

Research on the Electrical Parameters of Modern LED Street Luminaire

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The use of LED street luminaires is becoming more and more common in the design and reconstruction of street lighting systems. Taking into account the advantages of LED luminaires (such as longer life, better efficiency, better light quality), we should also not overlook the problems that might arise on the parameters on power grid. This is mainly due to the fact, that these luminaires are electronic devices, that need a stable DC power supply. Typically, the power modules are pulse power supplies with different characteristics and qualities.

The purpose of the work is to study the electrical parameters (P, Q, S, $\cos \phi$, PF, harmonic pollution and etc.) of a modern street lighting.

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Figure 2. LED Street Luminaire Vega 1-30

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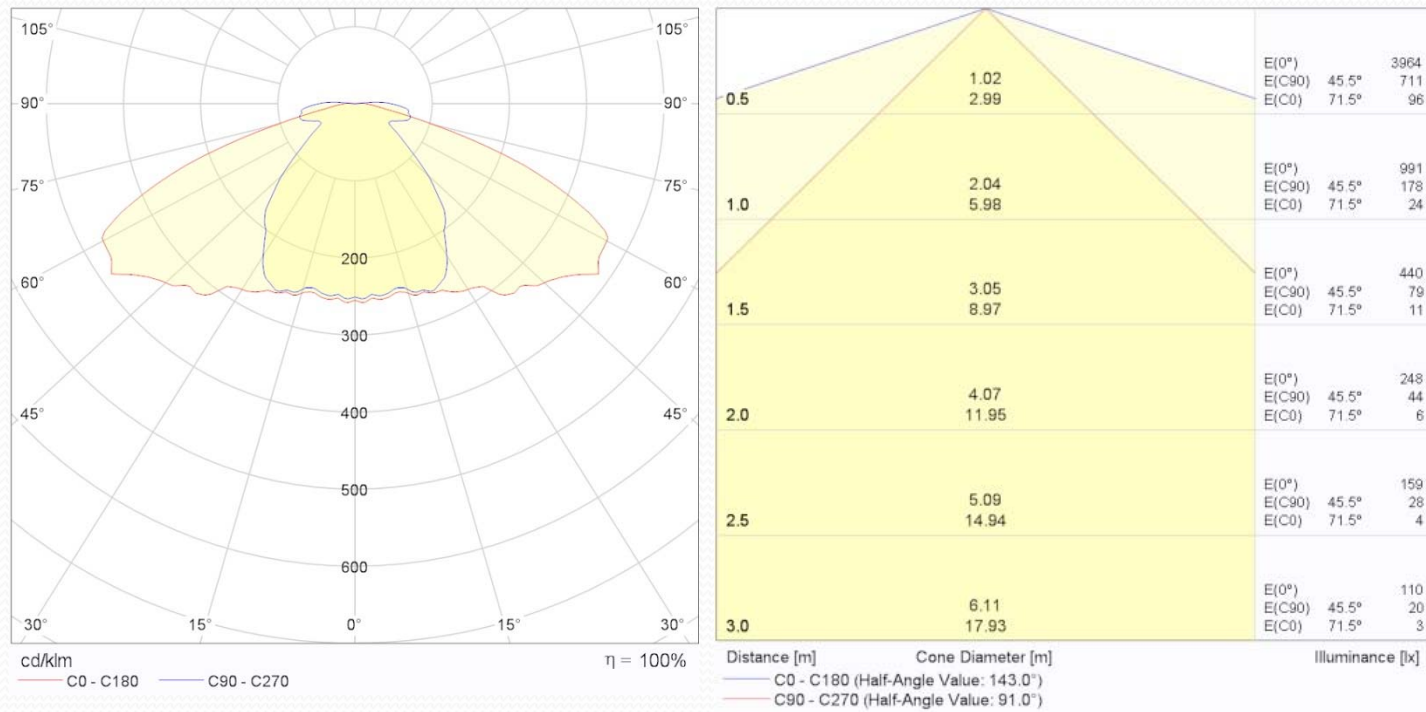


Figure 2. Light Distribution Curve and the Cone Diagram of the Luminaire Vega 1-30

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Technical characteristics of the tested luminaire

Model	Vega 1-30
LED Chip	CITIZEN
LED Driver	Meanwell
Power	30 W
Power factor	> 0.95
Power supply	190 – 250 V
Luminous flux	3900 lm
Color temperature	5000 K
Color rendering index (CRI)	> 80
Temperature working range	- 35° до + 45°
Internal Protection	IP 66
Lifetime	> 50 000 h
Case	Aluminum

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Voltage parameters

Harmonic	Yu,	Yu,			
Y	V	%			
1	224,5	100	cos ϕ =	0,957	
3	1	0,5	PF =	0,931	
5	3,7	1,6	Q =	-0,007	kVAr
7	0,6	0,3			
9	1,3	0,6			
11	0,5	0,2	THD U =	1,9	%
13	0,9	0,4	RMS =	224,6	V
15	0,7	0,3			
17	0,4	0,2			
19	0,4	0,2			

