MIDSTREAM

DEFINITION OF MAINTENANCE FACTOR

1. OVERVIEW

A correct definition of the Maintenance Factor (MF), which must be used in lighting calculations with LED products, is becoming increasingly important in an industry of continuous research (in the field of new sources and optical systems) to achieve higher energy savings. Continuous innovation must, however, comply with the norms (i.e. EN 13201).

The Maintenance Factor depends mainly on:

Protection degree of the fitting: a watertight product (IP65 or higher), for instance, will have a higher maintenance factor than a fitting with a low protection against penetration of water and dust (IP23 or similar), since its tightness prevents it from penetration of dirt/soil in the optical compartment.

Type of light source: a fitting whose light source are LEDs or fluorescent lamps will have a higher maintenance factor than one with high intensity discharge lamps, as a result of lower temperatures on the closure screens of the fittings and therefore resulting in lower adhesion of dust and dirt to the closure screen.

Type of installation: a fitting for street or residential lighting, which is normally installed downwards, with a glass surface parallel to the road, should have a higher maintenance factor than a fitting for other installation/use, especially in those cases where the glass of the fitting is directed upwards and therefore exposed to possible contaminations (i.e. recessed fittings, architectural floodlights).

Frequency of maintenance operations: another factor which influences the calculation of the Maintenance Factor for light fittings is the cleaning interval of the fitting. As far as conventional lighting fittings are concerned, the need to replace the lamp approximately each two years led to frequent cleaning intervals, since the cleaning of the closure screen of a fitting was mainly carried out during the same intervention when the lamp was replaced. The use of LED sources removes the need of periodic replacement of the light source, but this does not mean that the cleaning procedure must be cancelled as well; a periodical maintenance for the cleaning of the closure screens must be foreseen also for LED products, in order to maintain them in the best possible conditions (as far as efficiency is concerned). The cleaning interval must be calculated according to the environmental conditions and determined case by case.

2. FORMULA FOR THE CALCULATION OF THE MAINTENANCE FACTOR

The method which MIDSTREAM is adopting in order to define the general maintenance factor for the lighting calculations with LED products is the one included in the norm IESNA RP-8-00 dtd. 2005, which connects all the factors listed in the Overview in a single formula:

MF = LLMF x LSF x LMF

where:

MF = Maintenance factor

LLMF = Lamp Lumen Maintenance Factor

This represents the reduction of the flux of the LEDs during the lifetime of the fitting and it is expressed as a coefficient which represents the ratio between the initial lumen output and the remaining lumen output at the end of a certain period which is defined as lifetime of the LEDs; this data is provided by the manufacturers of the LED chips.

LSF = Lamp Survival Factor

This represents the percentage of the surviving LEDs after a certain period starting from the installation date; this data is provided by the manufacturers of the LED chips.

LMF = Luminaire Maintenance Factor

This specifically represents the influence of the external factors on the fitting and it is strongly connected with the environment the fitting is installed in. It is expressed as a coefficient, representing the ratio between the initial lumen output and the remaining lumen output after a certain period, to be defined according to the clearing intervals. This coefficient is based on IESNA standard tables and we normally refer to “very clean” environments.

Maintenance Factor for Titan Range:

LLMF : 0,94

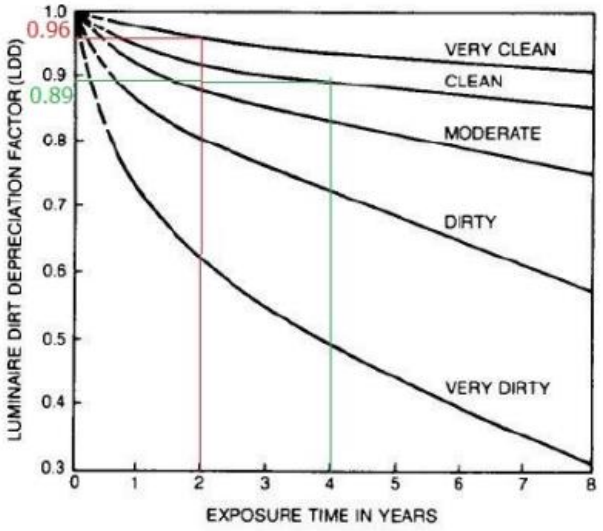
LSF : 0,99861

LMF : 0,96

MF = LLMF x LSF x LMF = 0,94 x 0,99861 x 0,96 = 0,9011

MF 0,9

ANSI / IESNA RP-8-00



SELECT THE APPROPRIATE CURVE IN ACCORDANCE WITH THE TYPE OF AMBIENT AS DESCRIBED BY THE FOLLOWING EXAMPLES:

VERY CLEAN—No nearby smoke or dust generating activities and a low ambient contaminant level. Light traffic. Generally limited to residential or rural areas. The ambient particulate level is no more than 150 micrograms per cubic meter.

CLEAN—No nearby smoke or dust generating activities. Moderate to heavy traffic. The ambient particulate level is no more than 300 micrograms per cubic meter.

MODERATE—Moderate smoke or dust generating activities nearby. The ambient particulate level is no more than 600 micrograms per cubic meter.

DIRTY—Smoke or dust plumes generated by nearby activities may occasionally envelope the luminaires.

VERY DIRTY—As above but the luminaires are commonly enveloped by smoke or dust plumes.

Figure A5. Luminaire Dirt Depreciation (LDD) factors.