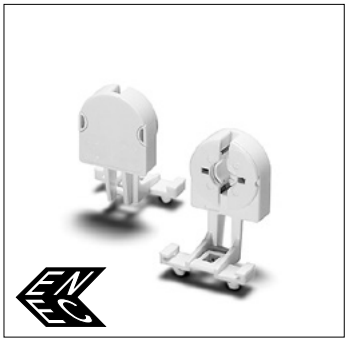
G13 push-fit lampholder for lamps T8
Lamp axis: 23.5 mm
Casing: PC, white, rotor: PBT GF, white
T130, nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Base split pins for wall thickness up to 1.2 mm
Lampholder foot/luminaire: IP40
Weight: 5.8 g, packaging unit: 1000 pcs.
Type: 27350
Ref. No.: 100548



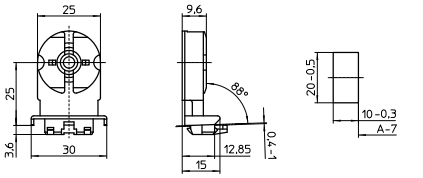


G13 push-fit lampholder for lamps T8 and T12
Lamp axis: 30 mm
Casing: PC, white, rotor: PBT GF, white
T130, nominal rating: 2/250
Push-in twin terminals: 0.5–1 mm²
Base split pins for wall thickness up to 1.2 mm
Lampholder foot/luminaire: IP40
Weight: 5.9 g, packaging unit: 1000 pcs.
Type: 27360
Ref. No.: 100552

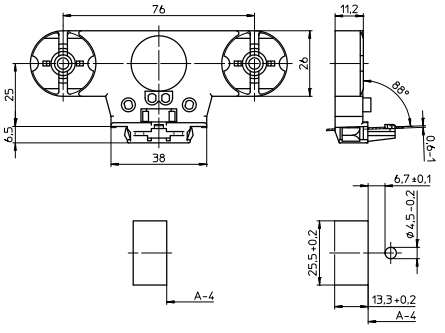


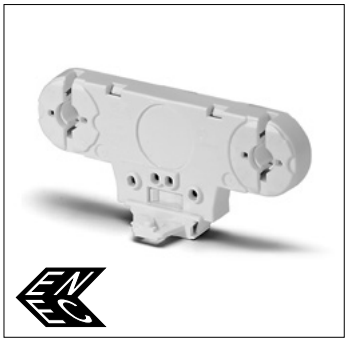


G13 push-fit lampholder for lamps T8 and T12
Lamp axis: 25 mm
Casing: PC, white, rotor: PBT GF, white
T130, nominal rating: 5/500
Lateral and base push-in terminals: 0.5–1 mm²
Push-fit foot for luminaire cut-out 10x20 mm
for wall thickness 0.4–1 mm
Weight: 6 g, packaging unit: 500 pcs.
Type: 28921
Ref. No.: 108438



G13 twin lampholders for lamps T8 and T12
Lamp axis: 25 mm
Distance between two lamp axes: 76 mm
Casing: PC, white, rotor: PBT GF, white
T130, nominal rating: 2/500
Base push-in terminals: 0.5–1 mm²
Push-fit foot for wall thickness 0.6–1 mm
Weight: 21 g, packaging unit: 200 pcs.
Type: 22604/22602 without starter attachment
Ref. No.: 108816 with stop
Ref. No.: 100487 without stop



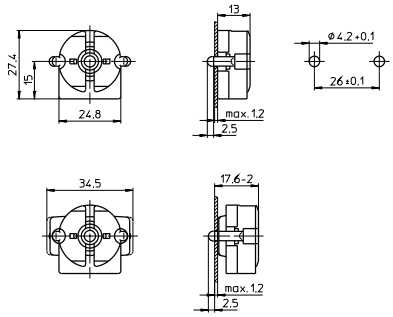


G13 Built-in Lampholders

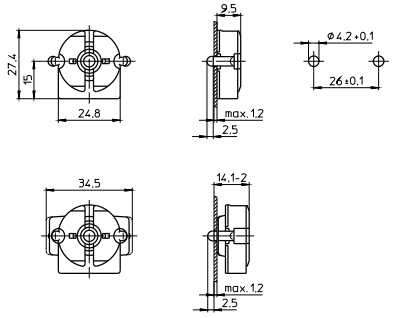
For fluorescent lamps T8 (T26), T12 (T38)

Lampholders with integrated starter holder
are equipped with big rotor and have
push-in twin terminals for the lamp circuit and
push-in terminals for the the starter circuit.
Pin support for reliable contact
(except for type 485)

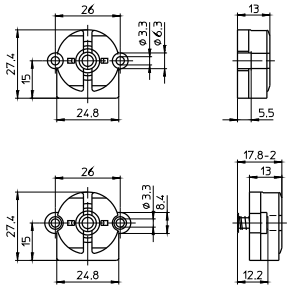
G13 built-in lampholders for lamps T8 and T12
Lampholder thickness: 13 mm
Casing: PC, white, frontplate/rotor: PBT GF, white
T130, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Rear split pins for wall thickness up to 1.2 mm
Weight: 5/5.5 g, packaging unit: 1000 pcs.
Type: 47105/47106
Ref. No.: 101685
Ref. No.: 101690 with spring adjustment



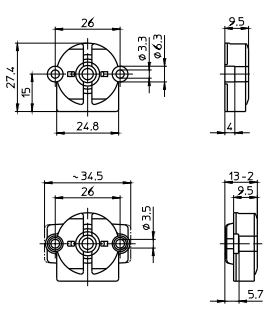
G13 built-in lampholders for lamps T8 and T12
Lampholder thickness: 9.5 mm
Casing: PC, white, frontplate/rotor: PBT GF, white
T130, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Rear split pins for wall thickness up to 1.2 mm
Weight: 5/5.5 g, packaging unit: 1000 pcs.
Type: 47505/47506
Ref. No.: 101749
Ref. No.: 101753 with spring adjustment



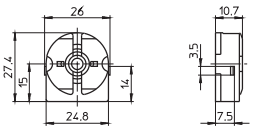
G13 built-in lampholders for lamps T8 and T12
Lampholder thickness: 13 mm
Casing: PC, white, frontplate/rotor: PBT GF, white
T130, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Fixing holes for screws M3
Weight: 5/6 g, packaging unit: 1000 pcs.
Type: 47100/47102
Ref. No.: 101674
Ref. No.: 101681 with spring adjustment



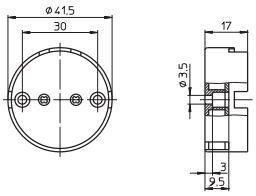
G13 built-in lampholders for lamps T8 and T12
Lampholder thickness: 9.5 mm
Casing: PC, white, frontplate/rotor: PBT GF, white
T130, nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Fixing holes for screws M3
Weight: 5/5.5 g, packaging unit: 1000 pcs.
Type: 47500/47502
Ref. No.: 101738
Ref. No.: 101740 with spring adjustment

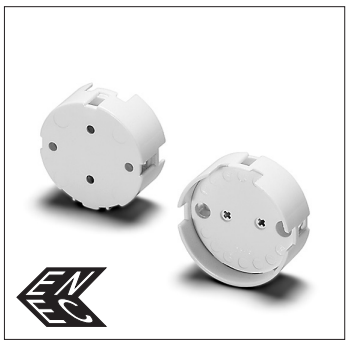


G13 built-in lampholder for lamps T8 and T12
Lampholder thickness: 10.7 mm
Casing: PC, white, frontplate/rotor: PBT GF, white
T130, nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Lateral fixing clips
Weight: 4.7 g, packaging unit: 1000 pcs.
Type: 47504
Ref. No.: 101745

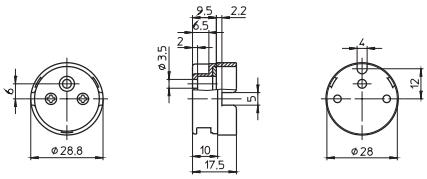


G13 lampholder
For push-fitting onto lamps T12
Lampholder thickness: 9.5 mm
Casing: PC, white, T110
Front cover plate: PBT GF, white
Nominal rating: 2/250
Push-in terminals: 0.5–1 mm²
Fixing holes for screws M3
Weight: 10.5 g, packaging unit: 1000 pcs.
Type: 47700
Ref. No.: 101781

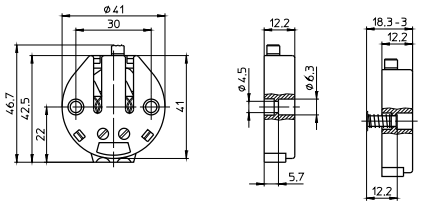




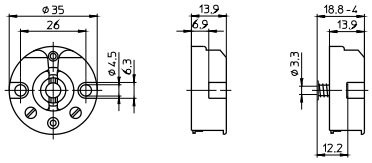
G13 lampholder
For push-fitting onto lamps T8
Lampholder thickness: 9.5 mm
Casing: PC, white, T110
Front cover plate: PBT GF, white
Nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Fixing hole for screw M3
Weight: 5.3 g, packaging unit: 1000 pcs.
Type: 47900
Ref. No.: 101784



G13 built-in lampholder with lamp lock
for lamps T8 and T12
Contacts on both sides
Casing: PBT GF, white, T130, nominal rating: 2/500
Screw terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Weight: 12.9/18 g, packaging unit: 500 pcs.
Type: 46100/46101
Ref. No.: 101643
Ref. No.: 101647 with spring adjustment



G13 built-in lampholders for lamps T8 and T12
Casing: PC, white, T110
Nominal rating: 2/500
Screw terminals: 0.5–2.5 mm²
Fixing holes for screws M3
5 rotation stops
Weight: 9/10.6 g, packaging unit: 1000 pcs.
Type: 48500/48501
Ref. No.: 101787
Ref. No.: 101789 with spring adjustment

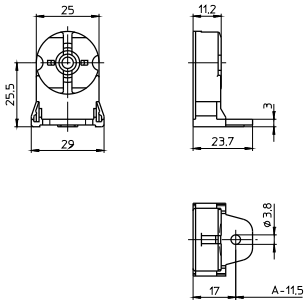


G13 Surface-mounted Lampholders

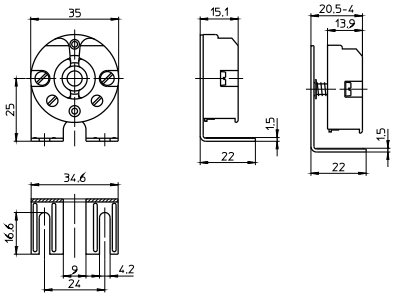
For fluorescent lamps T8 (T26), T12 (T38)

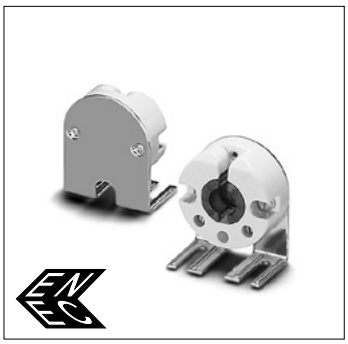
Pin support for reliable contact
(except for type 485)
Max. permitted temperature T_m
on the rear side of the lampholder: 110 °C

G13 surface-mounted lampholder for lamps T8 and T12
Lamp axis: 25.5 mm
Casing: PC, white, rotor: PBT GF, white, T130
Nominal rating: 2/500
Push-in twin terminals: 0.5–1 mm²
Fixing hole: Ø 3.8 mm
Weight: 7.2 g, packaging unit: 500 pcs.
Type: 27722
Ref. No.: 100572



G13 surface-mounted lampholders for lamps T8 and T12
Lamp axis: 25 mm
Casing: PC, white, T110, nominal rating: 2/500
Screw terminals: 0.5–2.5 mm²
Bracket: zinc-coated polished steel
Fixing slots for screws M4
5 rotation stops
Weight: 26/28.1 g, packaging unit: 500 pcs.
Type: 48502/48503
Ref. No.: 101791
Ref. No.: 101793 with spring adjustment



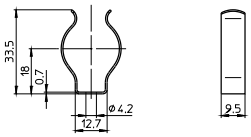


Accessories

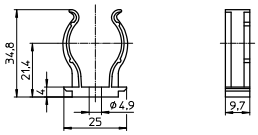
For lampholders for fluorescent lamps T8 (T26), T12 (T38)

The luminaire manufacturer is responsible for the right choice of accessories.

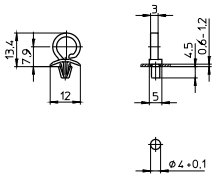
Lamp supports for lamps T8
Material: zinc-coated polished steel
Fixing hole for screw M4
Weight: 4.3 g, packaging unit: 500 pcs.
Type: 20400
Ref. No.: 100442



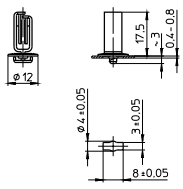
Lamp supports for lamps T8
Material: PC, crystal-clear
Fixing hole for screw M4
Weight: 2 g, packaging unit: 1000 pcs.
Type: 20501
Ref. No.: 100448



Cable holder
Material: PA, white
Push-fit foot for cut-out Ø 4 mm
for wall thickness 0.6–1.2 mm
Weight: 0.2 g, packaging unit: 5000 pcs.
Type: 97147
Ref. No.: 109086



Cable holder
For the automatic luminaire wiring and manual wiring
Material: PC, white
Degree of protection IP50
Weight: 0.5 g, packaging unit: 5000 pcs.
Type: 97117
Ref. No.: 108845



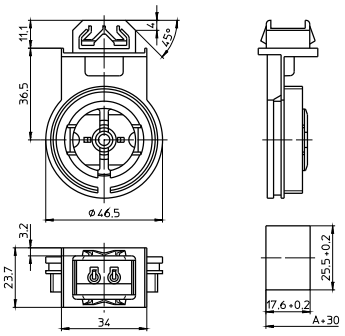
G13 Lampholders, Degree of Protection IP65/IP67

For fluorescent lamps T8 (T26), T12 (T38)
For luminaires of protection class I and II

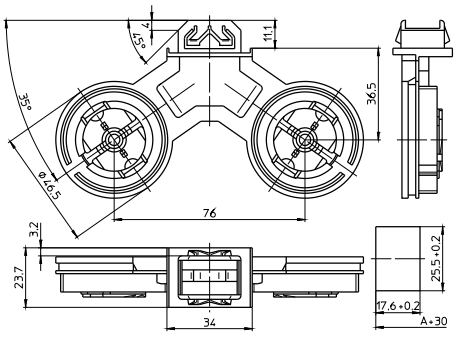
Lampholders protected against dust and jet of water (IP65)
Dust and watertight lampholders (IP67)
Pin support for reliable contact with spring adjustment

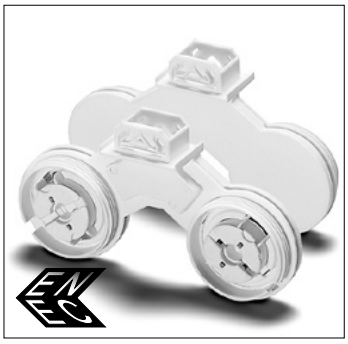
Max. permitted temperature T_m on the rear side of the lampholder: 110 °C

G13 push-fit lampholders for lamps T8/T12
Casing: PC, interior part: PBT GF
Rotor: PBT GF, white, T140
Nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Fixing clips for wall thickness 1.4–2 mm
Screw rings see next page
Weight: 17.3 g, packaging unit: 500 pcs.
Type: 84172 system 163
Ref. No.: 107958 casing white
Ref. No.: 108666 casing grey

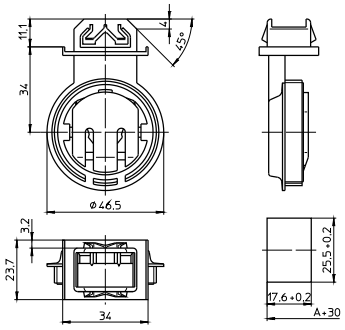


G13 push-fit twin lampholders for lamps T8/T12
Casing: PC, interior part: PBT GF
Rotor: PBT GF, white, T140
Nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Fixing clips for wall thickness 1.4–2 mm
Screw rings see next page
Weight: 34.2 g, packaging unit: 250 pcs.
Type: 84174 system 164
Ref. No.: 107960 casing white
Ref. No.: 108669 casing grey

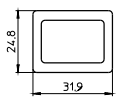




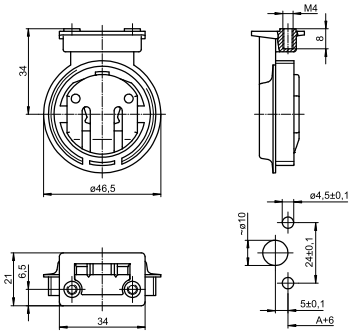
G13 push-fit lampholders for lamps T8/T12
Casing: PC, interior part: PBT GF, T140
Nominal rating: 2/500
Push-in terminals: 0.5–1 mm²
Fixing clips for wall thickness 1.4–2 mm
With slot insertion
Screw rings see next page
Weight: 14.5 g, packaging unit: 250 pcs.
Type: 84175 system 165
Ref. No.: 108608 casing white
Ref. No.: 108614 casing grey



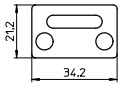
Foot gaskets
For lampholder systems 163, 164, 165
Weight: 1/1.1 g
For degree of protection IP65
Material: cellular rubber
Type: 98004
Ref. No.: 108267
For degree of protection IP67
Material: silicone, transparent
Type: 98011
Ref. No.: 504078



G13 lampholder for lamps T8/T12
Casing: PC, white, interior part: PBT GF, T140
Nominal rating: 2/500
Screw fixing foot with tapped holes M4
Screw rings see below
With slot insertion
Weight: 14 g, packaging unit: 250 pcs.
Type: 84105 system 152
Ref. No.: 521123



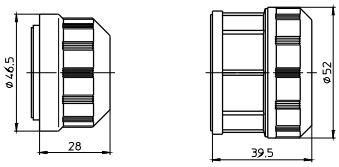
Foot gasket for degree of protection IP65/IP67
For lampholder system 152
Material: EPDM, black
Weight: 1.4 g, packaging unit: 1000 pcs.
Type: 98085
Ref. No.: 106094



Screw Rings for G13 Lampholders, Degree of Protection IP54, IP65, IP67

For lampholder systems 152, 163, 164, 165

Screw rings
Ring: PBT GF, gasket: silicone
Weight: 17/20 g, packaging unit: 500/250 pcs.
Type: 84122 for lamps T8
Ref. No.: 103710 white
Ref. No.: 103709 grey
Type: 84123 for lamps T12 or
for lamps T8 with protection tube Ø 38 mm
Ref. No.: 103712 white
Ref. No.: 103711 grey



OPTIMUM START WITH COMPONENTS MADE BY VS

STARTER HOLDERS AND TERMINAL BLOCKS, ACCESSORIES

Vossloh-Schwabe provides a comprehensive range of miscellaneous accessories for operating fluorescent lamps.

Starter holders
Starters are needed for lamp circuits operated with electromagnetic ballasts. VS provides a number of starter holders with various designs for this purpose. Almost all starter holders are made of polycarbonate and qualify for a T110 temperature rating.

Terminal blocks
Furthermore, Vossloh-Schwabe's product range also includes connection terminals, some of which feature the VDE-approved IDC method in addition to the well-known and installation-friendly push-in connectors. The connection terminals therefore make it possible to automate luminaire wiring and thus wire up several terminals using a single cable.

The range is rounded off by built-in rocker switches.

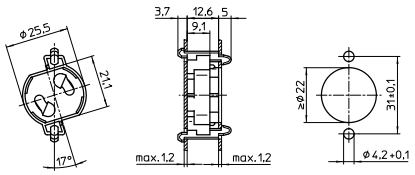
3 Starter Holders and Terminal Blocks, Accessories

Starter Holders, Accessories

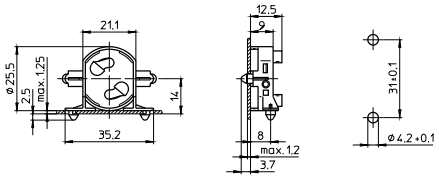
For starters acc. to DIN VDE 0712 part 101, IEC 60155

Material: PC, white
T110, nominal rating: 2/250

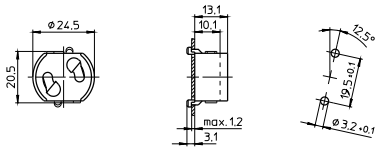
Starter holders
Push-in terminals: 0.5–1 mm², single-core
Front and rear split pins for wall thickness up to 1.2 mm
Rear of starter holder/luminaire: IP40
Weight: 2.8 g, packaging unit: 1000 pcs.
Type: 02110/02111
Ref. No.: 100061
Ref. No.: 100063 with central stud for luminaires of protection class II



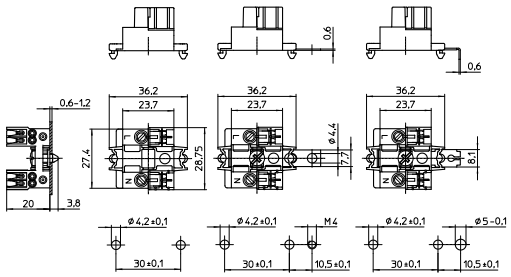
Starter holder
Push-in terminals: 0.5–1 mm²
Rear split pins for wall thickness up to 1.2 mm
Lateral split pins for wall thickness up to 1.25 mm
Rear of starter holder/luminaire: IP40
Weight: 3.7 g, packaging unit: 1000 pcs.
Type: 02120
Ref. No.: 100064

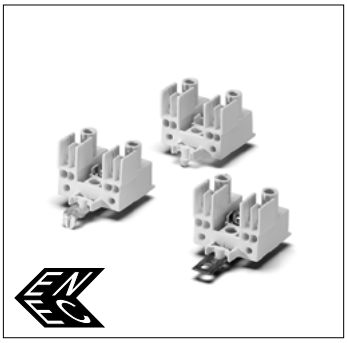


Starter holder
Push-in terminals: 0.5–1 mm²
Rear split pins for wall thickness up to 1.2 mm
Rear of starter holder/luminaire: IP40
Weight: 3.3 g, packaging unit: 1000 pcs.
Type: 43000
Ref. No.: 101627



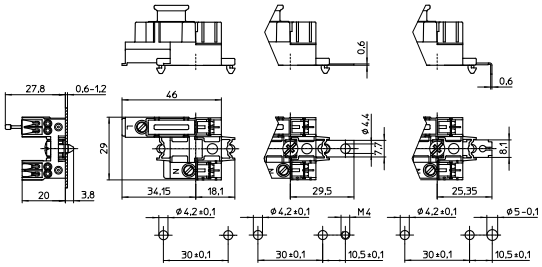
Terminal blocks
Casing: PC, white, T85
Nominal rating: 450 V
Primary connection:
screw terminals 2.5 mm²
Secondary connection:
push-in twin terminals 1.5 mm²
(with IDC contacts: 1 mm²)
push-in terminal 0.5 mm²
For the automatic luminaire wiring:
IDC terminals for leads H05V-U 0.5
Base split pins for wall thickness 0.6–1.2 mm

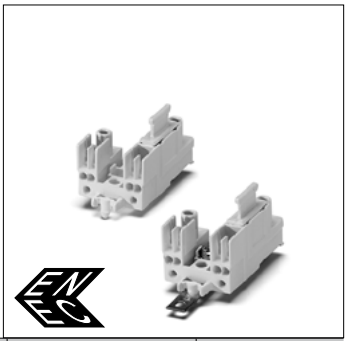




Type	**Ref. No.**	IDC	Number of poles	Earth-contact connection	Weight (g)	Unit (pcs.)
40660	**543793**	no	3-poles	not earthed	5.7	1000
40662	**543795**	no	3-poles	earth strap M4	8.4	1000
40666	**543800**	no	3-poles	earth finger	8.3	1000

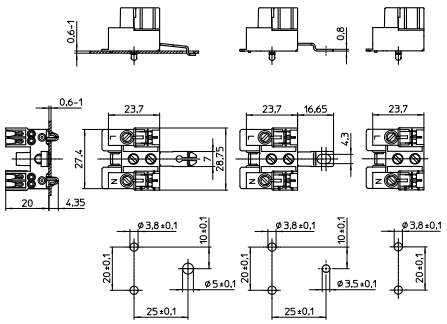
Terminal blocks with fuse holder
Material: PC, white, T70
nominal rating: 250 V
Primary connection: screw terminals 2.5 mm²
Secondary connection:
push-in twin terminals 1.5 mm²
(with IDC contacts: 1 mm²)
push-in terminal 0.5 mm²
For the automatic luminaire wiring:
IDC terminals for leads H05V-U 0.5
With retaining clip for fuses 5x20 mm
With integrated fuse on request
Base split pins for wall thickness 0.6–1.2 mm

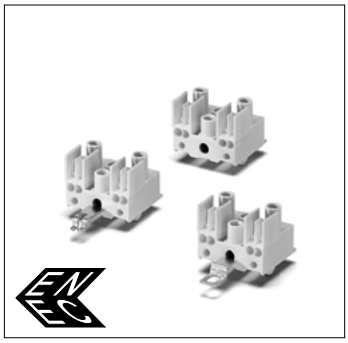




Type	**Ref. No.**	IDC	Number of poles	Earth-contact connection	Weight (g)	Unit (pcs.)
40670	**543802**	no	3-poles	not earthed	8.7	1000
40672	**543805**	no	3-poles	earth strap M4	11.5	1000
40676	**543809**	no	3-poles	earth finger	14.1	1000

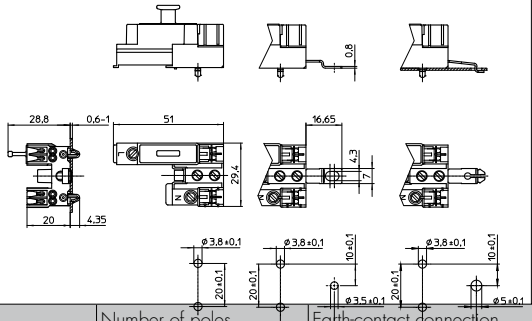
Terminal blocks
Casing: PC, grey, T85
Nominal rating: 450 V
Primary connection:
screw terminals 2.5 mm²
Secondary connection:
push-in twin terminal 1.5 mm²
(with IDC contacts: 1 mm²)
push-in terminal 0.5 mm²
For the automatic luminaire wiring:
IDC terminals for leads H05V-U 0.5
Base split pins for wall thickness 0.6–1.2 mm

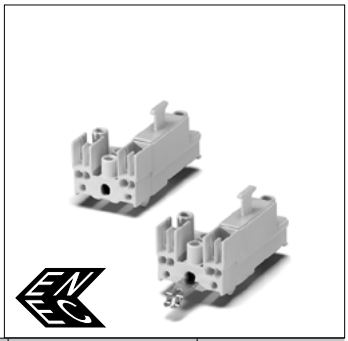




Type	**Ref. No.**	IDC	Number of poles	Earth-contact connection	Weight (g)	Unit (pcs.)
40560	**543770**	no	3-poles	not earthed	8	1000
40562	**543772**	no	3-poles	earth strap M4	8.7	1000
40566	**543777**	no	3-poles	earth finger	8.8	1000

Terminal blocks with fuse holder
Material: PBT, grey, T70
Nominal rating: 250 V
Primary connection: screw terminals 2.5 mm²
Secondary connection:
push-in twin terminals 1.5 mm²
(with IDC contacts: 1 mm²)
push-in terminal 0.5 mm²
For the automatic luminaire wiring:
IDC terminals for leads H05V-U 0.5
With retaining clip for fuses 6x25 mm
With integrated fuse on request
Base split pins for wall thickness 0.6–1.2 mm

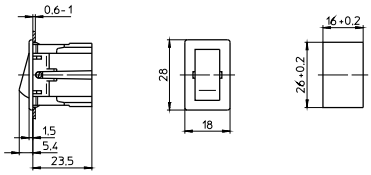


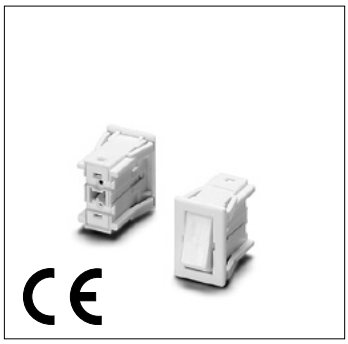


Type	**Ref. No.**	IDC	Number of poles	Earth-contact connection	Weight (g)	Unit (pcs.)
40570	**543781**	no	3-poles	not earthed	11	500
40572	**543783**	no	3-poles	earth strap M4	11.7	500
40576	**543787**	no	3-poles	earth finger	11.8	500

Built-in Rocker Switches

Built-in rocker switch 1-pole
For cut-out 16x26 mm
Casing: PC, white, T100
Contact pillar and rocker: PBT, white
Terminal: nichrome steel
Nominal rating: 6(2)/250~
Push-in terminals: 0.5–1 mm²
Lateral fixing clips for wall thickness 0.6–1 mm
Weight: 7.2 g, unit: 500 pcs.
Type: 20200
Ref. No.: 100437





3 Components for Fluorescent Lamps

Ballasts for fluorescent lamps

The operation of a fluorescent lamp depends on a ballast that stabilises the lamp's preheat current after connection to the mains and, in conjunction with the starter, also supplies the required lamp ignition voltage after preheating. After ignition, the ballast then serves to limit the lamp current. As fluorescent lamps are characterised by a negative characteristic current-voltage curve, lamp current stabilisation is essential with regard to both the lamp's stable operation and a long service life, which is also dependent on compliance with the starting conditions (preheat current and ignition voltage). Unfavourable starting conditions cause damage to the electrodes every time the lamp is started and thus reduce the lamp's service life. Furthermore, care should be taken to prevent crossdischarge in the electrode area during preheating, which also shortens lamp service life.

Electromagnetic (inductive) ballasts have to be operated in conjunction with starters for lamp ignition and capacitors for blind current compensation. In addition, capacitors for RFI suppression will also be required for certain circuits. Electronic ballasts do not require any additional components.

Electronic ballasts (EB)

VS electronic ballasts are designed for mains voltages of 220 V to 240 V (exceptions are devices for the North American market where the nominal mains voltage is 120 V or 277 V) and are used to operate fluorescent lamps at high frequencies. The lamps are ignited with an internally generated ignition voltage, thereby removing the need for an external starter. The power factor (λ) > 0.95 also removes the need for compensation, unlike with electromagnetic ballasts. Luminaires fitted with electronic ballasts are characterised by low energy consumption as they draw substantially less system power than conventional, inductive applications. This is firstly because the lamp consumes less power to achieve the same luminous flux and secondly because the internal loss of an electronic ballast only amounts to approx. 8% to 10% of the lamp's output. Furthermore, thanks to their modern circuitry, the power input of VS electronic ballasts remains constant even in the event of mains voltage fluctuations, thus ensuring permanently low energy consumption.

VS electronic ballasts permit a broad range of applications. For instance, the VS product range includes many ballast types for multiple lamp operation. These ballasts reduce installation and component costs and thus enable particularly efficient luminaires. Twin-lamp electronic ballasts permit so-called master-slave operation. The lamps of two single-lamp luminaires are operated by a twin-lamp electronic ballast that is built into the so-called master luminaire. The lamp of the slave luminaire is electrically connected to the electronic ballast.

The use of electronic ballasts makes a lighting system both more convenient and efficient to operate:

- reduced power consumption (up to 30%) at undiminished light output
- 50% longer service life
- stabilised lamp output
- overvoltage protection
- no stroboscopic effect
- flicker-free lamp start
- no need for a starter or capacitor
- low wiring effort
- no radiated electromagnetic interference
- low self-heating due to minimal power loss
- automatic shutdown of defective lamps
- automatic restart once the lamp has been changed

Vossloh-Schwabe electronic ballasts are developed on the basis of the latest technological and component standards and are produced using state-of-the-art technology, whereby consideration is taken of our customers' quality standards in our quality assurance system.

Assembly Instructions for Electronic Ballasts

For mounting and installing of electronic ballasts for fluorescent lamps

Mandatory regulations

EN 61347-1	Lamp controlgear – part 1: general and safety requirements
EN 61347-2-3	Lamp controlgear – part 2-3: particular requirements for a.c. supplied electronic ballasts for fluorescent lamps
EN 60929	AC-supplied electronic ballasts for tubular fluorescent lamps
DIN VDE 0100	Erection of low voltage installations
EN 60598-1	Luminaires – part 1: general requirements and tests
EN 61000-3-2	Electromagnetic compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (device input current up to and including 16 A per conductor)
EN 55015	Maximum values and methods of measurement for RFI suppression in electrical lighting installations and similar electrical appliances
EN 61547	Installations for general lighting purposes – EMC immunity requirements

Descriptions of VS electronic ballasts (EBs)

ELXc ballasts (warm start)
ELXc ballasts have a power factor of better than 0.95 and cover the complete capacity range.
ELXc ballasts ensure the lamp is started following a defined lamp electrode preheating period of approx. 1–2.5 seconds using a fixed ignition voltage. This particularly gentle lamp start makes over 20,000 lamp starts possible. ELXc ballasts should be used for applications with high switching frequencies (e.g. hotels or offices) where energy savings as well as low maintenance costs are desired. The average service life of these ballasts totals 50,000 hours with a failure rate of ≤ 0.2% per 1,000 operating hours.

To guarantee trouble-free operation and a long service life of the various types of electronic ballast, attention should be paid to the regulations and mounting instructions. In addition, the installation instructions for lighting systems must be observed when installing luminaires with electronic ballasts.

Mechanical mounting

Surface	Solid, flat surface for good heat dissipation required. Avoid mounting on protruding surfaces.
Mounting location	Electronic ballasts must be protected against moisture and heat. Installation in external luminaires: water protection rate of ≥ 4 (e.g. IP54 required)
Fastening	With M4 screws in the designated holes
Heat transfer	If the ballast is destined for installation in a luminaire, sufficient heat transfer must be ensured between the ballast and the luminaire casing. Electronic ballasts should be mounted with the greatest possible clearance to heat sources or lamps. During operation, the temperature measured at the t_c point of the ballast must not exceed the specified maximum value.

Supplement for independent electronic ballasts

Mounting position	Any
Clearance	Min. of 0.10 m from walls, ceilings, insulation Min. of 0.10 m from other electronic ballasts Min. of 0.25 m from sources of heat (lamp)
Surface	Solid; device must not be allowed to sink into insulation materials

Technical specifications

Operating voltage range	AC: 220 to 240 V (±10%) DC: please observe the specifications on the individual product pages
Preheat time	ELXc ballasts t = 0.5 or 1.5 to 2.5 seconds (warm start)
Leak current	≤ 0.5 mA per electronic ballast

Product features

Overheating — VS EBs for fluorescent lamps are not protected against overheating

Overvoltage protection

AC: up to 48 hours at U_{NAC} = 320 V
DC: no disorders occur with input voltages of up to U_{NDC} 285 V.
U_{NDC} voltages in excess of 288 V destroy the ballast.

Shutdown of defective lamps

During starting operation, the electronic ballast will detect whether a lamp is connected. If no lamp is present, the ballast will cancel the starting operation. Deactivated lamps or interrupted electrodes are detected and lead to the high-frequency supply being switched off after an unsuccessful ignition attempt. Changing a lamp during operation will lead to the high-frequency supply being switched off.

EOL effect

Up to now, it has not been possible to conclusively reproduce the end-of-life effect under laboratory conditions. However, it can be qualitatively described for fluorescent lamps as follows: when the emitter material of the cathode (i.e. the filament in conventional bi-pin lamps) has been fully consumed or has otherwise lost its emitting power, the emission of electrons is hampered, which leads to a voltage drop at the cathode. Frequent cold starts accelerate active emitter loss.

Operating a lamp with a constant current (an electronic ballasts (EB) provides a near-constant current) results in high dissipation losses that also cause the lamp base and lampholder to heat up and can even cause damage to both. This is often referred to as the EOL effect; from an electrical point of view, this is manifested in the so-called "partial rectifier effect".

The EOL cut-out ensures that a ballast is safely switched off and the lamp base does not overheat at the end of a lamp's service life.

EN 61347-2-3:2011 + AC:2011 describes three possible tests.
The first are now in widespread use and are described in more detail here.
The third test is not conducted at VS.

1. EOL Test 1 (61347-2-3:2011 + AC:2011 17.2)
   Asymmetric pulse test
2. EOL Test 2 (61347-2-3:2011 + AC:2011 17.3)
   Asymmetric power test
3. EOL Test 3 (61347-2-3:2011 + AC:2011 17.4)
   Exposed filament test

The first two tests attempt to simulate the rectifier effect:

- Test 1 pulse switching of rectifying effect
- Test 2 by applying a DC voltage that is constantly higher than required by the lamp.

VS EBs are capable of suitably assessing the altered voltage signal in comparison to normal operation so as to meet EOL requirements.

Protection against transient mains peaks

Values are in compliance with EN 61547 (interference immunity)
(1 kV for AC and 0.5 kV for DC and control conductors).

Electrical installation

Wiring

The wiring between the mains, electronic ballast and lamp must comply with the respective circuit diagram.
The electronic ballast must be earthed using a toothed washer or similar (protection class I, ignition help, compliance with RFI/BCI standards).
To ensure compliance with RFI-suppression limits, mains conductors should not be wired in parallel to high-frequency carrying lamp conductors; maximum clearance should be ensured and all conductors marked with an * must be kept short. As a general rule, a maximum conductor length should not be exceeded when using conventional conductors (see table on page 131 for precise details). Luminaire must be tested for compliance with the RFI suppression limits stipulated by EN 55015.