Measurement of the electrical parameters of the tested luminaire

Current parameters

Harmonic	Y _I ,	Y _I ,			
Y	A	%			
1	0,15	100	THD I =	55,1	%
3	0,08	55,2	RMS =	0,15	A
5	0,03	17,2			
7	0,01	3,4			
9	0	0			
11	0	0			
13	0	0			
15	0	0			
17	0,01	3,4			
19	0	0			

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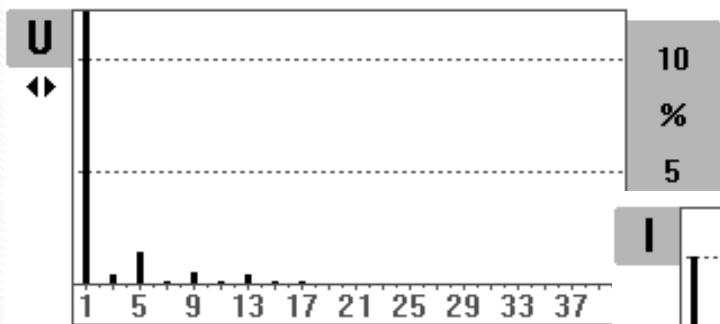


Figure 3.1. Generated Harmonic Voltage Pollution

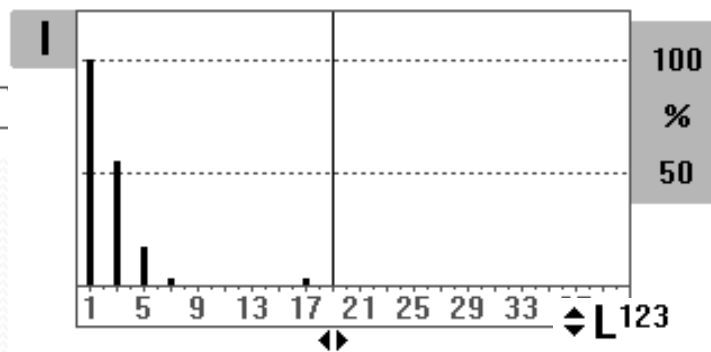


Figure 3.2. Generated Harmonic Current Pollution

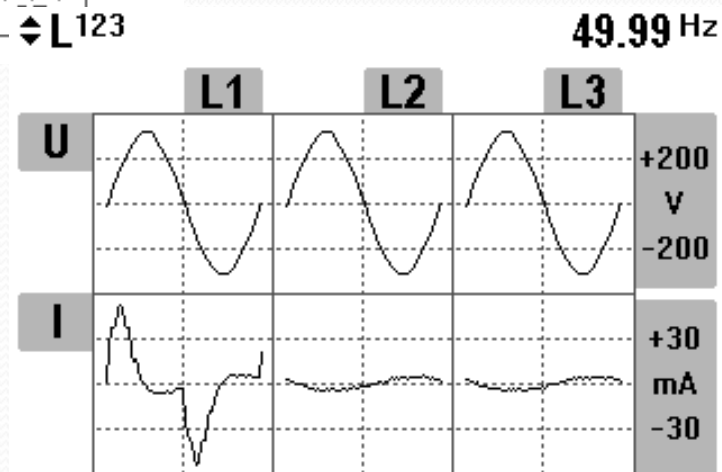


Figure 3.3. Form of the sinewave of the supply voltage and current

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Voltage parameters					
Harmonic	Yu,	Yu,			
Y	V	%			
1	224,5	100	P =	0,031	kW
3	1	0,5	S =	0,032	kVA
5	3,7	1,6	cos ϕ =	0,957	
7	0,6	0,3	PF =	0,931	
9	1,3	0,6	Q =	-0,007	kVAr
11	0,5	0,2	THD U =	1,9	%
13	0,9	0,4	RMS =	224,6	V
15	0,7	0,3			
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Measurement of the electrical parameters of the tested luminaire

Current parameters					
Harmonic	Y _I ,	Y _I ,			
Y	A	%			
1	0,15	100	THD I =	55,1	%
3	0,08	55,2	RMS =	0,15	A
5	0,03	17,2			
7	0,01	3,4			
9	0	0			
11	0	0			
13	0	0			
15	0	0			
17	0,01	3,4			
19	0	0			

Conclusion

- The electrical parameters of a street-type LED luminaire of a modern type were studied. Tested luminaire have a nominal electrical power of 30 W and a quality power module.
- It has been established from the tests, that the THD I parameter, which determines the generated total harmonic current pollutions, has a very high value (THD I = 55.1%) exceeding the recommended according to EN 61000. From the graphical dependence are shown that this is harmonics with numbers 3 and 5. When constructing a lighting system comprising many luminaires, respectively increasing the power of the system, it can be expected that the influence of harmonics on current will be substantial.
- The remaining electrical parameters are within the limits prescribed by the standard.

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