Hints and Tips

for installing HF electronic lighting in a professional way
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I. Introduction

On account of their great advantages compared to conventional gear, high-frequency (HF) electronic ballasts have gained great popularity in many applications over the last decades. The use of electronics provides more comfort and flexibility, whilst the light can be easily regulated to one’s own requirements. Another highly relevant benefit of HF lighting is the fact that considerable cost reductions can be obtained thanks to energy-saving qualities of HF electronics. Besides, the compact electronic components of these days allow for a new innovative design of luminaires. A typical example of this is the TLS system. This booklet is related to the European products of Philips Lighting (HF-Regulator, HF-Performer, HF-Basic, e-Kyoto and HF-Matchbox).

1.1. The built-in quality of Philips lighting components

In many laboratories all over the world, lighting engineers are working hard on constant improvement of Philips products, including ballasts, for the provision of reliable and first-rate lighting installations. Obviously, great emphasis is thereby laid on quality in terms of performance, lifetime and similar aspects. Philips HF electronic ballasts are manufactured in ISO 9001-certified factories. All ballasts fulfil the relevant international norms, ensuring optimum performance and the new lighting installation.

But in the Philips vision that is not enough. Also easy installation and operation are critically taken into account during the product creation process. And the opinion of the end-user highly valued in this process.

On top of that, Philips also takes full responsibility for the care of the environment and is therefore ISO 14001-certified. This implies that the use of Philips HF electronic ballasts ensures the fulfillment of the environmental management system, as certified by the official approval of the Dutch test authority KEMA.

1.2. This guide

In this guide useful hints and tips can be found on how to apply HF electronic ballasts in a lighting installation. Subjects that will be dealt with include: the proper construction of luminaires designed to be equipped with HF control gear, as well as how to install and operate such luminaires. Also aspects like testing, trouble-shooting and maintenance will be covered.

The interaction between HF lighting installations and the environment will receive special attention too.

Finally, a few words will be spent on dimming and emergency lighting, and the guide concludes with a list of literature for further reading.

And remember:

Obtaining an outstanding lighting installation is not simply a matter of choosing the best possible components: their proper installation and operation in the system is equally important.
2. Hints for the construction of luminaires with HF control gear

2.1. Earthing
Unless specially mentioned, it is assumed that the HF ballasts are mounted in a Class I luminaire (provided with a ground point), and that they are electrically very well connected to some metal part of the luminaire.

For ballasts housed in a metal case this is normally obtained by means of the fixing screws with which the ballasts is mounted to the earthed mounting plate. Tooth-lock washers should be used to ensure a proper earth contract right through the paint or lacquer covering the luminaire. Fixing screws for mounting the ballast should be 4 mm diameter. Ballasts in a plastic housing must be earthed via the connector if available.

2.2. Ignition aid
Generally speaking, fluorescent lamps at all temperatures require an ignition aid for proper ignition. This is stated in IEC 60081-Annex A. If a certain type of lamp does not need an ignition aid, this must be specifically mentioned in the relevant lamp documentation provided by the lamp manufacturer, for example, PL-T lamps.

2.2.1. What is an ignition aid?
An ignition aid, sometimes also called ‘starting aid’, is a metal plate with a length extending at least over the lamp length and a width of at least 1.5 times the lamp diameter. It should be connected to earth (or to an earth contact on the ballast). Its purpose is to make lamp ignition easier.

Typically, the distance between the ignition aid and the surface of the lamp should be:
- 13 mm for TL-D lamps
- 6 mm for TLD5 lamps
- 12 mm for PL-L lamps

Note:
Under no circumstance should there be any conducting (metal) plate between the ignition aid and the lamp, unless it is electrically connected to the earth point of the luminaire (or an earth contact on the ballast). This also applies, for instance, for an aluminium reflector or a reflector made of synthetic material that is sprayed with lacquer that contains metal particles. The ignition aid must always directly face the lamp. Ignoring this can result in not igniting lamps.