Conductors must not exceed 3 m in length in the event of master-slave operation.

Dimmable electronic ballasts are unsuitable for master/slave operation.

Cord grip

EBs with cord grip can be used with the following conductors, for instance:

Designation	**Lead type**
Mains lead	H03VV-F 3X0.75 mm² or NYM 3X1.5 mm²
Control lead	H03VV-F 2X0.5 mm²
Mains and control lead in one lead	H03VV-F 5X0.75 mm²
Lamp lead	H05VV-F 4X1 mm² or 5X1 mm²

Connection terminals for automatic luminaire wiring (ALF connections)

- Use copper (not stranded) wire
- Rquired diameter for push-in connection 0.5–1 mm²
- Stripped lead length 8–9 mm
- Required diameter for IDC 0.5 mm², max. Ø 2 mm including insulation, no wire stripping required; mounting requires a special tool

Push-in terminals

The integrated terminals can be used with flexible or rigid leads with a crosssection of 0.5–1.5 mm². The stripped lead length ranges between 8.5–9.5 mm for a 3.5 mm terminal grid.

Error current

Impulse-resistant leak-current protection must be installed. Distribute the luminaires to phases L1, L2 and L3; install tri-phase FI switches. If permissible, install FI switches with 30 mA leak current; connect no more than 15 luminaires as FI switches can be triggered at half the leak current value.

Tri-phase connection of luminaires with EB

- Prior to operating newly installed lighting systems: check the mains voltage is appropriate to the electronic ballast's mains voltage range (AC, DC).
- The N-type conductor must be properly connected to all luminaires or ballasts.
- Conductors can only be connected or disconnected if the ballast is disconnected from the mains. Attention: N-type conductors must never be disconnected individually or as the first element.
- Insulation resistance test: from L to PE (L and N must not be connected)
- The neutral conductor must be reconnected after completion of the test.

Power factor/compensation

Luminaires with electronic ballasts do not require compensation:
power factor ≥ 0.95.

Selection of automatic cut-outs

Dimensioning automatic cut-outs

High transient currents occur when an EB is switched on because the capacitors have to load. Lamp ignition occurs almost simultaneously. This also causes a simultaneous high demand for power. These high currents when the system is switched on put a strain on the automatic conductor cut-outs, which must be selected and dimensioned to suit.

Release reaction The release reaction of the automatic conductor cut-outs comply with VDE 0641, part 11, for B and C characteristics.

No. of electronic ballasts (see the table on pages 131)

The maximum number of VS ballasts applies to cases where the devices are switched on simultaneously. Specifications apply to single-pole fuses. The number of permissible ballasts must be reduced by 20% for multi-pole fuses. The considered circuit impedance equals 400 mΩ (approx. 20 m of conductor [2.5 mm^2] from the power supply to the distributor and a further 15 m to the luminaire). Doubling circuit impedance to 800 mΩ increases the possible number of ballasts by 10%.

EB output voltage Electronic ballasts bear the information "U_{OUT}" on their type plates. All subsequently connected components must be designed for this EB output voltage. When using T5 lamps, any components connected to the output side of the EB must be approved for a voltage of ≥ 430 V (especially lampholders).

Lamps and dimmed operation

For lighting systems with dimmable electronic ballasts, Vossloh-Schwabe recommends that fluorescent lamps always be replaced as a **full complement** to maintain uniform lighting levels and colour impressions. New lamps must be burnt in at maximum brightness for approx. 100 hours.
Without restrictions, VS electronic ballasts can be used to operate T8 fluorescent lamps.

Potential interference with IR systems

Operating lamps at frequencies of 20 to 50 kHz can cause interference with infrared systems (remote controls, sound transmission, personal pager systems).
Countermeasures: optical filters, switching to infrared systems with higher carrier frequencies (over 400 kHz).

Electromagnetic Compatibility (EMC)

Vossloh-Schwabe's electronic ballast range was developed in accordance with valid EMC standards (interference, interference immunity and mains harmonics) and specially designed to ensure safe compliance with the limiting values.
It is assumed that that any remarks regarding conductor wiring and conductor length in the instructions for installing electronic ballasts in luminaires or for independent ballasts will be observed.

Vossloh-Schwabe electronic ballasts are also tested in commercially available luminaires in addition to the CISPR 30 sample luminaires.

Mains harmonics: the maximum values laid down in EN 61547 (Interference Immunity) are satisfied.

Additional information

Information on the installation of electronic ballasts for optimising EMC

To ensure good radio interference suppression and the greatest possible operating safety, the following points should be observed when installing electronic ballasts:

- Conductors between the EB and the lamp (HF conductors) must be kept short (reduction of electromagnetic interference). High-potential lamp conductors must be kept as short as possible, in particular with tubular lamps. Lamp conductors of this kind are labelled with an * in the wiring diagram on the type plate (see page 131).
- Mains and lamp conductors must be kept separate and if possible should not be laid in parallel to one another. The distance between HF and mains conductors should be as large as possible, ideally > 5 cm. (This prevents the induction of interference between the mains and lamp conductors.)
- The mains conductor within the luminaire must be kept short (to reduce the induction of interference).
- Devices must be properly earthed. EBs require secure contacts to the luminaire casing or must be earthed using a PE connection. This PE connection should be effected using an independent conductor to achieve better dissipation of the leak current. EMC improves at frequencies greater than 30 MHz.
- The mains conductor must not be laid too close to the EB or the lamp (this is especially important in the event of through-wiring).
- Mains and lamp conductors must not be crossed. Should this be impossible to avoid, conductors should be crossed at right angles to one another to avoid inducing interference between mains and HF conductors.
- Should conductors be wired through metal parts, such conductors must always be additionally shielded (e.g. with an insulating sleeve or grommet).

Temperature

Reference point temperature t_c

The safe operation of electronic ballasts is dependent on the maximum permissible temperature not being exceeded at the measuring point. Vossloh-Schwabe has determined a casing temperature measuring point – $t_{c\ max.}$ – on all EB casings. To avoid shortening the service life or diminishing operating safety, the stipulated maximum temperature must not be exceeded at this t_c point. This point is determined by testing the convertor during normal, IEC-standardised operation at the specified ambient temperature (t_a), which is also indicated on the type plate. As both the design-related ambient temperature and the ballast's inherent heat, as determined by the installed load, are subject to great variation, the casing temperature should be tested at the t_c point under real installation conditions.

Ambient temperature t_a

The ambient temperature – as specified on every EB – denotes the permissible temperature range within the luminaire.

Reliability and service life

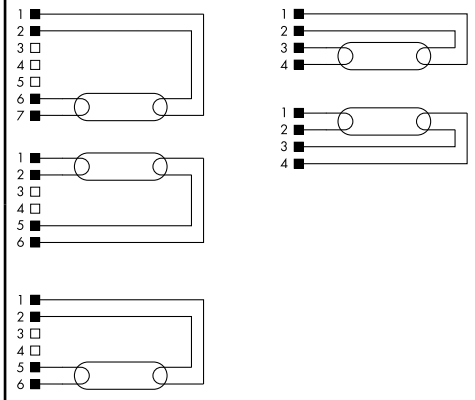
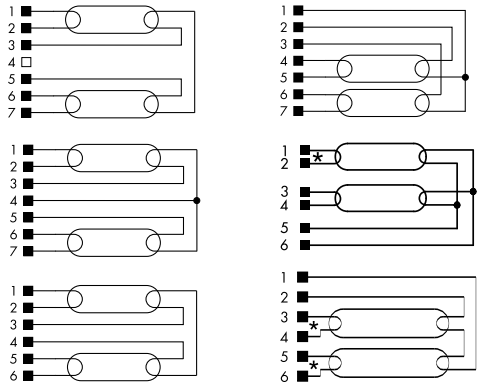
If the max. temperature at the t_c reference point (as specified on the type plate and the technical documentation of the ballast) is not exceeded, the defined service life can be expected to be achieved, assuming a switching cycle of 165 minutes on and 15 minutes off. See page 126 for service life details regarding the various electronic ballast families.

Emergency lighting

All Vossloh-Schwabe EBs that are suitable for DC voltage operation can be used in emergency lighting systems. Consideration must, however, be taken of system requirements.

Circuit diagrams for Vossloh-Schwabe electronic ballasts

The circuit diagrams shown here are wiring examples for Vossloh-Schwabe electronic ballasts, whereby the number and configuration of the contacts differ. See the table below for details.

EB	1 lamp	2 lamps
ELXc		

Explanation of circuit diagrams for Vossloh-Schwabe electronic ballasts (see above)

Electronic ballasts		Lamp	Electronic ballasts															Max. lead length		Operation	Output	THD	Possible quantity of			
Ref. No.	Type	Quantity	Terminals															hot*	cold	frequency	voltage		EB/automatic cut-outs			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				U_{OUT}		B	B	C	C
																		(m/pf)	(m/pf)	kHz	V	%	(10A)	(16A)	(10A)	(16A)
ELXc																										
188095	ELXc 149.858	1	x*	x*	x	x	—	—	—	—	—	—	—	—	—	—	—	1/100	2/200	28	330	< 10	11	18	18	30
188140	ELXc 140.862	1	x*	x*	x	x	—	—	—	—	—	—	—	—	—	—	—	1/100	2/200	45	250	< 10	11	18	18	30
188142	ELXc 154.864	1	x*	x*	x	x	—	—	—	—	—	—	—	—	—	—	—	1/100	2/200	34	300	< 10	9	15	15	25
188144	ELXc 180.866	1	x*	x*	x	x	—	—	—	—	—	—	—	—	—	—	—	1/100	2/200	45	300	< 10	9	15	15	25
188616	ELXc 240.863	2	x*	x*	x	—	x	x	x	—	—	—	—	—	—	—	—	1/100	2/200	46	360	< 15	7	12	12	20
188617	ELXc 249.859	2	x*	x*	x	x	x	x*	x*	—	—	—	—	—	—	—	—	1/100	2/200	43	480	< 10	7	12	12	20
188618	ELXc 254.865	2	x*	x*	x	—	x	x	x	—	—	—	—	—	—	—	—	1/100	2/200	43	390	< 10	7	12	12	20
188619	ELXc 280.538	2	x*	x*	x	x	x	x*	x*	—	—	—	—	—	—	—	—	1/100	2/200	50	420	< 10	—	10	—	10
188704	ELXc 136.207	1	x	x	—	—	x*	x*	—	—	—	—	—	—	—	—	—	—	—	48	350	< 20	11	18	18	30
188705	ELXc 236.208	2	x	x	x	x	x*	x*	—	—	—	—	—	—	—	—	—	—	—	45	250	< 20	11	18	18	30
188707	ELXc 258.210	2	x	x	x	x	x*	x*	—	—	—	—	—	—	—	—	—	—	—	48	350	< 20	7	12	12	19
188921	ELXc 135.220	1	x*	x*	x	x	—	—	—	—	—	—	—	—	—	—	—	1/100	2/150	41	300	< 10	11	18	18	30
188922	ELXc 235.221	2	x	x	x	x	x	x*	x*	—	—	—	—	—	—	—	—	1/100	2/150	41	300	< 10	11	18	18	30

Electromagnetic ballasts

Electromagnetic (inductive) ballasts are active components that in conjunction with starters preheat the lamp electrodes, supply the ignition voltage and stabilise lamp currents during operation. Series or parallel capacitors are required to compensate blind current.

For installation in luminaires, consideration must be taken of the mains voltage and mains frequency, the dimensions and maximum thermal values as well as any potential noise generation. To fulfil these special requirements, Vossloh-Schwabe provides a large variety of different ballasts.

VS magnetic ballasts have been optimised with regard to their magnetic fields and loads so that usually so that noise cannot usually be perceived. However, the luminaire design can cause magnetic vibrations to affect large areas. When designing luminaires, it might therefore be necessary to fit a concertina section or grooves to prevent vibrations from spreading and thus from noise being generated.

The service life of an inductive ballast is mainly determined by the material chosen for the winding insulation. The maximum winding temperature denotes the temperature (tw) that the insulation will withstand for a period of 10 years given continuous operation under rated conditions. This maximum winding temperature must not be exceeded in real conditions to ensure the ballast can achieve its full service life. The winding temperature of the ballast that is measured in the luminaire is made up of the ambient temperature of the luminaire, the thermal conditions within the luminaire and the power loss of the ballast. The Δt marking on the ballast type plate provides a measure of the power loss of the ballast. In addition to this, the power loss of ballast-lamp circuits is measured in accordance with EN 50294. This test method forms the basis for the CELMA energy classification of ballasts and is also applied in European Regulation 245/2009/EG "Definition of eco-design requirements regarding fluorescent lamps without an integrated ballast, high-pressure discharge lamps as well as ballasts and luminaires in their operation and the invalidation of Directive 2000/55/EC" (see pages 142–143 for further details).

As a result of their design features, inductive ballasts cause leak current that is discharged via the earth conductor of the luminaire. The maximum permissible leak current for protection class I luminaires is 1 mA, a value of which all Vossloh-Schwabe electronic ballasts fall clearly short. Values of max. 0.1 mA are measured per electromagnetic ballast. However, as these values accumulate with the number of installed ballasts, this should be taken into account when dimensioning the F1 protective switch.

Starters for fluorescent lamps

As mentioned above, the operation of fluorescent lamps also requires starters in addition to ballasts. A distinction is made between glow starters, which are also available with automatic cut-outs, and electronic starters. The correct choice of voltage and power range is crucial. Starters are available for 220–240 V and for 110–127 V mains voltage. The latter are also required for twin-lamp operation (e.g. 2x18 W at 230 V).

Assembly Instructions for Electromagnetic Ballasts

For mounting and installing of electromagnetic ballasts for fluorescent lamps

Mandatory regulations

DIN VDE 0100	Erection of low voltage installations
EN 60598-1	Luminaires – part 1: general requirements and tests
EN 61347-1	Operating devices for lamps – part 1: general and safety requirements
EN 61347-2-8	Operating devices for lamps – part 2-8: special requirements for ballasts for fluorescent lamps
EN 60921	Ballasts for fluorescent tube lamps – performance requirements
EN 50294	Methods for measuring the total input power of ballast-lamp circuits
EN 55015	Maximum values and methods of measurement for RFI suppression in electrical lighting installations and similar electrical appliances
EN 61000-3-2	Electromagnetic Compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (device input current up to and including 16 A per conductor)
EN 61547	Installations for general lighting purposes – EMC immunity requirements

Technical specifications

Operating voltage range	VS ballasts can be operated at the specified mains voltage within a tolerance range of ±10%
Leak current	≤ 0.1 mA per ballast
Error current	Impulse-resistant leak-current protection must be installed. Distribute the luminaires to phases L1, L2 and L3; install tri-phase FI switches. If permissible, install FI switches with 30 mA leak current; connect no more than 15 luminaires as FI switches can be triggered at half the leak current value.
Power factor	Inductive ballasts: $\lambda \geq 0.5$ Parallel-compensated ballasts: $\lambda \geq 0.85$
Compensation	VS recommends the use of parallel capacitors owing to their technical advantages and power balance.
Possible interference with IR systems	Are not known to occur

Mechanical mounting

Mounting position
Any

Mounting location
Ballasts are designed for installation in luminaires or comparable devices. Independent ballasts do not need to be installed in a casing.

Fastening Preferably using screws Ø 4 mm

Maximum temperatures
The stipulated winding temperature (tw 130, tw 140 and tw 150, respectively) must not be exceeded during normal operation. The corresponding maximum values (232 °C, 248 °C and 264 °C, respectively) must be observed during anomalous operation. These values must be checked by measuring resistance during operation.

Temperature increase
The lamp current flowing through the ballast generates a power loss that leads to an increase in winding temperature. The Δt values for normal and abnormal operation provide
a measure of this temperature increase. The Δt values are ascertained using standardised connections for measurement and are provided on the ballast type plate in Kelvin.

Example: Δt = 55 K/140 K:
The first Δt value indicates the temperature increase for normal operation at the lamp's operating current. The second value, 140 K in this case, denotes the temperature increase of the winding that results from the current that flows when the lamp's discharge path is short-circuited. The current that flows in this state is the preheat current through the lamp's electrodes.

Electromagnetic compatibility (EMC)

Interference Interference voltage measurements have to be taken at the connection terminals for luminaires with magnetic ballasts as these are systems that operate with lamp voltages of under 100 Hz. These low-frequency interference voltages are generally not critical with magnetic ballasts.

Interference immunity
Thanks to the robust design and choice of materials, magnetic ballasts provide a high degree of interference immunity and are not impaired by admissible mains power interference.

Mains Harmonics
After every zero crossing of the lamp current, fluorescent lamps experience a re-ignition peak as the lamps go out for a brief (imperceptible) moment. These re-ignition peaks generate mains harmonics that are smoothed by the ballast's impedance. The right design, i.e. determining the operating point of the magnetic ballast, ensures mains harmonics are limited to the maximum values permitted by EN 61000-3-2. VS electromagnetic ballasts all comply with the stipulated maximum values.

Selection of automatic cut-outs for VS electromagnetic ballasts

Dimensioning automatic cut-outs

When a ballast is switched on, high transient current peaks occur due to parasite capacitances that can accumulate with the number of luminaires. These high system switch-on currents put a strain on the automatic conductor cut-outs. For this reason, only surge-current-proof automatic cut-outs should be used for lighting systems.

Release reaction The release reaction of the automatic conductor cut-outs comply with VDE 0641, part 11, for B and C characteristics.

No. of ballasts The following values are meant as guidelines only and may vary depending on the respective lighting system. The maximum number of VS ballasts applies to cases where the devices are switched on simultaneously. Specifications apply to single-pole fuses. The number of permissible ballasts must be reduced by 20% for multi-pole fuses. The considered circuit impedance equals 400 mΩ (approx. 20 m of [2.5 m²] conductor from the power supply to the distributor and a further 15 m to the luminaire). Doubling circuit impedance to 800 mΩ increases the possible number of ballasts by 10%. The values quoted in the following tables are guidelines and can be affected by systemspecific factors.

Possible number of ballasts connected to automatic cut-outs for compact fluorescent lamps (single lamp operation)

Lamp output	10 A (B)		16 A (B)	
W	Inductive	Parallel compensation	Inductive	Parallel compensation
5/7/8/9/10/11/13	50	90	80	130
18 (TC-L)	27	32	43	51
18 (TC-D)	40	65	65	110
24	25	32	40	51
26	27	32	43	51
36	23	32	37	51

Possible number of ballasts connected to automatic cut-outs for tubular and U-shaped fluorescent lamps (single lamp operation)

Lamp output	10 A (B)		16 A (B)	
W	Inductive	Parallel compensation	Inductive	Parallel compensation
4/6/8/10	50	90	80	130
13	45	80	70	115
15/18/20	27	32	43	51
30/36/38/40	23	32	37	51
58/65	15	20	22	32
70	13	18	20	30

Reliability and service life

Provided the specified maximum values for the winding temperature are complied with, a service life of 10 years can be expected. Failure rate: ≤ 0.025%/1,000 hours.

Electrical installation

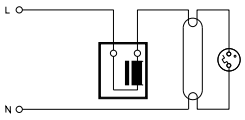
Connection terminals (combination terminals)

- Use copper (not stranded) wire
- Required diameter for push-in connection 0.5–1 mm²
- Stripped lead length 8 mm
- Required cross-section for IDC zone 0.5 mm²; max. Ø 2 mm including Insulation, no wire stripping required; mounting requires a special tool

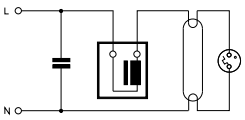
Push-in terminals The integrated terminals can only be used with rigid leads. Rigid leads: 0.5–1.5 mm². The stripped lead length totals 8 mm.

Wiring The wiring between the mains, ballasts and lamps must comply with the respective circuit diagram.

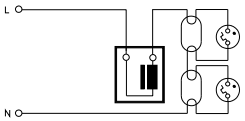
Circuit diagrams for the operation of fluorescent lamps with Vossloh-Schwabe electromagnetic ballasts



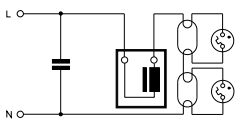
Inductive single circuit



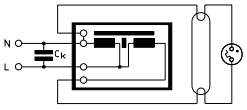
Parallel-compensated single circuit



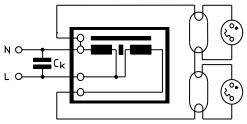
Inductive tandem circuit



Parallel-compensated tandem circuit



Parallel-compensated single circuit with high-reactance transformer



Parallel-compensated tandem circuit with high-reactance transformer

Connection terminals

In the interest of ensuring firm contacts and long component service life, Vossloh-Schwabe uses only top-quality materials for plastic or metal parts during the production of connection terminals. These quality features apply to both Vossloh-Schwabe's luminaire connection terminals as well as to the terminals fitted to ballasts and lampholders.

Notes on connection terminals on electronic ballasts

Vossloh-Schwabe electronic ballasts are fitted with installation-friendly push-in connectors . In addition, many models for linear fluorescent lamps are also available with IDC terminals (for solid conductors 0.5 mm²) and supplementary push-in terminals (for solid conductors 0.5–1 mm²), stripped length 8–9 mm. IDC terminals permit automated luminaire wiring and testing using the ALF system and are thus particularly efficient.

Notes on connection terminals on electromagnetic ballasts

Standard issue Vossloh-Schwabe electromagnetic ballasts are fitted with installation-friendly push-in terminals. The terminals are designed for use with solid conductors with cross-sections of 0.5–1.5 mm² and are approved for current loads of up to 16 A. The lead stripping length totals 7–9 mm for push-in terminals. On request, many ballasts can also be provided with screw terminals (current load up to 16 A) for conductor cross-sections of 0.5 to 2.5 mm².

Notes on connection terminals on lampholders

Vossloh-Schwabe usually equips lampholders for T and TC lamps as well as starter lampholders with installation-friendly push-in terminals for solid conductors of 0.5–1 mm². Most lampholders are fitted with twin push-in terminals and thus permit through-wiring. The required lead stripping length amounts to 8–9 mm for all types.

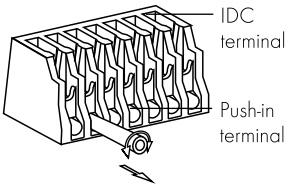
IDC terminals

In order to fully exploit the vast potential for rationalisation offered by automated wiring and testing, a totally new component family was developed that is equipped with the VDE-tested IDC terminal technology. This technology has already been used very successfully on a large scale in other branches of industry. This connection technology dispenses with the stripping of conductors that is required for the push-in, screw or crimping methods. The tried-and-tested IDC terminal technology has created the foundation for efficient automation as it ensures both high connection quality and rapid contacting. Components equipped in this fashion make it possible to through-wire several terminals with a single conductor. This constitutes a further economic advantage as it significantly reduces the required conductor lengths. Furthermore, this design principle makes it possible to use adapters to simply and reliably make electrical contact from above for a VDE-compatible final luminaire inspection.

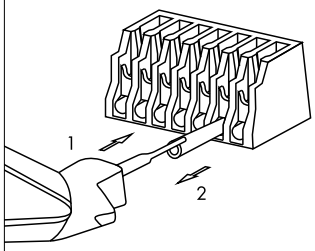
ALF connection

Height: 12 mm

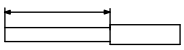
Release by twisitng and pulling the conductor at the same time



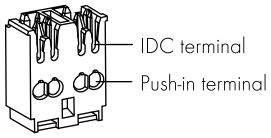
1. Insert release tool above the conductor
2. Pull out the conductor



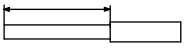
Stripping the conductor for push-in terminal 0.5–1 mm²: 8–9 mm



IDC/Push-in terminal for electromagnetic ballasts



Stripping the conductor for push-in terminal 0.5–1 mm²: 7–9 mm



Lampholders for Fluorescent Lamps

Lampholders for compact fluorescent lamps
Vossloh-Schwabe produces the majority of lampholders for TC lamps using PBT, a thermoplastic material. This highly heat-resistant material is responsible for the T140 temperature rating. Leading lamp manufacturers also use PBT for the lamp bases they produce. This material harmonisation in conjunction with fatigue-free, stainless steel lamp mounting springs ensures a permanently secure lamp fit.

Lampholders for double-ended fluorescent lamps
VS lampholders for T lamps are characterised by a number of technical features that guarantee a high degree of reliability and safety. The heat-resistant PBT rotor with which most VS lampholders are fitted is a recognised trademark. In addition to the lampholders with the field-tested large rotor, VS also provides a generation of lampholders featuring innovative "Rotoclic" rotor technology. This VS technology constitutes a further milestone in the development of highly heat-resistant rotor systems.
Among the special features of this technology is a T140 temperature rating thanks to a front plate made entirely of PBT as well as a clearly audible click when the lamp is inserted or replaced. As a result, the motion of turning the lamp from "replacement" to "operating" position is aided acoustically.
In addition to this, VS produces a further series of lampholders with a rotor-like function, whose front plates are also made of highly heat-resistant PBT and have similarly been given a T140 temperature rating.
The maximum permissible temperature at the back of all lampholders is T_m 110 °C. Another key feature common to all VS lampholders is a highly effective support for the lamp pin that reliably prevents any base pin deflection, even with older lamps, and guarantees a durable and firm contact.

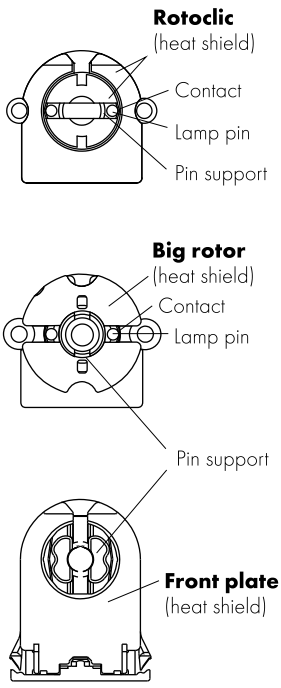
Push-through lampholders
Push-through lampholders are inserted from below through a cut-out in the luminaire casing and are secured by lateral catches. This type of lampholder is frequently used in luminaires on which the lampholder remains visible from the outside, e.g. in so-called strip lighting. The electrical leads are laid beneath the sheet metal level. Luminaire directive EN 60598-1 Para. 8.2 must be observed with regard to the luminaire.

Push-fit lampholders
This lampholder type, which is frequently found in surface-mounted ceiling and built-in luminaires, is pushed into the luminaire casing from above. The lampholder foot should protrude by no more than 4 mm to match the usual height of the spacing cams in the luminaire casing. These lampholders are mostly wired above the luminaire casing to the side of the lampholder. However, there are also lampholders on which the wiring runs through the lampholder foot, with the leads laid beneath the luminaire casing.

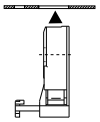
Built-in lampholders
This design is also predominantly used for recessed ceiling and surface-mounted luminaires. However, unlike push-fit lampholders, built-in lampholders are usually fitted at the ends of the luminaire boxes. In addition to the usual fixing with split pins attached to the rear, there are also countless versions with fixing clips, push-fit studs or screw-in holes, which are also available with spring-loaded length compensation. Built-in lampholders offer luminaire designers a wealth of scope regarding the choice of lamp position in relation to the reflector. This enables great variation in light distribution as the lampholder does not dictate the distance of the centre of the lamp from the metal casing.

Surface-mounted lampholders
The fastening system of surface-mounted lampholders usually consists of screws or rivets above a fixing level, along which the wiring is also laid. As this type of installation is usually too costly nowadays for large unit numbers, these lampholders are used almost exclusively for special applications, e.g. displays or illuminated advertisements.

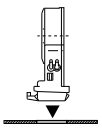
VS lampholders for the UL market and UL approved leads are available for all common lamp types. Further information can be found at www.unvlt.com/products/legacy/lampholders.



Push-through lampholder

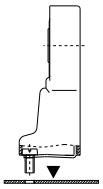


Push-fit lampholder

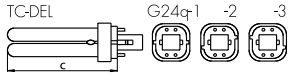
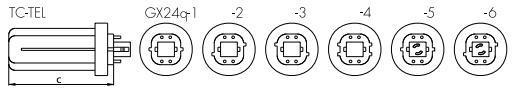
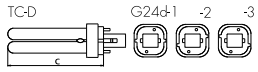
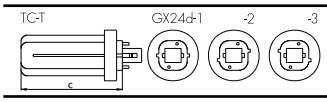
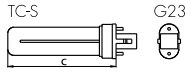
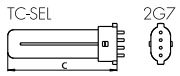
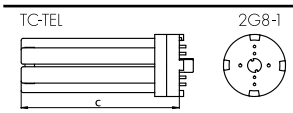
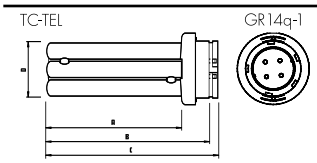
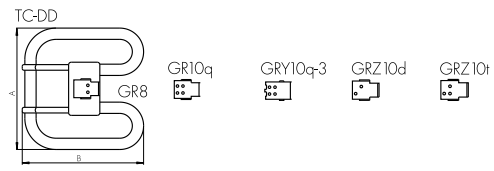
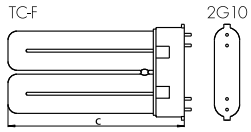
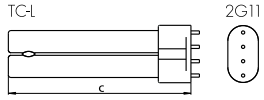


Built-in lampholder

Surface-mounted lampholder

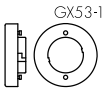
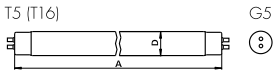
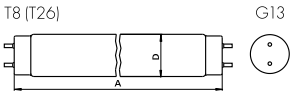
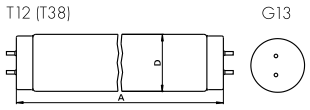


Lamp Table – Fluorescent Lamps

Lamp type/lamp base	Base	Output (W)	Max. length (C) acc. to IEC			
	G24q-1	10 13	95 130			
	G24q-2	18	140			
	G24q-3	26	160			
	GX24q-1	13	90			
	GX24q-2	18	110			
	GX24q-3	26 32	130 145			
	GX24q-4	42	155			
	GX24q-5	57	191			
	GX24q-6	70	219			
	G24d-1	8 10 13	73* 95 130			
	G24d-2	18	140			
	G24d-3	26	160			
	GX24d-1	13	90			
	GX24d-2	18	110			
	GX24d-3	26	130			
	G23	5 7 9 11	85 115 145 215			
	2G7	5 7 9 11	85 115 145 215			
	2G8-1	60 85 120	167 208 285			
			A	B	C	D
	GR14q-1	14 17	99.7 121.7	120 142	126.6 148.6	41* 41*
			A	B		
	GR8	16 28	138 205	141 207		
	GR10q	10 16 21 28 38	92 138 138 205 205	95 141 141 207 207		
	GRY10q-3	55	205	205*		
	GRZ10d	18	137	141*		
	GRZ10t	30	202	206*		
	2G10	18 24 36	122 165 217			
	2G11	18 24 34 36 40 55 80	225 320 533* 415 535 535 565			

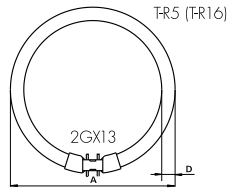
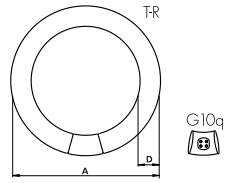
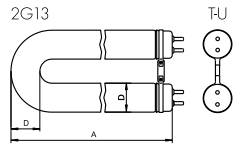
*not included in IEC standard (non-committal specifications)

Lamp Table – Fluorescent Lamps

Lamp type/lamp base	Base	Output (W)	Ø D (mm)	Length A/C (mm) acc. to IEC 60081/ 60901 (for circular lamps B)
	GX53-1	7 9		
	W4.3x8.5d	6 8 11 13	7 7 7 7	219.3 320.9 422.5 524.1
	G5	4 6 8 13 14 20 21 24 25 28 32 34 35 39 45 49 50 54 73 80	16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16	135.9 212.1 288.3 516.9 549.0 549.0 849.0 549.0 1149.0 1149.0 1449.0 849.0 1449.0 849.0 1449.0 1449.0 1449.0 1149.0 1449.0 1449.0
	G13	10 14 15 16 16 18 20*1 23 30 32 33 34 36 36 38 50 51 58 70	26 26 26 26 26 26 26 26 26 26 26 26 26 26 26 26 26 26 26	470.0*2 360.0*2 437.4 589.8 720.0*2 589.8 438.0*2 970.0*2 894.6 1199.4 1149.0 1047.0*2 1199.4 970.0*2 1047.0 1500.0 1500.0 1500.0 1763.8
	G13	20 25 30 40 65 75 80*1 85 85*1 100 100*1 115 125 140 140*1 160*1	38 38 38 38 38 38 38 38 38 38 38 38 38 38 38 38	589.8 970.0 894.6 1199.4 1500.0 1763.8 1500.0 2374.3 1763.8 2374.3 1800.0*2 1200.0*2 2374.3 1500.0*2 1800.0*2 1800.0*2

*1 UV solarium lamps
*2 Not included in IEC standard (non-committal specifications)

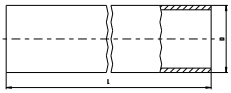
Lamp Table – Fluorescent Lamps

Lamp type/lamp base	Base	Output (W)	Ø D (mm)	A (mm)
	2GX13	22 40 55 60	16 16 16 16	230.0 305.0 305.0 379.0
	G10q	22 32 40 60	29 29 29 30	215.9 304.8 406.4 408.8*
	2G13-92	18 36 58	26 26 26	304* 566, 601* 566, 759*

* Not yet included in IEC standard (non-committal specifications)

Tube lengths of plastic and glass protective tube

Ø D (mm)	Length L (mm)
$38^{\pm 0.5}$	$L = A–20^{\pm 1}$
$50^{\pm 0.8}$	$L = A–30^{\pm 1}$



Key to lamp designations

TC-S	Tube Compact-Single
TC-SEL	Tube Compact-Single Electronic
TC-D	Tube Compact-Double
TC-DEL	Tube Compact-Double Electronic
TC-T	Tube Compact-Triple
TC-TEL	Tube Compact-Triple Electronic
TC-Q	Tube Compact-Quad
TC-QEL	Tube Compact-Quad Electronic
TC-DD	Tube Compact-Double D-Shape
TC-L	Tube Compact-Long
TC-F	Tube Compact-Flat
T2 (T7)	Tube Ø 2/8" (7 mm)
T5 (T16)	Tube Ø 5/8" (16 mm)
T8 (T26)	Tube Ø 8/8" (26 mm)
T12 (T38)	Tube Ø 12/8" (38 mm)
T-U	Tube, U-Shape
T-R	Tube, Ring-Shape
T-R5 (T-R16)	Tube, Ring-Shape Ø 5/8" (16 mm)

Energy efficiency classification

Based on Directive 2009/125/EC, the European Commission has revised and redefined the limit values from Regulations (EC) 244/2009, (EC) 245/2009 and (EU) 1194/2012 in the third stage with Regulation (EU) 2019/2020 laying down ecodesign requirements for light sources and separate control gear. This regulation will enter into force on 1 September 2021. In the process, the scope was extended to LED light sources and separate control gear of any kind. In addition, limit values for losses in the so-called standby mode, no-load mode and the standby mode in network operation were added. The energy classes for separate control gears are no longer applicable and the limit values of the former class A2 apply. This means that within the EU, only control gears of energy class A2 and better are permitted.

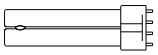
Furthermore, regulation (EU) 2019/2020 sets higher efficiency requirements for the most common T8 lamps from 1 September 2023, which de facto prohibits the placing of T8 lamps on the EU market.

The following table summarises the minimum energy efficiencies based on the energy classifications of ballasts valid until 1.9.2021. From 1.9.2021, classes A3 to B2 will be banned in the EU and the only minimum energy efficiency requirement will be the values of class A2, which are highlighted in the following table.

