Investigation of contemporary illuminants characteristics the led lamps example

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Abstract. The problems of investigation of contemporary illuminants characteristics are considered. Particularly the LED lamps of the following trade marks were tested: «Maxus», «Electrum», «Lemaso». Photometric and electrotechnical parameters, stated by the producers, were tested.

The investigation revealed that the stated illuminants' power did not correspond to the actual experimental data, in some cases the 8% exceeding was registered (Lemaso). On the other hand, the actual power of "Maxus" and "Electrum" LED lamps was lower than stated, -22,5 % and -2,35 % accordingly.

The low power coefficient is the major drawback of LED lamps in Ukrainian market. Its actual value ranges are 0,4–0,65, whereas its minimal value for a LED lamp of 5-25 Watt power is considered to be not less than 0,8.

Key words: illuminants**,** illumination, LED lamp, luminous efficacy, power coefficient.

INTRODUCTION

The replacement of incandescent lamps (ICLs) for emitting diode (LED) lamps with light output 5-8 times higher than the LR is considered to be one of the effective ways of reducing electricity consumption for lighting. Despite the obvious benefits, proved in Latvia, the LED lamps are not yet that widespread use of which claim specialists in lighting. One reason for this is the low quality and false information about the products brought to the market Ukraine, causing distrust of consumers. These problems are not unique to Ukraine, but also for industrialized countries. So we decided to experimentally explore available to us modern electric light sources, for example LED - lamps for direct replacement of ICLs.

THE ANALYSIS OF RECENT RESEARCHES AND PUBLICATIONS

Advances in semiconductor physics, optics and optoelectronics over the last 10-15 years helped to create light sources to energy efficiency 4-10 times, and duration of combustion in 30-100 times more compared to incandescent lamps. These include solid-state light sources LED (SD). The advantages MD and forecasts for the future development of their lately published in journals lighting unusual amount of materials [1-3].

Many authors believe that today for LEDs not solved one problem - is the high cost of LEDs. Certainly, this is one of the main problems. But she is not alone. The main consumer benefits of LEDs - High luminous efficiency much higher reliability and durability of combustion compared to traditional light sources today - can not always compensate for their shortcomings.

Therefore, the problem of quality, reliability and safety of new light sources, is very important.

OBJECTIVES

Research objectives - to study the real characteristics of LED lamps which come on the market of Ukraine and conformity assessment of the declared data.

THE MAIN RESULTS OF THE RESEARCH

We researched LED lamps trademark «Maxus», «Electrum», «Lemaso» declared in accordance lighting and electrical parameters. For the study was formed three samples (sample) 3-4 LED lamps each. Complex research key features LED - bulbs produce according to method [5].

Manufacturers submitted the following characteristics of light sources:

- LED (Maxus) - 10 W, 900 lm, lifetime of 30,000 h.;
- LED (Lemaso) - 10 W, 900 lm, lifetime of 20,000 h.;
- LED (Electrum) - 10 W, 800 lm, lifetime 2000 h.

Scheme for research performance electric light sources below.