2.2.2. When and how to use an ignition aid
- For Class I (i.e. mains earthed) metal luminaires a separate ignition aid will in general not be required, as the luminaire itself will fulfil this function.
- For Class I plastic luminaires, a separate ignition aid has to be mounted and connected to the earth contact of the ballast.
- In the case of a Class II luminaire (no provision for protective ground), the ignition aid must be connected to the earth connection of the ballast.

2.2.3. What to do if the use of an ignition aid is not possible?
The proper ignition of the lamp(s) will depend on the type of ballast, the position of the ballast and the wiring between the ballast and the lamp(s).

For this reason, luminaires without ignition aid can only be released after testing. If help is required, please contact your local Philips sales representative.

2.3. Voltage rating of components and wiring
In general, 250V-rated electrical components and 300V-rated wiring (as H05 classification) can be used in luminaires. Exceptions to this rule are the dimming systems for PL-T and TL5. Here, 500 V-rated lamp holders and 450V-rated lamp wiring (like H07) have to be used, on account of the high lamp voltages (up to 430 Vrms) when dimming the lamp(s).

Normal ‘H07’ wiring has a minimum conductor cross-section of 1.0 mm².
Most ballasts are suitable for such a conductor thickness, and most TL5/PL-T lamp holders can cope with a maximum wire cross-section of 1.0 mm².

Note: High lamp voltages may arise when fluorescent lamps are dimmed. If this happens, it always has to do with the chosen lamp concept and is not dependent on ballast technology.

2.4. Hints for wiring
2.4.1. Introduction
It is important to pay attention to the following indications...
in order to get optimum system performance and minimum radio frequency interference:
- Keep mains (and control) wiring away from lamp wiring and lamps (minimum distance 2 cm) (see Figure 1).
- If complete separation is not possible, screen the mains (and control) wiring by an earthed metal sheath or plate.
- Keep mains (and control) wires as short as possible.
- As a general rule, the length of the wires should be in accordance with the advised figure for the relevant ballast type.
- Avoid loops in all wiring.
- Take care of firm electrical contact between all metal parts and the ballast housing.

Figure 1

2.4.2. Control wiring (regulating ballasts)
In the case of control wiring, the following points should be regarded:
- The wiring to the control input must be dealt like mains wiring.
- If 1-10V ballasts are used, take care that the polarity of the dimming connection is correct.

2.4.3. Special wiring
In the case of throughput wiring:
- Take extra care that throughput wiring in a luminaire is completely separated from the lamp wiring in order to avoid deterioration of the EMC behaviour of the luminaire.

2.4.4. Changing from conventional to HF gear
HF electronic ballasts consist of one single unit, replacing various components in conventional electromagnetic systems, such as a radio-interference capacitor, a starter and the electromagnetic ballast. When changing from a conventional ballast system to an electronic one, but also when swapping from one electronic ballast to another, it is advised to check:
1. The quality of wires and lamp holders (ageing). If these components are not in optimum condition, replace all existing wiring before installing a new electronic ballast. Also all redundant components of the previous (electromagnetic) system should be removed.
2. Follow the hints as given in section 2.4.1: General wiring.

2.4.5. Wiring for luminaires with three or four HF ballasts
When three or four HF ballasts are used in a Class I luminaire, the maximum earth leakage current may surpass the maximum allowed 1.0 mA (according IEC 60598). Reverse-connecting the mains and neutral on one or two of the ballasts in the luminaire might cause the maximum earth leakage current to fall below the required 1.0 mA. This depends on the type of ballast that is used. HENCE: this trick is not guaranteed to work with all types of ballasts. This is because some ballasts do not have an L and N marking and have internally a somewhat different setup.

2.4.6. Wiring diagrams
All wiring diagrams can be found in the related product leaflet per type of ballast. Also on each ballast a wiring diagram is printed in order to make it easy to install the ballast without the need of a product data sheet.

