



CELMA

C.E.L.M.A.

*Federation of National Manufacturers
Associations for Luminaires and
Electrotechnical Components for
Luminaires in the European Union*

CELMA STATEMENT

Do T5 Adapters for T8 Luminaires ensure energy saving and conformance with relevant standards?

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Energy savings as well as the responsible use of our natural resources is of major interest to the lighting technologist. Recent innovations in the lighting industry and, as a consequence also of the many European Directives, energy savings have increased dramatically and will subsequently contribute to safeguard the living conditions of future generations. (The LVD, EMC, WEEE, RoHS Directive, EPBD, Ballast Directive, EuP Directive and CELMA EEI are terms and regulations used by those who are involved in the design of modern luminaire installations respecting all safety standards)*. *see below

Fluorescent lamps with a tube diameter of 16 mm (T5 fluorescent lamps) and the luminaires especially developed for these lamps are an example of innovative lighting. The use of T5 lamps requires electronic ballasts. The "high efficiency versions" can reach a lamp luminous efficiency of more than 100 lm/W. The tube length of T5 fluorescent lamps is 50 mm shorter than the T8 lamps tube length and shows optimised luminous flux-temperature behaviour. Sophisticated engineered luminaires for T5 fluorescent lamps enable the realisation of extra economic and innovative lighting systems.

It would appear quite simple and economically viable to replace T8 lamps in luminaires with magnetic ballasts by a T5 lamp adapter and, hence, do a "quick step" into modern lighting technology.

It is, however, questionable if this "quick step" is ecologically and economically wise.

T5 lamp adapters are offered in different versions. In principle the adapter consists of a length of compensating elements with G5 sockets and G13 plinths (caps) and integrated electronic ballast. Depending on the system, the starter unit will be dismantled or replaced by a "box". The conventional magnetic ballast is then used as a filter unit. The commonly used compensation capacitors (parallel or serial circuit) must be removed in any case requiring the services of a skilled person. The remaining capacitors may cause over-voltage or increased electrical currents (resonances), which may result in the destruction of the adapters and other luminaire parts.

Special items with regard to the use of T5 lamp adapters

A) Responsibility of the luminaire manufacturers – legal consequences

T8 luminaires are designed with regard to safety and lighting technology for the use of T8 lamps not T5 lamps.

The product liability and the assured quality are only valid for luminaires, which are released by the manufacturer for the respective lamps. The manufacturer's data thereto is printed on the label of the luminaires and/or may be found in the manufacturer's catalogues or documentation.

CE marking and the safety engineering certification of the luminaire by independent certification institutes (e.g. ENEC) is based on the use of lamps as named by the luminaire manufacturer and as marked on the luminaire.

When a user of a lighting installation manipulates the system by, for example, installation of an adapter, the responsibility is transferred from the luminaire manufacturer to the customer. Safety certificates from neutral certification institutes as well as CE-marking are no longer valid.

Due to the subsequent manipulation of the luminaire the responsibility of the manufacturer expires. All documented performance features of the luminaire, the basic safety requirements as well as verified EMC compatibility criteria lose their validity. Many luminaire manufacturers include this evidence in their manuals in relation to the product as designed not to the product modified by unauthorised application of an adapter.

Following one example of such a declaration:

“Any manipulation of our products and their packaging like changing, revamping (modification), marking is illegal and infringes our registered trademarks. Such modifications may influence the technical properties of our products, may even destroy the product and possibly cause subsequent damage to other objects, which cannot be attributed to the “manufacturers’ name”.

B) Technological conditions for the use of T5 lam adapters

B1) Lighting characteristics:

The original characteristics of a luminaire is predetermined by the luminaire manufacturer and is fundamentally changed due to the mounting of the T5 lamp adapters in a way that the calculated lighting performance of the application is no longer applicable. The optical elements are optimized for T8 fluorescent lamps. The use of T5 lamp adapters may change the position and form of the light source in respect to the allocation of the optical luminaire elements, which result in a change of the luminosity distribution. In any case, an inspection of the adherence of the default lighting characteristics (e.g. distribution of the luminosity and the limitation of glare at workplaces) is necessary to respect the demands of health and industrial safety. The change in the operation of the lamps may result in a decreased lifetime of the lamp.

In most cases T5 lamp adapters for high efficiency lamps replace T8 fluorescent lamps. The power and the related luminous flux of the lamps used are reduced considerably. This is a point of discussion, since economic energy consumption is promoted, and, hence, the amount of light required is neglected and remains far behind the planned requests.

The facts of comparing measurements are displayed in the following chart.