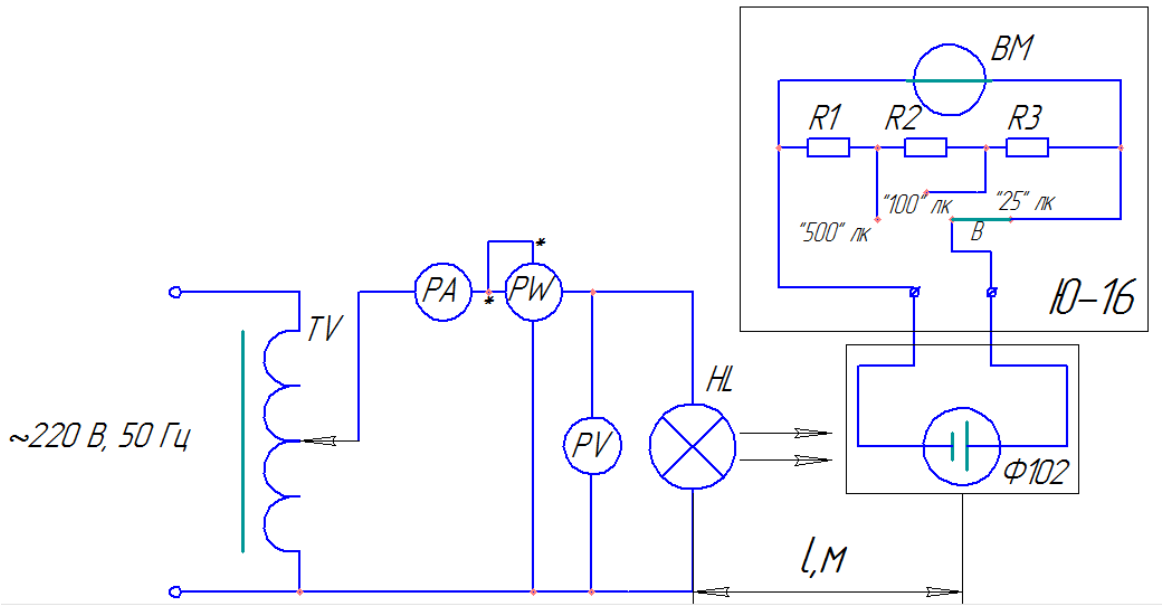

Fig. 1. The study scheme of electrical and lighting parameters of illuminants: TV - autotransformer; HL - investigated the lamp; PA, PV, PW-ammeter, voltmeter and wattmeter respectively; VM - measuring mechanism; B - switch; Ф102 - photocell; Ю -16 - luxmeter.

The value of the measurement results of light and electrical parameters LED - bulbs of various trade marks are given in Table. 2.

After some experimentation, we have indicators for active power at nominal voltage of 220 V, which are listed in the table. 1:

Table 1. Comparative characteristics of passport and measured power values CFL

Type of light source	$P_з$, W	$P_ф$, W	The difference between actual and declared capacity, %
СВД – Maxus	10	8,16	-22,5%
СВД – Lemaso	10	10,9	+8,26 %
СВД – Electrum	10	9,77	-2.35%

The results of the study indicate that among the investigated parties lamps average value of active power on all producers submitted does not meet the declared capacity of the packaging.

Table 2. The results of the LED lamps parameters measurement

lamp type	Parameter	U, B								
		160	170	180	190	200	210	220	230	240
1	2	3	4	5	6	7	8	9	10	11
Maxus, 10 W,900 lm, 30000 hor	I,A	0,06	0,066	0,0705	0,075	0,08	0,0865	0,0925	-	-
	E, lx	475	525	575	615	715	825	925	-	-
	P, W	3,84	4,488	5,076	5,7	6,4	7,266	8,14	-	-
Maxus, 10 W,900 lm, 30000 hor	I,A	0,06	0,065	0,0695	0,078	0,084	0,091	0,094	-	-
	E, lx	495	575	600	670	745	860	945	-	-
	P, W	3,84	4,42	5,004	5,89	6,72	7,644	8,25	-	-
Maxus, 10 W,900 lm, 30000 hor	I,A	0,0595	0,067	0,07	0,076	0,0825	0,0875	0,092	-	-
	E, lx	485	535	610	655	725	790	920	-	-
	P, W	3,808	4,505	5,04	5,795	6,6	7,35	8,096	-	-
The average value E, lx		485	545	595	646,67	728,33	825	930	-	-
The average value P, W		3,829	4,471	5,04	5,795	6,573	7,42	8,162	-	-
The average value H, lx /W		126,654	121,9	118,05	111,59	110,8	111,186	113,943	-	-
Reactive power, Q		8,774	10,244	11,548	13,278	15,061	17,001	18,701		
Full power S		9,57	11,18	12,6	14,4875	16,43	18,55	20,405	-	-
Power factor		0,4								