On each ballast it is also printed:
1. What wiring diameters can be used
2. What the optimum strip length of the wires is
3. Which wires are to be kept as short as possible

2.5. Ambient temperatures and lifetime of the ballasts
The maximum temperature in a luminaire is important for the lifetime and reliability of electronic ballasts. The only correct way of measuring Tambient for the ballasts in the luminaire, is to measure Tcase at the test point on the ballasts. The measurements can be done with temperature-indicating devices or with a thermocouple. For almost all HF electronic ballasts, the maximum Tcase temperature is 75 °C.

The nominal lifetime of the ballasts is 50,000 hours at a Tcase temperature of 75 °C (10 % failures). Every increase
of the T<sub>case</sub> by 10 °C will halve the lifetime of the ballast.

Example:

T<sub>case</sub> = 65 °C, lifetime approx. 100,000 hours,
T<sub>case</sub> = 85 °C, lifetime approx. 25,000 hours.

Exceeding the maximum T<sub>case</sub> temperature with more than 10 °C, this will result in an undefined reduction of the ballast's lifetime. Below T<sub>case</sub> = 65 °C the lifetime of the ballasts will improve, but not by a factor 2 per 10 °C.

Some types of ballasts (HF-Matchbox Blue and e-Kyoto) have a slightly different lifetime expectation. For the HF-Matchbox Blue and e-Kyoto the data are 80,000 hours and 20,000 hours.

Tips for ballasts temperature reduction:
1. Mount the ballast not too close to the lamp ends.
2. Take care of good heat transport to the surroundings, called heatsinking.
3. Avoid heat radiation from lamp to ballast.
4. Create extra luminaire volume.
5. Have some airflow around the ballast.
3. Hints for the installation of HF luminaires

3.1. Master-slave applications
There are situations where two single-lamp luminaires in a so-called master-slave configuration will be operated on one HF ballast designed to operate two lamps (see Figure 2). Although in most cases this is not advised, follow the indications below with regard to cable length and maximum distances as shown in the accompanying drawing. This is to avoid problems with regard to radio frequency interference and ignition. The cable connecting the master luminaire with the slave luminaire should not be of the shielded type. Also the wiring for both lamps should be of the same length.

HF and master-slave wiring length (see Figure 2)

<table>
<thead>
<tr>
<th>Ballasts type</th>
<th>D</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-Kyoto</td>
<td>&lt; 1 m</td>
<td>&lt; 3 m</td>
</tr>
<tr>
<td>HF-B TL-D</td>
<td>&lt; 1 m</td>
<td>&lt; 3 m</td>
</tr>
<tr>
<td>HF-P TL-D</td>
<td>&lt; 1 m</td>
<td>&lt; 3 m</td>
</tr>
<tr>
<td>HF-P TL5 (not advised)</td>
<td>&lt; 0.1 m</td>
<td>&lt; 2 m</td>
</tr>
<tr>
<td>HF-R TL-D/TL5 (not advised)</td>
<td>&lt; 0.1 m</td>
<td>&lt; 2 m</td>
</tr>
</tbody>
</table>

Table 1

Figure 2

3.2. Earth leakage circuit breakers
The earth leakage current of HF electronic ballasts is normally less than 0.5 mA. At the moment of switching-on the installation, the earth leakage current may, however, be temporarily higher. For this reason it is advised not to connect more than 30 ballasts on one 30 mA earth leakage circuit breaker (residual current detector).

3.3. Inrush currents
Like all electronic equipment, electronic HF ballasts have a peak current shortly after the mains is switched on, the so-called inrush current. When a number of HF ballasts are operated on Mains Circuit Breakers (MCB’s) and are therefore switched on simultaneously, the inrush currents have to be taken into account when calculating the maximum permitted load on the MCB’s. The various types of Phillips HF ballasts have been measured when operated on MCB’s under the worst conceivable mains conditions. Both B-type and C-type 16 A MCB’s have been considered. The results of these measurements are reproduced in the tables in the relevant datasheets, stating recommended maximum number of ballasts to be operated on one MCB for various lamp loads.