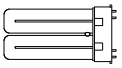
Lamp data					Ballast efficiency (P_{LS}/P_{Input}) (non-dimmable ballasts)				
Type	Nominal output W	ILCOS-Code	Typical rating 50 Hz W	HF W	A2 BAT %	A2 %	A3 %	B1 %	B2 %
T8	15	FD-15-E-G13-26/450	15	13.5	87.8	84.4	75.0	67.9	62.0
	18	FD-18-E-G13-26/600	18	16	87.7	84.2	76.2	71.3	65.8
	30	FD-30-E-G13-26/900	30	24	82.1	77.4	72.7	79.2	75.0
	36	FD-36-E-G13-26/1200	36	32	91.4	88.9	84.2	83.4	79.5
	38	FD-38-E-G13-26/1050	38.5	32	87.7	84.2	80.0	84.1	80.4
	58	FD-58-E-G13-26/1500	58	50	93.0	90.9	84.7	86.1	82.2
	70	FD-70-E-G13-26/1800	69.5	60	90.9	88.2	83.3	86.3	83.1
TC-L	18	FSD-18-E-2G11	18	16	87.7	84.2	76.2	71.3	65.8
	24	FSD-24-E-2G11	24	22	90.7	88.0	81.5	76.0	71.3
	36	FSD-36-E-2G11	36	32	91.4	88.9	84.2	83.4	79.5
TC-F	18	FSS-18-E-2G10	18	16	87.7	84.2	76.2	71.3	65.8
	24	FSS-24-E-2G10	24	22	90.7	88.0	81.5	76.0	71.3
	36	FSS-36-E-2G10	36	32	91.4	88.9	84.2	83.4	79.5
TC-D/ TC-DE	10	FSQ-10-E-G24q=1 FSQ-10-I-G24d=1	10	9.5	89.4	86.4	73.1	67.9	59.4
	13	FSQ-13-E-G24q=1 FSQ-13-I-G24d=1	13	12.5	91.7	89.3	78.1	72.6	65.0
	18	FSQ-18-E-G24q=2 FSQ-18-I-G24d=2	18	16.5	89.8	86.8	78.6	71.3	65.8
	26	FSQ-26-E-G24q=3 FSQ-26-I-G24d=3	26	24	91.4	88.9	82.8	77.2	72.6
TC-T/ TC-TE	13	FSM-13-E-GX24q=1 FSM-13-I-GX24d=1	13	12.5	91.7	89.3	78.1	72.6	65.0
	18	FSM-18-E-GX24q=2 FSM-18-I-GX24d=2	18	16.5	89.8	86.8	78.6	71.3	65.8
	26	FSM-26-E-GX24q=3 FSM-26-I-GX24d=3	26.5	24	91.4	88.9	82.8	77.5	73.0
TC-DD/ TC-DDE	10	FSS-10-E-GR10q FSS-10-L/P/H-GR10q	10.5	9.5	86.4	82.6	70.4	68.8	60.5
	16	FSS-16-E-GR10q FSS-16-I-GR10q FSS-10-L/P/H-GR10q	16	15	87.0	83.3	75.0	72.4	66.1
	21	FSS-21-E-GR10q FSS-21-I-GR10q FSS-21-L/P/H-GR10q	21	19	89.4	86.4	79.2	73.9	68.8
	28	FSS-28-E-GR10q FSS-28-I-GR10q FSS-28-L/P/L-GR10q	28	26	89.7	86.7	81.3	78.2	73.9
	38	FSS-38-E-GR10q FSS-38-L/P/L-GR10q	38.5	36	92.3	90.0	85.7	84.1	80.4

Lamp types

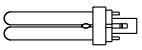
T8



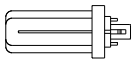
TC-L



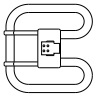
TC-F



TC-D/TC-DE



TC-T/TC-TE



TC-DD/TC-DDE

Lamp data					Ballast efficiency (P_{LS}/P_{Input}) (non-dimmable ballasts)				
Type	Nominal output W	ILCOS-Code	Typical rating 50 Hz W	HF W	A2 BAT %	A2 %	A3 %	B1 %	B2 %
TC	5	FSD-5-I-G23 FSD-5-E-2G7	5.4	5	72.7	66.7	58.8	49.3	41.4
	7	FSD-7-I-G23 FSD-7-E-2G7	7.1	6.5	77.6	72.2	65.0	55.7	47.8
	9	FSD-9-I-G23 FSD-9-E-2G7	8.7	8	78.0	72.7	66.7	60.3	52.6
	11	FSD-11-I-G23 FSD-11-E-2G7	11.8	11	83.0	78.6	73.3	66.7	59.6
T5	4	FD-4-E-G5-16/150	4.5	3.6	64.9	58.1	50.0	45.0	37.2
	6	FD-6-E-G5-16/225	6	5.4	71.3	65.1	58.1	51.8	43.8
	8	FD-8-E-G5-16/300	7.1	7.5	69.9	63.6	58.6	48.9	42.7
	13	FD-13-E-G5-16/525	13	12.8	84.2	80.0	75.3	72.6	65.0
T9-C	22	FSC-22-E-G10q-29/200	22	19	89.4	86.4	79.2	74.6	69.7
	32	FSC-32-E-G10q-29/300	32	30	88.9	85.7	81.1	80.0	76.0
	40	FSC-40-E-G10q-29/400	40	32	89.5	86.5	82.1	82.6	79.2
T2	6	FDH-6-L/P-W4.3x8.5d-7/220		5	72.7	66.7	58.8	–	–
	8	FDH-8-L/P-W4.3x8.5d-7/320		7.8	76.5	70.9	65.0	–	–
	11	FDH-11-L/P-W4.3x8.5d-7/420		10.8	81.8	77.1	72.0	–	–
	13	FDH-13-L/P-W4.3x8.5d-7/520		13.3	84.7	80.6	76.0	–	–
	21	FDH-21-L/P-W4.3x8.5d-7		21	88.9	85.7	79.2	–	–
	23	FDH-23-L/P-W4.3x8.5d-7		23	89.8	86.8	80.7	–	–
T5-E	14	FDH-14-L/P-G5-16/550		13.7	84.7	80.6	72.1	–	–
	21	FDH-21-L/P-G5-16/850		20.7	89.3	86.3	79.6	–	–
	24	FDH-24-L/P-G5-16/550		22.5	89.6	86.5	80.4	–	–
	28	FDH-28-L/P-G5-16/1150		27.8	89.8	86.9	81.8	–	–
	35	FDH-35-L/P-G5-16/1450		34.7	91.5	89.0	82.6	–	–
	39	FDH-39-L/P-G5-16/850		38	91.0	88.4	82.6	–	–
	49	FDH-49-L/P-G5-16/1450		49.3	91.6	89.2	84.6	–	–
	54	FDH-54-L/P-G5-16/1150		53.8	92.0	89.7	85.4	–	–
	80	FDH-80-L/P-G5-16/1150		80	93.0	90.9	87.0	–	–
	95	FDH-95-L/P-G5-16/1150		95	92.7	90.5	84.1	–	–
	120	FDH-120-L/P-G5-16/1450		120	92.5	90.2	84.5	–	–
T5-C	22	FSCH-22-L/P-2GX13-16/225		22.3	88.1	84.8	78.8	–	–
	40	FSCH-40-L/P-2GX13-16/300		39.9	91.4	88.9	83.3	–	–
	55	FSCH-55-L/P-2GX13-16/300		55	92.4	90.2	84.6	–	–
	60	FSCH-60-L/P-2GX13-16/375		60	93.0	90.9	85.7	–	–
TC-LE	40	FSDH-40-L/P-2G11		40	91.4	88.9	83.3	–	–
	55	FSDH-55-L/P-2G11		55	92.4	90.2	84.6	–	–
	80	FSDH-80-L/P-2G11		80	93.0	90.9	87.0	–	–
TC-TE	32	FSMH-32-L/P-GX24q=3		32	91.4	88.9	82.1	–	–
	42	FSMH-42-L/P-GX24q=4		43	93.5	91.5	86.0	–	–
	57	FSM6H-57-L/P-GX24q=5 FSM8H-57-L/P-GX24q=5		56	91.4	88.9	83.6	–	–
	70	FSM6H-70-L/P-GX24q=6 FSM8H-70-L/P-GX24q=6		70	93.0	90.9	85.4	–	–
	60	FSM6H-60-L/P-2G8=1		63	92.3	90.0	84.0	–	–
	62	FSM8H-62-L/P-2G8=2		62	92.2	89.9	83.8	–	–
	82	FSM8H-82-L/P-2G8=2		82	92.4	90.1	83.7	–	–
	85	FSM6H-85-L/P-2G8=1		87	92.8	90.6	84.5	–	–
	120	FSM6H-120-L/P-2G8=1 FSM8H-120-L/P-2G8=1		122	92.6	90.4	84.7	–	–
TC-DD	55	FSSH-55-L/P-GR10q		55	92.4	90.2	84.6	–	–

With the Ecodesign Regulation (EU) 2019/2020, the minimum energy efficiency values of the 3rd stage from 2017 corresponding to class A2 are prescribed, which are calculated as follows:

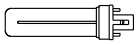
If $P_{LS} \leq 5$ W $\quad \eta_{min.} = 0.71$

If $5\ W < P_{LS} \leq 100$ W $\quad \eta_{min.} = P_{LS}/(2*\text{sqrt}\,(P_{LS}/36)+38/36*P_{LS}+1)$

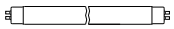
If $P_{LS} > 100$ W $\quad \eta_{min.} = 0.91$

(P_{LS} = measured light source power)

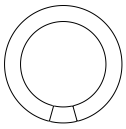
Lamp types



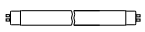
TC



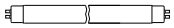
T5



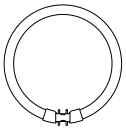
T9-C



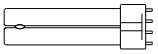
T2



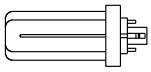
T5-E



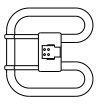
T5-C



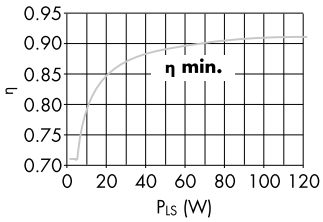
TC-LE



TC-TE



TC-DD



SYSTEM-OPTIMISING COMPENSATION

PARALLEL CAPACITORS

Capacitors are designed to compensate inductive reactive current of discharge lamps in 50/60 Hz networks when operated with electro-magnetic ballasts. As required by utility companies, capacitors serve to compensate the reactive current generated by the respective ballast. A power factor of $\lambda \geq 0.9$ is achieved.

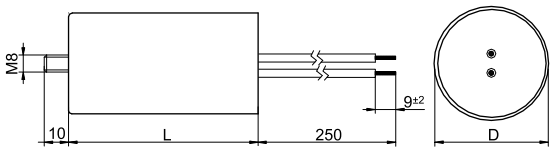
In addition, capacitors can also be used to compensate or generate phase displacements. Careful selection of the raw materials as well as special thermal treatment of the capacitor coil guarantee a long servicelife and stable capacitance.

4 Parallel Capacitors

Parallel Connected Capacitors with Leads 250 V, 50/60 Hz

Capacitors type A

Casing: plastics, white
Fastening: male nipple M8x10
with nut and washer included
Discharge resistance
Leads: H05V2U 0,5 mm², length: 250 mm



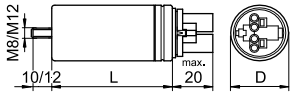
Ref. No.	Capacity µF (±10%)	Temperature range °C	Ø (D) mm	Length (L) mm	Male nipple/ length (mm)	Weight g	Packaging unit pcs.
571653	2.5	–25 to 85	30	55	M8x10	26	350
526169	4.0	–25 to 85	30	55	M8x10	27	350
571654	4.5	–25 to 85	30	55	M8x10	27	350
526170	6.0	–25 to 85	30	55	M8x10	28	350
526171	8.0	–25 to 85	30	55	M8x10	35	350
571655	9.0	–25 to 85	33	63	M8x10	40	250
529665	10.0	–25 to 85	33	63	M8x10	42	250
526172	12.0	–25 to 85	33	63	M8x10	45	250
543402	13.5	–25 to 85	33	63	M8x10	47	250
529666	16.0	–25 to 85	40	63	M8x10	61	200
551644	18.0	–25 to 85	40	63	M8x10	65	200
528552	20.0	–25 to 85	40	63	M8x10	69	200
508484	25.0	–25 to 85	40	63	M8x10	71	200
536743	30.0	–25 to 85	45	88	M8x10	95	120
528554	35.0	–25 to 85	45	88	M8x10	105	120
571656	40.0	–25 to 85	45	88	M8x10	113	120
528555	45.0	–25 to 85	45	88	M8x10	123	120
571657	50.0	–25 to 85	45	88	M8x10	127	120
571658	55.0	–25 to 85	50	94	M8x10	147	100
571659	60.0	–25 to 85	50	94	M8x10	157	80
571660	65.0	–25 to 85	50	94	M8x10	167	80

Parallel Connected Capacitors with Break-action Mechanism

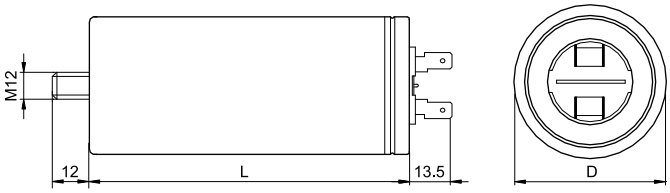
Capacitors type B

Casing: aluminium
Filling material: based on vegetable oil
Fastening: male nipple
with nut and washer included
Discharge resistance
Overpressure protection
On request further capacities or connectors

A Push-in twin terminals 0.5–1 mm²



B Double spade connector 6.3x0.8 acc. to IEC 61210



Ref. No.	Capacity µF (±10%)	Temperature range °C	Drawing	Ø (D) mm	Length (L) mm	Male nipple/ length (mm)	Weight g	Packaging unit pcs.
250 V, 50/60 Hz								
536379	4.0	–40 to 100	A	30	60	M8x10	35	144
536380	6.0	–40 to 100	A	30	60	M8x10	40	144
536381	8.0	–40 to 100	A	35	72	M8x10	42	144
536382	10.0	–40 to 100	A	35	72	M8x10	46	144
536383	12.0	–40 to 100	A	35	72	M8x10	49	144
536386	18.0	–40 to 100	A	40	72	M8x10	76	105
536387	20.0	–40 to 100	A	40	72	M8x10	80	105
536388	25.0	–40 to 100	A	40	72	M8x10	82	105
536389	30.0	–40 to 100	A	40	97	M8x10	101	96
536390	32.0	–40 to 100	A	40	97	M8x10	105	96
536392	40.0	–40 to 100	A	45	97	M8x10	132	70
536393	45.0	–40 to 100	A	45	97	M8x10	142	70
536394	50.0	–40 to 100	A	45	97	M8x10	150	70
536396	60.0	–40 to 100	A	45	121	M8x10	175	35
537058	65.0	–40 to 100	B	60	105	M12x12	201	36
506360	85.0	–40 to 100	B	60	130	M12x12	248	36
506363	100.0	–40 to 100	B	60	130	M12x12	286	36

Ref. No.	Capacity µF (±10%)	Temperature range °C	Drawing	Ø (D) mm	Length (L) mm	Male nipple/ length (mm)	Weight g	Packaging unit pcs.
450 V, 50/60 Hz								
536400	32.0	–40 to 85	A	45	97	M8x10	179	70
536401	37.0	–40 to 85	A	45	97	M8x10	200	70
536402	50.0	–40 to 85	B	45	121	M8x10	360	35
536404	60.0	–40 to 85	B	60	130	M12x12	270	36
536405	85.0	–40 to 85	B	60	130	M12x12	420	36

4 Capacitors for Fluorescent and Discharge Lamps

Compensation of idle current

When using magnetic ballasts a phase shift occurs between the mains voltage and the current drawn. This phase shift is expressed by the power factor λ, which generally ranges between a value of 0.3 and 0.7 with inductive circuits.

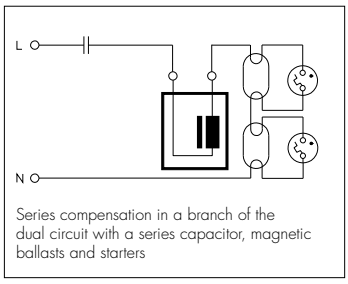
As a result of this phase shift, idle current, which does not boost the efficiency of the lighting unit, is also taken up from the power supply network in addition to real power. Power utility companies therefore require an increase of the power factor to values of over 0.85 for systems exceeding a certain rating (usually upwards of 250 W per external conductor).

Compensation capacitors are used to counteract idle current (by increasing the power factor) and can be connected either in parallel or in series.

Thanks to a power factor of approx. 0.95, electronic ballasts do not need to be operated with compensation capacitors.

Compensation using series capacitors

Series compensation employs a so-called dual circuit (two fluorescent lamp circuits connected in parallel), whereby the capacitor, which is connected in a branch of the circuit, over compensates the inductive idle current to such an extent that it covers the idle current of both ballasts. This type of circuit is only used with fluorescent lamps. As series capacitors are dimensioned for nominal-voltage and ballast tolerances, the lamp in the capacitor branch of the dual circuit operates with a higher current and thus also with a higher rating. Apart from differences in lamp brightness, the power loss in the circuit branch with the capacitor will also be greater.



Series compensation in a branch of the dual circuit with a series capacitor, magnetic ballasts and starters

An advantage of the dual circuit is that it prevents the radiated light from flickering.

The higher current in the so-called capacitive lamp circuit causes an up to 14% increase in lamp rating and a reduction of the lamp service life by as much as 20%. This goes hand in hand with substantial technical, ecological and economic disadvantages.

Series capacitors have to meet very high technical requirements to suit various aspects like temperature, nominal voltage, tolerances of the capacitance values, etc.

As defined by EC directive 2000/55/EC (European Standard EN 50294 governing the measurement of total power consumption), a series capacitor is considered to be a part of the ballast. If the system rating of the capacitive circuit containing the lamps and ballasts is then determined in line with the above definition, rating increases of up to 14% will become apparent in comparison to operation without a series capacitor. Experience has shown that this increased power consumption often means devices fall in the directive's "banned" category. It is therefore strongly advised that due consideration be given to the elevated power consumption values common to using series capacitors for compensation purposes.

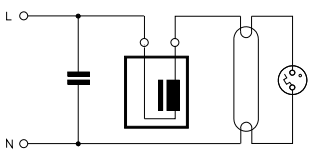
Parallel compensation

During parallel compensation, each lamp circuit is assigned to a capacitor connected in parallel to the mains. Only one capacitor providing sufficient capacitance is needed for luminaires with several lamps. Parallel compensation does not affect current flow through a discharge lamp. The requirements placed on parallel capacitors are clearly lower than those for series capacitors.

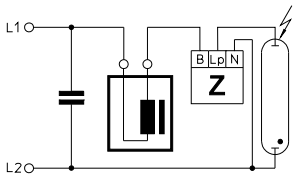
However, parallel compensation can be subject to limitations when using audio-frequency ripple control pulses if the system operates with a connected rating of over 5 kVA and ripple control frequencies of over 300 Hz are used. The respective power utility company should be consulted for advice in such cases.

Parallel compensation is used in fluorescent lamp and high-pressure discharge lamp circuits.

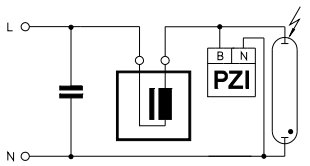
As parallel compensation offers substantial advantages, this has become the accepted method in the last few years.



Parallel compensation of a fluorescent lamp circuit



Parallel compensation of a high-pressure discharge lamp circuit with a superimposed ignitor



Parallel compensation of a high-pressure discharge lamp circuit with a pulse ignitor

Metallised polypropylene film capacitors

Metallised polypropylene film capacitors are designed to compensate the inductive idle current drawn by discharge lamps (fluorescent lamps, high-pressure mercury vapour lamps, high-pressure sodium vapour lamps and metal halide lamps with a ceramic discharge tube) in 50 Hz/60 Hz grids. All Vossloh-Schwabe compensation capacitors for luminaires feature a metallised polypropylene film dielectric. Compensation capacitors help to increase the power factor to values of over λ 0.85 as required by power utility companies.

Construction of metallised polypropylene film capacitors

VS MPP capacitors contain a low-loss metallised polypropylene film dielectric, which is produced by depositing a thin layer of zinc and aluminium or pure aluminium vapour onto one side of the polypropylene film. The contacts at either end of the capacitor coil are created by spraying on a layer of metal and thus guarantee a high current-carrying capacity as well as a low-inductive connection between the terminals and the coils.

All capacitors with a nominal voltage upwards of 280 V are filled with oil or resin after the coils have been inserted and then hermetically sealed. This protects the coils from environmental influences and reduces partial discharge, which contributes to a long service life and stable capacitance. The effects of partial discharge only play a minor role for capacitors with a nominal voltage of under 280 V so that these devices do not need to be filled.

Hermetically sealed, filled capacitors with an overpressure contact breaker should always be used in critical ambient conditions (high humidity, aggressive atmospheres, high temperatures), if the workload and power supply conditions are unknown as well as in situations that demand increased attention to safety.

VS MPP capacitors feature a self-healing dielectric. In the event of a dielectric breakdown in the coil (short circuit), the metal coating vaporises around the breakdown site owing to the high temperature of the transient arc that is produced. Owing to the excess pressure generated during such a breakdown, the metal vapour is pushed outwards away from the centre of the site within the space of just a few microseconds. This creates a coating-free corona around the breakdown site that completely isolates it and means the capacitor remains fully functional during a dielectric breakdown.

The self-healing properties of a capacitor can decrease with time and with constant overloading. This bears the risk of a non-healing breakdown with a permanent short circuit. Therefore self-healing must not be confused with failsafe.

Compensation capacitors are divided into two type families (A and B) in accordance with IEC 61048 A2.

- Type A capacitors defined:
  "Self-healing parallel capacitors; without an (overpressure) contact breaker in the event of failure".
  They are referred to as unsecured capacitors.

- Type B capacitors defined:
  "Self-healing capacitors for series connection in lighting circuits or self-healing parallel capacitors; with an (overpressure) contact breaker in the event of failure".
  These are referred to as hermetically sealed, secured capacitors.

In accordance with the standard, the discharge resistor of both capacitor families must be capable of reducing capacitor voltage to a value of under 50 V in the space of 60 seconds after disconnection from the mains.

Capacitors without a contact breaker, unsecured,
Type A capacitors in accordance with IEC 61048 A2

IEC 61048 A2-compliant Type A capacitors are self-healing and require no short-circuit protection for normal operation.

Type A capacitors are not fitted with a specific failsafe mechanism as prescribed by the standards for Type B capacitors. Nevertheless, the requirements laid down in the standard for Type A capacitors, especially with regard to temperature and service life tests, are designed to ensure a sufficient degree of device safety and availability **provided the device was correctly installed and operated under calculable and known ambient operating conditions**.

Even so, in very rare cases these capacitors can still develop erratic behaviour due to overloading or at the end of the device's service life.

For that reason, Type A capacitors should only be integrated into luminaires for operation in ambient conditions that are uncritical with regard to flammable materials. Luminaires should feature protection against secondary damage inside and outside the luminaire in the event of a defect.

**Capacitors with a contact breaker,
secured Type B capacitors in accordance with IEC 61048 A2**

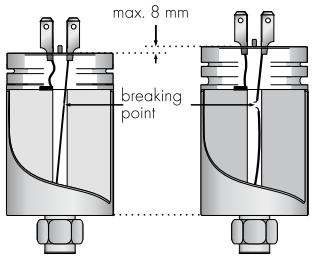
Self-healing capacitors do not require short-circuit protection for normal operation as they automatically regenerate after a dielectric breakdown. However, as a result of frequent self-healing caused by overloading (voltage, current, temperature) or towards the end of the capacitor's service life, overpressure can build up inside the capacitor (due to the decomposition products of the vaporised polypropylene).

In order to prevent the capacitor casing from exploding in such cases, hermetically sealed capacitors in accordance with IEC 61048 A2 (Type B capacitors) are fitted with an overpressure contact breaker. If excess pressure builds up within these capacitors, e.g. due to undue thermal loading or excessive voltages or at the end of the capacitor's service life, a concertina section opens out that causes the casing to expand lengthways. As a result, the wire contacts rupture at a predetermined breaking point, which irreversibly interrupts the current (contact breaker).

This type of overpressure-protected capacitor with a contact breaker is also referred to as a flame- and explosion-proof capacitor with a break-action mechanism.

Type B capacitors with a contact breaker are available in an aluminium casing.

Contact breaker



Assembly Instructions for Capacitors

For mounting and installing compensation capacitors

Mandatory regulations

DIN VDE 0100	Erection of low voltage installations
EN 60598	Luminaires – part 1: General requirements and tests
EN 55015	Maximum values and testing methods for radio disturbance of electrical lighting facilities and similar electrical equipment
EN 61000-3-2	Electromagnetic Compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (ballast input current up to and including 16 A per conductor)
EN 61048	Operating devices for lamps – capacitors for fluorescent lamp circuits and other discharge lamp circuits; general and safety requirements
EN 61049	Operating devices for lamps – capacitors for fluorescent lamp circuits and other discharge lamp circuits; performance requirements

Mechanical mounting

Fastening

Base screw (permissible torque):
- M8x10 – 5 Nm (aluminium casing)
- M8x10 – 2.2 Nm (plastic casing)

Mounting location

Any
Capacitors fitted with overpressure protection require clearance of at least 10 mm above the contacts so ensure the casing can expand unhindered if the contact breaker is triggered.

Heat transfer — Capacitors should be mounted with the greatest possible clearance to heat sources or lamps. During operation, the temperature measured at the t_c point must not exceed the specified maximum value.

t_c point — The t_c point is defined as an arbitrary point on the surface of the capacitor, which is not specifically marked.

UV Radiation — Capacitors should not be installed in an unprotected manner directly next to any sources of light, heat radiation or convection (ballasts, lamps, heating elements, etc.) as both high temperatures and constant exposure to UV radiation can lead to premature ageing. In combination with high temperatures, UV radiation or other substances and influencing factors, chemicals such as ozone and chlorine can lead to accelerated ageing and material embrittlement.

Thermal load — All capacitor casings are made of flame-retardant materials. However, the potting material, oils and the winding material are flammable and consideration must be taken of this fact during installation. The thermal load of an MKP capacitor is approx. 40 MJ/kg.

Safety functions

Type A capacitors
are not fitted with any special protective functions in case of defect.
Temperature-protected capacitors are a further development of Type A capacitors and feature a thermal fuse that is triggered by excess temperatures and disconnects the capacitor from the mains.

Type B capacitors
are fitted with an overpressure contact breaker in case of defects at the end of the capacitor's service life.

Connection — Parallel capacitors for fluorescent lamps:
- Casing diameter 25–30 mm: push-in terminals for 0.5–1 mm² conductors
- Casing diameter > 30 mm: push-in terminals for 0.5–1 mm² conductors

Parallel capacitors for high-pressure lamps:
- Casing diameter 25–30 mm: push-in terminals for 0.5–1 mm² conductors
- Casing diameter > 30 mm: push-in terminals for 0.5–1 mm² conductors

Reliability and service life

Provided the max. specified voltage and current loads, temperature, humidity and mains harmonics values are observed,
- approx. 50,000 hours for overpressure-protected parallel capacitors
- approx. 30,000 hours for parallel capacitors without overpressure protection in a plastic or aluminium casing

A 3–10% decrease in capacitance must be expected in the course of the capacitor's service life.
Failure rate: 1‰ per 1,000 operating hours when maximum voltage, current and temperature values are not exceeded.

Electrical installation

Nominal voltage 250 V, 50/60 Hz; 450 V, 50/60 Hz
(dependent on type)

Capacitance tolerance
±10% (±5% dependent on type)

Temperature range
–25/–40 °C to +85/+100 °C (dependent on type, details see product page)

Optional thermal fuse

Relative humidity Class F for Type B capacitors: 75% annual mean, 95% peak value on 30 days
Class G for Type A capacitors: 65% annual mean, 85% peak value on 30 days

Condensation Impermissible

Capacitors for fluorescent lamp circuits

Lamp		Parallel compensation capacitor (µF ±10% at 250 V)	
Output W	Type	220–240 V/50 Hz µF	220–230 V/60 Hz µF
4	T	2**	2**
6	T	2**	2**
8	T	2**	2**
10	T	2	2
13	T	2	2
14	T	4.5	4.5
15	T	3.5 or 4*	3 or 4*
16	T	2	2
18	T	4.5 or 4*	4**
20	T	4.5 or 4*	4**
23	T	3.5	3
25	T	3.5	3
30	T	4.5	4
36	T	4.5	4
36-1m	T	6.5	–
38	T	4.5	4
40	T	4.5	4
42	T	6.5	–
58	T	7	6
65	T	7	6
70	T	6	–
75	T	6	–
80	T	9	8
85	T	8	6.5
100	T	10	9
115	T	18	16
140	T	14	14
160	T	14	14
16	T-U	2	2
18/20	T-U	4.5 or 4*	4**
36/40	T-U	4.5	4
58/65	T-U	7	6
22	T-R	5	4.5
32	T-R	5	4.5
40	T-R	4.5	4

Lamp		Parallel compensation capacitor (µF ±10% at 250 V)	
Output W	Type	220–240 V/50 Hz µF	220–230 V/60 Hz µF
5/7/9/11	TC-S	2**	2**
10	TC-D/TC-T	2	2
13	TC-D/TC-T	2	2
18	TC-D/TC-T	2	2
26	TC-D/TC-T	3.5	3
10	TC-DD	2	2
16	TC-DD	2	2
21	TC-DD	3	3
28	TC-DD	3.5	3
38	TC-DD	4.5	4
18	TC-L/TC-F	4.5 or 4*	4**
24	TC-L/TC-F	4.5	4
34	TC-L/TC-F	4.5	4
36	TC-L/TC-F	4.5	4

*) Two lamps connected to a ballast in series
**) Applies to one lamp connected to a ballast or two lamps connected in series

Capacitors for discharge lamp circuits

Lamp		Compensation capacitor (µF ±10%)			
Output W	Type	220/230/240/252 V 50 Hz (µF)	220 V 60 Hz (µF)	380/400/420 V, 50 Hz (µF)	380 V/60 Hz 60 Hz (µF)
high-pressure mercury vapour lamp circuits					
50	HM	7	6		
80	HM	8	7		
125	HM	10	10		
250	HM	18	15		
400	HM	25	25		
700	HM	40	35		
1000	HM	60	50		
high-pressure sodium vapour lamp circuits					
35	HS	6	5		
50	HS	8	8		
70	HS	12	10		
100	HS	12	10		
150	HS	20	16		
250	HS	32	25		
400	HS	45	40		
600	HS	65	55	25	20
750	HS	70	60	25	25
1000	HS	100	85		
metal halide lamp circuits					
35	HI	6	5		
70	HI	12	10		
100	HI	12	10		
150	HI	20	16		
250	HI	32	25		
400	HI	35/45	35/45		
1000	HI	85	75		
2000	HI	125	125		
2000	HI			37	37
2000	HI			60	60
2000	HI			60	60
2000	HI			100	100

ELECTRONIC CONVERTERS

FOR LOW-VOLTAGE HALOGEN INCANDESCENT LAMPS

The operating voltage of low-voltage halogen lamps is normally 12 V (6 and 24 V are also used for special applications). As a result, transformers are required in order to connect such lamps to the normal mains supply within buildings, whereby international requirements governing building installations specify that safety transformers or converters (electronic transformers) be exclusively used for such purposes nowadays. These devices are designed in such a way as to prevent both personal injury and the outbreak of fire should the lighting system malfunction.

Electronic converters

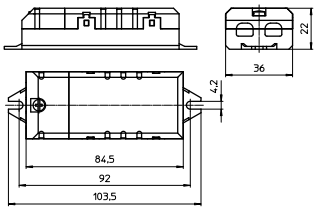
The following chapter provides an overview of the VS range of electronic converters that feature a whole range of advantages: light and compact, superior efficiency (approx. 95%), short-circuit protection, integrated overheating and overload protection, soft start for longer lamp life, broad part-load range and dimmability.

5 Electronic Converters for Low-voltage Halogen Incandescent Lamps

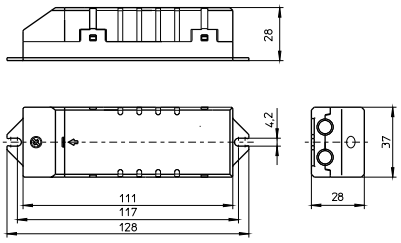
Independent Electronic Converters – LiteLine

Electronic safety converters
for low-voltage halogen incandescent lamps 12 V
Casing: heat-resistant polyamide
Mains frequency: 50–60 Hz
Protection against "no load" operation
Protection against short-circuit:
electronic switch-off with automatic restart
Electronically controlled overload
and temperature protection
Suitable for installation in furniture
and on combustible surfaces
Power factor: > 0.95
Efficiency: ≥ 94%
Dimming: optional with phase-cutting leading-edge or phase-cutting trailing-edge dimmer
Screw terminals: 2.5 mm²
(EST 60/12.635 primary: 4 mm²)
Quantity of screw terminals:
1x2-poles primary
1x2-poles secondary
With integrated cord grip
Protection class II
SELV
Degree of protection: IP20
RFI-suppressed

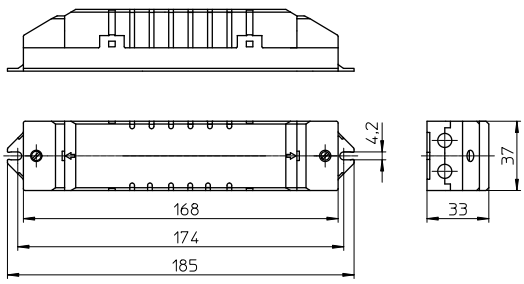
A



B



C



Type	**Ref. No.**	Capacity range (W)	Voltage (V) prim. (±10%)	sec.	Nominal current A	Ambient temperature t_a (°C)	Casing temperature t_c (°C)	Drawing	Weight g
Dimensions: 22x36x103.5 mm									
EST 60/12.635	**186173**	10–60	220–240	10.2–12	0.258–0.260	–20 to 45	max. 85	A	70
Dimensions: 28x37x128 mm									
EST 70/12.380	**186072**	20–70	230–240	11.3–11.7	0.30–0.31	–20 to 45	max. 70	B	85
EST 105/12.381	**186077**	20–105	230–240	11.2–11.7	0.435–0.445	–20 to 40	max. 85	B	95
Dimensions: 33x37x185 mm									
EST 150/12.622	**186098**	50–150	230–240	11.2–11.6	0.595–0.605	–20 to 45	max. 85	C	175

LOW- AND MAINS VOLTAGE LAMPHOLDERS

LAMPHOLDERS FOR HALOGEN INCANDESCENT LAMPS

As the tungsten-halogen cycle and the high lamp current can cause very high temperatures when operating low-voltage halogen lamps, close attention must be paid to the luminaire's thermal conditions and components must be made of high-grade materials.

VS lampholders for low-voltage halogen lamps
The following chapter contains Vossloh-Schwabe's comprehensive range of connection elements, lampholders and accessories for safe and reliable installation in accordance with the latest regulations and developments.

VS lampholders for mains voltage halogen lamps
The following chapter contains Vossloh-Schwabe's comprehensive range of lampholders for single-ended halogen lamps (GU/GZ10 and G9 bases), lampholders for bayonet lamps (B22d bases) as well as lampholders for double-ended tubular lamps (R7s base).

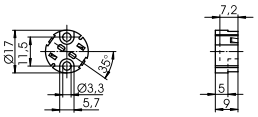
5 Lampholders for Halogen Incandescent Lamps

G4, GZ4, G5.3, GX5.3, G6.35, GY6.35 Lampholders, Accessories

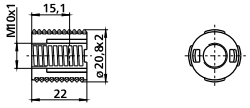
For low-voltage halogen incandescent lamps

The lampholders listed in this chapter permit the use of lamps with different bases. It is important to ensure that under no circumstances a lamp with a smaller pin diameter is used if a lamp with a larger pin diameter has already been used.