Continuation of Table 2

1	2	3	4	5	6	7	8	9	10	11
Lemaso 10 Вт,900	I,A	0,0395	0,0475	0,0525	0,058	0,0638	0,069	0,075	0,082	0,087
	E, lx	560	750	1010	1090	1160	1240	1330	1415	1500
	P, W	4,108	5,25	6,14	7,163	8,29	9,42	10,725	12,203	13,65
Lemaso 10 Вт,900 lm	I,A	0,04	0,046	0,0525	0,059	0,065	0,068	0,0775	0,081	0,086
	E, lx	550	760	1000	1090	1150	1225	1350	1410	1450
	P, W	4,16	5,111	6,14	7,32	8,45	9,282	11,083	12,147	13,46
Lemaso 10 W,900 lm	I,A	0,0398	0,046	0,053	0,059	0,065	0,068	0,0763	0,082	0,088
	E, lx	555	750	980	1075	1170	1200	1350	1430	1490
	P, W	4,1392	5,083	6,201	7,287	8,45	9,32	10,904	12,26	13,65
The average value E, lx		555	753,3	996,67	1085	1160	1221,67	1343,3	1418,3	1480
The average value P, W		4,136	5,147	6,162	7,256	8,396	9,34	10,904	12,203	13,585
The average value H, lx /W		134,2	146,35	161,74	149,54	138,164	130,82	123,2	116,23	108,95
Reactive power, Q		4,835	6,018	7,204	8,483	9,816	10,918	12,748	14,267	15,88
Full power S		6,363	7,92	9,48	11,16	12,92	14,37	16,78	18,77	20,9
Power factor		0,65								
Electrum 10 W, 800 lm, 20000 hor.	I,A	0,1075	0,1025	0,098	0,0935	0,089	0,085	0,0805	-	-
	E, lx	1095	1125	1155	1175	1205	1275	1360	-	-
	P, W	9,46	9,584	9,702	9,78	9,79	9,82	9,74	-	-
Electrum 10 W, 800 lm, 20000 hor.	I,A	0,105	0,1025	0,096	0,0925	0,0875	0,0835	0,08	-	-
	E, lx	1025	1095	1175	1205	1225	1275	1345	-	-
	P, W	9,24	9,584	9,653	9,67	9,625	9,64	9,68	-	-
Electrum 10 W, 800 lm, 20000 hor.	I,A	0,105	0,101	0,095	0,092	0,0863	0,0825	0,08	-	-
	E, lx	1075	1100	1150	1200	1215	1250	1375	-	-
	P, W	9,24	9,44	9,405	9,614	9,49	9,53	9,68	-	-
Electrum 10 W, 800 lm, 20000 hor.	I,A	0,11	0,105	0,1	0,094	0,088	0,084	0,0825	-	-
	E, lx	1025	1080	1125	1185	1215	1260	1325	-	-
	P, W	9,68	9,82	9,9	9,823	9,68	9,702	9,98	-	-
The average value E, lx		1055	1100	1151,25	1191,25	1215	1265	1351,25	-	-
The average value P, W		9,405	9,607	9,66	9,7185	9,65	9,67	9,78	-	-
The average value H, lx/W		112,17	114,5	119,12	122,578	125,96	130,77	138,3	-	-
Reactive power, Q		14,281	14,588	14,676	14,757	14,647	14,688	14,837		
Full power S		17,1	17,47	17,57	17,67	17,54	17,59	17,77	-	-
Power factor		0,55								

Based on this study can be stated that when the supply voltage in the range of 160-240 in luminous flux, power, light returns virtually unchanged paws Electrum only 10 W (Fig. 2 - 4), according to Table 1. These lamps power unit functions as a stabilizer power. As for the other two producers - namely brand Maxus and Lemaso, nature changes the luminous flux of light return from the supply voltage has a different relationship. This relationship is represented graphically in Fig. 2.

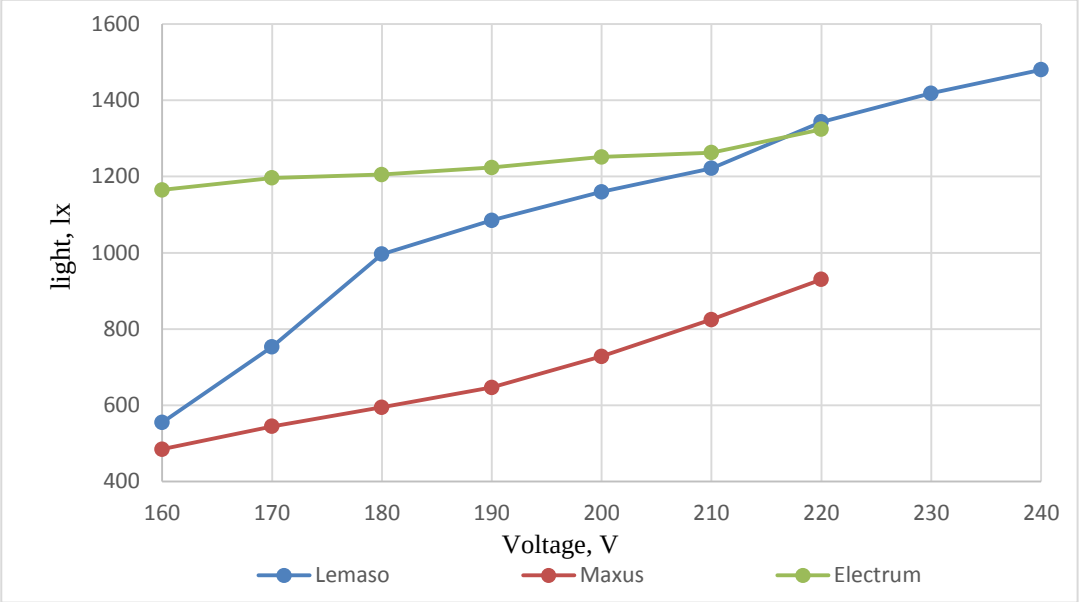

Fig. 2. Dependence of illuminants' illumination on voltage supply.