Systems (lamp, ballast, nominal luminous flux)	System power	System current	Measured luminous flux	Relative luminous flux
58W/840 T8 lamp with low loss ballast 58W (5200 lm)	64,7 W (100 %)	612mA	4792 lm	100 %
35W/840 T5 lamp with Electronic Ballasts (3300 lm)	38,2 W (59 %)	176 mA	3354 lm	70 %
35W/840 T5 lamp with lo loss ballast 58W, T5 lamp adapter (3300 lm)	32,5 W (50,2 %)	154 mA	2986 lm	62,3 %

The luminous flux of the 35W/T5 fluorescent lamp operated with low loss ballast and T5 adapter are reduced by 37,7 % in comparison to the T8 lamp version with low loss ballast. The result is a reduction in illumination. The illumination and the quality of light with regard to EN 12464-1 of the original planning cannot be maintained. Additionally, an inspection by authorities for the protection of employees would be an essential requirement.

The economic view has to be put into perspective because an additional system would be required besides the T5 adapter in order to reach the original specified and design illumination.

B2) Safety features, quality and thermal load

A T5 lamp adapter may adversely influence the temperature within the luminaire. A possible over-temperature may occur in the adapter itself or in other parts of the luminaire. Creepage distances and clearances as well as the mechanical strains on the sockets, due to the greater weight of the T5 lamp adapter, need to be considered.

The lifetime of T5 lamp adapters is not congruent to the demands of the market in many cases.

T5 lamp adapters are, in principle, electronic ballasts, which are operated under aggravated circumstances. Luminaires are certified with the use of electronic ballasts in relation to the existing temperature (tc being one such measurement point) for a suitable lifetime of the ballast. The luminaire, as originally designed, is tested also to prove suitability under abnormal conditions of use. This condition is not proven for the adapter kits during installation. A statement of the temperature load (life time expectation and safety) is not given. Error status and its impact on other components of the luminaire, especially for the magnetic ballast (e.g. warming up due to rectifier effects) is not examined.

B3) Economic efficiency – energy efficiency

Luminaires for T8 fluorescent lamps with T5 lamp adapters can never reach the economic efficiency of luminaires with electronic ballasts, which are engineered and optimized for the use of T5 lamps. An optimisation of the system (determination and choice of the high guiding and optical elements, the temperature control, choice and arrangement of the components of the luminaire) cannot be regarded for the adapter kits. The total energy consumption of lamp and ballast referring to EN 50294 and the classification scheme of CELMA for fluorescent lamp circuits require, for the compensation of measurement data, a minimum ballast-lumen-factor. The standard stipulates a ballast-lumen-factor between 0,925 and 1,075. The tested T5 lamp adapters in the chart shown above do not reach these values.

B4) Electromagnetic compatibility (EMC)

Many samples of T5-adapters have been found to not respect the limits of electromagnetic compatibility specified in EN 55015 and required by the EMC Directive nor the new CDN-measurement method for the frequency range from 30 MHz to 300 MHz. Compliance with the EMC Directive may only be proven with the adaptor installed in the luminaire within which it is intended to used.

The following common statement of the “Bundesnetzagentur” and the DKE-working group “EMC of lighting systems” supported by CELMA, provides a clear briefing.

**Joint statement by Working Group 767.11.15
"EMC of lighting equipment"
and the
Federal Network Agency, section 413,
on the
EMC assessment of T5 adapters**

In EMC assessments, only the components specified by the manufacturer are considered in assessing the interference behaviour of luminaires. Retro-fitted electronic ballasts also require assessment.

T5 adapters to be fitted into luminaires designed for T8 lamps with magnetic ballasts are considered electronic ballasts from the electromagnetic compatibility point of view. Hence they have to be treated as electronic ballasts, requiring proof to be furnished of the modified luminaires' compliance with permitted interference levels, especially with regard to emissions. The interference voltage and the magnetic and electric interfering field strength are measured after the luminaire has been modified.

Manufacturers are required to provide proof of safety for T5 adapters intended for retro-fitting to luminaires with T8 lamps and magnetic ballasts. Such proof should include a list (favourable status list) of all luminaires to which T5 adapters can be fitted without causing them to exceed the limits for interference levels.

Where such a list is not provided, the assessment will be performed using off-the-shelf luminaires.

