INFLUENCE BETWEEN A CONSTRUCTION OF A LIGHT FITTING AND A UTILITY FACTOR

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ABSTRACT

This article describes the influence of the construction of the light fitting on the efficiency of luminaries systems or the utility factor as the case may be. The main aim of this paper is draw of a reciprocal relation between the efficiency of the light fitting and the utility factor.

1. INTRODUCTION

Indoor and outdoor luminaries systems are very important part of our lives. They enable to work at reduced capacity of a daily light or at night, better orientation in dark areas and they provide our security in outdoor at night. Our population developes and the consumption of electric energy for the luminaries systems rises. We can decrease the quantum of electric energy which is used for feeding of the luminaries systems by many ways. One of them is adaptation of the construction of light fitting. In this paper there is a description of the influence between the construction of the light fitting and the utility factor. There are models where the same type of the light fitting is used, but there are modifications of a diffuser. At the first case there is diffuser without the modifications and at the second case there is diffuser with inside reflector.

2. DEFINITION OF THE UTILITY FACTOR

2.1. Calculation results

The utility factor is a value which describes efficiency of the utilization of the luminous flow from the luminous sources of the luminaries systems according to a comparative flat. The utility factor is describes by the following formula:

$$\eta_E = \frac{\phi_3}{\sum \phi_z} [-], \qquad (1)$$

when: ϕ_3……..total luminous flow which is bounced on the comparative flat

$\sum \phi_z$ …total luminous flow from all sources of the luminaries system

The utility factor is used when we design a new luminaries system. The value of necessary luminous flow is described by the following formula:

$$\phi_z = \frac{\overline{E_m} \cdot A}{z \cdot \eta_E} [\mathrm{lm}], \qquad (2)$$

when: ϕ_z …... total luminous flow from all sources of the luminaries system

$\overline{E_m}$ … minimal average required illuminance on the comparative flat

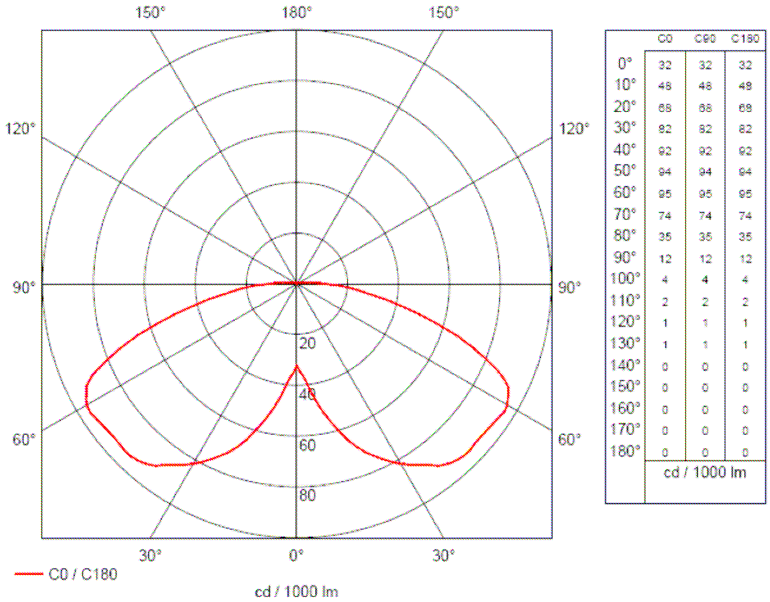
A …...area of the comparative flat

z ……keeping factor

η_E ….utility factor

3. RESEARCHING AND CALCULATIONS

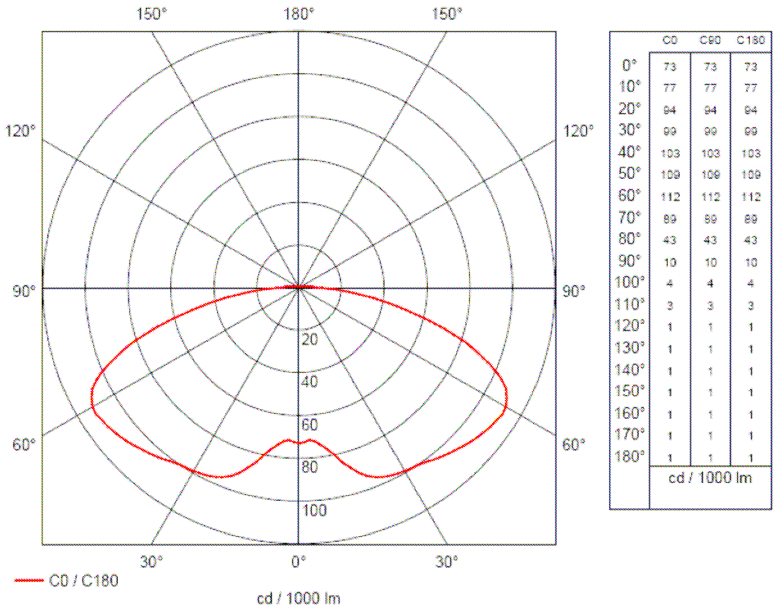
All model situations were calculated in RELUX software. I selected light fitting from the SITECO Company. In the first case there was diffuser without modification, efficiency was 45,1% and in the next case it has diffuser with inside reflector with efficiency 53,6%. In both cases was luminous source of 108 W power and 6300 lm luminous flow.