Notes:
1. It is advised to apply type C MCB’s in lighting installations equipped with electronic ballasts.
2. Always make sure that the mains current of the load does not exceed the nominal permitted value of the MCB concerned. In fact, it is recommended that the installation be designed for a maximum load of 80 % of the nominal permitted MCB load.
3. If an existing installation is changed from conventional control gear to electronic gear the higher simultaneous inrush currents in the new situation necessitate the installed switch rating and protection levels to be reconsidered.

Maximum number of ballasts to be used on one MCB on account of inrush currents is mentioned in each datasheets and in the catalogue as well. If other types of MCB’s are used than what is given in the datasheets, a conversion table (Table 2) is available to recalculate the value for these other MCB’s.

<table>
<thead>
<tr>
<th>MCB type</th>
<th>MCB rating</th>
<th>Relative number of ballasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>16A</td>
<td>100 %</td>
</tr>
<tr>
<td>B</td>
<td>10A</td>
<td>63 %</td>
</tr>
<tr>
<td>C</td>
<td>16A</td>
<td>170 %</td>
</tr>
<tr>
<td>C</td>
<td>10A</td>
<td>104 %</td>
</tr>
<tr>
<td>L, I</td>
<td>16A</td>
<td>108 %</td>
</tr>
<tr>
<td>L, I</td>
<td>10A</td>
<td>65 %</td>
</tr>
<tr>
<td>G, U, II</td>
<td>16A</td>
<td>212 %</td>
</tr>
<tr>
<td>G, U, II</td>
<td>10A</td>
<td>127 %</td>
</tr>
<tr>
<td>K, III</td>
<td>16A</td>
<td>254 %</td>
</tr>
<tr>
<td>K, III</td>
<td>10A</td>
<td>154 %</td>
</tr>
</tbody>
</table>

Table 2
As a starting point in all cases the number of ballasts is given for the 16 A B type MCB. From this given number the new amount of ballasts can be calculated for the other MCB.

Example:
For a specific type the number of ballasts that can be connected to a 16 A B type MCB is 28 ballasts. In use is a 10 A C type MCB. The number of ballasts that can be connected to this new MCB is 104 % (see Table 2) of the 16 A B type so the result will be 28 x 1.04 = 29 ballasts.

Tip: If it is absolutely necessary to connect more than the specified number of ballasts to one MCB, install one or more relays in the circuitry as shown in Figure 3. Thus, it is ensured that the peak current in the connected ballasts does not occur simultaneously. Of course this has to be checked by the installer. Philips cannot guarantee that this will work in all cases.

Figure 3

3.4. Testing the installation
Testing a HF lighting installation on wire insulation should be carried out with the luminaires disconnected in order to exclude luminaire influences (see Figure 4 and Figure 5). The earth leakage current of the ballast will, for example, lead to unreliable measurements. When, however, in special circumstances the luminaires must remain connected, the following warnings should be paid attention to:
- Voltages of max. 500 V DC with limited currents (< 2 mA) between mains and earth or between neutral and earth are allowed for a maximum time of 1 minute.
- Testing between mains and neutral is not permitted, as this might cause damage to the ballast.
- After the test has been completed, make sure that the neutral is reconnected, since a disconnected neutral will result in unpredictable mains voltages (50 V,...400 V), which, again, may damage the ballast.