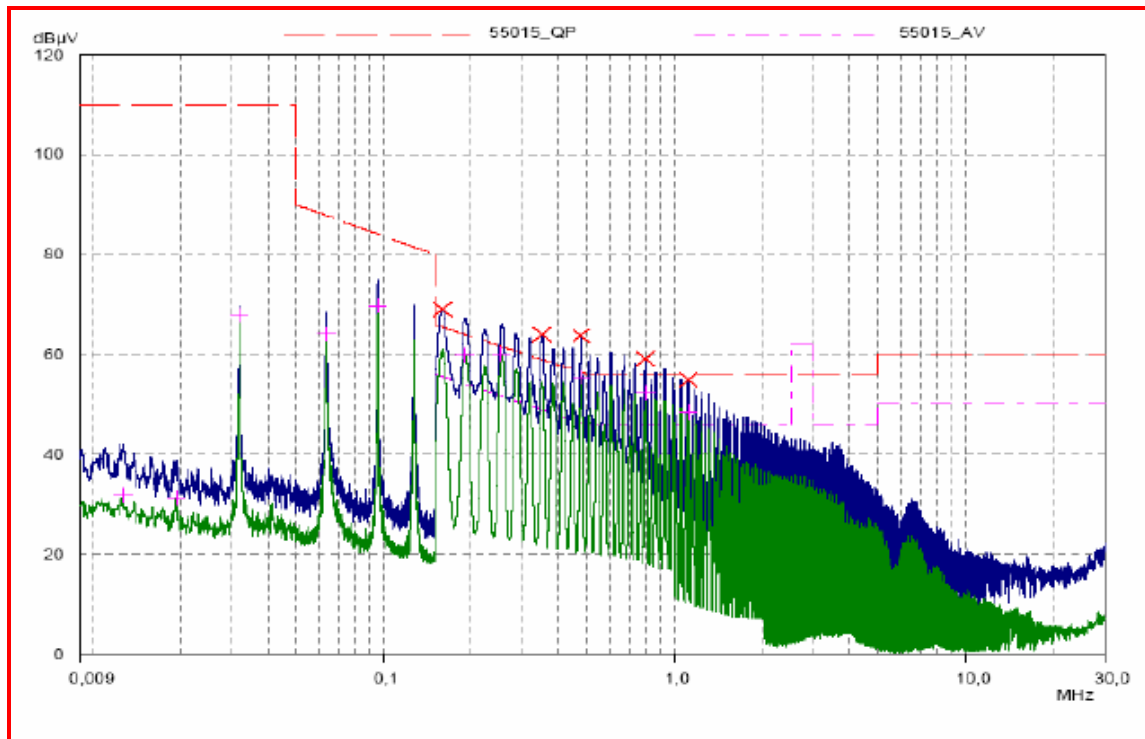
Proposals for standardisation in this matter are being prepared by IEC.

BERLIN, FEBRUARY 2006

For the Federal Network Agency, section 413

For DKE Working Group 767.11.15

The following figure displays a measurement of the radio interference voltage referring to EN 55015 of a common luminaire for T8-fluorescent lamp with low loss ballasts and T5 lamp adapter kit installed with a 35W T5 lamp. The values are up to 9 dB μ V higher than the allowed limits. This luminaire is not permitted in the European Community due to possible interference with radio communication, digital TV, police- and fire department radio frequencies, etc.



C) Environmental aspects

The recycling obligation of the luminaire manufacturer is restricted to the originally lamp delivered. Subsequent mounted components are not within this responsibility – respective agreements have to be set up with the T5 lamp adapter manufacturer.

The T5-adapter has to be in compliance with the European “Restriction of Hazardous Substances Directive” (RoHS Directive).

D) Conclusion

The presented aspects demonstrate that the mentioned “quick step = development jump” from T8-luminaire to modern T5-luminaire with T5-adapter is not so easy to realize. Users of luminaire installations should not use the slogan “Economics before safety” since the total bill may be presented later on!

The use of T5-adapters is connected with numerous risks:

- Take over of product risk (responsibility) due to conversion
- The base of the initial CE conformity is omitted
- Certifications of independent certification institutes lose their validity
- Shifting of the guaranteed lighting characteristics
- Enormous reduction of the illumination, undershoot of the requested ballast-lumen factor (standards and directive for working places)
- No temperature assessment within the luminaire (lifetime and safety)
- Possibly no appraisal of the adapter in the luminaire in respect to error recovery of the adapter and abnormal operation mode of the lamps
- Quality and thermal load within the luminaires
- Possibly no certificate of EMC
- Recycling duty missing

Notations (Terms):

T5, T8	Lamp diameter in x-eighths of inch
LVD	Low voltage directive
EMCD	Electromagnetic compatibility (EU-directive)
CELMA EEI	Energy Efficiency Index (CELMA System)
WEEED	Waste of Electric and Electronic Equipment
RoHSD	Restriction of Hazardous Substances
EPBD	Total Energy Efficiency for Buildings
EuPD	Framework Directive for Energy using Products
EN 55015	Limits and methods of measurement for radio interference suppression of electric luminaire installations and related electric appliances
EN 12464-1	Light and Lighting. Lighting of work places. Part 1: Indoor work places
EN 50294	Method of measurement of the total power of ballast lamp circuits
CELMA	Federation of National Manufacturers Associations for Luminaires and Electro technical Components for Luminaires in the European Union
T5-Lamp Adapter	Adapter for T5-lamps for the insertion of T8 lamps in T8-luminaires
CDN-Measurement	Assessment of EMC behaviour in the frequency range of 30....300 MHz