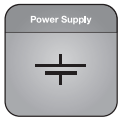
IP PROTECTION CATEGORY

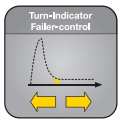
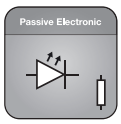
What does IP protection category mean?
IP stands for International Protection. The IP protection categories are determined according to DIN 40 050, Part 9. The purpose of the standard is the exact definition of electrical vehicle equipment against the penetration of solid materials including dust and against water penetration. The different degrees of protection important for signalling systems are explained below.

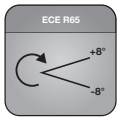
Protective category IP 5K4K
Dust may only penetrate to the extent that function and safety are not impaired. Water that is sprayed from every direction at increased pressure against the housing must not have any damaging effect: water pressure approx. 4 bar.

Protection class IP 9K
Water that is directed from high-pressure / steam-cleaning equipment onto the housing must not have any damaging effect: water pressure approx. 80 – 100 bar.

Protection class IP 6K7
Dust must not penetrate. No water may penetrate, even if the device is submersed for some time. HELLA products meet the highest requirements and are ideally protected against all kinds of weather conditions.

FEATURES	DESCRIPTION	COMMENTS
power consumption of LED lamps	**Advantages of the LED:** Generally, LED lights consume less power than a light with an incandescent lamp. Savings of up to 90 % are possible, which also helps to reduce CO_2.	
Vehicle electrical system voltage 	Defines the voltage supply of the light. This can be 12 V, 24 V or a flexible voltage range for Multivolt (8 – 33 V).	Multivolt is the most flexible: Requires fewer versions, but has more electronic circuit components and is therefore more expensive.
Dust and water protection IP 	International Protection (IP) as per DIN 40050, Part 9. Specific definition for road vehicles. 5K = Dust protected 6K = Dust tight 9K = Protection against water during pressure / steam cleaning.	The higher the protective category, the better the protection against penetrating media. IP 67 maximum value → Completely sealed against dust and water.
	Resistant to high-pressure jet cleaners	

FEATURES	DESCRIPTION	COMMENTS
Indicator failure check according to ECE-R48 	**Regulation according to ECE-R48:** The driver must be informed if the indicator function fails. To remain legally compliant, this requirement must also be met for LED lights. This requirement is met by an integrated self-diagnostic unit on the PCB of the LED and an electrical pulse. Since the end of 2011, this HELLA failure check with a pulse has been ISO Standard: ISO 13207.	If the indicator failure check is not ensured, the general vehicle type approval becomes void. This means it is illegal to operate vehicles without indicator failure check in countries affiliated to ECE-R48. The indicator failure check is ensured in combination with ballasts, HELLA part no. 5DS 009 552.
Electronic circuit **Active**  **Passive**	Basically, two different circuits are possible for LED lamps: **Active:** LED current regulation through active electronics **Passive:** A specific voltage range is preset for the LED through input resistance.	**Active:** Higher expenditure during development because of complex circuit and necessary EMC approval. Higher price because of electronic components, but optimal current regulation allows maximum LED design life. **Passive:** Cost-effective solution without complex protection measures. Shorter LED design life in case of failure. No EMC approval required.
Thermal management **Active** **Passive**	**Active:** Electronic power control of LEDs in the event of impermissibly high ambient temperatures. This ensures the LEDs are protected against destruction caused by overheating. **Passive:** Optimised layout of the components for even temperature distribution and spread.	**Active:** More development overhead with active thermal management and higher parts prices ensure optimal conditions for maximum design life. **Passive:** The warmer the LED gets through exterior factors or heating caused by its own operation, the shorter the service life.
Overvoltage protection 	Supplement to the electronics for protecting the LED against high voltage / current in the vehicle's electric system as per ISO 7637-2.	Overloading of the LEDs can be caused by voltage peaks in the vehicle because of: → Jump-starting → Faulty control units → Load dump impulse (incorrect battery contact) These can stress or damage the LED, which can lead to a failure or a reduction in the design life. By supplementing the circuit with appropriate components, it can be protected, so that the service life is extended and failures are prevented.

FEATURES	DESCRIPTION	COMMENTS
Bi-polarity of the lamp 	Even if the connecting cable is attached with reverse polarity, the LED is still fully functional.	The semi-conductor in an LED must always be operated with the correct polarity. Inverse polarity damages the LED, so that LED lamps are generally equipped with reverse polarity protection (diode). However this function only works if "+" and "-" are correctly connected. If a lamp has a bi-polar circuit, then it will work independently of the contact connections. This ensures poka-yoke (avoiding faulty installations) in connection with indentation clamping technology, for example. However, the additional components on the PCB also increase the costs.
Reverse polarity protection 	Even if the connecting cable is connected the wrong way round, there is still no danger for the electronics.	The semi-conductor in an LED must always be operated with the correct polarity. Inverse polarity damages the LED, so that LED lamps are generally equipped with reverse polarity protection (diode). However this function only works if "+" and "-" are correctly connected. If a lamp has a bi-polar circuit, then it will work independently of the contact connections. This ensures poka-yoke (avoiding faulty installations) in connection with indentation clamping technology, for example. However, the additional components on the PCB also increase the costs.
ECE 	Product is licensed according to ECE guidelines.	
ECE-R65 	Defines the light values, light distribution and color location of beacons that are to be achieved.	Only beacons that fulfil ECE-R65 can be used on public roads.

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Beacons - failure control (DIN 14630 – blue) 	Beacons for preferential road use.	A function monitoring system must be provided.
Approval for transport of dangerous goods 	Light approved for transport of dangerous goods according to Hazardous Waste Road Directive (GGVS).	Generally required for lorry and trailer lighting. Precondition for approval: damage to the light source must not cause explosive media to ignite.
Electromagnetic compatibility 	Electromagnetic compatibility (EMC) tested and EC type approval issued.	If the light is not constructed according to EMC specifications, and thus is not certified, then interaction between it and other safety-relevant electronic systems may occur. **Examples:** Interference in a radio loudspeaker, impairment of ABS electronics, or failure of the lamp due to sensitivity to interference.
Automotive Electronic Council 	Components qualified according to automotive standard.	Electronic components (LEDs, diodes, ...) are more robust and safer than electronic components for industry thanks to automotive specifications. By using certified suppliers, a more robust design of the circuit is possible - even for longer periods of time with consistent quality. Thus slightly higher costs for components improve the design life of LED lamp functions.