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General technical details

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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 378 on. On request, we will gladly provide information about all of the existing approvals. You can also find test certificates in our online catalogue at

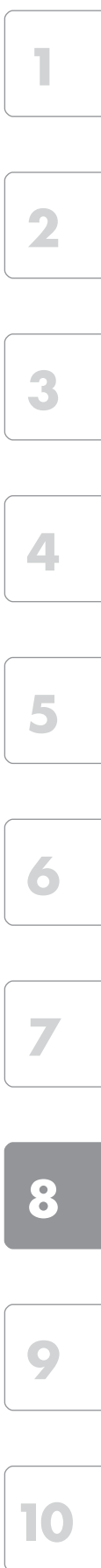
www.vossloh-schwabe.com

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.



General Technical Details

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 24 testing houses in 20 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	TR IPTÜV - 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.

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:

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.
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/EU	Directive governing the recycling of used electric and electronic devices (WEEE Directive)
2012/27/EU	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
1194/2012/EC	Ecodesign requirements for directional lamps, light emitting diode lamps and related equipment
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
2010/30/EC	Indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (this directive supersedes directive 98/11/EC)
859/2009/EC	Ecodesign requirements on ultraviolet radiation of non-directional household lamps
245/2009/EC	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 of the European Parliament and Council.
244/2009/EC	Definition of eco-design requirements regarding household lamps with non-directional light.
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. Regulations 244 and 245 remain unaffected by this change.
1907/2006/EC	Specifications governing the registration, evaluation, authorisation and description of chemicals: REACH (R egistration, E valuation, A uthorisation and R estriction of C hemical 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

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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 CO₂ 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-related **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**uildings) 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 CO₂ 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 **C**hemical 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.

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.



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



Ballasts with double or reinforced insulation



Protection class III

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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 (X1), 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 $\varnothing \geq 50$ mm	Protected against vertically dripping water
2	Protected against finger contact	Protected against solid foreign bodies $\varnothing \geq 12$ mm	Protected against diagonally dripping water (angle of 15° from above)
3	Protected against contact with tools	Protected against solid foreign bodies $\varnothing \geq 2.5$ 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 $\varnothing \geq 1$ 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