	C0	C90	C180
0°	32	32	32
10°	48	48	48
20°	68	68	68
30°	82	82	82
40°	92	92	92
50°	94	94	94
60°	95	95	95
70°	74	74	74
80°	35	35	35
90°	12	12	12
100°	4	4	4
110°	2	2	2
120°	1	1	1
130°	1	1	1
140°	0	0	0
150°	0	0	0
160°	0	0	0
170°	0	0	0
180°	0	0	0

cd / 1000 lm

Fig. 1 – Curve of the illuminating power for diffuser without modifications



	C0	C90	C180
0°	73	73	73
10°	77	77	77
20°	94	94	94
30°	99	99	99
40°	103	103	103
50°	109	109	109
60°	112	112	112
70°	89	89	89
80°	43	43	43
90°	10	10	10
100°	4	4	4
110°	3	3	3
120°	1	1	1
130°	1	1	1
140°	1	1	1
150°	1	1	1
160°	1	1	1
170°	1	1	1
180°	1	1	1

cd / 1000 lm

Fig. 2 – Curve of the illuminating power for diffuser with inside reflector

For both light fitting I created models, when I changed high of the hinge fro 4 m up to 6 m. The light fitting was in the middle of the square area. The following parameters was used in the models:

$z = 0.8$

$A = 49\ \mathrm{m}^2$

$\rho = 0.2$ – reflection factor of surfaces

4. RESULTS

Table 1 – Results for light fitting with diffuser without modifications

Výška H[m]	**4**	**5**	**6**
$\overline{E_m}$ [lx]	14,5	10,2	7,36
E_{min} [lx]	8,1	7	4,87
E_{max} [lx]	17,9	11,4	7,95
$E_{min} / \overline{E_m}$ [-]	0,55	0,69	0,66
E_{min} / E_{max} [-]	0,45	0,61	0,61
η_E [-]	0,141	0,099	0,072

Table 2 – Results for light fitting with diffuser with inside reflector

Výška H[m]	**4**	**5**	**6**
$\overline{E_m}$ [lx]	17,9	13	9,8
E_{min} [lx]	9,3	8,2	7
E_{max} [lx]	24,7	15,8	11
$E_{min} / \overline{E_m}$ [-]	0,52	0,63	0,71
E_{min} / E_{max} [-]	0,38	0,52	0,64
η_E [-]	0,174	0,126	0,095

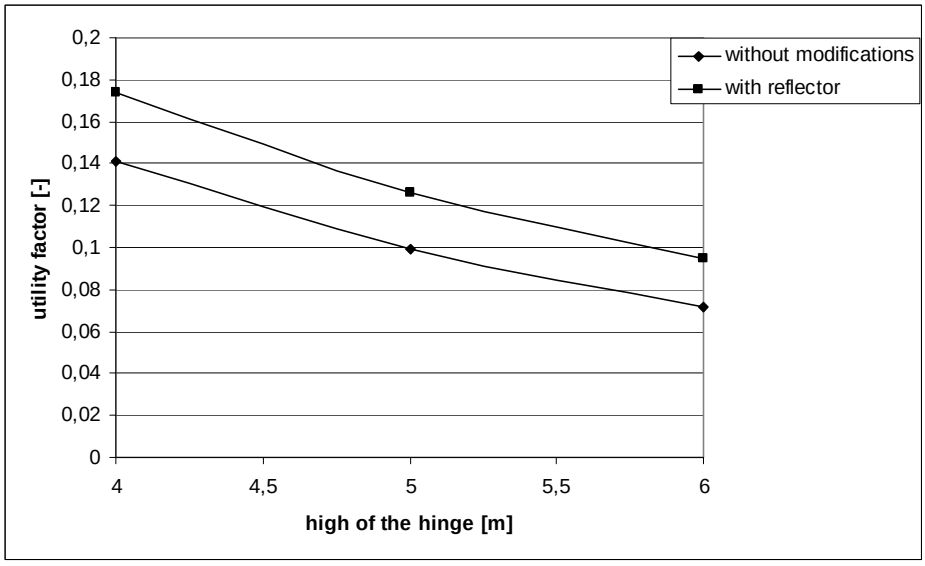


Fig. 3 – Comparison of results

5. CONCLUSIONS

The shapes of both curves are the same. There is only one big difference – light fitting with reflector has the utility factor higher. If we will improve the light fittings, we reach the minimal average required illuminance earlier than if we use the light fitting without modifications. The consumption of electric energy will be lower too.

REFERENCES

[1] *Švuger, Dalibor:* Vztah mezi účinností svítidla a činitelem využití. ZČU Plzeň 2010

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