The criterion is enerhoekonomichnosti luminous efficiency lamps. Cross structures investigated CFLs graphically depicted in Figure 3.

The most effective is the LED lamp company Electrum, whose luminous efficiency at the rated voltage of 220 V has a maximum value - 138.3 lux / W.

A major drawback of LED - lights coming in the market of Ukraine is the low power factor (cos φ). We have studied the power factor LED - lights manufacturers Maxus, Electrum and Lemaso ranges 0,4-0,65, although according to the Cabinet of Ministers of Ukraine on October 15, 2012 №992, the minimum allowable values of power factor LED lighting for indoor lighting devices public and industrial buildings with capacity from 5 to 25 W should be at least 0.8. Low power factor data of lighting requires more reactive power compensation lighting network, to improve technical - economic indicators for power supply and reduce energy losses.

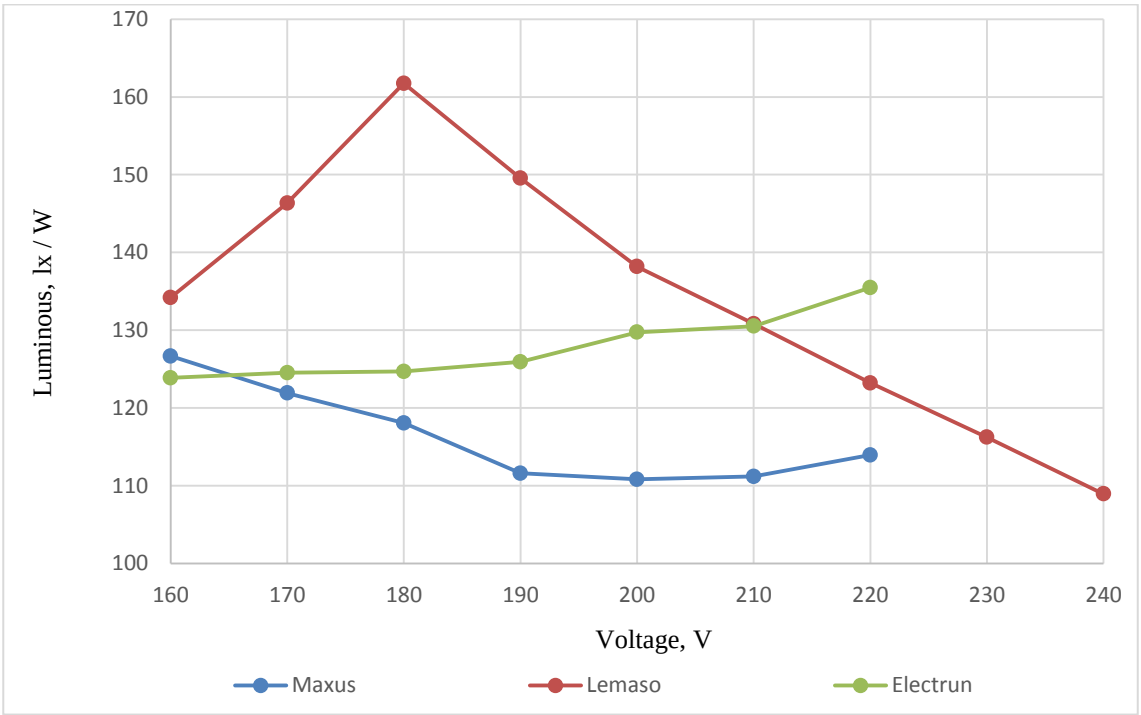

Fig. 3. The dependence of the LED lamps light output on voltage supply.

On the basis of measurements and calculations determined the dependence of active, reactive and full power from the supply voltage Fig. 4.