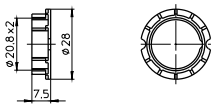
G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: LCP, black, T270
Nominal rating: 8/24 (for G4/GZ4 lamps: 4/24)
Multipoint contacts: CuNiZn
Push-in terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
Weight: 2.4 g, unit: 1000 pcs.
Type: 33300
Ref. No.: 109547



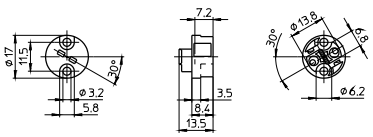
Cover caps
For push-fit onto lampholders type 333
External thread 20.8x2
Material: LCP
Moulded thread: M10x1
Weight: 3.8 g, unit: 1000 pcs.
Type: 97255
Ref. No.: 109548



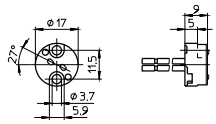
Screw rings
For components with external thread 20.8x2
Material: LCP
Weight: 1.4 g, unit: 1000 pcs.
Type: 97257
Ref. No.: 507490



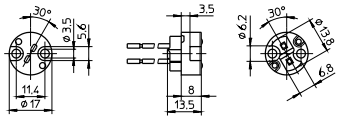
G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: LCP, black, T270
Nominal rating: 8/24 (for G4/GZ4 lamps: 4/24)
Multipoint contacts: CuNiZn
Push-in terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
Weight: 2.6 g, unit: 1000 pcs.
Type: 33400
Ref. No.: 109674



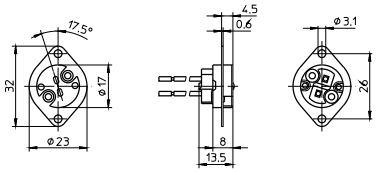
G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: ceramic, cover plate: mica
T350
Nominal rating: 10/24
Contacts: Ni
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Fixing holes for screws M3
Weight: 6.8 g, unit: 500 pcs.
Type: 32400
Ref. No.: 100939



G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: ceramic, cover plate: mica
T300
Nominal rating: 10/24
Multipoint contacts: CuNiZn
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Fixing holes for screws M3
Weight: 7.1 g, unit: 1000 pcs.
Type: 32700
Ref. No.: 101258



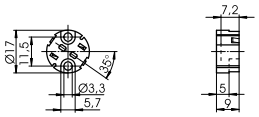
G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: ceramic, cover plate: mica
T300, nominal rating: 10/24
Multipoint contacts: CuNiZn
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Fixing plate: zinc-coated polished steel
Fixing holes for screws M3
Weight: 8.8 g, unit: 1000 pcs.
Type: 32720
Ref. No.: 101274



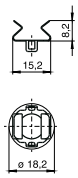
Lampholders with Separate Mounting Spring for GU4 Lamps

For low-voltage halogen incandescent lamps

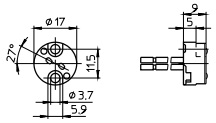
G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: LCP, black, T270
Nominal rating: 8/24 (for G4/GZ4 lamps: 4/24)
Multipoint contacts: CuNiZn
Push-in terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
For cover cap (see p. 162)
Weight: 2.4 g, unit: 1000 pcs.
Type: 33300
Ref. No.: 109547



GU4 mounting spring for lamp
Material: stainless steel
For push-fit onto lampholders type 333 and 32210
Weight: 0.8 g, unit: 1000 pcs.
Type: 94095
Ref. No.: 109553



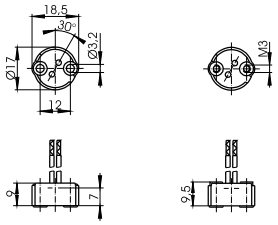
G/GZ4-, G/GX5.3, G/GY6.35 lampholder
Casing: ceramic, cover plate: mica
T350
Nominal rating: 10/24
Contacts: Ni
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Fixing holes for screws M3
Weight: 6.8 g, unit: 500 pcs.
Type: 32400
Ref. No.: 100939



GX5.3 Lamp Connectors

For low-voltage halogen incandescent lamps

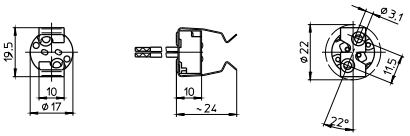
GX5.3 lamp connectors
Casing: ceramic, cover plate: mica
T300, nominal rating: 10/24
Multipoint contacts: Ni
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Weight: 7.8/8.5 g, unit: 500 pcs.
Type: 32600 holes for screws M3
Ref. No.: 101162
Type: 32620 threaded bushes M3
Ref. No.: 101207

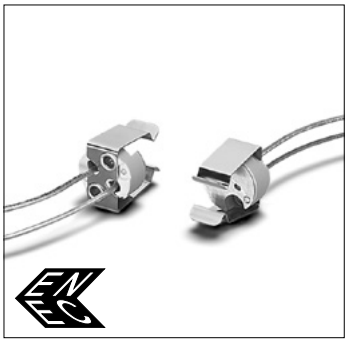


GU5.3 Lampholders

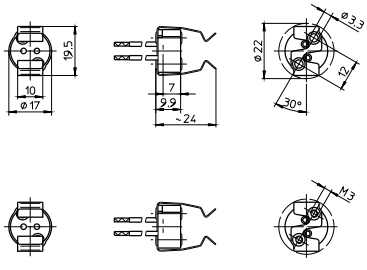
For low-voltage halogen incandescent lamps

GU5.3 lampholder
Casing: ceramic, cover plate: mica
T350, nominal rating: 10/24
Contacts: Ni
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Fixing holes for screws ST2.9
Mounting spring for lamp: stainless steel
Weight: 9.1 g, unit: 1000 pcs.
Type: 32480
Ref. No.: 106457





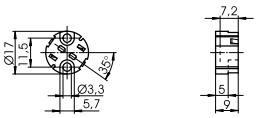
GU5.3 lampholders
Casing: ceramic, cover plate: mica
T300, nominal rating: 10/24, multipoint contacts: Ni
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Mounting spring for lamp: stainless steel
Weight: 11/12 g, unit: 500 pcs.
Type: 32680 holes for screws M3
Ref. No.: 101248
Type: 32690 threaded bushes M3
Ref. No.: 101253



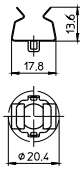
Lampholders with Separate Mounting Spring for GU5.3 Lamps

For low-voltage halogen incandescent lamps

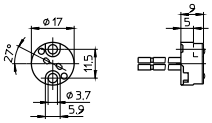
G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: LCP, black, T270
Nominal rating: 8/24 (for G4/GZ4 lamps: 4/24)
Multipoint contacts: CuNiZn
Push-in terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
For cover cap (see p. 162)
Weight: 2.4 g, unit: 1000 pcs.
Type: 33300
Ref. No.: 506199



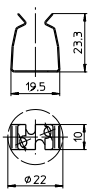
GU5.3 mounting spring for lamp
Material: stainless steel
For push-fit onto lampholders type 333
Weight: 1.1 g, unit: 1000 pcs.
Type: 94096
Ref. No.: 109554



G/GZ4, G/GX5.3, G/GY6.35 lampholder
Casing: ceramic, cover plate: mica
T350
Nominal rating: 10/24
Contacts: Ni
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 140 mm
Fixing holes for screws M3
Weight: 6.8 g, unit: 500 pcs.
Type: 32400
Ref. No.: 100939



GU5.3 mounting spring for lamp
Material: stainless steel
The mounting spring has to be fastened
to the lampholder 100939.
The luminaire manufacturer is responsible
for the attachment.
Weight: 2 g, unit: 1000 pcs.
Type: 94060
Ref. No.: 106256

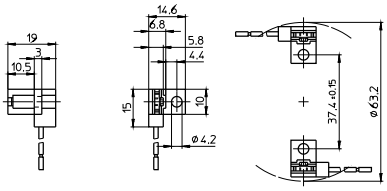


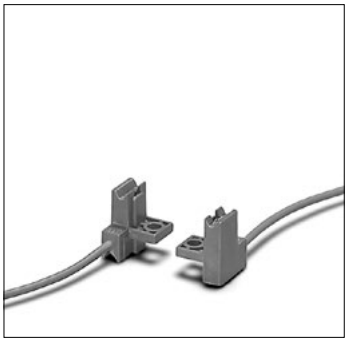
G53 Lamp Connectors

For low-voltage halogen incandescent lamps

G53 lamp connector
Casing: PPS, black
Nominal rating: 10/24
Contacts: CuNiZn
Lead: Cu tinned, stranded conductors 0.75 mm², Si-insulation, length: 140 mm

Fixing hole for screw M4
Lead exit: lateral
Weight: 4.4 g, unit: 1000 pcs.
Type: 33100
Ref. No.: 107694



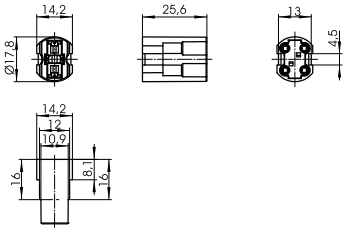


G9 Lampholders, Accessories

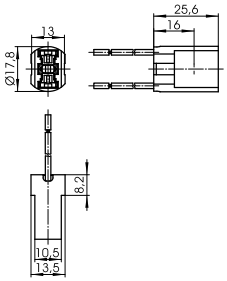
For mains voltage halogen incandescent lamps

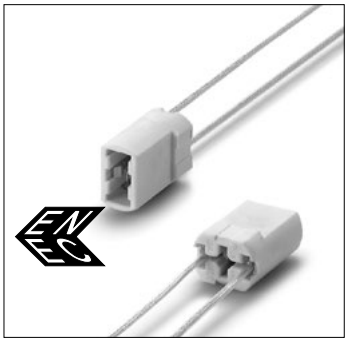
For luminaires of protection class II

G9 lampholder
Casing: ceramic, cover plate: LCP, natural
T300, nominal rating: 2/250
Push-in twin terminals for stranded conductors with ferrule on bare end of core Ø 1.4–1.8 mm
Weight: 7.5 g, unit: 1000 pcs.
Type: 33800
Ref. No.: 568006

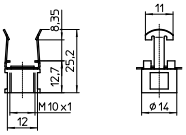


G9 lampholder
Casing: ceramic, T300, nominal rating: 2/250
Leads: Cu nickel-plated, stranded conductors 0.75 mm², double PTFE-insulation, length: 180 mm
Weight: 12.8 g, unit: 1000 pcs.
Type: 33906
Ref. No.: 532610

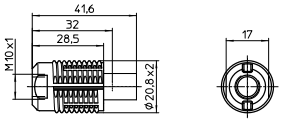




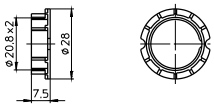
Metal bracket with nipple
For G9 lampholders type 338/339
Material: zinc-coated steel
Female nipple: M10x1
Weight: 7.8 g, unit: 1000 pcs.
Type: 94455
Ref. No.: 520880



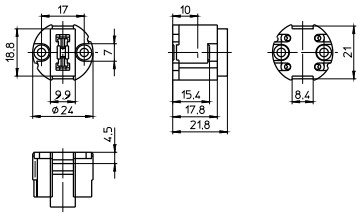
Cover cap for G9 lampholders type 339
Material: LCP
External thread 20.8x2
Moulded thread: M10x1
Weight: 3.2 g, unit: 1000 pcs.
Type: 97760
Ref. No.: 525583



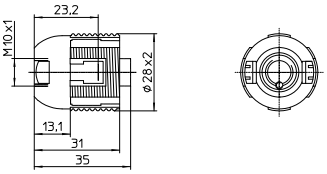
Screw rings
For components with external thread 20.8x2
Material: LCP
Weight: 1.4 g, unit: 1000 pcs.
Type: 97257
Ref. No.: 507490



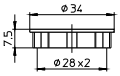
G9 lampholder
Casing: ceramic, cover plate: LCP, natural
T270, nominal rating: 2/250
Push-in twin terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
Weight: 14.4 g, unit: 1000 pcs.
Type: 33500
Ref. No.: 502004



Cover caps for G9 lampholder 502004
Material: LCP
External thread 28x2 IEC 60399
Fixing holes for screws M3
Weight: 8.7/4.6 g, unit: 1000 pcs.
Type: 83310 female nipple: M10x1
Ref. No.: 505951
Type: 97268 moulded thread: M10x1
Ref. No.: 501942



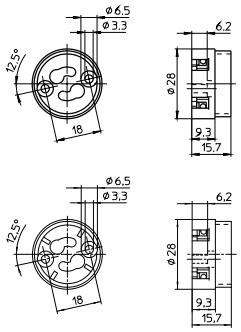
Screw ring
For components with external thread 28x2
Material: LCP
Ø 34 mm, height: 7.5 mm
Weight: 1.9 g, unit: 1000 pcs.
Type: 05202
Ref. No.: 508458



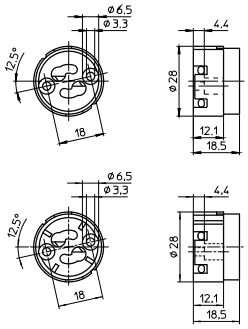
GU10, GZ10 Lampholders, Accessories

For mains voltage halogen incandescent lamps

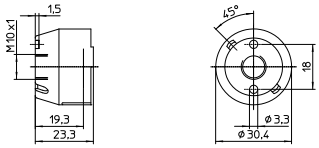
GU10, GZ10 lampholders
Casing: LCP, black, T270, nominal rating: 2/250
Push-in twin terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
Weight: 7 g, unit: 1000 pcs.
Type: 31000/31010
Ref. No.: 108979 GU10, GZ10 lampholder
Ref. No.: 109007 GU10 lampholder



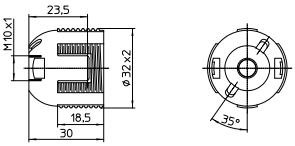
GU10, GZ10 lampholders
For luminaires of protection class II
Casing: LCP, black, T270, nominal rating: 2/250
Push-in twin terminals for stranded conductors
with ferrule on bare end of core Ø 1.4–1.8 mm
Fixing holes for screws M3
Weight: 8 g, unit: 1000 pcs.
Type: 31020/31030
Ref. No.: 502111 GU10, GZ10 lampholder
Ref. No.: 502112 GU10 lampholder



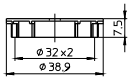
Cover cap for GU10, GZ10 lampholders type 310
Material: PA GF, black
Moulded thread: M10x1
Fixing holes for screws M3
Weight: 3.4 g, unit: 1000 pcs.
Type: 97244
Ref. No.: 109411



Cover cap for lampholders 502111/502112
External thread 32x2
Material: LCP
Moulded thread: M10x1
Weight: 6 g, unit: 1000 pcs.
Type: 97320
Ref. No.: 502064



Screw ring
For components with external thread 32x2
Ø 38.9 mm, height: 7.5 mm
Material: PPS, black
Weight: 2.3 g, unit: 1000 pcs.
Type: 97282
Ref. No.: 502416



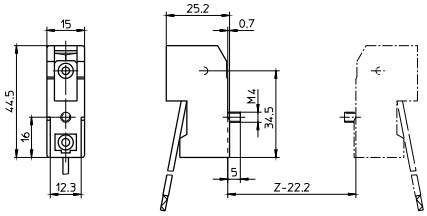
R7s Ceramic Lampholders

For mains voltage halogen incandescent lamps

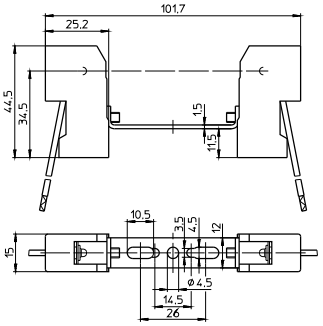
The luminaire design must ensure protection from electric shock as well as sufficient creepage distances and clearances from live parts on the back of lampholder.

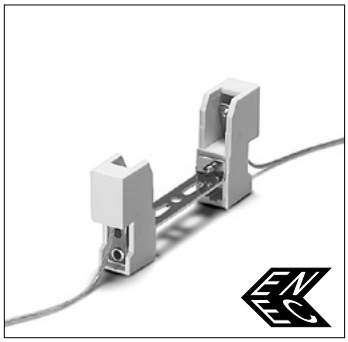
If the central hole on the bracket is used for fixing there must be a support within the luminaire to ensure that the bracket cannot be deformed.

Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
With fixing screw M4
Weight: 25.4 g, unit: 400 pcs.
Type: 32300
Ref. No.: 100912

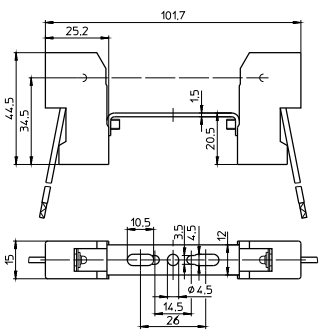


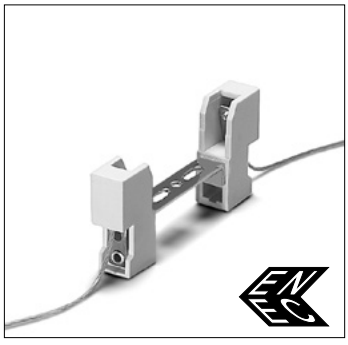
Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M3/M4
Central hole for screw M4
Weight: 59.3 g, unit: 200 pcs.
Type: 32390 contact distance: 74.9 mm
Ref. No.: 107213



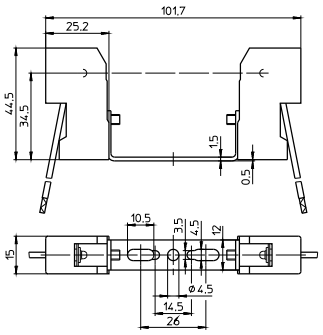


Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M3/M4
Central hole for screw M4
Weight: 61 g, unit: 200 pcs.
Type: 32391 contact distance: 74.9 mm
Ref. No.: 107214

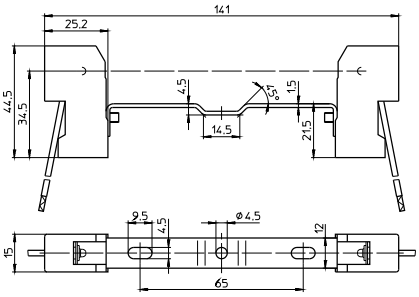


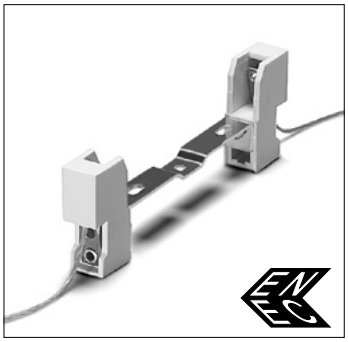


Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M3/M4
Central hole for screw M4
Weight: 61.3 g, unit: 200 pcs.
Type: 32395 contact distance: 74.9 mm
Ref. No.: 107215

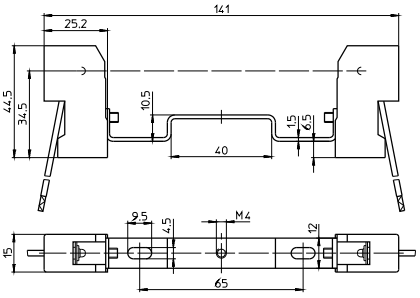


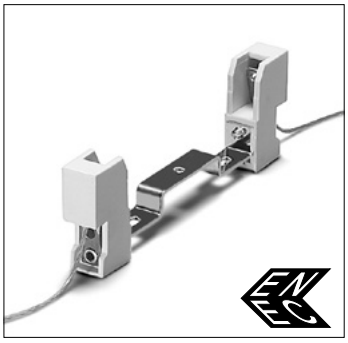
Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M4
Central hole for screw M4
Weight: 64.9 g, unit: 200 pcs.
Type: 32310 contact distance: 114.2 mm
Ref. No.: 107195



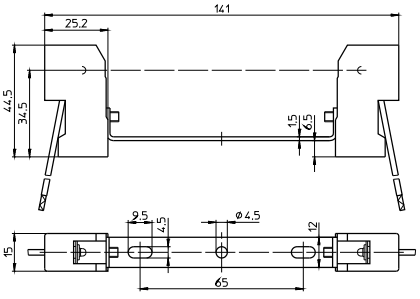


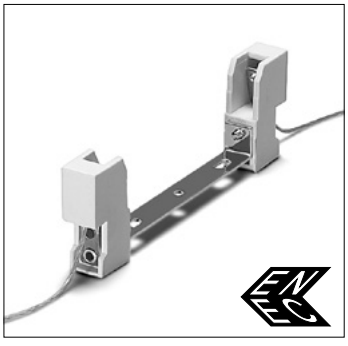
Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M4
Central threaded bush M4
Weight: 66.5 g, unit: 200 pcs.
Type: 32320 contact distance: 114.2 mm
Ref. No.: 107194



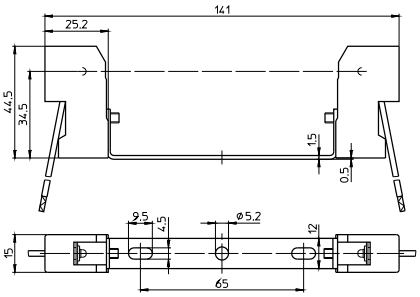


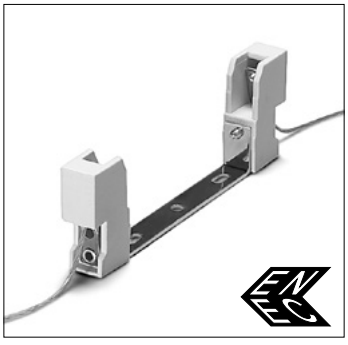
Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M4
Central hole for screw M4
Weight: 65.4 g, unit: 200 pcs.
Type: 32340 contact distance: 114.2 mm
Ref. No.: 107193



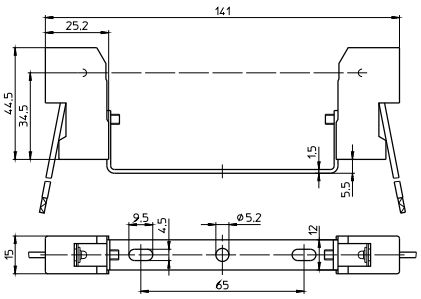


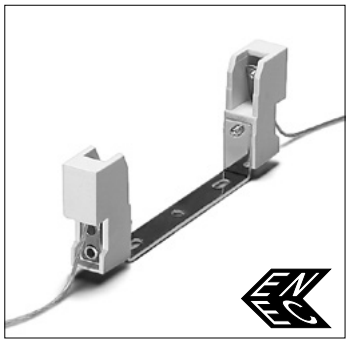
Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M4
Central hole for screw M5
Weight: 66.7 g, unit: 200 pcs.
Type: 32360 contact distance: 114.2 mm
Ref. No.: 107192





Partly enclosed R7s lampholder
Casing: ceramic, T350
Contact pin: Cu, silver bulb
Nominal rating: 8/250
Leads: Cu nickel-plated, stranded conductors
0.75 mm², PTFE-insulation, length: 200 mm
Oblong holes for screws M4
Central hole for screw M5
Weight: 71.3 g, unit: 200 pcs.
Type: 32380 contact distance: 114.2 mm
Ref. No.: 109497

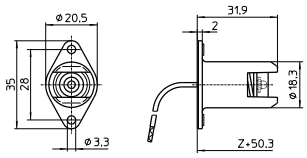




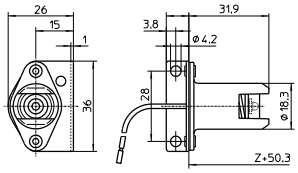
R7s Metal Lampholders

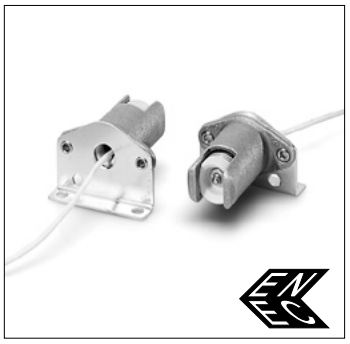
For mains voltage halogen incandescent lamps

R7s lampholder
Casing: Al, T300, contact pin: Cu, silver bulb
Nominal rating: 10/250
Lead: Cu nickel-plated, stranded conductors
1 mm², PTFE-insulation, length: 300 mm
Fixing flange
Fixing holes for screws M3
Weight: 15.7 g, unit: 1000 pcs.
Type: 30523
Ref. No.: 100710



R7s lampholder
Casing: Al, T300, contact pin: Cu, silver bulb
Nominal rating: 10/250
Lead: Cu nickel-plated, stranded conductors
1 mm², PTFE-insulation, length: 350 mm
Fixing bracket
Fixing holes for screws M4
Weight: 24.8 g, unit: 500 pcs.
Type: 30550
Ref. No.: 100720

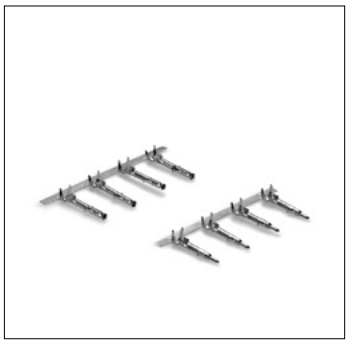




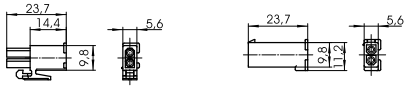
Connectors

Modular system for various assembly options
VDE registered
Connectors can be delivered pre-assembled with lampholder and lead assemblies

Male and female plug
Nominal rating: 7/600
For cable: 0.3–0.9 mm²
For crimping on the end of lead
Material: brass, tinned
Weight: 0.1 g, unit: 5000 pcs.
Type: 93088 male plug
Ref. No.: 505251
Type: 93089 female plug
Ref. No.: 506807



Male and female casing
For male and female plug
For push-fit assembly
Material: PA, natural
Weight: 0.8/1 g, unit: 2500 pcs.
Type: 97355 male casing
Ref. No.: 509295 UL94V-0
Ref. No.: 508562 UL94V-2
Type: 97356 female casing
Ref. No.: 509296 UL94V-0
Ref. No.: 508563 UL94V-2



LAMPHOLDERS MADE OF THERMO-PLASTICS, METAL AND PORCELAIN

LAMPHOLDERS FOR GENERAL-SERVICE INCANDESCENT LAMPS AND LED RETROFIT LAMPS

The general-service light bulb owes its name to its bulbous shape, which has remained almost unchanged to this day. The tungsten filament contained within the bulb's glass shell, in which there used to be a vacuum but which is nowadays more usually filled with an inert gas, begins to glow as electricity is passed through it. Despite the considerable technical progress that has been made, the typical disadvantages associated with light bulbs still remain. For instance, incandescent lamps mainly radiate heat with no more than 5–10% light output and have a service life of approx. 1000 operating hours. As a result of energy-efficiency regulations in the various regions of the world, the use of all-purpose incandescent lamps has been limited or even banned.

LED Retrofit lamps that comply with energy-efficiency regulations are being used as a replacement for all-purpose incandescent lamps and use the same lampholder systems found with E12/E14, E26/E27, E39/E40, B15d and B22d bases.
This makes it easy to switch to the more economical LED retrofit lamp when replacing a defective incandescent lamp. It is not necessary to replace the lampholder.

VS lampholders
Depending on the operating conditions, lampholders can be made of thermoplastics, metal or porcelain. Metal lampholders are most often used for high-grade decorative luminaires. In accordance with protection class I, metal lampholders must be included in the measures taken to earth the luminaire.

Due to their heat resistance, Edison lampholders made of porcelain are frequently used for higher-output lamps. Classic lampholder materials like metal and porcelain are increasingly being displaced by modern thermoplastics.

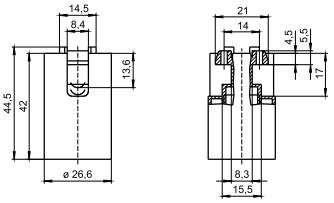
5 Lampholders for General-service Incandescent

E14 Thermoplastic Lampholders, One-piece

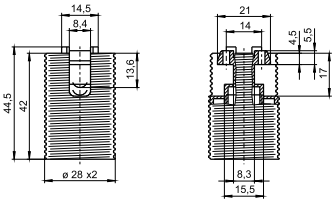
For incandescent lamps with base E14

E14 lampholders with temperature marking
Brass-finished versions are available on request.

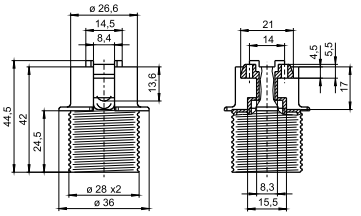
E14 lampholders, for cover caps
Plain casing
Casing: PET GF, T210, nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST2.9-C/F
Weight: 11.3/11.4 g, unit: 1000 pcs.
Type: 64001
Ref. No.: 109384 white
Ref. No.: 109383 black



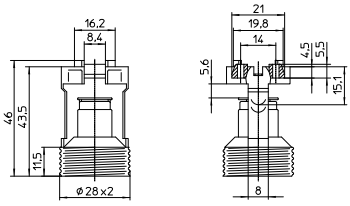
E14 lampholders, for cover caps
External thread 28x2 IEC 60399
Casing: PET GF, T210, nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST2.9-C/F
Weight: 12.5/12.2 g, unit: 1000 pcs.
Type: 64101
Ref. No.: 109387 white
Ref. No.: 109386 black



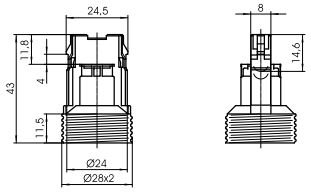
E14 lampholders, for cover caps
External thread 28x2 IEC 60399, with flange
Casing: PET GF, T210, nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST2.9-C/F
Weight: 12.7 g, unit: 1000 pcs.
Type: 64201
Ref. No.: 503924 white
Ref. No.: 503923 black



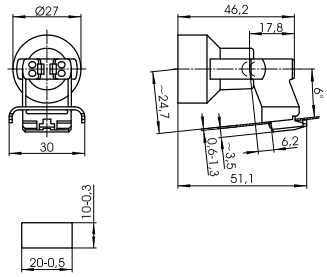
E14 lampholders, for cover caps
Profiled shape, short external thread 28x2 IEC 60399
Casing: PET GF, T210, Nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST2.9-C/F
Weight: 8.5/8.4 g, unit: 1000 pcs.
Type: 64370
Ref. No.: 546456 white
Ref. No.: 546454 black

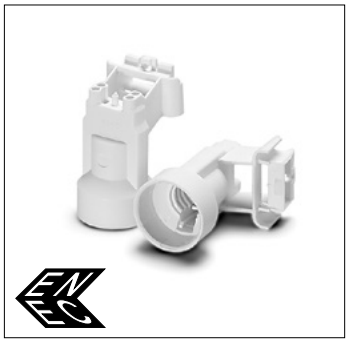


E14 lampholders
Profiled shape, short external thread 28x2 IEC 60399
Casing: PET GF, T210, nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
For clipping-in
Weight: 6.6/6.8 g, unit: 1000 pcs.
Type: 64360
Ref. No.: 506247 white
Ref. No.: 506249 black

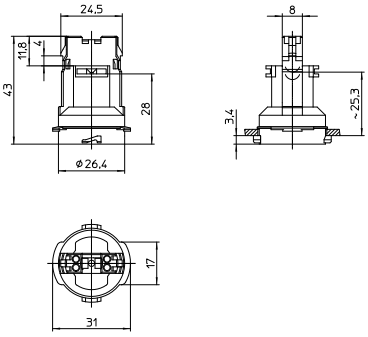


E14 lampholders
Profiled shape, nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
Lateral push-fit foot for cut-out 10x20 mm
for wall thickness 0.6–1.3 mm
Tilt of lamp axis: 6°
For cover cap 503579
Weight: 9.1/9.2 g, unit: 1000 pcs.
Type: 64307
Ref. No.: 108983 PBT GF, white, T180/–20
Ref. No.: 509263 PET GF, natural, T210

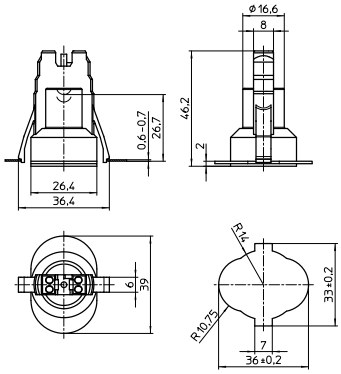




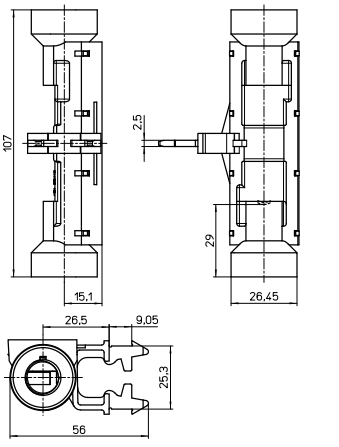
E14 lampholder
Profiled shape
Casing: PBT GF, white, T180/–20
Nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
For insertion, clipping-in or bayonet fixing
for plastic cut-out: Ø 27.5 mm
with wall thickness: 2.5 mm
Weight: 7.1 g, unit: 1000 pcs.
Type: 64308
Ref. No.: 533818

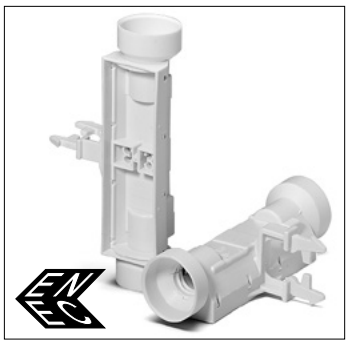


E14 lampholder
Profiled shape
Casing: PBT GF, white, T180/–20
Nominal rating: 2/250
Push-in twin terminals: 0.5–1.5mm²
For insertion: clipping-in for
a profiled hole with wall thickness 0.6–0.7 mm
Weight: 9 g, packaging unit: 1000 pcs.
Type: 64314
Ref. No.: on request



E14 double lampholder
Profiled shape
Casing: PBT GF, white
Nominal rating: 2/250
Push-in twin terminals: 0.5–1.5mm²
For insertion: clipping-in for a profiled hole
Weight: 29 g, packaging unit: 100 pcs.
Type: 64380
Ref. No.: 565816



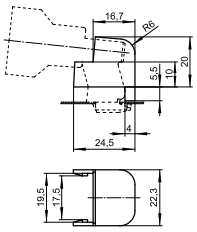


Cover Caps

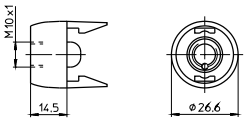
For E14 thermoplastic lampholders, one-piece

Brass-finished versions are available on request.

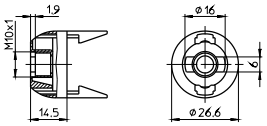
Cover cap for lampholders type 64307
For luminaires of protection class II
Material: PP, white
Weight: 2.4 g, unit: 1000 pcs.
Type: 97322
Ref. No.: 503579



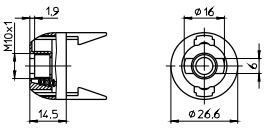
Cover caps
Material: PA GF
Female nipple: M10x1
Weight: 7.6/8.8 g, unit: 1000 pcs.
Type: 85075
Ref. No.: 109110 white
Ref. No.: 109112 black



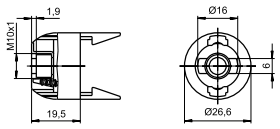
Cover caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
Weight: 2.7 g, unit: 1000 pcs.
Type: 97636
Ref. No.: 109676 white
Ref. No.: 109677 black



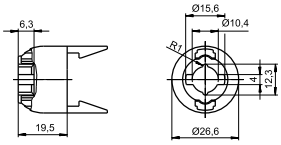
Cover caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
With locking screw
Weight: 3 g, unit: 1000 pcs.
Type: 85076
Ref. No.: 400818 white
Ref. No.: 400817 black



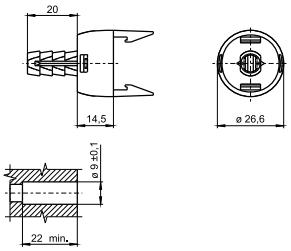
Cover caps
Height: 19 mm
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
With locking screw
Weight: 3.6/3.5 g, unit: 1000 pcs.
Type: 85074
Ref. No.: 520735 white
Ref. No.: 520736 black



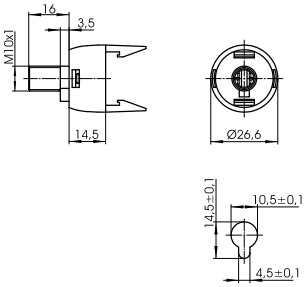
Cover caps
Height: 19 mm
Material: PA GF
Profiled hole: Ø 10.4 mm
Rotation stop: internal and external
Weight: 2.7 g, unit: 1000 pcs.
Type: 97708
Ref. No.: 520759 white
Ref. No.: 520760 black



Cover caps
With peg
With integrated cord grip
For leads H03VVH2-F 2X0.75
Material: PA GF
Weight: 4.2/4.3 g, unit: 1000 pcs.
Type: 97000
Ref. No.: 503457 white
Ref. No.: 503458 black



Cover cap
With male nipple: M10x1
With rotation stop
With integrated cord grip
For leads H03VVH2-F 2X0.75
Material: PA GF, white
Weight: 4.1 g, unit: 1000 pcs.
Type: 97037
Ref. No.: 508067



E14 Thermoplastic Lampholders, Three-piece

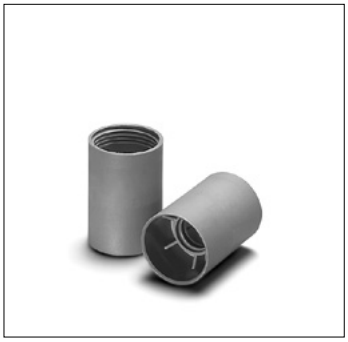
For incandescent lamps with base E14

Nominal rating: 2/250
Temperature marking: T190
Brass-finished versions are available on request.