Figure 4

3.5. Ambient luminaire temperatures and optimum ballast lifetime
The heat produced in the luminaire by ballast and lamps must be transferred to the surroundings. When a luminaire is physically isolated by the ceiling or by isolating blankets, the heat produced cannot easily flow to the surroundings. This will result in the ballast inside the luminaire being heated up, which in turn will have an adverse effect on its life.
To what degree this will be the case depends on the construction of the luminaire and the free airflow inside it. For an optimum lifetime of the ballast it is important to remember that:
- air should be able to flow freely around the luminaire,
- air handling through the luminaire has a positive effect on temperature control and thus on ballast life. (On the other hand, this can have a negative effect on the light output of the luminaire and can cause striations at the lamp. Especially with TL5 luminaires.)
3.6. Trouble shooting
By following the flow charts on the next pages possible installation problems can be traced and solved systematically if a lighting installation equipped with HF ballasts does not work properly (Chart 1). As regulating ballasts may create their own problems, a separate trouble-shooting flow chart has been included for them as well (Chart 2).
Hints and Tips

START
Mains supply is on

Lamp(s) do not burn

Remove and re-insert the lamp(s)

Remark: with 2, 3 or 4 lamp ballasts, all lamps stop if one fails

Lamp(s) burn

Yes

Possible cause: poor contact

No

Exchange lamp(s)

Lamp(s) burn

Yes

Cause: defective lamp(s)

No

Check mains voltage at the ballast

Mains voltage OK

No

Check mains wiring and fusing

Lamp(s) burn

Yes

Check ballast/lamp wiring and ballast/lamp type

Wiring type OK

No

Change ballast and/or wiring

Lamp(s) burn

Yes

No

Yes

Exchange ballast

Lamp(s) burn

No

Call local support office

Yes

STOP
Extension for 1-10V regulating ballasts

Chart 2
4. The lighting installation and environment

4.1. Electromagnetic compatibility
Electromagnetic compatibility, EMC, is the ability of a device or system to operate satisfactorily in its electromagnetic environment (see Figure 6), without causing unacceptable interference in practical situations.

Phillips HF electronic ballasts fulfil the requirements with regard to electromagnetic compatibility as laid down in European Norms EN 55015, EN 55022, IEC 61000-3-2 and IEC 61547.

4.1.1. RFI (radio frequency interference)
The radio frequency interference (RFI) regulations as laid down in EN 55015 concern the frequency range between 9 kHz and 30 MHz. However, nowadays more and more electronic products are being marketed that operate on higher frequencies, like for example communication equipment. The RFI-requirements for this kind of equipment are laid down in the more stringent norm EN 55022, valid for frequencies from 30 MHz up to 1000 MHz. Philips HF electronic ballasts fulfil the requirements of this latter norm and are therefore the best choice if they are to operate in an environment where other equipment is used working on frequencies up to 1000 MHz.

Apart from these general norms, there are some specific regulations in force for rooms where diagnostic or observation equipment is placed. In VDE 0107 norms are definitions for these kind of rooms. Measurements on Philips electronic ballasts have shown that in the relevant frequency ranges, no interference of any significance occurs.

4.1.2. Immunity
When the mains voltage deviates from its nominal value more than the ballast tolerance permits (220 V to 240 V ± 10 %), adverse effects on lamp life, ballast life and light output can be expected. Excessively high voltages (Umains > 320 V) over a considerable period of time (>48 hours) will damage the ballast. Mains transients and dips, on the other hand, will not harm the ballast, provided they are within the regulations of EN 61547.

4.2. Humidity
HF electronic ballasts do not have any special protection against humidity. Nevertheless, Philips electronic ballasts have been tested on sensitivity to humid conditions and have proven to be able to resist a relative air humidity of up to 95 %. Direct water ingress will, however, damage the ballast. It is therefore wise to pay attention to a few safeguards:
- Make sure that there can be no condensation on or in the ballast.
- Also make sure that the ballast is mounted in such a way that no condensed or other water can flow into the ballast.

4.3. Interference with infra red remote control equipment
Video and audio apparatus, computers and also lighting installations nowadays often operate on infrared remote control. The frequencies of such infrared signals are in the order of 36 kHz. In order to avoid any interference with this kind of equipment, the operating frequency of all Philips HF electronic ballasts has been chosen so that problems in the 36 kHz frequency area are out of the question.

