TRTLIGHTING
ROAD & TUNNEL SYSTEMS

CONSTANT LIGHT OUTPUT (CLO)

MAINTENANCE FACTORS

MADE IN BRITAIN

GUIDE

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TRT Maintenance Factors for Lighting Design CLO

When designing a lighting scheme with TRT lanterns, the maintenance factors to be used for CLO & non-CLO designs are different. This document is a guide for maintenance factor selection for CLO lanterns.

Maintenance Factor = LLMF x LMF x LSF

Where:

LLMF = lamp/LED lumen maintenance factor – LED output depreciation due to loss of efficacy over time appropriate to the operating characteristics in the specific luminaire & an additional precautionary allowance made by TRT for other potential system losses such as driver efficiency. For TRT CLO lanterns these losses are offset by a progressive power increase and so 1.00 is used.

LMF = luminaire maintenance factor – accounts for the loss of light output due to environmental factors allowing for the mounting height, cleaning cycle and the level of particle deposits (dirt) likely on the lantern in the area of installation. The level of dirt deposit from atmospheric pollution is taken as being indicated by the environmental zone categorisation. The overall LMF resulting from these factors is looked up from BS5489:1:2013.

LSF = LED survival factor - if the user wishes to allow for LED survival rate it is 98% as a precautionary value, that is 2% LED failures over 100,000 hrs, however, as the failures will not be evenly spread over lanterns and for many lanterns 2% of LEDs is less than 1 LED and so cannot be representative of the performance of any given lantern. In the unlikely event of a lantern experiencing multiple LED failures and so significantly contributing to the 2% aggregate value it is expected that it would be replaced, making the application of the 2% failure across all lanterns misleading. However, despite these concerns about the use of LSF and the wastage of energy it can lead to, examples are included below using LSF to illustrate strict conformity to the methodology given in BS EN 13201. The depreciation of different LED types over time can vary the CLO maintenance factor methodology adopted from the BS EN 13201 by TRT takes account of this, so the LLMF remains 1.00 over 100,000 hours regardless of LED type.

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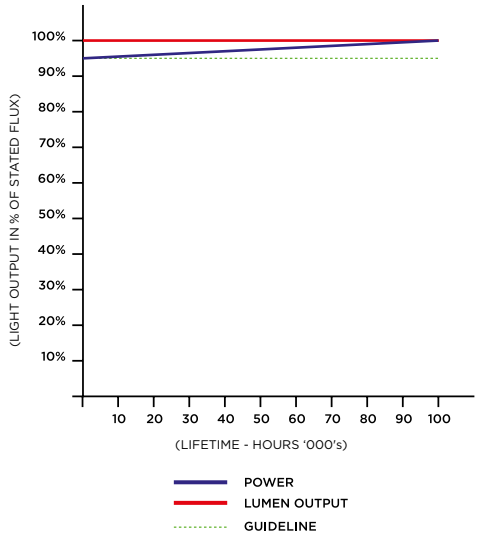
For CLO lanterns TRT increase the power to the LEDs over 100,000 hrs life to compensate for the gradual decrease in efficacy of LEDs and the increase in other potential losses over time and so ensuring that the lumen output remains constant at the stated level; the output does not depreciate, and hence the LLMF is 1.00. The power stated for the luminaire is the average system wattage over the 100,000 hrs as listed by Elexon.

TRT LIGHTING CLO GRAPH



*NB: It is critical when using CLO in designs that it is understood over what time period the lantern delivers CLO & what MF should be used as not all manufacturers state CLO flux in the same way or offer CLO over the same operating time period.

Luminaire Maintenance Factors

Environmental zone	Mounting height	LMF					
		Cleaning frequency 12 months	Cleaning frequency 24 months	Cleaning frequency 36 months	Cleaning frequency 48 months	Cleaning frequency 60 months	Cleaning frequency 72 months
E1/E2	<=6.00m	0.96	0.96	0.95	0.94	0.93	0.92
E1/E2	> 6.00m	0.96	0.96	0.95	0.94	0.93	0.92
E3/E4	<=6.00m	0.94	0.92	0.90	0.88	0.86	0.84
E3/E4	> 6.00m	0.96	0.96	0.95	0.94	0.93	0.92

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Med district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Example Maintenance Factors when using TRT CLO Lanterns

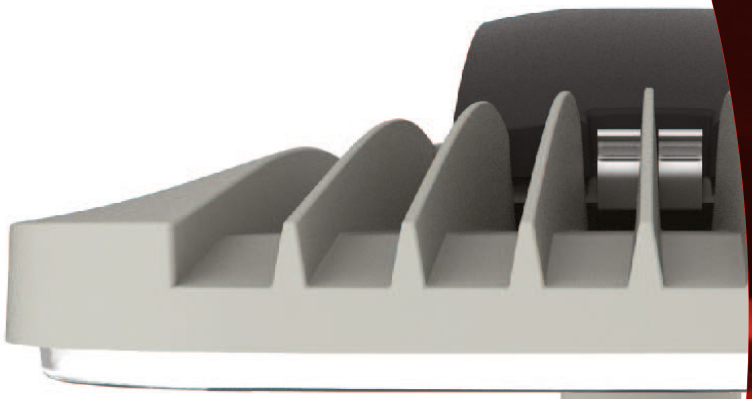
The following example maintenance factors for use with TRT CLO lanterns are calculated based on a 72 month cleaning cycle. Table B1 is BS5489 should be used to look up the LMF relevant to a specific project.

For column height <=6.00m in environmental zones E1 or E2 from BS5489 LMF = 0.92
Maintenance factor = LLMF x LMF = 1.00 x 0.92 = 0.92
Or if the decision is made to also include LSF = LLMF x LMF x LSF =1.00 x 0.92 x 0.98 = 0.90

For column height >6.00m in environmental zones E1 or E2 from BS5489 LMF = 0.92
Maintenance factor = LLMF x LMF = 1.00 x 0.92 = 0.92
Or if the decision is made to also include LSF = LLMF x LMF x LSF =1.00 x 0.92 x 0.98 = 0.90

For column height <=6.00m in environmental zones E3 or E4 from BS5489 LMF = 0.84
Maintenance factor = LLMF x LMF = 1.00 x 0.84 = 0.84
Or if the decision is made to also include LSF = LLMF x LMF x LSF =1.00 x 0.84 x 0.98 = 0.82

For column height >6.00m in environmental zones E3 or E4 from BS5489 LMF = 0.92
Maintenance factor = LLMF x LMF = 1.00 x 0.92 = 0.92
Or if the decision is made to also include LSF = LLMF x LMF x LSF =1.00 x 0.92 x 0.98 = 0.90



For more information

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