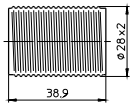
Inserts
Material: PET GF, black
Casing lock
Weight: 3.9/3.2 g, unit: 1000 pcs.
Type: 81095 screw terminals: 0.5–2.5 mm²
Ref. No.: 103424

Type: 81096 push-in twin terminals: 0.5–1.5 mm²
Ref. No.: 107716

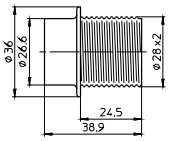
Plain casings
Material: PET GF
Weight: 9/8.5 g, unit: 1000 pcs.
Type: 81093
Ref. No.: 103415 white
Ref. No.: 103414 black



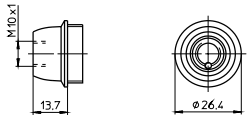
Threaded casings 28x2 IEC 60399
Material: PET GF
Weight: 9.8/9.6 g, unit: 1000 pcs.
Type: 81109
Ref. No.: 103431 white
Ref. No.: 103430 black



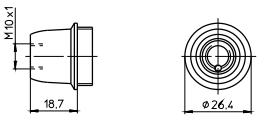
Threaded casings 28x2 IEC 60399
With flange
Material: PET GF
Weight: 10.6/10.4 g, unit: 1000 pcs.
Type: 81120
Ref. No.: 103443 white
Ref. No.: 103442 black



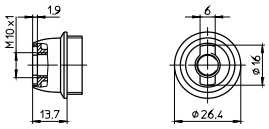
Caps
Material: PA GF
Female nipple: M10x1
Height: 13.7 mm
Weight: 6.9/7.2 g, unit: 1000 pcs.
Type: 81002
Ref. No.: 109102 white
Ref. No.: 109103 black



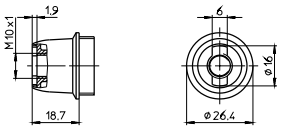
Caps
Material: PA GF
Female nipple: M10x1
Height: 18.7 mm
Weight: 7/7.3 g, unit: 1000 pcs.
Type: 81024
Ref. No.: 109805 white
Ref. No.: 109145 black



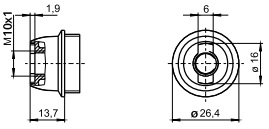
Caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
Height: 13.7 mm
Weight: 3.3/3.7 g, unit: 1000 pcs.
Type: 96159
Ref. No.: 109095 white
Ref. No.: 109084 black



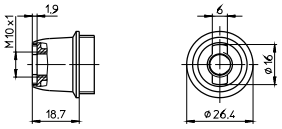
Caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
Height: 18.7 mm
Weight: 3.6/3.9 g, unit: 1000 pcs.
Type: 96211
Ref. No.: 109149 white
Ref. No.: 109150 black



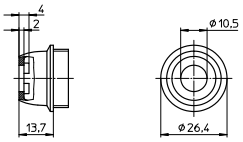
Caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
With locking screw
Height: 13.7 mm
Weight: 3.7/4 g, unit: 1000 pcs.
Type: 81130
Ref. No.: 109041 white
Ref. No.: 109054 black



Caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
With locking screw
Height: 18.7 mm
Weight: 3.9/4.3 g, unit: 1000 pcs.
Type: 81132
Ref. No.: 109152 white
Ref. No.: 109153 black



Caps
Material: PA GF
Round hole: Ø 10.5 mm
Rotation stop: internal
Height: 13.7 mm
Weight: 3.3 g, unit: 1000 pcs.
Type: 96004
Ref. No.: 508352 white
Ref. No.: 508353 black



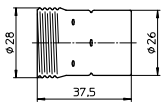
E14 Metal Lampholders, Three-piece

For incandescent lamps with base E14

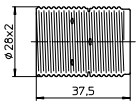
Nominal rating: 2/250
Temperature marking: T190/T240
Type: 513 plain casing
Type: 514 threaded casing 28x2

Insert
Material: porcelain, white
Casing lock
Screw terminals: 0.5–2.5 mm²
Weight: 10.3 g, unit: 500 pcs.
Type: 83142
Ref. No.: 550375

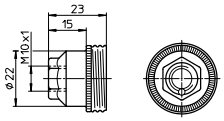
Plain casings
Material: zinc-coated polished steel
Weight: 14.3/14.2/18.3/18.2 g
Unit: 500 pcs.
Type: 81019 insulating threaded ring: PET, T190
Ref. No.: 103359 chrome-finish
Ref. No.: 103360 brass-finish
Type: 81018 insulating threaded ring: steatite, T240
Ref. No.: 507049 chrome-finish
Ref. No.: 507050 brass-finish

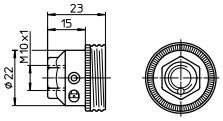


Threaded casings 28x2 IEC 60399
Material: zinc-coated polished steel
Weight: 14.4/14.4/18.9/18.9 g
Unit: 500 pcs.
Type: 81022 insulating threaded ring: PET, T190
Ref. No.: 103365 chrome-finish
Ref. No.: 103366 brass-finish
Type: 81017 insulating threaded ring: steatite, T240
Ref. No.: 507052 chrome-finish
Ref. No.: 507053 brass-finish



Caps
Material: zinc-coated polished steel
Female nipple: M10x1
Weight: 7.2/7.1/7.9/7.8 g
Unit: 500 pcs.
Type: 80006
Ref. No.: 102946 chrome-finish
Ref. No.: 102947 brass-finish
Type: 80003 with earth terminal
Ref. No.: 102938 chrome-finish
Ref. No.: 102939 brass-finish



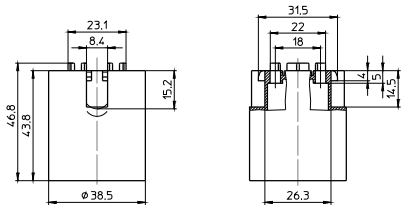


E27 Thermoplastic Lampholders, One-piece

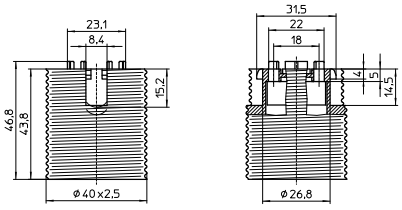
For incandescent lamps with base E27

E27 lampholders
Brass-finished versions are available on request.

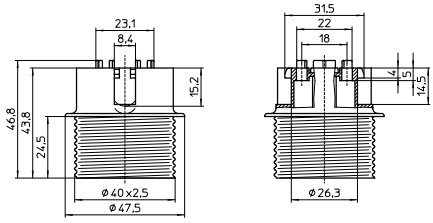
E27 lampholders, for cover caps
Plain casing
Casing: PET GF, T210
Nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M4
Weight: 17.4 g, unit: 500 pcs.
Type: 64401
Ref. No.: 108936 white
Ref. No.: 500810 black



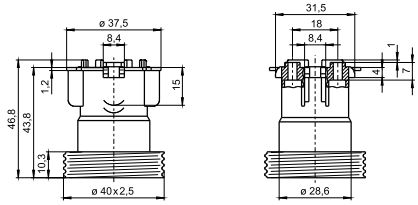
E27 lampholders, for cover caps
External thread 40x2.5 IEC 60399
Casing: PET GF, T210
Nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M4
Weight: 19.1/18.8 g, unit: 500 pcs.
Type: 64501
Ref. No.: 108965 white
Ref. No.: 109429 black



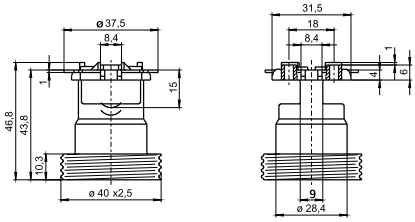
E27 lampholders, for cover caps
External thread 40x2.5 IEC 60399, with flange
Casing: PET GF, T210
Nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M4
Weight: 21.4 g, unit: 500 pcs.
Type: 64601
Ref. No.: 501358 white
Ref. No.: 501356 black



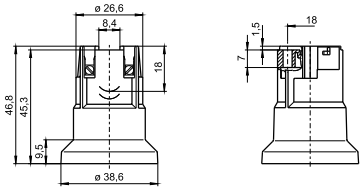
E27 lampholders, for cover caps
Profiled shape, external thread 40x2.5 IEC 60399
Casing: PET GF, T210, nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 14.8/14.9 g, unit: 500 pcs.
Type: 64719
Ref. No.: 504303 white
Ref. No.: 504302 black



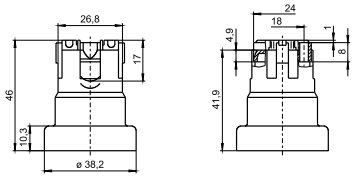
E27 lampholders, for cover caps
Profiled shape, external thread 40x2.5 IEC 60399
Casing: PET GF, T210, nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 11.4/11.3 g, unit: 500 pcs.
Type: 64775
Ref. No.: 506255 white
Ref. No.: 506257 black



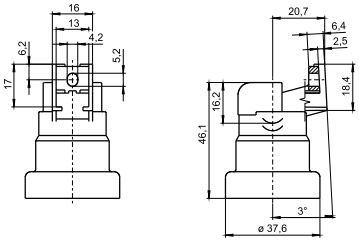
E27 lampholders
Profiled shape, plain, nominal rating: 4/250
Screw terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 11.7/11.5 g, unit: 500 pcs.
Type: 64785
Ref. No.: 506263 PET GF, white, T210
Ref. No.: 506265 PET GF, black, T210



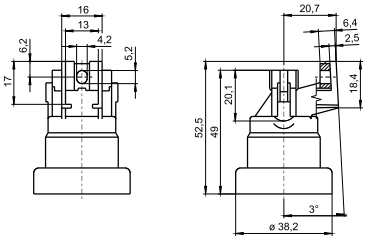
E27 lampholder
For cover caps type 97545/80023 (see p. 187)
Profiled shape, plain, nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Fixing holes for screws M3
Rear fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 11.5 g, unit: 500 pcs.
Type: 64770
Ref. No.: 108953 PET GF, natural, T210



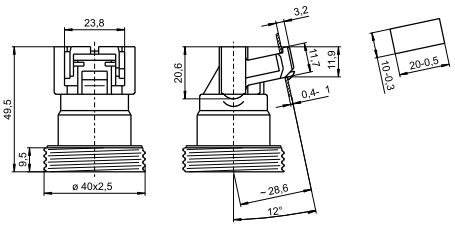
E27 lampholder
For luminaires of protection class II
Profiled shape, plain
Casing: PET GF, white, T210
Nominal rating: 4/250
Screw terminals: 0.5–2.5 mm²
Lateral fixing hole for screw M4
Tilt of lamp axis: 3°
Weight: 15.2 g, unit: 500 pcs.
Type: 64781
Ref. No.: 503041



E27 lampholders
Profiled shape, plain
Casing: PET GF, T210
Nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Lateral fixing hole for screw M4
Tilt of lamp axis: 3°
Weight: 13.3 g, unit: 500 pcs.
Type: 64740
Ref. No.: 108747 white
Ref. No.: 529599 natural



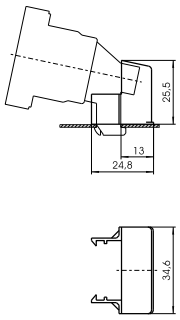
E27 lampholder
Profiled shape, external thread 40x2.5 IEC 60399
Casing: PET GF, natural, T210, nominal rating: 4/250
Push-in twin terminals: 0.5–2.5 mm²
Lateral push-fit foot for cut-out 10x20 mm
Fixing clips for wall thickness 0.4–1 mm
Tilt of lamp axis: 12°
For cover cap 504615 (see below)
Weight: 14.7 g, unit: 500 pcs.
Type: 64741
Ref. No.: 108758

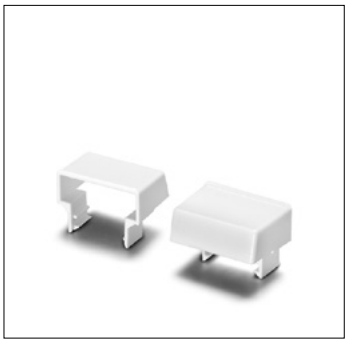


Cover Caps

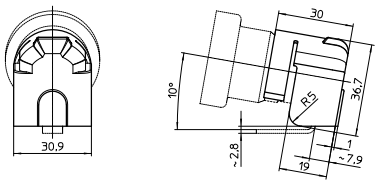
For E27 thermoplastic lampholders, one-piece and for B22d thermoplastic lampholders

Cover cap for lampholder 108758 (see above)
For luminaires of protection class II
Material: PA GF, white
Weight: 2.7 g, unit: 500 pcs.
Type: 97321
Ref. No.: 504615

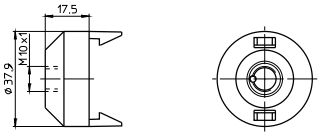




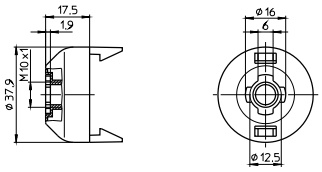
Protection caps for E27 lampholders with bracket with earth connection 400772 (s. p. 201)
For lampholder type 64770/64785 (s. p. 185)
For luminaires of protection class II
Material: PA GF, natural
Weight: 4.8 g, unit: 500 pcs.
Type: 97497
Ref. No.: 526886



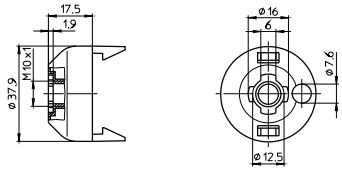
Cover caps
Material: PA GF
Female nipple: M10x1
Weight: 9.6/9.9 g, unit: 500 pcs.
Type: 85070
Ref. No.: 109077 white
Ref. No.: 109092 black



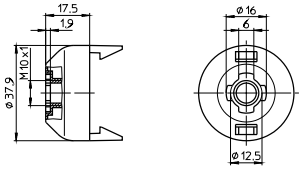
Cover caps
Material: PA GF
Moulded thread: M10x1
Cross groove for rotation stop: external
Weight: 4.4/4.6 g, unit: 500 pcs.
Type: 97665
Ref. No.: 109679 white
Ref. No.: 109680 black



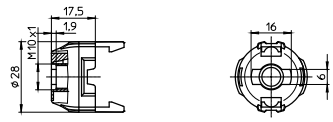
Cover caps
Material: PA GF
Moulded thread: M10x1
Cross groove for rotation stop: external
With lateral hole
Weight: 4/4.6 g, unit: 500 pcs.
Type: 97664
Ref. No.: 109795 white
Ref. No.: 109794 black



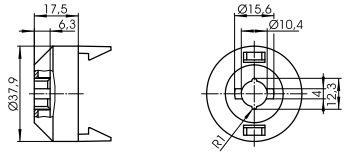
Cover caps
Material: PA GF
Moulded thread: M10x1
Cross groove for rotation stop: external
With locking screw
Weight: 4.7/4.9 g, unit: 500 pcs.
Type: 85077
Ref. No.: 400819 white
Ref. No.: 400820 black



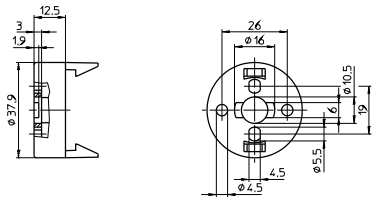
Cover caps
For E27 lampholders type 64770
Material: PA GF, black
Moulded thread: M10x1
Cross groove for rotation stop: external
Weight: 3.1/3.4 g, unit: 500 pcs.
Type: 97545
Ref. No.: 532390
Type: 80023 with locking screw
Ref. No.: 532391



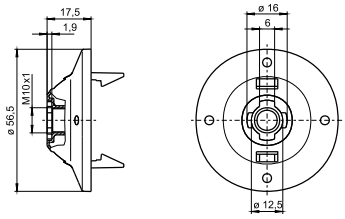
Cover caps
Material: PA GF
Profiled hole: Ø 10.4 mm
Rotation stop: internal and external
Weight: 5.7/5.9 g, unit: 500 pcs.
Type: 97698
Ref. No.: 109560 white
Ref. No.: 109184 black

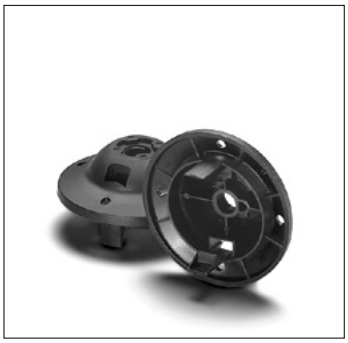


Cover caps
Material: PA GF
Round hole: Ø 10.5 mm
Rotation stop: external
Fixing holes for screws M4
Weight: 5.4/5.5 g, unit: 500 pcs.
Type: 97511
Ref. No.: 109045 white
Ref. No.: 109062 black

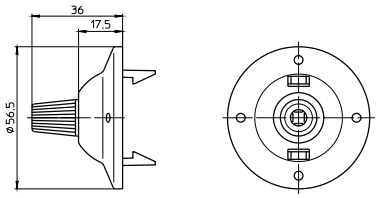


Cover caps
Conical shape
Material: PA GF
Moulded thread: M10x1
Cross groove for rotation stop: external
Weight: 8.9/8.8 g, unit: 500 pcs.
Type: 97260
Ref. No.: 109555 white
Ref. No.: 109556 black

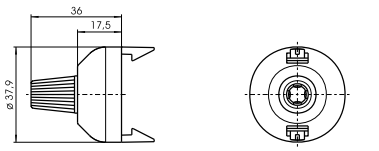




Cover caps
Conical shape
Material: PA GF
With integrated cord grip
For leads H03VV-F 2X0.5 or
H03VV-F 2X0.75
Weight: 10.6/10.5 g, unit: 500 pcs.
Type: 83282
Ref. No.: 109159 white
Ref. No.: 109462 black

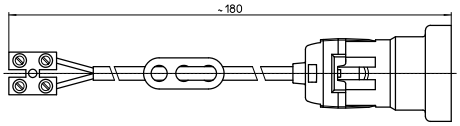


Cover caps
Material: PA GF
With integrated cord grip
For leads H03VV-F 2X0.5 or
H03VV-F 2X0.75
Weight: 6.6/5.8 g, unit: 500 pcs.
Type: 83283
Ref. No.: 504769 white
Ref. No.: 507075 black



E27 Renovation Kit Lampholders

For incandescent lamps with base E27



E27 renovation kit lampholders with suspension
Profiled shaped lampholder 64770 – T210
Cover cap with cord grip 532394
Nominal rating: 4/250
Lead: Cu, stranded conductors 0.75 mm², double PVC-insulation, length: 150 mm
Weight: 25.8/26.2 g, unit: 150 pcs.
Type: 64770
Ref. No.: 564680 black, with screw terminal
Ref. No.: 564681 black, with push-in terminal

E27 Thermoplastic Lampholders, Three-piece

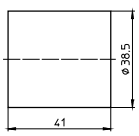
For incandescent lamps with base E27

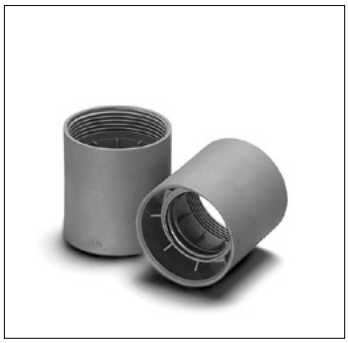
Nominal rating: 4/250
Temperature marking: T190
Brass-finished versions are available on request.

Inserts
Material: PET GF, black
Casing lock
Weight: 5.7/6.1 g, unit: 500 pcs.
Type: 83285 push-in terminals: 0.5–1.5 mm²
Ref. No.: 103643

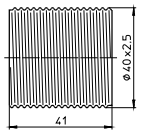
Type: 83011 screw terminals: 0.5–2.5 mm²
Ref. No.: 103520

Plain casings
Material: PET GF
Weight: 14.5/14.3 g, unit: 500 pcs.
Type: 83000
Ref. No.: 103468 white
Ref. No.: 103467 black

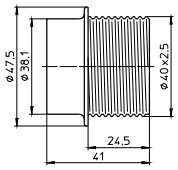




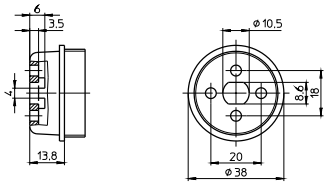
Threaded casings 40x2.5 IEC 60399
Material: PET GF
Weight: 17/16.1 g, unit: 500 pcs.
Type: 83002
Ref. No.: 103484 white
Ref. No.: 103483 black



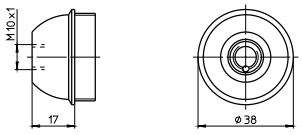
Threaded casings 40x2.5 IEC 60399
With flange
Material: PET GF
Weight: 16.7/17 g, unit: 500 pcs.
Type: 83173
Ref. No.: 103570 white
Ref. No.: 103569 black



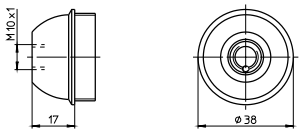
Caps
Material: PA GF
Profiled hole: Ø 10.5x8.6 mm
Fixing holes for screws M4
Height: 13.8 mm
Weight: 5.6/6 g, unit: 500 pcs.
Type: 96148
Ref. No.: 109188 white
Ref. No.: 109187 black



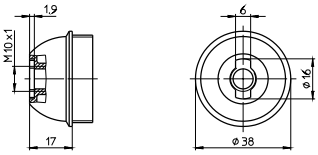
Caps
Material: PA GF
Female nipple: M10x1
Height: 17 mm
Weight: 9.8/10.1 g, unit: 500 pcs.
Type: 83007
Ref. No.: 109052 white
Ref. No.: 109039 black



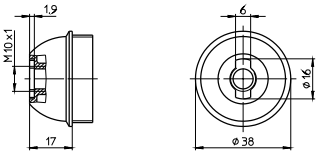
Caps with earth terminal
Material: PA GF
Female nipple: M10x1
Height: 17 mm
Weight: 10.7/11 g, unit: 500 pcs.
Type: 83035
Ref. No.: 109098 white
Ref. No.: 109099 black



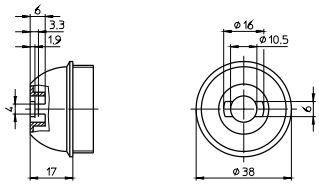
Caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
Height: 17 mm
Weight: 6.7/7 g, unit: 500 pcs.
Type: 96147
Ref. No.: 109195 white
Ref. No.: 109196 black



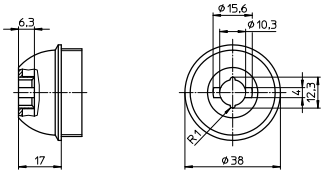
Caps
Material: PA GF
Moulded thread: M10x1
Rotation stop: external
With locking screw
Height: 17 mm
Weight: 7.1/7.3 g, unit: 500 pcs.
Type: 83293
Ref. No.: 109087 white
Ref. No.: 109074 black



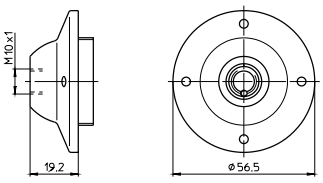
Caps
Material: PA GF
Round hole: Ø 10.5 mm
Rotation stop: internal and external
Height: 17 mm
Weight: 5.9/6.6 g, unit: 500 pcs.
Type: 96154
Ref. No.: 109190 white
Ref. No.: 109191 black



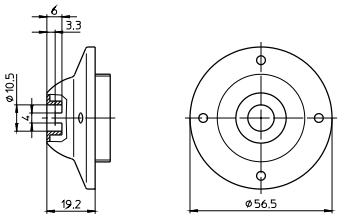
Caps
Material: PA GF
Profiled hole: Ø 10.3 mm
Rotation stop: internal and external
Height: 17 mm
Weight: 5.9/6.6 g, unit: 500 pcs.
Type: 96124
Ref. No.: 109559 white
Ref. No.: 109512 black



Caps
Conical shape
Material: PA GF
Female nipple: M10x1
Height: 19.2 mm
Weight: 14.2/15.2 g, unit: 500 pcs.
Type: 83274
Ref. No.: 109081 white
Ref. No.: 109093 black



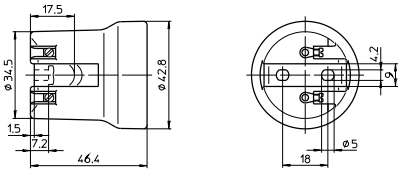
Caps
Conical shape
Material: PA GF
Round hole: Ø 10.5 mm
Rotation stop: internal
Height: 19.2 mm
Weight: 10.4/10.6 g, unit: 500 pcs.
Type: 96172
Ref. No.: 109060 white
Ref. No.: 109044 black



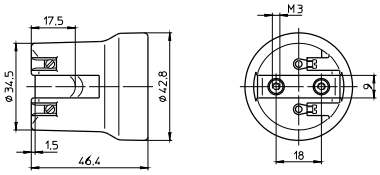
E27 Porcelain Lampholders

For incandescent lamps with base E27

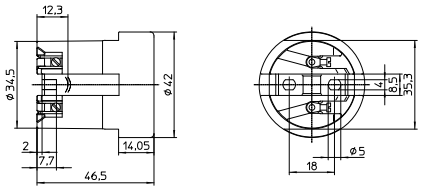
E27 lampholders, one-piece
Material: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screws M4
Weight: 60.6 g, unit: 250 pcs.
Type: 62050
Ref. No.: 102599
Type: 62010 with lamp safety catch (with spring)
Ref. No.: 102577
Type: 62009 with lamp safety catch (with crushing)
Ref. No.: 544605



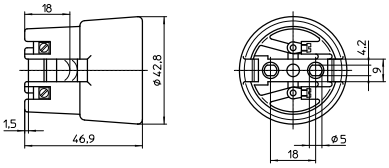
E27 lampholder, one-piece
Material: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing pillars for screws M3
Weight: 66.3 g, unit: 250 pcs.
Type: 62015
Ref. No.: 102582



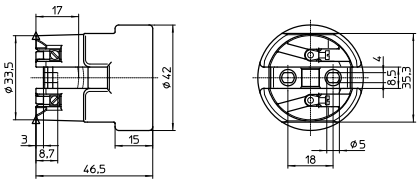
E27 lampholder, one-piece
Material: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screws M4
Weight: 60.5 g, unit: 200 pcs.
Type: 62070
Ref. No.: 543304



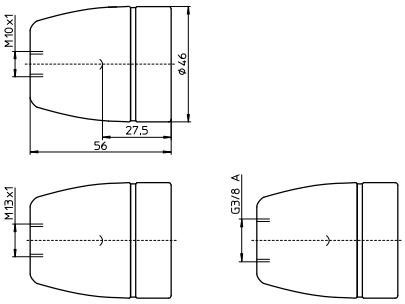
E27 lampholder, one-piece, for cover caps (see p. 186–188)
Material: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing oblong holes for screws M4
Weight: 66.5 g, unit: 250 pcs.
Type: 62310
Ref. No.: 102624



E27 lampholder
Material: porcelain, white, T270
Nominal rating: 4/250/5 kV
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact
Fixing holes for screw M4
Weight: 66.5 g, unit: 250 pcs.
Type: 62370
Ref. No.: 543303



E27 lampholder, three-piece
Material: porcelain, white, T240, nominal rating: 4/250, screw terminals: 0.5–2.5 mm²
Weight: 116/125/116/125/121.7/130.7 g
Unit: 25 pcs.
Type: 62061 female nipple: M10x1
Ref. No.: 535684
Ref. No.: 535685 with earth screw
Type: 62062 female nipple: M13x1
Ref. No.: 536451
Ref. No.: 536452 with earth screw
Type: 62063 female nipple: G3/8A
Ref. No.: 534832
Ref. No.: 534833 with earth screw



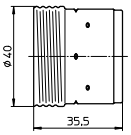
E27 Metal Lampholders, Three-piece

For incandescent lamps with base E27

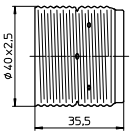
Nominal rating: 4/250
Type: 670 plain casing
Type: 671 threaded casing 40x2.5
Temperature marking: T240

Inserts
Material: porcelain, white
Screw terminals: 0.5–2.5 mm²
Spring loaded central contact, casing lock
Weight: 22.8/23.3 g, unit: 500 pcs.
Type: 83221
Ref. No.: 103595
Type: 83223 with earth terminal
Ref. No.: 103597

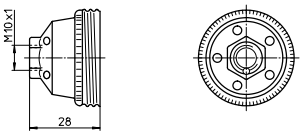
Plain casings
Material: zinc-coated polished steel
Weight: 23.5/22.9/27.1/27.1g
Unit: 500 pcs.
Type: 83218 insulating threaded ring: PPS
Ref. No.: 103582 chrome-finish
Ref. No.: 103583 brass-finish
Type: 83226 insulating threaded ring: steatite
Ref. No.: 504640 chrome-finish
Ref. No.: 504641 brass-finish

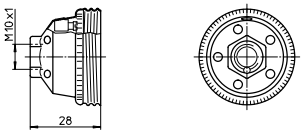


Threaded casings 40x2.5 IEC 60399
Material: zinc-coated polished steel
Weight: 24/23.1/27.3/27.6 g
Unit: 500 pcs.
Type: 83219 insulating threaded ring: PPS
Ref. No.: 103590 chrome-finish
Ref. No.: 103591 brass-finish
Type: 83227 insulating threaded ring: steatite
Ref. No.: 504643 chrome-finish
Ref. No.: 504644 brass-finish



Caps
Material: zinc-coated polished steel
Female nipple: M10x1
Weight: 10.6/10.8/11.4/11.3 g
Unit: 500 pcs.
Type: 80342
Ref. No.: 103020 chrome-finish
Ref. No.: 103021 brass-finish
Type: 80343 with earth terminal
Ref. No.: 103026 chrome-finish
Ref. No.: 103027 brass-finish



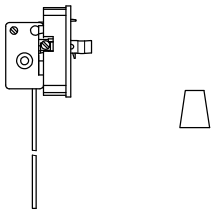


E27 Metal Pull-switch Lampholders

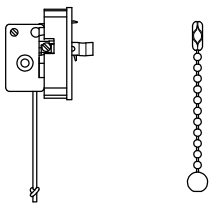
For incandescent lamps with base E27

Nominal rating: 2/250
Type: 55204 plain casing, with pull cord
Type: 55203 plain casing, with draw chain
Type: 55304 threaded casing 40x2.5, with pull cord
Type: 55303 threaded casing 40x2.5, with draw chain

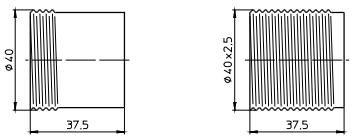
Insert with pull cord
Material: porcelain, white
Screw terminals: 0.5–2.5 mm²
Length of cord: 250 mm, casing lock
Weight: 28 g, unit: 500 pcs.
Type: 83006
Ref. No.: 103504
End button for pull cord, material: PS, white
Weight: 0.8 g, unit: 500 pcs.
Type: 96010
Ref. No.: 105144

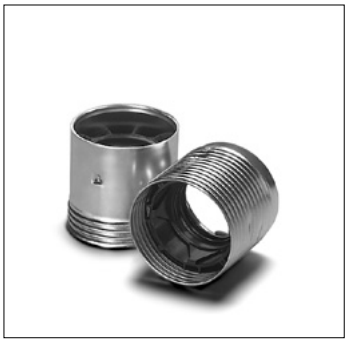


Insert for brass chain
Material: porcelain, white
Screw terminals: 0.5–2.5 mm²
Weight: 29.4 g, unit: 500 pcs.
Type: 83008
Ref. No.: 103515
Draw chain with end button
Material: brass, length of chain: 85 mm
Weight: 3.9 g, unit: 500 pcs.
Type: 94304
Ref. No.: 104928

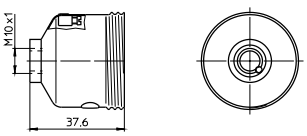


Casings
Material: brass, passivated
Insulating threaded ring: PPS
Weight: 21.5/22.7 g, unit: 500 pcs.
Type: 83218 plain casing
Ref. No.: 103587
Type: 83219 threaded casing 40x2.5
Ref. No.: 103594





Cap with earth terminal
Material: brass, passivated
Female nipple: M10x1
With insulating insert
Weight: 20 g, unit: 500 pcs.
Type: 80014
Ref. No.: 102956

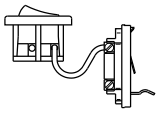


E27 Thermoplastic Rocker Switch Lampholders

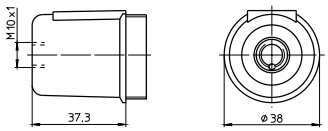
For incandescent lamps with base E27

Nominal rating: 2/250
Temperature marking: T180
Suitable casings see page 189–190:
Type: 83000 plain casing
Type: 83002 threaded casing 40x2.5
Type: 83173 threaded casing 40x2.5, with flange

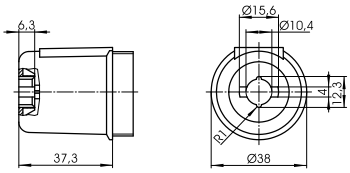
Inserts with switch
Material: PET GF, white
Screw terminals: 0.5–2.5 mm²
Weight: 11/11.1 g, unit: 500 pcs.
Type: 83015
Ref. No.: 107331 switch, white
Ref. No.: 107096 switch, black



Caps
Material: PA GF
Female nipple: M10x1
Weight: 14.2/14.7 g, unit: 500 pcs.
Type: 83260
Ref. No.: 109198 white
Ref. No.: 109199 black



Caps
Material: PA GF
Profiled hole: Ø 10.4 mm
Rotation stop: internal and external
Weight: 8.2/10.4 g, unit: 500 pcs.
Type: 96229
Ref. No.: 109200 white
Ref. No.: 109201 black

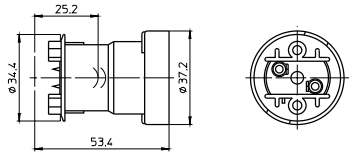


E27 Festoon Lampholders

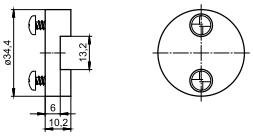
For lighting chains of protection class II

Degree of protection: IP44
Type: 64710/11
The lampholders may only be operated with the lamp pointing downwards and with a gasket.

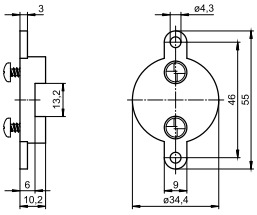
E27 festoon lampholder
For lamps max. 40 W
Material: PBT GF, black
Nominal rating: 4/250
Blade contacts
for festoon lead H05RN H2-F 2X1.5
To be used only with protection cap
Weight: 13.8 g, unit: 500 pcs.
Type: 83297
Ref. No.: 109158



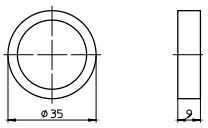
Protection cap
For E27 festoon lampholders
Material: PA GF, black
With ready-fitted stainless screws
Weight: 6.3 g, unit: 500 pcs.
Type: 83300 with non-removable screws
Ref. No.: 109243



Protection cap
For E27 festoon lampholders
Material: PA GF, black
With ready-fitted stainless screws
Fixing holes for screws M4
Weight: 7.2 g, unit: 500 pcs.
Type: 83301 with non-removable screws
Ref. No.: 502515



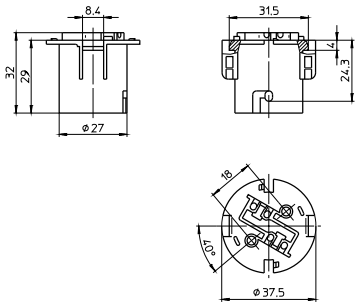
Gasket
For E27 festoon lampholders
Material: silicone
Weight: 4 g, unit: 500 pcs.
Type: 98006
Ref. No.: 106817



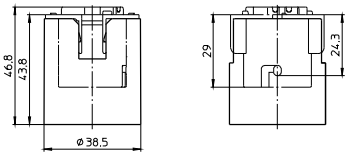
B22d Lampholders, Accessories

For mains voltage halogen incandescent lamps

B22d lampholders
For cover caps (see p. 186–188)
Nominal rating: 2/250
Push-in twin terminals: 0.5–1.5 mm²
Fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST3.9-C/F
Weight: 12.7/12.3 g, unit: 500 pcs.
Type: 64800
Ref. No.: 108748 PET GF, T180, white
Ref. No.: 544621 PET GF, T210, white



Plain casing
For B22d lampholders type 64800
For cover caps (see p. 186–188)
Threaded casing on request
Material: PA GF, white
Weight: 14.5 g, unit: 500 pcs.
Type: 96021
Ref. No.: 504749

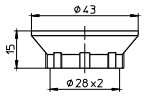


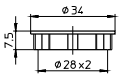
Accessories

For E14, E27 lampholders, one-piece and three-piece and B22d lampholders

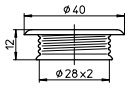
The luminaire manufacturer is responsible for
the right choice of accessories.
Brass-finished versions are available on request.