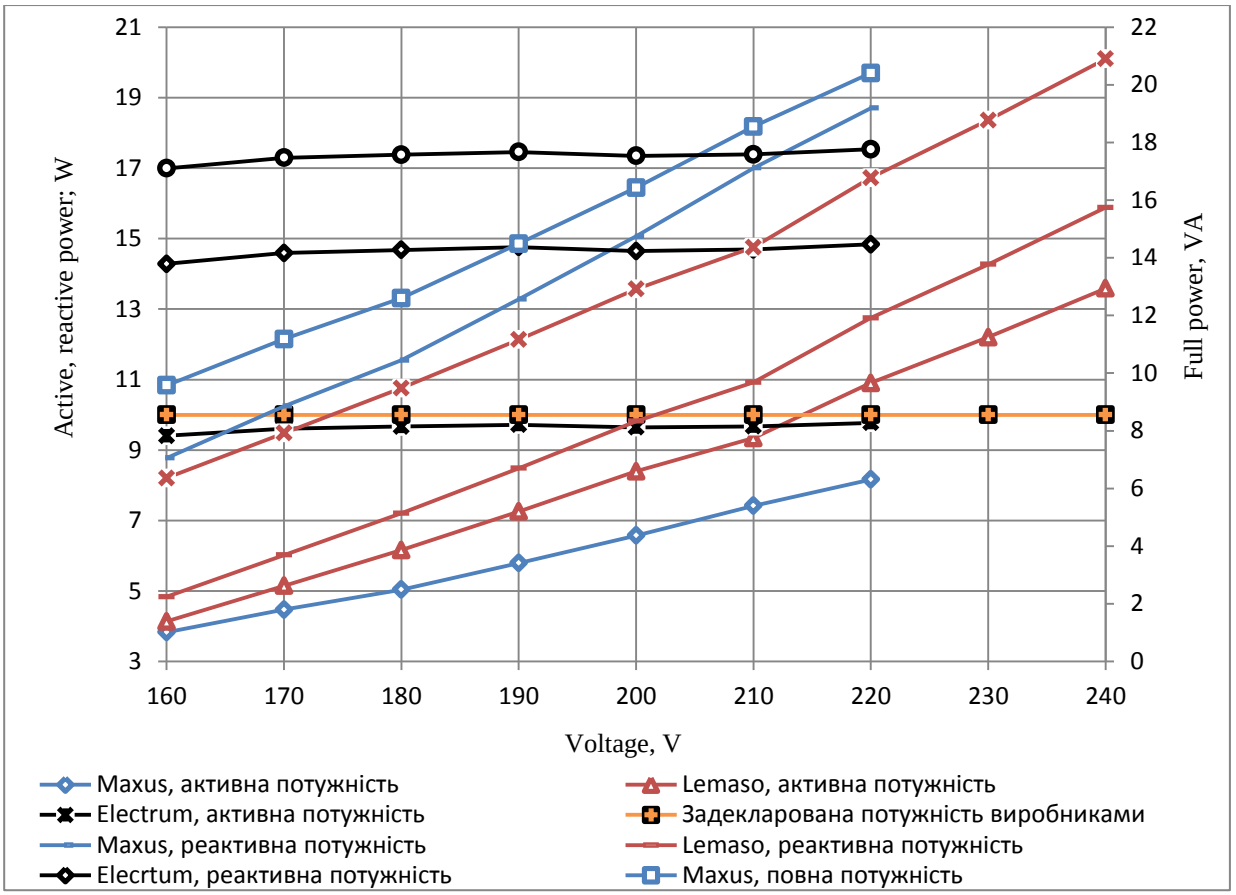

Fig. 4. Dependence of LED lamps power (active, reactive, and apparent) on voltage supply.

CONCLUSIONS

LED - lights are promising light sources for special and for general lighting, but much of lamps which come on the domestic market of Ukraine does not correspond to the declared lighting, electrical parameters as we see from studies investigated the alleged power trademarks LED lamps do not meet experimentally removed the data, in some cases exceed by more than 8% - LED (Lemaso), although it should be noted that at times it was lower than declared - LED (Maxus, Electrum) respectively -22.5% and -2.35% .

In turn for light output at the rated voltage of 220 data LED lamps can rank in this spinning wheel:

1. LED (Electrum) - 135,5 lx / W;
2. LED (Lemaso) - 130,8 lx / W;
3. LED (Maxus) - 113,94 lx / W.

A major drawback of LED lamps coming to market in Ukraine is low power factor, which ranges from 0,4-0,65, while the minimum allowable values of power factor for LED lighting devices with capacity of 5 to 25 W should not be less than 0 8.

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