Plastic screw rings
For E14 lampholders
with external thread 28x2 IEC 60399
Weight: 3.6/3.2/1.8/1.6 g, unit: 1000 pcs.
Type: 03210 Ø 43 mm, height: 15 mm
Ref. No.: 100125 PET GF, white
Ref. No.: 109162 PA GF, black
Type: 05202 Ø 34 mm, height: 7.5 mm
Ref. No.: 107154 PET GF, white
Ref. No.: 109166 PA GF, black

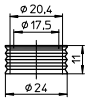




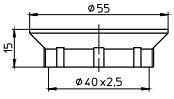
Metal screw ring
For E14 lampholders
with external thread 28x2 IEC 60399
Material: zinc-coated polished steel, chrome-finish
Ø 40 mm, height: 12 mm
Weight: 4.3 g, unit: 500 pcs.
Type: 06700
Ref. No.: 100194

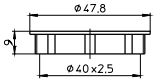


Front gasket
For E14 lampholders type 64308, 64360 and 64380
As lamp safety catch and for protection
against moisture acc. to IEC 60079-15
Material: elastomer
Weight: 1.1 g, unit: 2000 pcs.
Type: 98013
Ref. No.: 534689

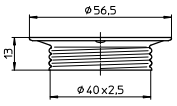


Plastic screw rings
For E27 and B22d lampholders
Weight: 4.9/4.4/3.3/3 g, unit: 500 pcs.
Type: 08610 Ø 55 mm, height: 15 mm
Ref. No.: 100270 PET GF, white
Ref. No.: 109285 PA GF, black
Type: 08701 Ø 47.8 mm, height: 9 mm
Ref. No.: 100273 PET GF, white
Ref. No.: 109291 PA GF, black

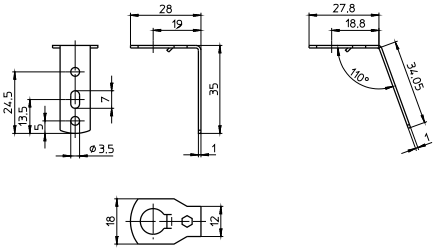




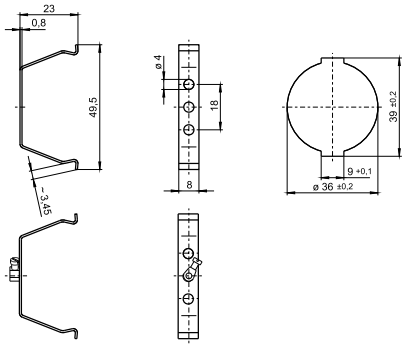
Metal screw ring
For E27 and B22d lampholders
Material: zinc-coated polished steel, chrome-finish
Ø 56.5 mm, height: 13 mm
Weight: 7 g, unit: 500 pcs.
Type: 07400
Ref. No.: 100217



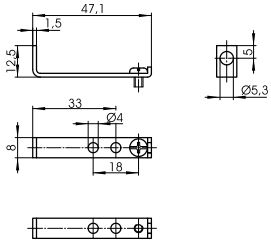
Brackets for E14 lampholders
For fastening with nipples 109249, 109247
Material: zinc-coated polished steel
Fixing holes for screws M3
Weight: 5.5/5.3 g, unit: 1000 pcs.
Type: 94068 internal bracket 90°
Ref. No.: 106767
Type: 94069 internal bracket 110°
Ref. No.: 106768



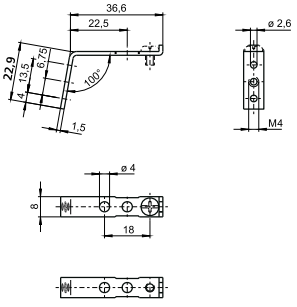
U-shaped clips
For E27 lampholders, one-piece
Material: zinc-coated polished steel, chrome-finish
For wall thickness: 0.5–2 mm
Weight: 3.7/4.3 g, unit: 2500 pcs.
Type: 94435
Ref. No.: 109621
Type: 80433 with earth terminal
Ref. No.: 103087



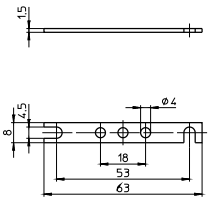
Brackets: 90°, 12.5x47.1 mm
For E14 and E27 lampholders, one-piece
Material: zinc-coated polished steel, chrome-finish
Fixing hole for screw M5
Weight: 5.6/4.8 g, unit: 500 pcs.
Type: 80475 with earth terminal
Ref. No.: 400779
Type: 94444
Ref. No.: 401536



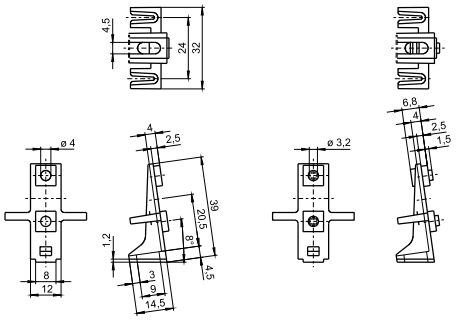
Brackets: 100°, 22.9x36.6 mm
For E14 and E27 lampholders, one-piece
Material: zinc-coated polished steel, chrome-finish
Fixing holes for self-tapping screws
acc. to ISO 1481/7049-ST2.9-C/F
Tapped hole M4
Weight: 5.5/4.6 g, unit: 1000 pcs.
Type: 80476 with earth terminal
Ref. No.: 400772
Type: 94438
Ref. No.: 401549



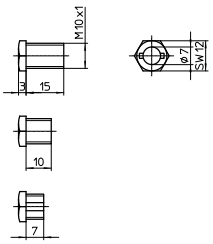
Fixing bracket
For E14 and E27 lampholders, one-piece
Material: zinc-coated polished steel, chrome-finish
With slots for screws M4
Weight: 4.6 g, unit: 1000 pcs.
Type: 94450
Ref. No.: 106829



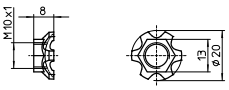
Fixing brackets: 8°, 14.5x39 mm
For E27 thermoplastic lampholders, one-piece
Material: PET GF, white
With cable holder
Oblong hole for screw M4
Weight: 3/3.6 g, unit: 1000 pcs.
Type: 97750 fixing holes: Ø 4 mm
Ref. No.: 109725
Type: 97752 fixing holes for self-tapping screws acc. to ISO 1481/7049-ST3.9-C/F
Ref. No.: 109728



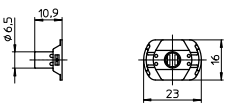
Nipples
For E14 cover caps with moulded thread: M10x1
Cross groove for rotation stop: external
For E27 caps (see p. 190–192)
Material: PA, white
Male nipple: M10x1, with hexagon flange
Weight: 0.5 g, unit: 1000 pcs.
Type: 09700/09703/09708
Ref. No.: 538089 length: 15 mm
Ref. No.: 109249 length: 10 mm
Ref. No.: 109247 length: 7 mm



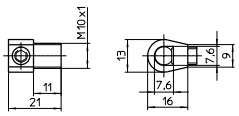
Locking nut for thread M10x1
Material: PA GF
Weight: 0.9 g, unit: 1000 pcs.
Type: 97267
Ref. No.: 507797 white
Ref. No.: 507798 black



Cord grip with insulating socket
For E14 and E27 lampholders
Material: PA, natural
For luminaires of protection class II
For leads H03VVH2-F 2X0.75
Weight: 0.6 g, unit: 1000 pcs.
Type: 97632
Ref. No.: 534097

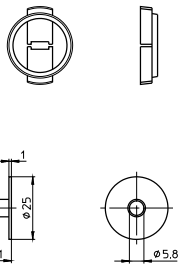


Cable grips
For leads H03VV-F and H03VVH2-F 2X0.5
or 2X0.75
Material: PA
Male nipple: M10x1, length: 11 mm
With locking screw
Weight: 1.6/1.5 g, unit: 1000 pcs.
Type: 09701
Ref. No.: 109248 white
Ref. No.: 109253 black

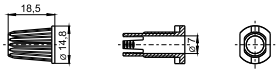


Cord grip
For E14 lampholders, three-piece,
with cap height: 19 mm
For leads H03VVH2-F
Material: PA, black
Weight: 0.6 g, unit: 1000 pcs.
Type: 09501
Ref. No.: 106948

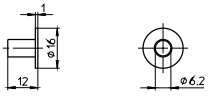
Cord grip
For E27 lampholders, three-piece (without switch)
For leads H03VVH2-F
Weight: 0.9 g, unit: 1000 pcs.
Type: 09502
Ref. No.: 106949 PA, black
Insulating socket
Material: PA, transparent
Weight: 0.5 g, unit: 1000 pcs.
Type: 09705
Ref. No.: 109592



Cord grips
For leads H03VV-F 2X0.5 or
H03VV-F 2X0.75
Material: PA
Weight: 0.9/0.8/1.7/1.6 g, unit: 1000 pcs.
Type: 09606 cord grips
Ref. No.: 506026 white
Ref. No.: 506027 black
Type: 96160 screw caps
Ref. No.: 109318 white
Ref. No.: 109317 black



Insulating socket for E14 lampholders
Material: PA, transparent
Weight: 1 g, unit: 1000 pcs.
Type: 09704
Ref. No.: 109600

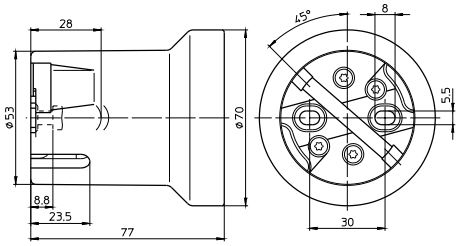


E40 Porcelain Lampholders

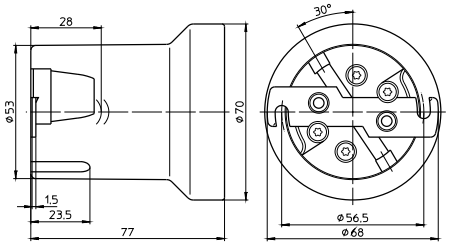
For incandescent lamps with base E40

Nominal rating: 18/500/5 kV
Screw terminals: 1.5–4 mm²
Spring loaded central contact

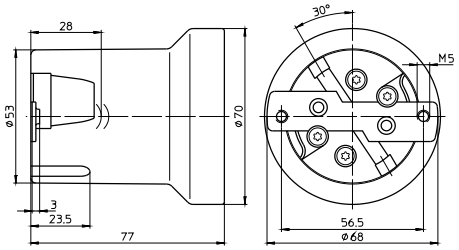
E40 lampholders
Material: porcelain, white, T270
Oblong holes for screws M5
Weight: 224/229.3/224/229.3 g
Unit: 48 pcs.
Type: 12800/12801
Ref. No.: 108208
Ref. No.: 107780 with lamp safety catch
With steel thread
Ref. No.: 532602
Ref. No.: 532603 with lamp safety catch



E40 lampholders
Material: porcelain, white, T270
Fixing bracket with slots for screws M5
Weight: 252.3/243/252.3/243 g
Unit: 48 pcs.
Type: 12810/12811
Ref. No.: 108374
Ref. No.: 108375 with lamp safety catch
With steel thread
Ref. No.: 532604
Ref. No.: 532605 with lamp safety catch



E40 lampholders
Material: porcelain, white, T270
Fixing bracket with tapped holes
for screws M5
With lamp safety catch
Weight: 252.8 g, unit: 48 pcs.
Type: 12812
Ref. No.: 108373
With steel thread
Ref. No.: 532606



5 Components for Incandescent Lamps

Transformers and converters for low-voltage halogen lamps

Operating low-voltage halogen lamps depends on operating devices that transform the usual mains voltage of 230 V to under 24 V. Safety transformers, of either electromagnetic or electronic (converter) design, have been in almost exclusive use for several years now. The type plate of electromagnetic transformers bears the symbol for safety transformers in accordance with VDE 0570, corresponding to EN 61558. Electronic converters are marked with the sign for Safety Extra-Low Voltage (SELV), which indicates that the product is an isolating converter whose secondary output is safe to touch even during no-load operation.

All Vossloh-Schwabe transformers are safety transformers, i.e. isolation transformers for supplying SELV (safety extra-low voltage) and PELV (protection extra-low voltage) circuits. With such systems, the voltage must not exceed a value of 50 V AC or 120 V DC (smoothed) between the conductors or a conductor and the earth conductor of a circuit that is separated from the mains by a safety transformer. The specified values apply for protected (non-touchable) voltages; 25 V AC and 60 V DC (smoothed) apply for exposed (touchable) voltages.

Depending on their design features to protect against touchable live parts, transformers and converters fall into one of two protection classes. Operating devices of protection class I are base-insulated and have a protective earth conductor connection terminal that must be connected to the protective earth conductor for safety reasons. Isolating transformers and converters of protection class II are equipped with double or reinforced insulation that protects against dangerous casing currents; these operating devices are solely available as independent operating devices (also see page 233; Protection Classes of Luminaires and Operating Devices).

Electronic converters can also be fitted with a functional earth terminal that must be connected to a functional earth to ensure compliance with EMC requirements. In addition, some electronic converters are designed in such a way that neither a protective earth conductor nor a functional earth needs to be connected.

Operating devices can also be differentiated according to the way they are used. Built-in transformers have to be installed in a permanent casing, e.g. a luminaire. In contrast, so-called independent transformers and converters can be operated independently of a luminaire. These are often found in ceiling installations; in order to prevent possible noise development, isolation transformers must be mounted in such a way as to avoid vibration transmission.

Transformers or converters bearing the MM mark can be mounted on surfaces of unknown flammability, which can be the case when mounting these devices on wooden furniture elements. Such devices comply with the temperature requirements of VDE 0710, part 14, of < 95 °C during normal and < 115 °C during abnormal operation.

Converters are labelled with a t_c point. The stipulated temperature (e.g. 75 °C) must not be exceeded when installed so that the service life of the converter is not shortened. The temperature quoted in the triangle (e.g. 110) denotes that the surface of the converter must never (even in the event of a defect) exceed this temperature.

Protection symbols

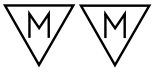
Safety transformer

SELV

Safety Extra Low Voltage

Protection class II

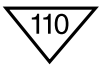
Independent operating device



Furniture installation
Normal operation < 95 °C
Abnormal operation < 115 °C

If the maximum value of 130 °C is not exceeded, the luminaire does not have to be tested in accordance with F conditions.

$t_c = 75$ °C
Measuring point for maximum permissible casing temperature



Temperature-protected converter (in this case < 110 °C)

Dimmability of transformers and converters

Electromagnetic transformers can be controlled using phase-cutting leading-edge dimmers. These dimmers "cut" the sinusoidal mains voltage in the negative and positive half wave at an angle in the ascending portion of this sinusoidal half wave. The higher the angle is set at the dimmer controls, the lower the effective value of the voltage and hence the lamp's output.

Electronic converters can be controlled using phase-cutting trailing-edge dimmers. In this case, a semiconductor ensures the predefined descending portion of the sinusoidal half wave is clipped, i.e. the voltage is reduced in reverse mode. Again, higher the angle is set at the dimmer controls, the lower the effective value of the voltage and hence the lamp's output.

Converters of the LiteLine (EST 60/12.635, EST 70/12.380, EST 105/12.381 and EST 150/12.622) families can be operated using conventional phase-cutting trailing-edge and phase-cutting leading-edge dimmers.

Dimmable using phase-cutting leading-edge or trailing-edge dimmers

Dimmable using phase-cutting leading-edge dimmers

Dimmable using phase-cutting trailing-edge dimmers

Electronic Converters

The safe operation of electronic converters is dependent on the maximum permissible temperature not being exceeded at the measuring point. Vossloh-Schwabe has determined a casing temperature measuring point – $t_{c\ max.}$ – on all converter casings. To avoid shortening the service life or diminishing operating safety, the stipulated maximum temperature must not be exceeded at this tc point. This point is determined by testing the converter during normal, IEC-standardised operation at the specified max. ambient temperature (ta), which is also indicated on the type plate. As both the design-related ambient temperature and the converter's inherent heat generation, as determined by the installed load, are subject to great variation, the casing temperature should be tested at the converter's tc point under real installation conditions.

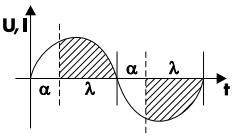
Temperature-protected converters feature a further protection symbol, namely a triangle containing the maximum temperature. This symbol certifies that the stipulated surface temperature of the device casing will not be exceed during any operating state or in the event of a defect.

Vossloh-Schwabe electronic converters are tested in accordance with EN 61347. Function tests are carried out in accordance with EN 61047. VS converters can be operated without causing any inadmissible system reactions as all devices comply with EN 61000-3-2 on the limitation of mains harmonics. They also meet the EMC requirements of EN 61547. These devices are thus also protected against mains surges (as defined in the standard) that can be caused by, for instance, inductive ballasts during combined operation of fluorescent and low-voltage halogen lamps.

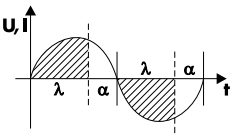
In addition, all devices comply with the RFI requirements of EN 55015. As the highly effective integrated filter can only limit the unit's own interference, the secondary conductor should be kept to under 2 metres in length so as to avoid RFI interference in the lighting system.

Working principle of a phase-cutting leading-edge dimmer

α = Ignition angle
λ = Operating angle
U = Voltage
I = Current



Working principle of a phase-cutting trailing-edge dimmer



Assembly Instruction for Electronic Converters

For mounting and installing electronic converters for low-voltage halogen lamps

Mandatory regulations

DIN VDE 0100	Erection of low voltage installations
EN 60598-1	Luminaires – part 1: general requirements and tests
EN 61000-3-2	Electromagnetic compatibility (EMC) – part 3: maximum values – main section part 2: maximum values for mains harmonics (device input current up to and including 16 A per conductor)
EN 55015	Maximum values and methods of measurement for RFI suppression in electrical lighting installations and similar electrical appliances
EN 61547	Installations for general lighting purposes – EMC immunity requirements
EN 61347-1	Operating devices for lamps – part 1: general and safety requirements
EN 61347-2-2	Operating devices for lamps – part 2-2: special requirements for DC- or AC-powered electronic converters for incandescent lamps
EN 61047	DC- or AC-powered electronic converters for incandescent lamps – performance requirements

Designations for VS converters

Designations for electronic converters are first listed by the name of the product family, which in each case reflects the visible product properties. The type designation should be read as follows:

EST	60	/12	.388
Electronic safety transformer	Max. wattage	Lamp voltage	Serial number

Mechanical mounting

Mounting position	Any
Clearance	Min. of 0.1 m from walls, ceilings, insulation; min. of 0.1 m from other electronic converters; min. of 0.25 m from sources of heat (lamp)
Surface	Solid; device must not be allowed to sink into insulation materials
Mounting location	In dry rooms or in luminaires, cases, casings or similar in the instance of built-in converters
Fastening	Independent converters: using screws, Ø 4 mm
Heat transfer	If the electronic converter is destined for installation in a luminaire, sufficient heat transfer must be ensured between the converter and the luminaire casing. During operation, the t_c point must not exceed the specified value.

Technical specifications

Type		Operating voltage range AC	Dimmability		Temperature protection	Through-wiring[3]	Type of automatic cut-out and number of possible VS devices			
		Unsuitable for DC operation	Phasecutting trailing edge[1]	Phasecutting leading edge[1]	Electronic control[2]	Converter quantity	B (10A)	B (16A)	C (10A)	C (16A)
LiteLine	EST 70/12.380	230–240	x	x	x	—	28	45	28	45
	EST 105/12.381	230–240	x	x	x	—	20	32	20	32
	EST 150/12.622	230–240	x	x	x	—	14	23	14	23
...Mini	EST 60/12.635	220–240	x	x	x	—	35	56	35	56

1 The dimmer is connected to the primary side between mains and converter.
It is possible to connect several converters to one dimmer (whereby the dimmer's minimum and maximum load must be observed).
The dimmer-converter system should be subjected to function and noise development tests prior to installation.
2 The rating is decreased electronically in the event of overheating.
3 Distributed secondary leads are only permitted on non-metallic surfaces (RFI suppression)

Properties of electronic converters

Overheating — Protection against overheating is provided by an electronic controller (see table above).

Short-circuit — The converter will be electronically disconnected in the event of a short-circuit at the output; once the short-circuit has been eliminated, the converter will switch on again automatically.

Overload — Minor overloads (< 50%) will trigger the temperature switch against overheating; major overloads (> 50%) will trigger the same reaction as for short-circuit.

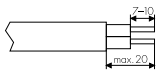
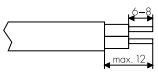
Should any of the above-mentioned safety functions be triggered, disconnect the converter from the power supply, then find and eliminate the cause of the problem.

Protection against transient mains peaks
Values compliant with EN 61547 (immunity)

Electrical installation

Conductors — Primary conductor cross-section: min. 0.75 mm²
Secondary conductor cross-section: min. 0,75 mm² for 50 W output and min. 1 mm² for 100 W output

Stripping

Converter	EST 60/12.635	EST 70/12.380, EST 105/12.381, EST 150/12.622
Type of lead	All usual types of lead up to 4 mm²	H03-VVH2-F 2X0,75 / H05-VVH2-F 2X0,75 / H03-VV-F 2X0,75 / H05-VV-F 2X0,75
Lead preparation		

Connections — Screw terminals: max. initial torque of 0.4 Nm must not be exceeded

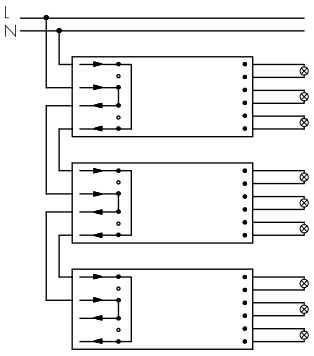
Secondary length
Min. 0.25 m (clearance to lamp), max. 2 m (RFI protection)

Secondary wiring
Min. 0.1 m clearance from the mains (RFI protection)

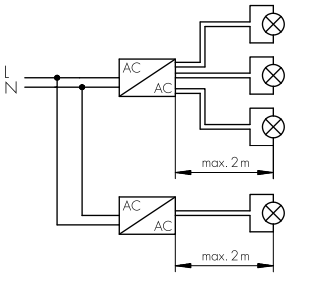
Star wiring — Twist single-wire or lead wires narrowly; silicone-insulated leads are recommended

Parallel connection
Secondary-side parallel connection is inadmissible

Connection circuit



Lead length

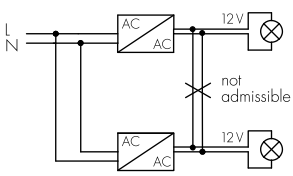


Feed-through of the mains voltage

See table on page 210

Distributed secondary leads are only permitted on non-metallic surfaces (RFI suppression)

Wiring



Selection of automatic cut-outs for VS converters

Dimensioning automatic cut-outs

High transient mains current pulses occur when a converter is switched on because the capacitor has to load. As the lamps ignite almost simultaneously, this also creates a high power drain. The high currents that occur when the system is switched on put a strain on the automatic conductor cut-outs, which must be selected and dimensioned to suit.

Release reaction Release reaction of automatic cut-outs in accordance with VDE 0641, Part 11; for B and C characteristics. The values provided in the table on page 210 are meant as guidelines only and may vary depending on the respective lighting system.

No. of converters The maximum number of VS converters (see table on page 210) applies to cases where the devices are switched on simultaneously. Specifications apply to single-pole fuses. The number of permissible ballasts must be reduced by 20% for multi-pole fuses. The considered circuit impedance equals 400 mΩ (approx. 20 m [2.5 mm²] of conductor from the power supply to the distributor and a further 15 m to the luminaire).

Dimmability of electronic converters

Dimmed operation

VS converters can be operated with phase-cutting trailing-edge and leading-edge dimmers. The dimmer is connected to the primary side between mains and converter. It is possible to connect several converters to one dimmer (whereby the dimmer's minimum and maximum load must be observed). The dimmer-converter system should be subjected tofunction and noise development tests prior to installation.

Electromagnetic compatibility (EMC)

Mains Harmonics

Maximum values are observed in accordance with EN 61000-3-2.

Interference The requirements of EN 55015 must be met for luminaires with converters for operating low-voltage halogen lamps.
Vossloh-Schwabe converters are designed and manufactured to ensure these requirements are satisfied provided the installation instructions regarding the interference voltage at the connection terminals and electromagnetic interference fields up to 300 MHz are observed.

Additional information

Wiring

To ensure good radio interference suppression and the greatest possible operating safety, the following points should be observed when installing electronic converters:

- Conductors between the EST and the lamp (HF conductors) must be kept short (reduction of electromagnetic interference).
- Mains and lamp conductors must be kept separate and if possible should not be laid in parallel to one another. The distance between HF conductors and mains conductors should be as large as possible, ideally > 5 cm. (This prevents the induction of interference between the mains and lamp conductors).
- The mains conductor within the luminaire must be kept short (to reduce the induction of interference).
- The mains conductor must not be laid too close to the EST (this is especially important in the event of through-wiring).
- Mains and lamp conductors must not be crossed. Should this be impossible to avoid, conductors should be crossed at right angles to one another (to avoid inducing interference between mains and HF conductors).
- Should conductors be wired through metal parts, such conductors must always be additionally shielded (e.g. with an insulating sleeve or grommet).

Temperature

Reference point temperature t_c

The safe operation of electronic converters is dependent on the maximum permissible temperature not being exceeded at the measuring point. Vossloh-Schwabe has determined a casing temperature measuring point – $t_{c\ max.}$ – on all converter casings. To avoid shortening the service life or diminishing operating safety, the stipulated maximum temperature must not be exceeded at this t_c point. This point is determined by testing the converter during normal, IEC-standardised operation at the specified ambient temperature (t_a), which is also indicated on the type plate. As both the design-related ambient temperature and the converter's inherent heat, as determined by the installed load, are subject to great variation, the casing temperature should be tested at the t_c point under real installation conditions.

Ambient temperature t_a

The ambient temperature – as specified on every converter – denotes the permissible temperature range within the luminaire or at the place of installation.

Reliability

Service life of 50,000 hrs at reference point temperature t_c, whereby a switching cycle of 165 minutes on and 15 minutes off is assumed. Failure rate: ≤ 0.2%/1,000 hrs

In order to achieve the average service life, the maximum temperature ($t_{c\ max.}$) must not be exceeded at the t_c point.

Emergency lighting

VS electronic converters cannot be used for emergency lighting purposes as they are unsuitable for DC voltage operation.

Conductors for low-voltage halogen installations

Conductors for installations with low-voltage halogen lamps

As the high temperatures associated with the operation of low-voltage halogen lamps place severe demands on lampholder conductors, a skilful combination of conductor and insulation is essential. Tin-plated copper conductors with silicone insulation are recommended for temperatures of up to 180 °C at the cable's conductor; nickel-plated copper cables with polytetrafluoroethylene (PTFE) sheathing are recommended for temperatures of up to 250 °C. Welded connections ensure the most effective heat discharge. Control measurements should be carried out if other connection types are used, e.g. crimping or plug connectors. To prevent the risk of additional heat generation, the maximum permissible current load must be observed when dimensioning the conductor cross-section. When using electromagnetic transformers, the conductor resistance causes a relatively large voltage drop. This drop in voltage is always associated with a reduction of luminous flux. For instance, an 11% drop in voltage will lead to a 30% drop in luminous flux. For this reason, care should be taken to ensure secondary conductors are kept as short as possible and conductor cross-sections are adequately dimensioned when wiring luminaires. Nevertheless, transformers should not be mounted too near the light source (> 25 cm clearance if possible) to prevent the heat generated by the lamp from raising the ambient temperature above the critical level for a transformer.

As electronic converters operate at high frequencies, consideration must be taken of the skin effect, i.e. the displacement of the electrons from the middle of the conductor to its surface. As a result, the full cross-section of the conductor is no longer used, resistance increases and thus leads to a greater drop in voltage. In addition, AC resistance, which is caused by feed line inductance, can result in an even greater voltage drop. It is therefore recommended that lamp conductors be laid closely parallel or twisted together.

Voltage losses (V) with a two-metre secondary conductor

Working frequency	Load	Cross-section/Voltage drop		
	W	0.75 mm²	1 mm²	1.5 mm²
50 Hz (electromagnetic transformers)	50	0,38 V	0.29 V	0.2 V
any wiring layout	100	0.74 V	0.56 V	0.39 V
40 kHz (electronic converters)	50	1.4 V	1.25 V	1.2 V
any wiring layout (loops)	100	3.3 V	3.1 V	3 V
40 kHz (electronic converters)	50	0.5 V	0.45 V	0.35 V
wires twisted together or closely parallel	100	1.2 V	1 V	0.85 V

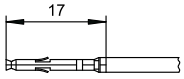
Conductors for installations with halogen lamps

All conductors must be selected to suit the luminaire conditions (see table) in terms of material, cross-section and insulation. Testing these conductors under worst case conditions is essential as the commonly occurring high temperatures considerably reduce the conductivity of the conductor and hence its current-carrying capacity.

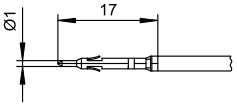
Insulation	Conductor Material	Cross-section mm²	Mains voltage V	Max. temperature °C
SI	Cu tin-plated (Cu vz)	0.75	300	180
FEP	Cu tin-plated (Cu vz)	0.75	300	180
PTFE	Cu nickel-plated (Cu vn)	0.75	500	250
PTFE	Cu nickel-plated (Cu vn)	1	500	250
PTFE	Ni	1	500	250
PTFE	Ni	1.5	500	250

Conductor Contacts

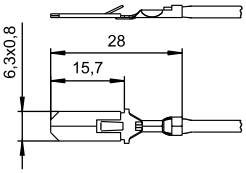
Pin contact Ø 1



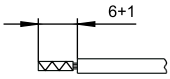
Socket connector



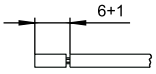
Flat connector 6.3x0.8



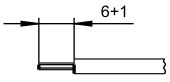
Cable with ferrules



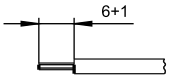
Cable, notched at 6 mm



Cable, bared at 6 mm



Ultrasonically welded cable end



Lampholders

For low-voltage halogen lamps

With the exception of B15d bases, the low-voltage sector is dominated by pin bases, which are fitted with a variety of different pin distances and diameters.

Apart from classic lampholders that ensure both the electrical contact and the correct positioning of the lamp, connection elements are also available. These components are solely responsible for establishing electrical contact and are used in cases where, for instance, the regulations demand that the lamp be attached to its reflector (e.g. cold-light reflector lamps with GZ4 and GX5.3 bases).

Extremely high temperatures are also generated when operating low-voltage halogen lamps as a result of the tungsten-halogen cycle and high lamp currents. In addition, the respective luminaires are often of very compact design, which leads to heat accumulation and thus to high internal temperatures. The materials the lampholder is made of thus play a vital role for the luminaire's operating safety and the lamp's service life. In addition to tried-and-tested materials – ceramics for casings and mica for covers – ever more frequent use is being made of highly heat-resistant plastics like LCP (liquid crystal polymer for e.g. G4, GU4, GX5.3, GU5.3 and GY6.35 lampholders) and PPS (polyphenylene sulphide for G4 lampholders). Plastic lampholders provide clear advantages: narrow dimensional tolerances, no material fractures, low weight and clip-attachment options.

The type of contact also plays an important role. Conventional contacts are only attached to one side of the lamp pin. In contrast, additional contact points – known as multipoint contacts – lead to a reduction of current density at the point of transition from the lamp pins to the lampholder contact and with that to a decrease in temperature. These contacts provide the further advantage of ensuring superior heat dissipation from the lamp pins to the conductor. The temperature advantage of multipoint contacts in defined conditions (including welded-on conductors) can amount to as much as 100 °C. In extremely rare cases, due to the high internal pressure in the bulb, it is possible for the lamp to shatter. For reasons of fire prevention (high temperature of the glass bulb), the lamp's components must be prevented from falling out. Enclosed luminaires meet these requirements. Open luminaires, however, may only be operated using lamps with enclosed bulbs or low-pressure lamps. Lamps of this kind are suitably marked with pictograms on the lamp's packaging and in the lamp manufacturer's documentation. Lamps marked with pictogram No. 1 are suitable for use with open luminaires, whereas those marked with pictogram No. 2 may only be used in enclosed luminaires.

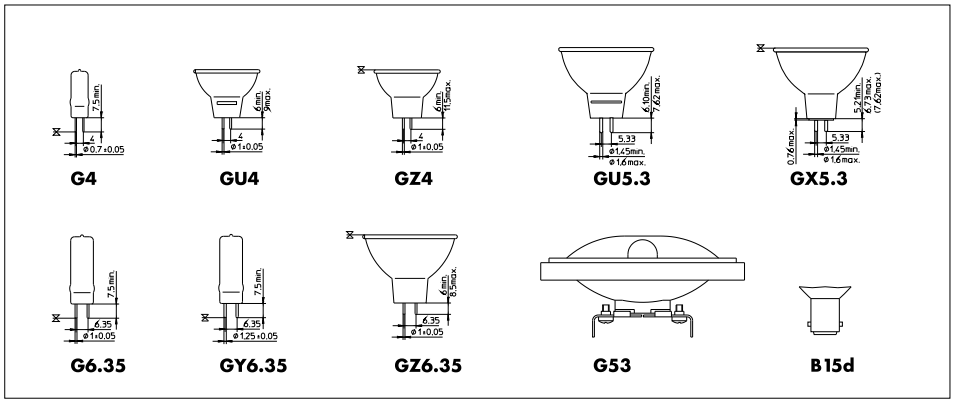
Lampholders for low-voltage halogen lamps are equipped with mounted cables or with plug-type connectors. In addition to the various lampholders contained in the catalogue, further lampholder models with various cable lengths and of various qualities as well as lampholders with plug-connected cables can be made available on request.

VS lampholders for the UL market and UL approved leads are available for all common lamp types.

Further information can be found at www.unvlt.com/products/legacy/lampholders.

1 **2**

Bases of the most widely used low-voltage halogen lamps



Lampholders for mains voltage halogen lamps

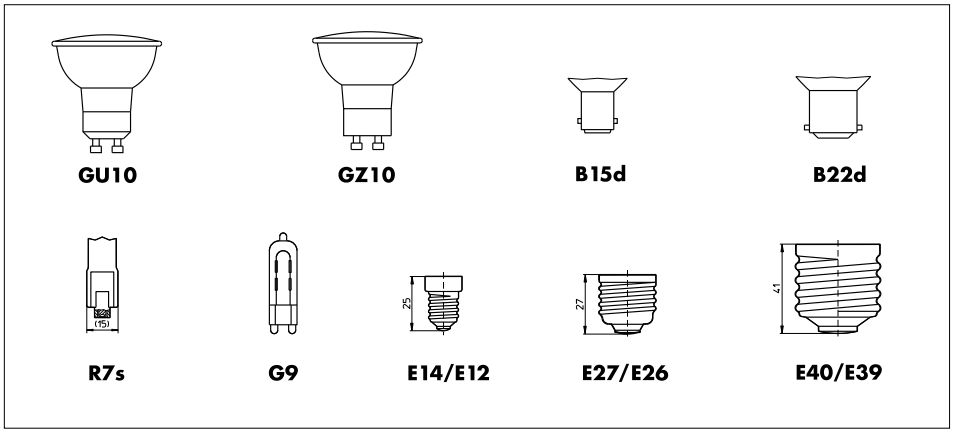
A major factor in lampholder design is the lamp temperature, which is determined by the tungstenhalogen cycle, high lamp current and high wattages. Lampholder casings can be made of ceramics, metal or the ever more popular highly heat-resistant thermoplastics like PET (polyethyleneterephthalate), PPS (polyphenylene sulphide) and LCP (liquid crystal polymer). The most suitable contact materials for these temperatures are nickel, copper-nickel alloys or copper materials with sufficiently thick nickel coatings. For tubular lamps (R7s base), the standard IEC 60061-2 7005-53 prescribes the respective contact pressure of lampholder contact materials.

Although halogen lamps offer twice the service life of general-purpose light bulbs, this can only be fully realised if luminaire manufacturers observe the recommended maximum temperatures at the lamp's pinch point. There is usually a welded-on molybdenum plate at the pinch point where the lamp base pins join the lamp filament. Lamp manufacturers ascertain the pinch temperature at this point, which is generally located within the lamp's quartz glass, using specially prepared measuring lamps. The pinch temperature is a critical thermal reference point which must not be exceeded within the luminaire.

VS lampholders for the UL market and UL approved leads are available for all common lamp types.

Further information can be found at www.unvlt.com/products/legacy/lampholders.

The bases of the most widely used mains voltage incandescent lamps



Retrofit Lamps

So-called retrofit lamps have been introduced to the market thanks to LED technology. Some of these can significantly exceed the weight of the original lamp.

When using such lamps in luminaires already introduced to the market (with conventional lampholders), but also for new luminaire designs (with conventional lampholders), this can cause a greater risk with regard to disconnecting the power supply and, in addition, can lead to greater mechanical damage.

6–80 W EMERGENCY LIGHTING MODULES

EMERGENCY LIGHTING

Emergency lighting systems spring to life any time normal artificial lighting systems fail. Emergency lighting is designed to ensure that work can continue without risk, that staff can safely leave any workplaces involving special hazards and that there is sufficient lighting to illuminate rescue paths/routes as well as to avoid panic situations.

As power cuts result in a risk to safety, legislation has been enacted in the form of the Health and Safety at Work Directive (Europe) and the Health and Safety at Work Acts of the individual European countries (e.g. Germany), all of which stipulate that emergency lighting must be provided. The requirements placed on emergency lighting installed in places of public assembly and public buildings are governed by supplementary directives and laws.

Vossloh-Schwabe's emergency lighting units are designed for use with T5, T8 and compact fluorescent lamps and can be operated with electromagnetic or electronic ballasts.

VS emergency lighting units are suitable for both continuous and standby circuits with a nominal operating period of 1 or 3 hours.

6 Emergency Lighting Modules for TC and T Lamps

Emergency Lighting Modules 6 to 80 W with Self-Diagnosis Function

EMXs – Emergency lighting modules

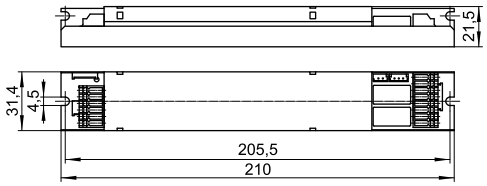
For one-, two-, three- or four-lamp operation with standard and dimmable electronic or magnetic ballasts
EB phase is switched off during emergency operation
Short circuit protection
RoHS-compliant (excluding rechargeable batteries)
5-pin technology and therefore EMC-compliant even during emergency operation
Suitable for protection class I
EN 61347-1, EN 61347-2-7
Suitable for systems in accordance with VDE 0108 or EN 50172
Not suitable for lamps with an integrated starter
Dimensions (LxWxH): 210x31.4x21.5 mm
Fixing hole distance: 205.5 mm
Nominal voltage: 230 V ±10%, 50–60 Hz
Ambient temperature t_a: 0 to 50 °C
Unit: 25 pcs.

These VS emergency lighting modules include an automatic self-diagnosis feature that performs a two-minute function test of the device, the lamp and the battery every seven days.
In addition, the operating period is tested every 12 months with subsequent battery reactivation.

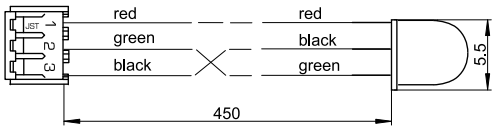
Optical status display

- Red LED, flashing intermittently: defective lamp. The status display will be reset approx. one minute after the fault has been rectified.
- White LED, not illuminated: if connected to the power supply, the LED must turn green after a maximum of five minutes. If not, the device either has no voltage supply or the emergency lighting module is defective.
- Red LED, permanently flashing: battery capacity is too low or the battery supply line has been interrupted.
- Green LED: fully functional.

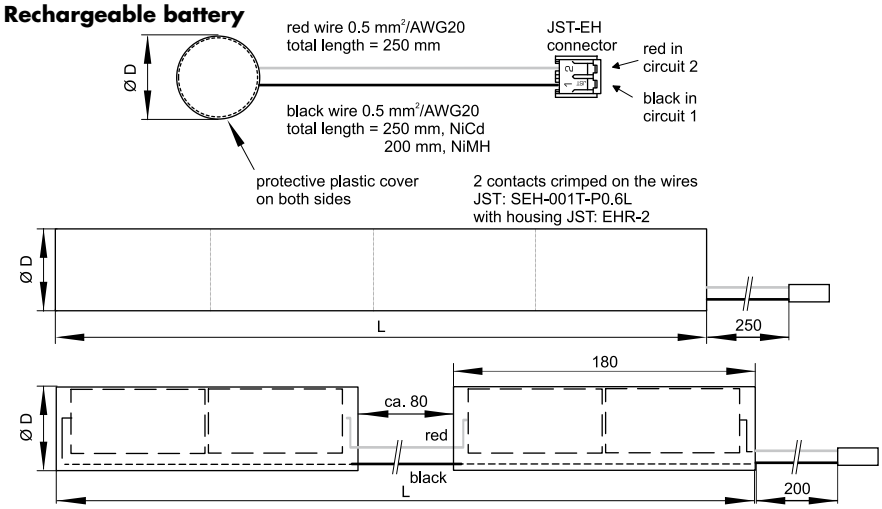
Emergency lighting module



LED



Rechargeable battery



Emergency Lighting Modules 6 to 80 W with Self-Diagnosis Function

EMXs – Emergency lighting modules

Type	**Ref. No. Module**	**Ref. No. Battery**	Nominal operating period hrs.	Rechargeable battery type	Dimensions LxD (Ø) of battery mm	Test function	Weight module g	Weight battery g
EMXs 180.000	**188792**	**188823**	1	4.8V 1.8Ah NiCd	1 / 190 x 23	automatic	160	200
EMXs 180.001	**188793**	**188824**	3	4.8V 4.5Ah NiCd	1 / 240 x 33	automatic	160	490
EMXs 180.002	**188794**	**188825**	1	4.8V 1.8Ah NiMH	1 / 200 x 17	automatic	160	140
EMXs 180.003	**188795**	**188826**	3	4.8V 4.5Ah NiMH	2 / 450 x 19	automatic	160	320

Circuit diagrams see page 224–226

Holders for Rechargeable Batteries for Emergency Lighting Modules

Material: PC (188828: PBT)
Type: Rechargeable Battery Holder

Ref. No.	For rechargeable battery type	Dimensions (mm) a	b	c	d	e	f
188827	4.8V 1.8Ah NiCd	35.0	18.0	26.3	26.7	13.0	5.5
188828	4.8V 4.5Ah NiCd	39.0	23.2	36.2	37.3	12.4	6.0
188829	4.8V 1.8Ah NiMH	22.5	15.0	22.8	22.5	8.0	4.0
188829	4.8V 4.5Ah NiMH	22.5	15.0	22.8	22.5	8.0	4.0

It is recommended to use two holders per rechargeable battery to ensure optimum hold.

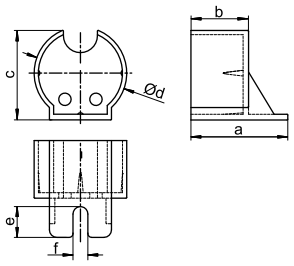


Table of suitable lamp types

Lamp type	Lamp nominal output W
T8	15, 18, 32, 36, 58, 70
T5 HE	14, 21, 28, 35
T5 HO	24, 39, 49, 54, 80
T5	6, 8, 13
T-R5 (T-R16)	22, 40, 55, 60
T-R (T29-R)	22, 32, 40
TC-L/TC-F	18, 24, 36, 40, 55, 80
TC-DEL	10, 13, 18, 26
TC-TEL	13, 18, 26, 32, 42, 57, 70
TC-SEL	7, 9, 11
TC-DD (2D)	10, 16, 21, 28, 38, 55

Luminous flux factor of lamps during emergency operation

Lamp nominal output W	Luminous flux factor* %
6	43.0
8	32.0
18	13.0
28	9.0
32	7.0
35	7.0
36	7.0
49	4.7
54	4.3
55	4.7
58	5.2
70	4.3
80	3.7

* Theoretically defined reference values at 25 °C ambient temperature

6 Emergency Lighting Modules for TC and T Lamps

Emergency lighting modules are designed for operation with 6 to 80 W, 4-pin fluorescent lamps.
Luminaires with integrated emergency lighting modules can be operated using a continuous or standby circuit.

Technical specifications	EMXs emergency lighting modules
Permissible mains voltage	230 V ±10%
Permissible mains frequency	50–60 Hz
Power consumption with standby circuit	3 W
Nominal period of operation	1 to 3 hours, depending on the type of rechargeable battery
Batteries	NiCd or NiMH
Ambient temperature	0* to 50°C
Charging time	24 hrs.
Protection class	I
Degree of protection	IP20
Certification	CENELEC
Tested in accordance with	EN 61347-2-7
Suitable for systems compliant with	VDE 0108 / EN 50172
Casing	Metal (zinc-plated)
Installation outside the luminaire	Permissible lead length between the emergency lighting module and the lamp must not exceed two metres.
Luminous flux factors during emergency operation	See the table on page 219, values apply to 25 °C ambient temperature.

* Ignition in progress; the values of the colour rendering index and the luminous flux factor may deviate.

Assembly Instructions for Emergency Lighting Modules

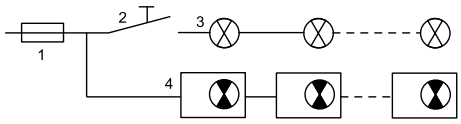
For mounting and installing of emergency lighting modules

If the emergency lighting module is integrated in the luminaire, the LED and battery have to be wired separately, i.e. not in parallel with the mains or lamp. Emergency lighting modules must be fixed in a suitable spot within the luminaire (4-mm bore holes for mounting).
In the interest of maximising battery capacity and service life, care must be taken to ensure the battery is positioned at the coolest part of the luminaire. The ambient temperature of the battery must not exceed 50 °C. Emergency lighting modules must not be mounted on surfaces that ignite, melt or undergo some other thermal change at a temperature of 60 °C. Moreover, emergency lighting modules must not be operated in explosionendangered enclosed spaces.

Electrical installation
The respective ordinances and standards valid at the place of operation must be observed for installation purposes. Emergency lighting modules and luminaires must only be installed by trained staff. Operating voltages exceed 50 V. Caution: potentially fatal hazard!

Prior to first operation of emergency luminaires, all covers must be attached. Furthermore, care must be taken to ensure that the supply voltage complies with the specifications on the type plate and the protective conductor is connected.

1. Fuse
2. Light switch
3. Room lighting
4. Emergency luminaires



Emergency luminaires must be connected to a direct phase to enable mains monitoring and ensure constant charge retention. This phase must be connected to the group fuse of the regular room luminaire. Emergency luminaires are generally delivered with uncharged batteries and must be connected to the mains for at least 48 hours to be fully functional or for approx. 10 minutes for mains operation in the case of a continuous circuit.

Additional information for optimising EMC

Information on the installation of electronic ballasts for optimising EMC

To ensure good radio interference suppression and the greatest possible operating safety, the following points should be observed when installing electronic ballasts:

- Conductors between the EB and the lamp (HF conductors) must be kept short (reduction of electromagnetic interference). High-potential lamp conductors must be kept as short as possible, in particular with tubular lamps.
  Lamp conductors of this kind are labelled with an * in the wiring diagram on the type plate.
- Mains and lamp conductors must be kept separate and if possible should not be laid in parallel to one another. The distance between HF and mains conductors should be as large as possible, ideally > 5 cm.
  (This prevents the induction of interference between the mains and lamp conductors.)
- The mains conductor within the luminaire must be kept short (to reduce the induction of interference).
- Devices must be properly earthed. EBs require secure contacts to the luminaire casing or must be earthed using a PE connection. This PE connection should be effected using an independent conductor to achieve better dissipation of the leak current. EMC improves at frequencies greater than 30 MHz.
- The mains conductor must not be laid too close to the EB or the lamp (this is especially important in the event of through-wiring).
- Mains and lamp conductors must not be crossed. Should this be impossible to avoid, conductors should be crossed at right angles to one another to avoid inducing interference between mains and HF conductors.
- Should conductors be wired through metal parts, such conductors must always be additionally shielded (e.g. with an insulating sleeve or grommet).

Maintenance

With regard to system maintenance and control, care must be taken to ensure compliance with any ordinances and standards governing emergency lighting at the place of installation. Prior to opening lamp covers, the following procedure must be observed:

1. Disconnect luminaires from the mains voltage.
2. Remove cover.
3. Disconnect battery from the emergency lighting module (disconnect the plug).

VS recommends connecting control LEDs to be visible on the outside of emergency luminaires to enable simple and regular control of emergency luminaires and emergency lighting modules.

Changing batteries

Batteries need to be replaced if the operating period of luminaires falls short of 60 minutes in the case of 1-hour operation and 180 minutes for 3-hour operation, respectively. Emergency lighting modules have a status display for this purpose.
Spent batteries must be replaced with the manufacturer's original batteries only. Furthermore, the polarity of the batteries must be strictly observed. The battery supply lines of the emergency lighting module are marked as follows:
red = **+**; black = **–**

Emergency lighting module display

Normal operation is indicated by a green LED. During emergency operation or for as long as the battery remains fully discharged, the LED is off (i.e. does not glow). The LED will flash red if the battery is missing or not properly connected.

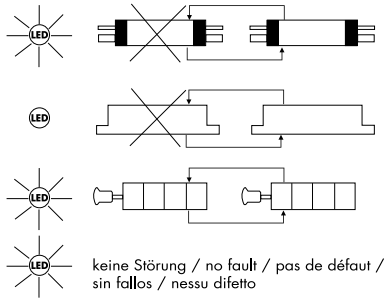
Automatic test of emergency lighting modules

In the case of emergency luminaires with emergency lighting modules, the operational readiness of the device, the lamp and the battery is tested automatically every seven days. In addition, battery capacity is measured during a simulated loss of mains power every 12 months.

The first capacity test will be carried out seven days following initial installation or any repair work. The LED must be checked after the first self-test. A green LED indicates all is in working order, any other display indicates a problem.

The device features a two-colour LED display to indicate that the emergency luminaire is ready for use.

Optical status display



Emergency luminaires merely require regular visual inspection of the status display (LED) and the luminaire itself.

Red LED, flashing intermittently	During initial operation, a lamp recognition test is first carried out. Prior to and during this test, the LED will be red and flash intermittently.
White LED, not illuminated	If connected to mains power, the LED must turn green after a maximum of five minutes. If not, the device has no mains voltage or the emergency lighting module is defective.
Red LED, continuous flashing	Battery capacity is too low or the battery supply line has been interrupted. The warning light will go off again as soon as the problem has been rectified.
Green LED	Fully functional.

Notes

Vossloh-Schwabe accepts no liability for any direct, indirect or incidental damage caused by putting a device to any improper use, i.e. any use not expressly permitted by VS. Similarly, Vossloh-Schwabe accepts no liability for third-party claims arising from putting a device to any improper use, i.e. any use not expressly permitted by VS. Emergency lighting modules must not be opened or modified in any way. The components of emergency lighting modules must be replaced with original parts only.

Should emergency lighting modules be damaged in a way that suggests it cannot be operated safely, the luminaires or emergency lighting modules, respectively, must not be operated. VS reserves the right to make changes to diagrams, weights, tables of dimensions or other such details included in the catalogue or instructions for use without prior notice if such changes prove to be necessary or are made as a result of technological progress. VS emergency lighting modules are patent protected.

Any act of producing counterfeit VS products will be prosecuted according to criminal and civil law.

Caution! Emergency lighting modules from VS must not be operated with amalgam lamps.

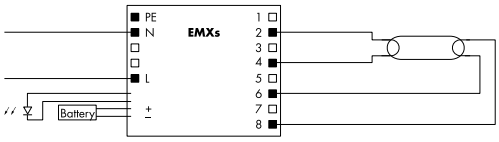
Circuit Diagrams

For VS emergency lighting modules

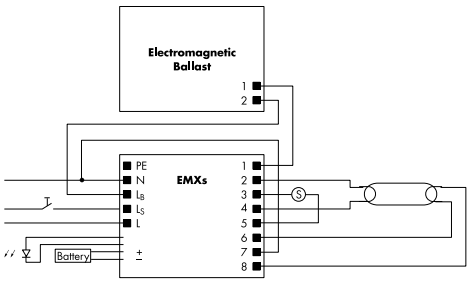
Notes for wiring:

- The distance between mains lead and lead 8 should be as large as possible
- Leads 2/4/6/8 must be kept short

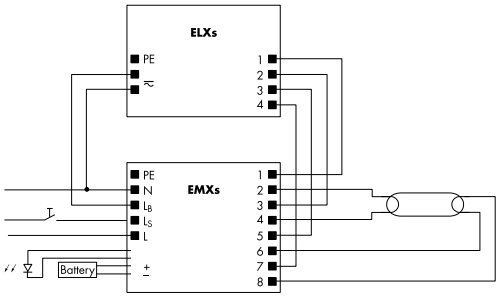
Circuit diagrams – 1-lamp operation



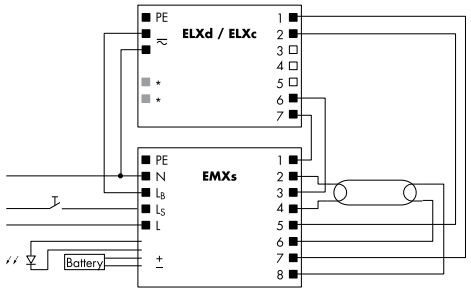
1-lamp operation
without electronic or electromagnetic ballast (continuous circuits)



1-lamp operation
with electromagnetic ballast

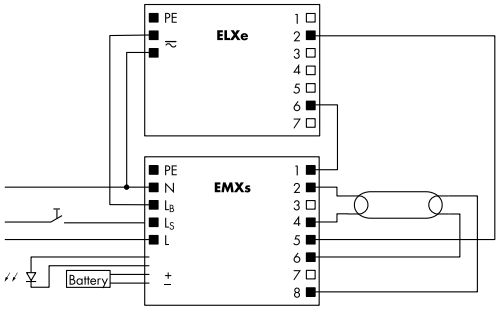


1-lamp operation – Warm start
with electronic ballast ELXs



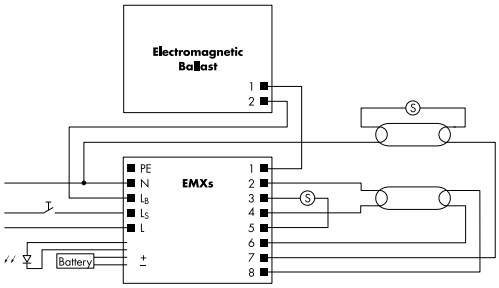
*nur bei dimmbaren Vorschaltgeräten/only with dimmable ballasts/juste avec ballasts graduables/solo con alimentatori dimmerabili/sólo con reactancia regulable

1-lamp operation – Dimming / Warm start
with electronic ballast ELXd / ELXc

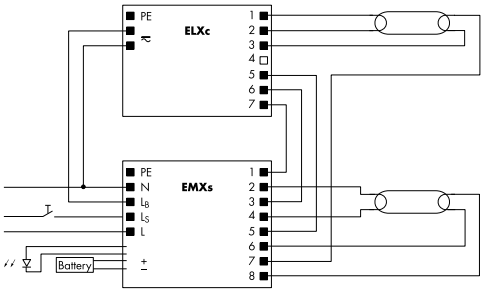


1-lamp operation – Instant start
with electronic ballast ELXe

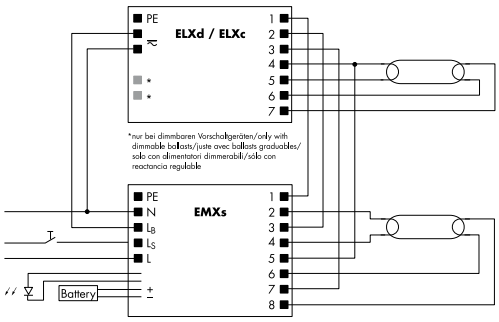
Circuit diagrams – 2-lamp operation



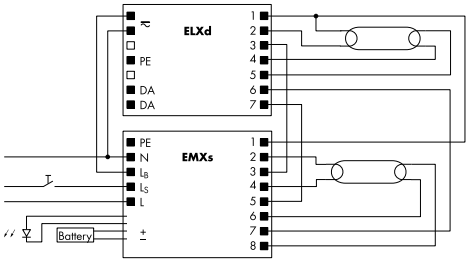
2-lamp operation
with electromagnetic ballast



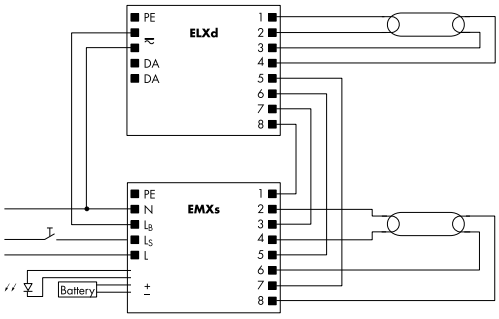
2-lamp operation – Warm start
with electronic ballast ELXc



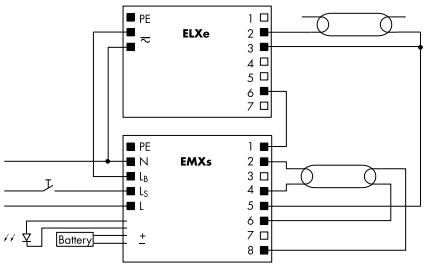
2-lamp operation – Dimming / Warm start
with electronic ballast ELXd / ELXc



2-lamp operation – Dimming
with electronic ballast ELXd

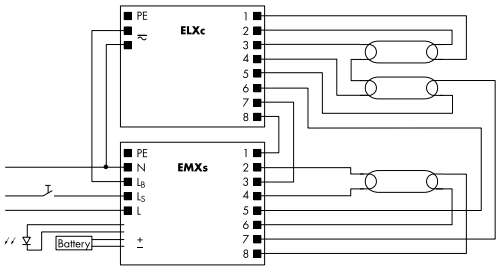


2-lamp operation – Dimming
with electronic ballast ELXd

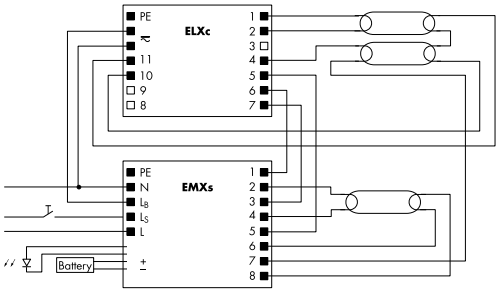


2-lamp operation – Instant start
with electronic ballast ELXe

Circuit diagrams – 3-lamp operation

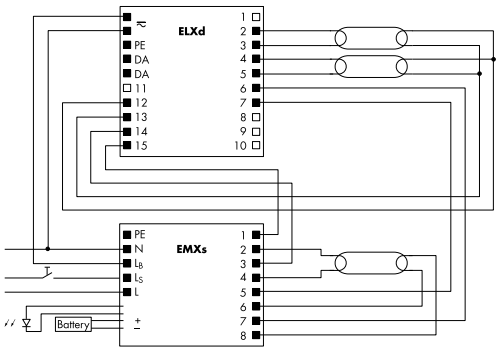


3-lamp operation – Warm start
with electronic ballast ELXc

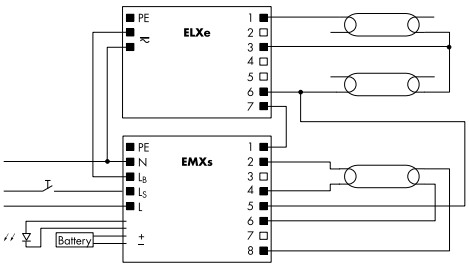


3-lamp operation – Warm start
with electronic ballast ELXc

Circuit diagrams – 3-lamp operation

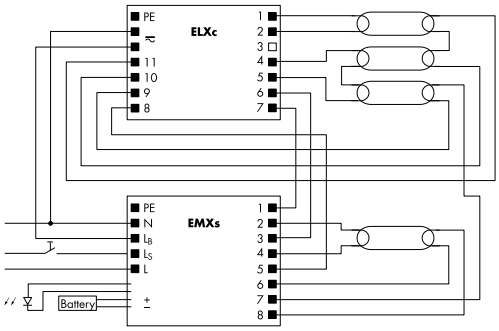


3-lamp operation – Dimming
with electronic ballast ELXd

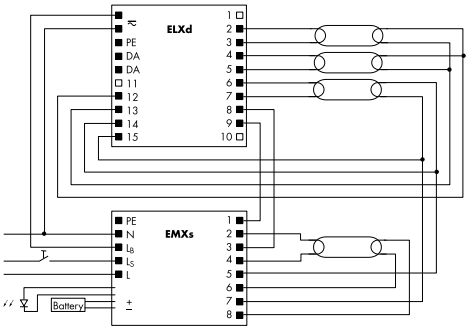


3-lamp operation – Instant start
with electronic ballast ELXe

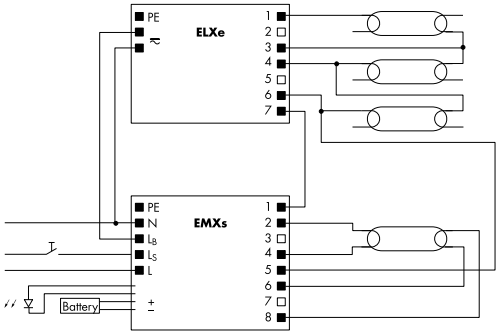
Circuit diagrams – 4-lamp operation



4-lamp operation – Warm start
with electronic ballast ELXc



4-lamp operation – Dimming
with electronic ballast ELXd



4-lamp operation – Instant start
with electronic ballast ELXe

7 General Technical Details

Product development and product certification

The increasingly converging world and the global markets that are being created are both placing new design demands on the sector and its technologies. Against this background, standardisation – both on a regional and international scale – is becoming more and more important in positioning new technologies and innovations on the market. Standardisation ensures the necessary degree of safety, reliability, exchangeability and cost-effectiveness.

Vossloh-Schwabe products have been developed and produced on the basis of technical innovations, internationally and regionally applicable standards and valid environmental regulations for more than 90 years. In this respect, we already take account of integrated components and materials, production methods and technologies, comprehensive environmental aspects as well as a product's energy efficiency during the development phase. An important entrepreneurial goal in all these years has been and continues to be to create lighting components that satisfy the requirements of our customers with regard to safety, function, longevity and cost-effectiveness.

In addition to observing valid, state-of-the-art standards, we also take consideration of the recommendations of industrial associations when developing new products.

Our cooperation in national and international committees ensures we receive early information about new or changed regulations and thus helps to guarantee future-orientated products.

In addition to undergoing internal production approval tests, mass-produced devices are also submitted to national and international testing institutes for certification. The applicable testing and assessment regulations of the testing institutes are subject to international variation. The marks of conformity shown here are therefore not valid for all the products featured in the catalogue. You will find an overview of the approval marks for the products presented in the catalogue from page 240 on. On request, we will gladly provide information about all of the existing approvals.

As the international IEC (International Electrotechnical Commission) standards for lighting technology are also adopted by the European Institute for Standardisation CENELEC (Comité Européen de Normalisation Electrotechnique), the European standards (EN) therefore contain the same requirements. In rare cases, national deviations are permitted. The certification (third-party testing) of VS catalogue products in accordance with EN standards is documented by the ENEC mark.

The ENEC mark (European Norms of Electrical Certification) was created in Europe as a uniform certification mark for electrotechnical products. The ENEC Agreement currently governs the following product groups:

- luminaires
- luminaire components
- energy-saving lamps
- IT equipment
- connection terminals, clips
- capacitors
- couplers
- switches for household appliances
- noise filters
- safety transformers
- tools
- consumer electronic
- batteries
- domestic appliance mobile tools
- IT products

There are plans to include further electrical equipment in the ENEC Agreement.

The certification of products is also expanded to include non-European manufacturers. However, certification testing for lighting equipment must be carried out by an ENEC testing institute in Europe.

At present, a total of 25 testing houses in 22 countries are signatories of the ENEC agreement (see table). Obtaining an ENEC mark for luminaire components like ballasts and ignitors also includes having the product assessed in accordance with the standards governing safety and function. Certification must be based on the EN standards listed in the Agreement.The mark documents that the product not only complies with the applicable standards, but also that ongoing production is monitored by inspectors from a testing institute and that the manufacturer operates an effective quality assurance system in accordance with the ISO 9000 standard suite (International Standards Organisation). ISO deals with the standardisation of non-electrotechnical products.

The ENEC mark is displayed with the identification number and often the logo of the testing institute, as follows:

Identification No.	Testing Institute	Identification No.	Testing Institute
01	AENOR – Spain	16	SGS Fimko – Finland
02	SGS – Belgium	17	NEMKO – Norway
03	IMQ – Italy	18	TRI MEEI – Hungary
04	CERTIF – Portugal	19	ITCL – United Kingdom
05	DEKRA – Netherlands	21	EZÚ – Czech Republic
08	LCIE – France	22	SIQ – Slovenia
09	MIR-TEC – Greece	23	TSE – Turkey
10	VDE – Germany	24	TRLPTÜV – Germany
11	ÖVE – Austria	25	TÜV SÜD PS – Germany
12	BSI – United Kingdom	28	SEP – BBJ – Poland
13	Electrosuisse – Switzerland	30	PREDOM – OBR – Poland
14	Intertek SEMKO – Sweden		EVPU – Slovakia
15	UL Int'l DEMKO – Denmark		

Apart from a product's safety and performance certification, a further useful selection aid is to have a product's electromagnetic compatibility (EMC) tested by an independent test institute, particularly in the case of electronic ballasts. If the product passes the EMC test, an additional test mark is awarded, for instance the VDE EMC mark of the VDE test and certification institute in Offenbach. The EMC certifications for control gears are helpful for the EMC luminaire certification and could reduce time and cost for the luminaire certification.

CE mark

EC Directives form the basis for a common European domestic market without any trade restrictions. Any products that are destined for the European market have to meet the requirements of all directives that apply to the product in question. Compliance with the directives is documented by the CE mark on the product or in the technical documents.

CE

This CE mark is therefore not a mark of compliance with standards (test certificate) of a testing institute, like the ENEC mark is, and can therefore not be issued by a testing institute. The CE mark must be printed on the product, the packaging or both and is not directed at the consumer, but at supervisory authorities.

The following table contains a list of key EC Directives governing lighting:

2019/2020/EC	Regulation setting ecodesign requirements for light sources and separate operating gears pursuant to Directive 2009/125/EC of the European Parliament and of the Council and repealing Commission Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2012
2019/2015/EC	Delegated Regulation supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of light sources and repealing Commission Delegated Regulation (EC) No 874/2012
2017/1369/EC	Regulation establishing a framework for energy labelling and repealing Directive 2010/30/EC
2015/1428/EC	Directive dated 25 August 2015 that amends Directive (EC) No. 244/2009 of the Commission with regard to laying down requirements for the eco-friendly design of households lamps with unbundled light and Directive (EC) No. 245/2009 of the Commission with regard to laying down requirements for the eco-friendly design of fluorescent lamps without a built-in ballast, high-pressure discharge lamps as well as ballasts and luminaires for their operation and for annulling Directive 2000/55/EC of the European Parliament and the Committee and Directive (EU) No. 1194/2012 of the Commission with regard to the eco-friendly design of lamps with bundled light, LED lamps and associated devices.
2015/863/EC	Commission Delegated Directive (Eu) 2015/863 of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances
2014/53/EC	Requirements for radio equipment (luminaires with built-in transmitters) dated 16 April 2014 governing the harmonisation of legal regulations on retailing radio equipment on the market and to render Directive 1999/5/EC invalid.
2014/35/EC	Electrical equipment designed for use within certain voltage limits (Low Voltage Directive); valid from 20.04.2016
2014/30/EC	Directive on the harmonisation of the laws of the Member States relating to electromagnetic compatibility; national laws had to take effect by 20.01.2007. Applicable to new products since 20.07.2007. (EMC Directive); valid from 20.04.2016
2012/19/EC	Directive governing the recycling of used electric and electronic devices (WEEE Directive)
2012/27/EC	Energy efficiency directive that amends Directives 2009/125/EC as well as 2010/30/EU and renders Directives 2004/8/EC and 2006/32/EC invalid
874/2012/EC	Energy labelling of electrical lamps and luminaires
2011/65/EC	Restrictions governing the use of certain hazardous substances in electrical and electronic devices. On 3 January 2015, the 2011/65/EU (RoHS 2) Directive superseded the previous 2002/95/EC (RoHS 1) Directive. Both directives are unofficially shortened to RoHS (Restriction of Hazardous Substances).
347/2010/EC	Ecodesign requirements for fluorescent lamps without an integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps
2010/31/EC	Directive governing the total energy efficiency of buildings
859/2009/EC	Ecodesign requirements on ultraviolet radiation of non-directional household lamps
2009/125/EC	Setting of ecodesign requirements for energy-related products (ErP). This directive supersedes directive 2005/32/EC. The new directive was extended and now includes all energy-consuming products.
1907/2006/EC	Specifications governing the registration, evaluation, authorisation and description of chemicals: REACH (**R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emical Substances) plus amending regulations; e.g. 348/2013/EC, latest amendment of the REACH regulation
2006/95/EC	Electrical equipment designed for use within certain voltage limits (Low Voltage Directive); valid till 19.04.2016
2006/32/EC	Energy end-use efficiency and energy services – ES Directive (Energy Service); national laws must take effect by 17.05.2008.
2006/25/EC	Directive on the minimum health and safety requirements regarding the exposure of workers arising from physical agents (artificial optical radiation)
2005/32/EC	Eco-design requirements for energy-using products – EuP directive (Energy using Products).
2005/20/EC	Directive regarding packaging
2004/108/EC	Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility; national laws had to take effect by 20.01.2007. Applicable to new products since 20.07.2007. (EMC Directive); valid till 19.04.2016
2004/40/EC	Directive on the minimum health and safety requirements regarding the exposure to the risks arising from physical agents (electromagnetic fields)
2004/12/EC	Directive on packaging
2003/66/EC	Directive on energy labelling of household electrical refrigerators, freezers and lamps
2002/96/EC	Old electrical and electronic devices; effective since 13.08.2005; does not fall under the CE mark directive
2002/91/EC	Total energy efficiency of buildings; effective since 04.01.2006; does not fall under the CE mark directive
2001/95/EC	Directive on general product safety
1999/05/EC	Requirements for radio-controlled systems and telecommunications equipment as well as reciprocal acknowledgement of their conformity (R&TTE = Radio Equipment and Telecommunications Terminal Equipment) dated 9 March 1999. Also applies to luminaires with built-in transmitters.
1998/11/EC	Energy rating of household lamps; effective since 14.06.1999
1994/62/EC	Directive on packaging
93/68/EWC	CE marking directive

Manufacturers are obliged to keep conformity declarations as well as test and production documentation ready for presentation.

The documents must be retained for a period of 10 years after the product was last marketed.

Vossloh-Schwabe operating devices all bear the CE mark; the respective conformity declaration and production documentation are available for inspection. As a consequence, all luminaires that are equipped with properly installed VS components and for which the assembly instructions were observed meet the legal requirements.

Climate and environmental protection

The European Union adopted a number of EU Directives that are designed to reduce the CO_2 output. Essentially, these objectives can be grouped into three categories:

- requirements placed on new products,
- requirements placed on buildings and
- revision of existing installations.

The requirements placed on new products are governed by the **ErP framework directive** (**E**nergy-**r**elated **P**roducts) together with the so-called implementation directives, which envisage the setting of special energy requirements for lamps (minimum lm/W requirements), operating devices (minimum efficiency ratings) and luminaires (minimum energy efficiency requirements) for all lighting technologies.
The directive on energy efficiency requirements regarding ballasts for fluorescent lamps is integrated into the implementation directives.

The requirements for buildings (**EPBD: E**nergy **P**erformance of **B**uil**d**ings) are specify targets for the maximum permissible primary output of lighting. In so doing, a calculation method is employed that will stipulate the permissible maximum electrical output values of the lighting system using a reference procedure.

With regard to the revision of existing installations the EU member states are called upon to set up national action plans (**Energy Service Directive**) that show which measures can be used to achieve the targeted CO_2 reductions.

In addition to the climate protection requirements, a number of directives were also produced to cover waste reduction and recycling, specifically the **WEEE** (**W**aste of **E**lectrical and **E**lectronic **E**quipment) and **RoHS** (**R**estriction of the use of certain **H**azardous **S**ubstances) directives. These directives regulate the disposal and reduction of waste and the use of hazardous substances.

As a result of the REACH system (**R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emical Substances) only registered chemical substances can now be brought onto the market. The principle is: no data, no market.

As operating devices and lampholders are constituent parts of luminaires, these components are to be disposed of along with the luminaire; separate disposal is not provided for.

Protection classes of luminaires and operating devices

The electric shock protection that luminaires and control gears are fitted with provides dual protection, which prevents any danger in the event of a technical defect. With regard to safety, the simultaneous occurrence of two errors can be taken into account in certain circumstances, e.g. given a street luminaire with two lamp casings, one of which is used to house the ballast that operates the lamp. This also applies to low-voltage LED lighting systems.

Luminaires and operating devices of **protection class I** provide protection against electrical shock solely using the base insulation and the safe connection of all exposed conductive parts to an earth conductor. Thus, should the base insulation fail, no exposed conductive parts can become live.

Luminaires and operating devices of **protection class II** provide protection against electrical shock using both the base insulation and an additional or reinforced insulation. Protection class II products do not feature a connection to a protective earth conductor. The mounting conditions do not ensure any additional degree of protection, either.

In special cases with Protection Class II luminaires, it can be permissible to connect a protective conductor or a function protection conductor, as follows:

- **for EMC reasons** – in such cases, it can be necessary to connect a function protection conductor to remain within EMC limiting values. The component manufacturer's specifications regarding the individual operating devices must be observed during the construction of the luminaire. If an operating device is marked as containing a function protection conductor, the creepage and air clearance distances of the operating device connection must comply with the requirements of protection class II (reinforced or additional insulation);

- **as an ignition aid for lamps** – connecting a function protection conductor can be necessary as a capacitive ignition aid for lamps. In such cases the creepage and air clearance distances around the ignition aid within the luminaire and the function protection conductor connection terminal have to comply with the requirements of protection class II (reinforced or additional insulation). The ignition behaviour of a lamp should be agreed with the manufacturer in these cases;

- **when wiring the protective conductor** from the luminaire to another device. This is an installation point of the protective conductor and creepage and air clearances must comply with the respective requirements laid down in the luminaire standard as well as any requirements regarding reinforced or additional insulation.
  Functional earth connections of control gear or Protection Class II luminaires must always feature double or reinforced insulation since no technical safety requirements exist for functional earth.

Connection terminal
for the protective
earth conductor
Protection class I

Connection of the function
protection conductor
(will drop in future)

General symbol for
an earth connection

Protection class II

Operating devices with double or reinforced insulation for installation in protection class II luminaires

Protection class II specifications have to be met by the luminaire along with its installed operating device. Both protection class I and class II ballasts can be installed. The design of the luminaire must be adapted to suit. This means that if a protection class I ballast is installed in a protection class II luminaire, the design of the luminaire has to be correspondingly sophisticated to ensure the creepage and air clearance distances can be met. On the other hand, using a protection class II ballast, only available as an independent ballast nowadays, will in most cases result in a need for too much technical effort and thus in high costs. Against this background, the standards contain special requirements for ballasts destined for installation in protection class II luminaires.

These "**double or reinforced insulation ballasts**" and respective protection class II lampholders permit technically and cost-effective construction of protection class II luminaires.

Ballasts with double or
reinforced insulation

Protection class III

Protection class III luminaires provide protection against electrical shock by using Safety Extra Low Voltage (SELV). Luminaires of protection class III are not permitted to generate higher voltages than the Safety Extra Low Voltage (SELV).

The following table, which has been taken from the luminaire standard EN 60598-1, provides an overview of the insulation coordination between the various types of built-in electronic ballasts and the types of insulation found in luminaires.

Operating gear		**Necessary insulation between active parts and exposed conductive parts**		
Insulation between LV supply and the secondary circuit	Output voltage	Protection class I Insulation of exposed, earthed and conductive parts	Protection class II Insulation of an exposed, conductive part or more as one with potential equalisation	Protection class II Insulation of more than one exposed, conductive part without potential equalisation
None	$U_{OUT} > LV_{Supply}$	Basic insulation suitable for U_{OUT}	Double or reinforced insulation suitable for U_{OUT}	Double or reinforced insulation suitable for U_{OUT}
	$U_{OUT} \leq LV_{Supply}$	Basic insulation suitable for U_{OUT}	Double or reinforced insulation suitable for U_{OUT}	Double or reinforced insulation suitable for LV_{Supply}
Basic	Voltage > ELV	Basic insulation suitable for U_{OUT}	Additional insulation suitable for U_{OUT} plus LV_{Supply}	Insulation must satisfy the higher requirement of a) or b) a) Additional insulation suitable for U_{OUT} plus LV_{Supply} b) Double or reinforced insulation suitable for U_{OUT}
	ELV (FELV)	Basic insulation suitable for U_{OUT}	Additional insulation suitable for U_{OUT} plus LV_{Supply}	Additional insulation suitable for U_{OUT} plus LV_{Supply}
Double or reinforced	Voltage > ELV	Basic insulation suitable for U_{OUT}	Basic insulation suitable for U_{OUT}	Double or reinforced insulation suitable for U_{OUT}
	ELV (SELV)	Basic insulation suitable for U_{OUT}	Basic insulation suitable for U_{OUT}	Basic insulation suitable for U_{OUT}
		also see requirement of IEC 60598-1, sections 8, 10 and 11		

Protection classes of luminaires and operating devices

IEC 60529 (EN 60529) defines protection classes for enclosures of casings. The IP Code (International Protection Code) describes the level of protection provided against accidental contact and penetration by foreign bodies as well as protection against water. The first number stands for protection against foreign bodies, the second stands for protection against water. These specifications are important with particular regard to built-in or mounted luminaires as the provisions governing protection against accidental contact provide the basis for the insulation system for components and conductors (also see luminaire standard EN 60598-1).

To comply with the IP requirements, the installation instructions supplied by the luminaire and/or operating device manufacturer(s) must be observed.

Number	1st Number		2nd Number
	Protection against contact	Protection against foreign bodies	Protection against water
0	No protection	No protection	No protection
1	Protected against contact with the back of the hand	Protected against solid foreign bodies Ø ≥ 50 mm	Protected against vertically dripping water
2	Protected against finger contact	Protected against solid foreign bodies Ø ≥ 12 mm	Protected against diagonally dripping water (angle of 15° from above)
3	Protected against contact with tools	Protected against solid foreign bodies Ø ≥ 2.5 mm	Protected against diagonal water spray up to an angle of 60° from above
4	Protected against contact with wire	Protected against solid foreign bodies Ø ≥ 1 mm	Protected against water splashes from any direction
5	Protected against contact with wire	Protected against dust	Protected against jets of water
6	Protected against contact with wire	Dust-tight	Protected against strong jets of water
7	–	–	Protected against temporary immersion in water
8	–	–	Protected against permanent submersion in water. Specific testing conditions must be agreed, especially with regard to high-pressure cleaning equipment.
9	–	–	For high-pressure cleaning IPx9 in accordance with DIN 4005

If any components like ballasts or conductors of built-in or mounted luminaires (e.g. wall-mounted luminaires) are accessible to accidental contact, they must comply with the requirements of the two safety levels stipulated for these components. Luminaire construction must be in line with these conditions, which can mean that, for instance, conductors have to feature additional or reinforced insulation.

For lampholders the compliance with the two safety levels is proved by conducting a special voltage test.

European standard EN 50102 "Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)" introduces an IK code, analogous to the IP degree of protection of electrical control gear, that was also adopted as a national standard in France, e.g. with the French standard NF EN 50102. Testing is carried out using a pendulum hammer that, in accordance with the IK code, must be dropped from a certain height with respective weights attached to exert the specified impact energy. The table details impact energy values for luminaires (IK00 to IK10).

IK Code	Energy Nm or Joule	IK Code	Energy Nm or Joule
IK00	0.0	IK06	1
IK01	0.14	IK07	2
IK02	0.2	IK08	5
IK03	0.35	IK09	10
IK04	0.5	IK10	20
IK05	0.7		

Selection of components, materials and dimensions

The documentation provided by Vossloh-Schwabe is carefully researched. Technical advice is given to the best of our knowledge. The details on the product or the type plate are binding in every case.

Any manipulation of VS products or product packaging is illegal and violates registered trademark rights. Manipulations can negatively influence or destroy technical properties and can possibly result in secondary damage. Vossloh-Schwabe does not accept any liability for manipulated products and cannot be held responsible for any secondary damage.

Manufacturers of luminaires and lighting systems remain responsible for the selection of suitable luminaire components, e.g. operating devices and lampholders, and component materials just as for their safe and correct installation in line with luminaire and system set-up regulations.

Particular attention should be paid to the following:
- temperature measurements and temperature limits
- compliance with creepage and air clearance distances and insulation thicknesses
- selection of components to suit their operating conditions and degree of strain (e.g. voltage, current, mechanical loading, UV radiation)
- protection against contact and safe protective earth conductor connections
- resistance to corrosion

The product drawings without tolerances are contained in this catalogue only feature nominal dimensions. For space and simplicity reasons, the full dimensions and particularly the associated tolerances cannot be shown. For detailed information resp. details of luminaire design, please request our in-depth dimensional assembly drawings.

All VS products comply with the relevant standards and are developed and produced using the latest technological expertise.

To ensure safe luminaire production we do not recommend reusing dismantled lampholders.

Impulse voltage categories for lampholders

Lampholder	Standard	Impulse voltage category
E14: 250 V / 2 A	IEC 60238 / VDE 0616-1	2
E27: 250/500 V / 4 A		2
E40		2
Starters: 250 V / 2 A	IEC 60400 / VDE 0616-3	2
Fluorescent lamps 250 V / 500 V / 2 A	IEC 60400 / VDE 0616-3	2
Halogen lamps and other lamps	IEC 60838-1 / VDE 0616-5	2
Bayonet fitting	IEC 61184 / VDE 0616-2	2

Torques for screws

With regard to lampholders secured with screws, we recommend using a torque of around 80% of the value stipulated in DIN EN 60598-1

Nominal diameter of the screw's outside thread mm	Torque (Nm) for screws with a head in acc. with DIN EN 60598-1
to 2.8	0.40
< 2.8 to 3.0	0.50
< 3.0 to 3.2	0.60
< 3.2 to 3.5	0.80
< 3.6 to 4.1	1.20
< 4.1 to 4.7	1.80
< 4.7 to 5.3	2.00
< 5.3 to 6.0	2.50

A	**A type, B type capacitors**	The requirements of the safety standard for capacitors differentiates between capacitor types; A type capacitors stand for plastic can capacitors; B type capacitors stand for aluminium can capacitors.
	Analogue interface 1–10 V	Bipolar interface of dimmable operating devices with a built-in constant current source.
	Average service life	Specified service life of electronic operating devices with a failure rate per unit of time.
B	**Ballast**	Device that is connected in between the voltage supply and one or more discharge lamps and serves the purpose of igniting the lamps and limiting lamp current during operation.
	Ballast-Lumen Factor (luminous flux factor of a ballast)	The ratio of luminous flux emitted by a reference lamp when operated with a particular production ballast to the luminous flux emitted by the same lamp when operated with its reference ballast.
C	**Capacitive circuit (series compensation)**	Circuit of an inductive ballast with a capacitor connected in series.
	CE Mark	European regulation governing all products that are introduced to the market. Products must comply with the respective EC directives.
	CELMA	Association of European component and luminaire manufacturers (Committee of E.E.C. Luminaires Components Manufacturers Associations).
	CENELEC	European committee for electronic standardisation (Comité Européen de Normalisation Electrotechnique).
	CISPR	International special commission for radio interference (Comité International Spécial des Perturbations Radioélectriques).
	Colour rendering index (CRI) R_a	Index to determine the degree of deviation from a viewed body colour (with 8 standardised test colours) under a given type of lighting. R_a = 100 denotes a light source that causes no distortion of any colour. Lower R_a values denote light sources with less positive colour rendition properties.
	Compensated circuit (parallel compensation)	Circuit of an inductive ballast with a capacitor between phase and neutral conductor.
	Compensation capacitors	The power factor can be increased to a value of 0.9–0.98 by using compensation capacitors.
	Conformity declaration	Documentation for an operating device or a luminaire regarding compliance with European directives; this documentation is for submission to national supervisory authorities (e.g. regulation authority for telecommunications and post (Reg. TP) or trade supervisory authorities).
	Convertors	Electronic convertor (electronic conversion of mains voltage in extra-low voltage) to generate operating voltage for low-voltage halogen lamps.
	Creepage and air clearance distances	Regulation minimum distances between voltage-carrying components of different polarity or between voltage-carrying components and the accessible casing surfaces (air clearance: shortest distance through air; creepage distance: shortest distance across a surface).
	Cross discharge	Discharge in the lamp electrode region during preheating.
D	**DALI**	Digital interface for controlling dimmable electronic operating devices (Digital Addressable Lighting Interface).
	Δt	Increase in the winding temperature during the operation of a ballast (the ballast is mounted on 75 mm high wooden blocks and its temperature is measured at an ambient temperature of 25 °C).
	Δt_{an}	Temperature increase during short-circuit operation (e.g. defective starter, defective lamp).
	DIAL	German institute for applied lighting technology (Deutsches Institut für Angewandte Lichttechnik), Lüdenscheid, Germany.
	DiiA	The Digital Illumination Interface Alliance (DiiA) is an open, global consortium of lighting companies. DiiA aims to grow the market for lighting-control solutions based on digital addressable lighting interface (DALI) technology.
	DKE	German electrotechnical commission of the DIN and VDE.
	Driver	Name commonly given to ballasts used for operating LED modules.
E	**EC directives**	Regulations (laws) of the European Community that have to be transposed into national laws within a prescribed period of time.
	Efficiency	Ratio of power output in relation to power input.
	ELC	European Lamp Companies Federation
	EMC	Electromagnetic compatibility
	EMF	Electromagnetic fields
	ENEC agreement	Agreement between the European testing institutes for issuing the European test mark.
	ENEC mark	Marking for a device that complies with the European standards and that was tested by a testing institute that is a part of the ENEC agreement (European Norms of Electrical Certification).
	Energy classification EEI	CELMA system to determine energy classes for ballasts for fluorescent lamps (Energy Efficency Index).
	Error current	Current that is caused by a fault in the insulation of a device or via creepage or air clearance distances.
	Error current protection switch	Evaluates the magnitude of the error current and switches the circuit off if a predefined maximum value is reached.
F	**Feed-through of mains voltage**	The possibility of connecting two lamps to a single terminal so that an electrical connection can be made to another device.
	FELV	Functional extra-low voltage without adequate protection from accidental contact with higher voltages in other parts of the same circuit.
	FEP capacitors	Flame- and explosion-proof capacitors with a contact breaker.
	FGL	Promotion Society for Good Lighting (Fördergemeinschaft Gutes Licht – ZVEI).
	Function protection conductor	It may be necessary to connect a "function protection conductor" to ensure compliance with the EMC requirements or as a starting aid for lamps; VS operating devices are suitably marked.

I	**IDC terminal (ALF terminal)**	IDC-type connection terminal (Insulation Displacement Connection) for automatic luminaire fabrication (ALF terminal).
	IEC	International Electrotechnical Commission
	ILCOS lamp designation system	International IEC marking system for lamps.
	Illuminance Ev	Illuminance (Ev) is the total luminous flux (Φ) incident on a horizontal, vertical or angled illuminated surface (per unit area). The unit is lux [lx=lm/m²], with luminous flux in [lm] and area in [m²]. Illuminance Ev forms the basis for all lighting calculations and designs.
	Impedance	Impedance is a conductor's apparent resistance to an alternating current.
	IMQ	Italian institute for quality marking; at the same time, the mark of conformity with standards (Istituto Italiano del Marchio di Qualitá).
	Independent lamp operation	Possibility of operating a single lamp with a multi-lamp operating device after the other lamps have failed.
	Independent operating device	Operating device that does not have to be installed in a casing; the safety regulations are fulfilled by the operating device itself.
	Inductance	Inductance establishes the connection between the current and the magnetic flux caused by it in a conductor arrangement after taking account of all design and material fluctuations.
	Inductive circuit	Operation of a fluorescent lamp with a ballast without a capacitor.
	Interference	Interference signals emitted by operating devices via the mains voltage or the air.
	Interference immunity	Property of an operating device to remain fully functional despite interference emitted by other operating devices.
	IP numbers	Code system for marking the protection level of an operating device or a luminaire against moisture or foreign bodies entering (the first figure stands for foreign bodies and the second for moisture).
	IPP technology	Generating the ignition voltage required for high-pressure lamps using the special intelligent pulse pause technology.
L	**LBS lamp designation System**	Marking system for lamps, established for Europe.
	Leak current	Current of an operating device or a luminaire that is discharged via the potential compensation conductor (earth conductor).
	LED (light emitting diode)	Solid state device embodying a p-n junction, emtting optical radiation when excited by an electric current.
	LED light engine	Functional unit consisting of an LED module and control gear. The LED light module and the control gear can be used separately in two different casings or combined as a single unit.
	LED module	Unit supplied as a light source. In addition to one or more LED's it may contain other components, e.g. optical, electrical, mechanical and/or electronic.
	Light colour	Perceived colour of the light radiated by a lamp.
	LightingEurope	An industry association consisting of European lamp, component and luminaire manufacturers as well as national lighting associations in Europe. LightingEurope is the successor organisation of CELMA and ELC (European Lamp Companies). LightingEurope represents the interests of the European lighting industry.
	Light intensity distribution curve	Represents the spatial distribution of the light intensity of light sources.
	LiTG	German Association for Lighting Technology (Deutsche Lichttechnische Gesellschaft)
	Luminance L	Luminance L is the luminous intensity density of an area that emits or reflects light with a certain emission angle. The unit of luminance L is [cd/m²] and is the photo-technical measure that corresponds to the subjective perception of the level of brightness of a light source or an object, while luminous flux Φ, luminous intensity I and illuminance E are not visible, i.e. not sensed by the human eye. Light only becomes visible when it hits an object that it is either reflected by or penetrates in a diffused manner. Objects of different levels of brightness therefore only seem to be darker or brighter at same illuminance because they reflect the light differently.
	Luminous efficiency / efficiency	Ratio of luminous flux to power input (lm/W).
	Luminous flux Φ (photon radiation)	Luminous flux Φ is the radiated/emitted light power in lumen [lm] of a light source, a unit of measurement for the number of light photons emitted in all directions. Luminous flux is the photometrical light output perceived by the human eye.
	Luminous intensity I	Luminous intensity I in [cd] is decisive for characterising of a source of light and is defined as a quotient of the emitted luminous flux Φ and the radiated area of the solid angle Ω. Luminous intensity I is thus the focused luminous flux Φ within the radiated solid angle Ω. Today's LEDs can reach a luminous intensity of more than I=10 cd. The luminous intensity value depends on the viewing angle, i.e. the luminous intensity of an LED chip in a 30° reflector will be higher than that of an identical LED chip in a 60° reflector. This is because a 60° reflector results in the same luminous flux Φ having to illuminate a larger area.
M	**Mains harmonics**	Mains current distortions by higher-frequency currents.
	Master/slave circuit	Operating several lamps in different luminaires with one ballast.
	µF	Unit of capacitance (microfarad)
	MPP capacitors	Metallised polypropylene film dielectric capacitors.
P	**Parallel-compensated circuits**	Circuit of an inductive ballast with a capacitor between phase and neutral conductor (connected in parallel to the lamp circuit).
	Part load range	Variable load range up to the maximum rated load.
	PELV	Protective extra-low voltage with adequate protection from accidental contact with higher voltages in other parts of the same circuit.
	Phase-cutting leading-edge control	In accordance with the defined angle, voltage regions are suppressed of the positive and negative sinusoidal oscillations of the mains voltage in an upwards direction starting with the voltage zero crossing.
	Pinch temperature	This is measured at a defined point of the lamp base; the permissible maximum values are internationally determined.
	Polyester resin impregnation	High-grade vacuum impregnation with polyester resin.
	Power factor	Ratio of true power to apparent power (total power). Lambda (λ) expresses the power factor for non-sinusoidal currents and voltages. In contrast, cos φ (phi) expresses the power factor for sinusoidal currents or voltages.
	Pulse Ignition	Generation of the ignition voltage for high-pressure lamps with the help of ballasts (ballast insulation must match the ignition voltage).
	PUSH	Key-operated bipolar interface of VS electronic ballasts for controlling the brightness of connected lamps.

R	**Reference ballast**	Special ballast that is either inductive for lamps operated with mains voltage or ohmic for lamps operated at high frequencies. Reference ballasts are designed to deliver comparable values for testing ballasts, selecting reference lamps and testing mass-produced lamps under standardised conditions.
	Reference lamp	When used in combination with a suitable reference ballast, reference lamps provide key electrical data that are close to the target values laid down in the lamp standards.
S	**Safety transformer**	Isolation transformer for supplying circuits with safety extra-low voltages.
	SELV	Safety extra-low voltage.
	Short-circuit-proof	Short-circuit-proof operating devices do not pose a safety risk if a short-circuit occurs at the output of the operating device; a difference is made between operating devices offering limited and unlimited protection against short-circuit; in the case of operating devices with limited short-circuit protection, an additional mechanism has to be installed.
	Solid angle Ω	Solid angle Ω is the area within a sphere that is pervaded by the light emitted by a light source. The steradian (sr) is the unit of measure for solid angle, whereby 1sr = 65.5°. This describes a cone with its peak in the light source and a beam spread angle of 65.5°. A whole solid angle is expressed as 4Πsr = 12.56 sr.
	Standards	VS products comply with the regulations of the following European standards: • **Electronic ballasts for fluorescent lamps:** EN 61347-1, EN 61347-2-3, EN 60929, EN 55015, EN 61547, EN 61000-3-2, IEC 62493 • **Electronic ballasts for high-pressure discharge lamps:** EN 61347-1, EN 61347-2-12, EN 55015, EN 61547, EN 61000-3-2, IEC 62493 • **Electronic convertors:** EN 61347-1, EN 61347-2-2, EN 61047, EN 55015, EN 61547, EN 61000-3-2, IEC 62493 • **Electromagnetic ballasts:** EN 61347-1, EN 61347-2-8, EN 61347-2-9, EN 60921, EN 60923, EN 50294, EN 55015, EN 61547, EN 61000-3-2, IEC 62493 • **Electromagnetic transformers:** EN 61558-1, EN 61558-2-6, EN 55015, EN 61547, EN 61000-3-2, IEC 62493 • **Ignitors:** EN 61347-1, EN 61347-2, EN 60927, EN 55015, EN 61547, EN 61000-3-2 • **Capacitors:** EN 61048, EN 61049 • **Lampholders:** EN 60238, EN 60400, EN 60838-1, EN 61184, EN 60399 • **Digital control inputs of operating devices:** IEC 62386 • **LED:** IEC 62031, IEC 61347-1, IEC 61347-2-13, IEC 62384, IEC 61231, IEC TR 61341, IEC 60838-2-2, IEC 62471(-1), EC 62471-2 • **EMC/EMF:** EN 55015, EN 61547, EN 61000-3-2, IEC 62493
	Stroboscopic effect	Optical illusion whereby objects appear either to be moving or stationary in contrast to their actual state when illuminated by periodically alternating light.
	Superimposed ignition	Generation of the ignition voltage required for high-pressure lamps by the ignitor independent of the ballast (superimposed over the mains voltage).
	System power consumption	Total power input of lamp and operating device (in watt).
T	**t_a**	Ambient temperature
	TALQ	Industrial consortium for the globally recognised standardisation of a management software interface for outdoor lighting networks. The aim is to enable the interoperability of central management systems and outdoor lighting networks made by different manufacturers.
	Tandem circuit	Series connection of two fluorescent lamps using a single ballast.
	t_c	Maximum operating temperature of the casing at the marked measuring point.
	Temperature details	The temperature details on our VS ballasts are always maximum values; these are based on the maximum voltage values given on the type plate.
	The Connected Lighting Alliance	Industrial consortium that was founded by GE Lighting, Lutron, OSRAM, Panasonic, Philips, Toshiba in August 2012 for the purpose of supporting global use and distribution of wireless connectivity in lighting applications.
	Thermal classes	Classification of transformers according to the degree of heat resistance offered by the insulation materials.
	Thermal cut-out	Protection from overheating due to abnormal lamp conditions (rectifier effect, short-circuit and overload), with automatic restart after cooling.
	Transient mains overvoltages	Voltage peaks that briefly occur and are superimposed over the mains voltage.
	T rating	Rated value of the lampholder's maximum operating temperature (e.g. T130).
	Tungsten-halogen cycle	In the outer, cooler part of the lamp, the halogen combines with the tungsten vapour released by the filament to form a tungsten-halogen molecule which then decomposes and deposits the tungsten on the filament.
	tw	Maximum permissible winding temperature.
U	**UL, UL approval**	Underwriters' Laboratories Inc., USA; US conformity mark for safety.
V	**VDE mark**	Safety mark on the basis of the German safety standard for electrical equipment; tested by the VDE-PZI (Verband Deutscher Elektrotechniker – Prüf- und Zertifizierungsinstitut).
W	**Winding temperature**	Temperature of the copper winding in a magnetic ballast; the change in winding temperature is measured using the change of the resistance of the copper winding.
Z	**Zhaga**	Global industrial consortium that has taken on the task of standardising the interfaces needed for LED light engines.
	ZVEI	Central association of the electrotechnical and electronics industry in Germany (Zentralverband Elektrotechnik- und Elektronikindustrie e.V.).

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526172	Capacitor 12 µF	146	1
526886	97497	186	–
528252	12900	45	–
528253	12910	46	–
528254	12911	46	–
528552	Capacitor 20 µF	146	1
528554	Capacitor 35 µF	146	1
528555	Capacitor 45 µF	146	1
528582	L 18.121	89	1
528958	12901	45	–
529029	LN 36.149	88	1
529599	64740	185	1,33
529665	Capacitor 10 µF	146	1
529666	Capacitor 16 µF	146	1
529836	84103	107	–
530252	L 36.158	89	14
530878	11000	100	1,3,33
530879	11010	100	1,3,33
530941	LN 18.131	88	1
532390	97545	187	–
532391	80023	187	–
532430	13010	49	1
532431	13010	49	1
532602	12800	45, 204	1
532603	12801	45, 204	1
532604	12810	45, 204	1
532605	12811	45, 204	1
532606	12812	45, 204	1
532610	33906	167	1
533428	12600	44	1
533429	12601	44	1
533430	12610	44	1
533431	12611	44	1
533432	12612	45	1
533663	37001	46	1
533818	64308	177	1
534073	84108	107	1,3
534097	97632	202	–
534252	LN 58.722	89	1
534584	L 36.124	89	14
534624	L 18.933	89	–
534627	L 18.936	89	–
534689	98013	200	–
534832	62063	194	1

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535684	62061	194	1
535685	62061	194	1
535977	L 36.132	88	14
536220	12614	45	1
536379	Capacitor 4 µF	147	1
536380	Capacitor 6 µF	147	1
536381	Capacitor 8 µF	147	1
536382	Capacitor 10 µF	147	1
536383	Capacitor 12 µF	147	1
536386	Capacitor 18 µF	147	1
536387	Capacitor 20 µF	147	1
536388	Capacitor 25 µF	147	1
536389	Capacitor 30 µF	147	1
536390	Capacitor 32 µF	147	1
536392	Capacitor 40 µF	147	1
536393	Capacitor 45 µF	147	1
536394	Capacitor 50 µF	147	1
536396	Capacitor 60 µF	147	1
536400	Capacitor 32 µF	147	–
536401	Capacitor 37 µF	147	–
536402	Capacitor 50 µF	147	–
536404	Capacitor 60 µF	147	–
536405	Capacitor 85 µF	147	–
536451	62062	194	1
536452	62062	194	1
536743	Capacitor 30 µF	146	1
537058	Capacitor 65 µF	147	1
538072	L 36l.342	88	1
538089	09700	202	–
543303	62370	44, 194	1
543304	62070	43, 193	1
543402	Capacitor 13.5 µF	146	1
543770	40560	121	1
543771	40561	121	1
543772	40562	121	1
543773	40563	121	1
543777	40566	121	1
543778	40567	121	1
543781	40570	121	7
543782	40571	121	7
543783	40572	121	7
543784	40573	121	7
543787	40576	121	7
543788	40577	121	7
543793	40660	120	1
543794	40661	120	1
543795	40662	120	1
543796	40663	120	1
543800	40666	120	1
543801	40667	120	1
543802	40670	120	7
543803	40671	120	7
543805	40672	120	7
543806	40673	120	7
543809	40676	120	7
543810	40677	120	7
544605	62009	43, 193	1

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543805	40672	120	7
543806	40673	120	7
543809	40676	120	7
543810	40677	120	7
544605	62009	43, 193	1
544621	64800	199	–
545894	09446	105	1,3
545896	09447	106	1,3
545933	09432	105	1,3
545935	09433	105	1,3
545937	09434	105	1,3
545939	09435	105	1,3
546454	64370	176	1,33
546456	64370	176	1,33
546641	27700	108	1,3
546642	27701	108	1,3
550375	83142	182	1
551644	Capacitor 18 µF	146	1
554270	JD 2000.81	18	–
554283	JD 2000.83	18	–
554303	J 2000.71	18	–
554304	J 2000.72	18	–
554305	J 2000.73	18	–
554306	JD 2000.81	18	–
554307	JD 2000II.91	18	–
554308	JD 2000II.92	18	–
554309	JD 2000I.85	18	–
554310	JD 2000I.86	18	–
554311	J 1200.95	18	–
554312	J 2500.96	18	–
554313	VNaHJ 1000.75	19	–
554314	VJ 2000.76	19	–
554315	VJD 2000.77	19	–
554316	VJD 2000I.78	19	–
554904	VNaHJ 1000.75	19	–
554905	VJ 2000.76	19	–
554906	VJD 2000.77	19	–
554909	VJD 2000I.78	19	–
560664	LNN 36.648	90	–
564680	64770	189	–
564681	64770	189	–
565816	64380	177	1
569031	LNN 58.960	90	–
570958	NaH 50.654	15	–
570961	NaHJ 35.638	15	–
570962	NaHJ 70.653	15	–
570963	NaHJ 250.915	15	–
570964	NaHJ 100.941	15	–
570965	Q 80.510	20	–
570966	Q 125.512	20	–
570967	Q 250.513	20	1
570968	Q 80/50.551	20	–
570969	Q 125.568	20	1
570970	Q 80.584	20	–
570971	Q 400.612	20	1
570972	Q 250.528	20	1
570973	Q 400.669	20	–

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570974	NaHJ 150.995	16	–
570975	NaHJ 70.158	16	–
570976	Q 125.549	20	–
570977	NaHJ 70.300	15	–
570978	NaHJ 250.340	15	–
570980	NaHJ 100.941	16	–
570981	Q 125.598	20	–
570982	NaHJ 250.340	15	–
570993	NaHJ 250.915	16	–
570994	NaHJ 150.995	16	–
570995	NaHJ 70.158	16	–
570996	Q 250.703	20	–
570997	NaHJ 100.126	15	1
570998	Q 400.613	20	1
570999	NaHJ 150.679	15	–
571000	Q 400.616	20	–
571003	Q 250.606	20	–
571004	NaHJ 150.159	15	1
571006	NaHJ 250.204	15	1
571008	NaHJ 70.128	15	1
571009	NaHJ 70.128	16	1
571010	NaHJ 70.128	16	1
571011	NaHJ 70.226	16	–
571012	NaHJ 70.226	16	–
571013	NaHJ 150.620	15	1
571015	NaHJ 150.620	16	1
571018	NaHJ 70.128	15	–
571019	NaHJ 150.620	15	–
571020	NaHJ 70.128	16	–
571022	NaHJ 70.128	15	–
571023	NaHJ 150.620	16	–
571025	NaHJ 150.166	16	–
571028	NaHJ 100.941	16	–
571031	NaHJ 100.213	16	–
571042	NaHJ 250.727	17	–
571043	NaHJ 1000.089	17	–
571044	NaHJ 400.006	17	1
571045	NaH 600.010	17	1
571046	NaHJ 1000.089	17	1
571047	NaHJ 400.006	17	–
571048	NaHJ 1000.089	17	1
571049	NaHJ 250.727	17	–
571050	NaHJ 400.737	17	–
571051	NaHJ 1000.089	17	–
571052	NaHJ 250.727	17	–
571053	NaHJ 400.737	17	–
571054	NaHJ 400.737	17	–
571055	NaH 600.005	17	–
571056	NaHJ 1000.089	17	–
571057	NaHJ 400.012	17	–
571058	NaH 600.140	17	1
571074	NaHJ 35.485	15	–
571075	NaHJ 35.485	16	–
571076	NaHJ 35.209	16	–
571077	NaH 50.486	15	–
571078	NaH 50.486	16	–
571080	Q 125/80.611	20	–
571081	NaHJ 70/50.157	16	–

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571085	NaHJ 70/50.695	16	—
571244	NaHJ 150/100.973	16	—
571249	NaHJ 250.163	15	—
571254	Q 1000.311	21	—
571255	Q 1000.096	21	—
571256	Q 1000.145	21	—
571257	Q 1000.097	21	—
571653	Capacitor 2.5 µF	146	1
571654	Capacitor 4.5 µF	146	1
571655	Capacitor 9 µF	146	1
571656	Capacitor 40 µF	146	1
571657	Capacitor 50 µF	146	1
571658	Capacitor 55 µF	146	1
571659	Capacitor 60 µF	146	1
571660	Capacitor 65 µF	146	1
on requ.	64314	177	

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Subsidiaries

Subsidiaries	Adress	Phone / Fax / Email
Vossloh-Schwabe Deutschland GmbH	Stuttgarter Straße 61/1	Phone: +49/(0)7181/80 02-0
Germany, Benelux, CIS, Georgia, Great Britain, Ireland,	73614 Schorndorf, Germany	Fax: +49/(0)7181/80 02-122
Austria, Switzerland, Scandinavia, Ukraine		info.vsv@vossloh-schwabe.com
Australia, New Zealand	Branch Office Sydney	Phone: +61 (0)2 88 43 07 00
Vossloh-Schwabe Deutschland GmbH	Unit 4C, 6 Boundary Road	Fax: +61 (0)2 7803 9213
	Northmead, NSW, 2152, Australia	vs.sales@vsaus.com.au
China	Room 503, Tower A, Site 1	Phone: +86/756 6842737
Vossloh-Schwabe Lighting Solutions (Zhuhai) Ltd.	Hengqin International Innotech Center, No. 418	
	Houpu Road, Hengqin New Area, Zhuhai, China	
East Europe & Turkey	Sales office Serbia	Phone: +381 35 8150 122
Vossloh-Schwabe Deutschland GmbH	Karl Rojm b.b.	Phone: +49 7181 8002 835
	35210 Svilajnac, Serbia	sales.ee@vossloh-schwabe.com
France	Branch Office France	Phone: +33/(0)389/20 12 12
Vossloh-Schwabe Deutschland GmbH	10 Rue Denis Papin CS50101	Fax: +33/(0)389/24 18 65
	68025 Colmar, France	commercial@vossloh-schwabe.com
Hong Kong, Asian Region	Room B5, 17/F., TML Tower	Phone: +852/2877 9688
Vossloh-Schwabe Hong Kong Ltd.	3 Hoi Shing Road,	Fax: +852/2877 9933
	Tsuen Wan, N.T., Hong Kong	sales.vshk@vossloh-schwabe.com
Italy	Via Strada S. Martino 15	Phone: +39/0547/9 81 11
Vossloh-Schwabe Italia S.p.A.	47027 Sarsina/Forlí-Cesena, Italy	Fax: +39/0547/9 82 60
		vs-i@vossloh-schwabe.com
South Africa	Branch Office Johannesburg	Phone: +27/11/31 44 340
Vossloh-Schwabe Deutschland GmbH	154, Lechwe Avenue, Corporate Park	Fax: +27/11/31 45 287
	Midrand 1685, South Africa	reinhard.koegel@vossloh-schwabe.com
Spain, South America, Portugal	Venezuela 105, 5° - A	Phone: +34/93/481 70 70
Vossloh-Schwabe Ibérica, S.L.	08019 Barcelona, Spain	Fax: +34/93/481 70 71
		vs-e@vossloh-schwabe.com
Thailand	3rd Floor, Unit 1, Bangkok Union Insurance Bldg.	Phone: +66 2634-7311
Vossloh-Schwabe Trading Ltd.	175–177 Surawong Road, Kwaeng Suriyawong	Fax: +66 2634-7313
	Khet Bangrak, Bangkok 10500, Thailand	nipaporn.meepa@vossloh-schwabe.com
USA, Canada, Mexico	26 Century Blvd.	Phone: +1/615/316-5100
Universal™ Lighting Technologies	Nashville, TN 37214-3683, USA	Fax: +1/615/316-5205
		oem_sales@unvlt.com

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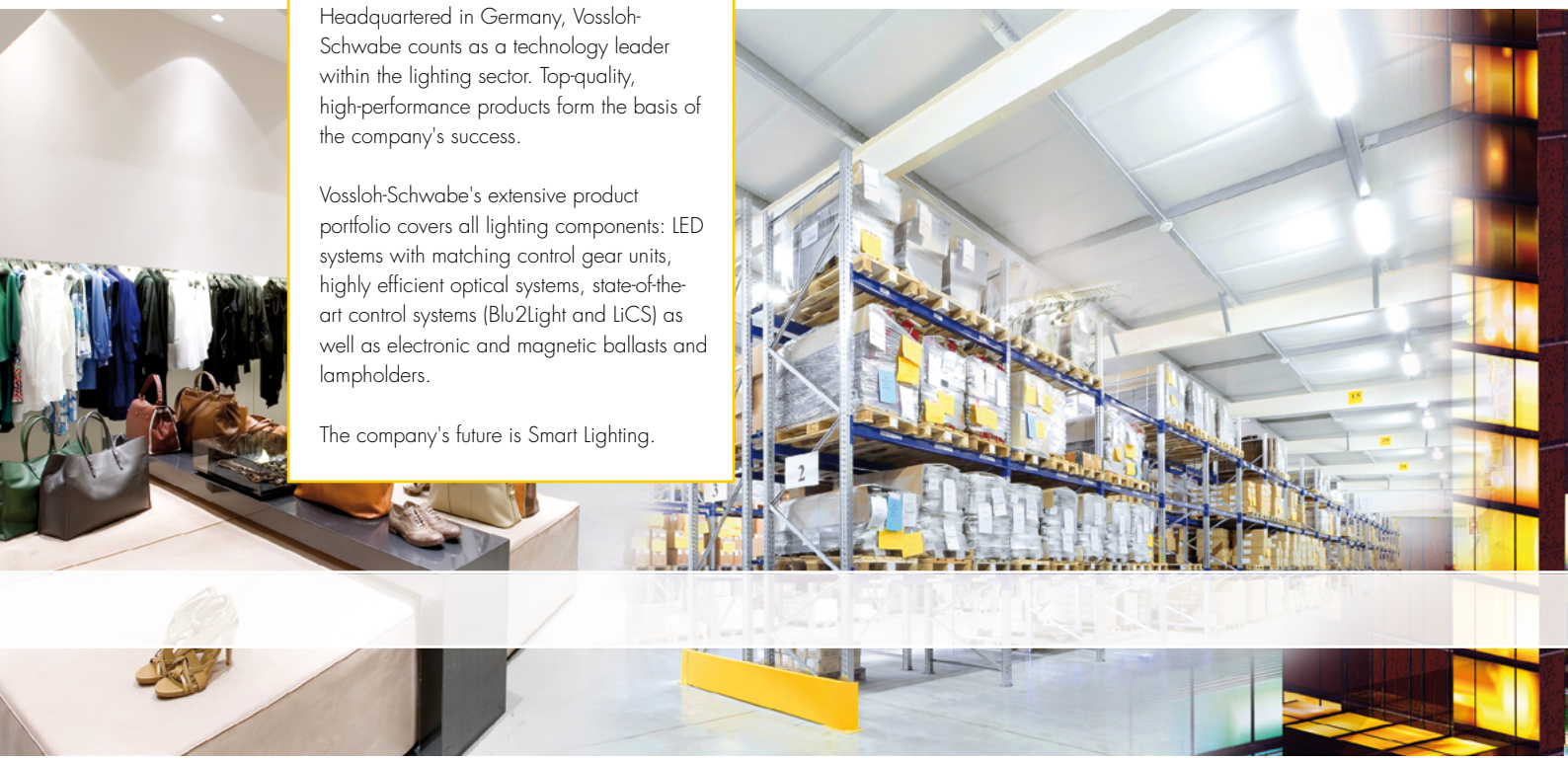
Headquartered in Germany, Vossloh-Schwabe counts as a technology leader within the lighting sector. Top-quality, high-performance products form the basis of the company's success.

Vossloh-Schwabe's extensive product portfolio covers all lighting components: LED systems with matching control gear units, highly efficient optical systems, state-of-the-art control systems (Blu2Light and LiCS) as well as electronic and magnetic ballasts and lampholders.

The company's future is Smart Lighting.



Vossloh-Schwabe Deutschland GmbH

Stuttgarter Straße 61/1 · 73614 Schorndorf · Deutschland
Telefon +49/(0)71 81/80 02-0 · Fax +49/(0) 71 81/80 02-122

www.vossloh-schwabe.com

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