4.4. Interference with translation / congress systems
Hints:
- It is advised not to apply HF regulating ballasts in areas where the translation/congress systems mentioned are in use.
- The lower frequency bands between 55 and 175 kHz of translation systems should not be used in rooms where electronic ballasts have been installed.

4.5. Norms, standards and approvals

Philips HF electronic ballasts comply with all relevant international rules and regulations as shown in Table 3.

<table>
<thead>
<tr>
<th>Safety</th>
<th>IEC 61347-2-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>IEC 60929</td>
</tr>
<tr>
<td>Harmonics</td>
<td>IEC 61000-3-2</td>
</tr>
<tr>
<td>Radio frequency interference 9kHz to 30 MHz</td>
<td>EN 55015</td>
</tr>
<tr>
<td>Radio frequency interference 30 MHz to 1000MHz</td>
<td>EN 55022</td>
</tr>
<tr>
<td>Immunity for: mains transients, voltage dips, electrostatic discharge</td>
<td>IEC 61547</td>
</tr>
<tr>
<td>Vibration test</td>
<td>IEC 60068-2-6 Fc</td>
</tr>
<tr>
<td>Bump tests</td>
<td>IEC 60068-2-29 Eb</td>
</tr>
<tr>
<td>Emergency lighting</td>
<td>IEC 60598-2-22</td>
</tr>
<tr>
<td>Approvals</td>
<td>ENEC*</td>
</tr>
<tr>
<td></td>
<td>CE**</td>
</tr>
<tr>
<td></td>
<td>VDE-EMV</td>
</tr>
<tr>
<td>Quality standard</td>
<td>ISO 9001</td>
</tr>
<tr>
<td>Environment management system</td>
<td>ISO 14001</td>
</tr>
</tbody>
</table>

Table 3

*ENEC is the abbreviation of European Norm Electrotechnical Certification. More than twenty Certification bodies from CENELEC member countries have joined the ‘Agreement on the use of a commonly agreed mark of conformity for luminaires complying with European standards’. This agreement is in short referred to as the LUM agreement. It means that if the ENEC marking is given by one Certification body, it is also recognised by all the other members. The marking can be obtained for luminaires for which a European Norm (EN) exists, with the exception of luminaires for emergency lighting. In 1995 the LUM group and the LVE-AC (Low Voltage Electrical Equipment Advisory Committee) decided that luminaire accessories like gear, ignitors, lamp holders, electronic converters and capacitors can obtain the ENEC marking if they fulfil the harmonised EN standards. Philips HF electronic ballasts received the ENEC marking on the basis of complying with IEC 61347-2-3, IEC 60929 and the ISO 9001 certificate.

**All Philips HF electronic ballasts carry the CE marking. CE is the abbreviation of Conformité Européenne. It states conformity of products to the essential requirements of the European Community Directives. It is a kind of passport for goods to circulate freely throughout the European Union. Furthermore, it enables Market Controlling Bodies to carry out their inspection more easily. Lighting products are covered by three European directives: the Electromagnetic Compatibility (EMC) Directive, the Low Voltage (LV) Directive and the ballast directive. Philips HF electronic ballasts carry the CE marking on the basis of fulfilment of the following standards: IEC 61547, IEC 61000-3-2, EN 55015 (tested in a reference luminaire described by CISPR 30) and EN 50294.
5. Other basic aspects

5.1. Emergency lighting
Most electronic ballasts are suitable for use in emergency lighting installations. Distinction must, however, be made between centralised and decentralised emergency lighting. Provided the correct voltages are applied, electronic ballasts can be used in centralised installations. When talking about a decentralised emergency lighting set-up, many different configurations are possible. In general the emergency converter must have a four-pole switchover relay to ensure that the wiring between the HF ballasts and the lamp is completely shut off when the emergency lighting is in operation. Interference from the emergency converter to the HF ballast is then eliminated. Three-pole switchover relay should not be used in combination with HF electronic ballasts unless the lamp is normally connected with only three wires to the ballast.

5.2. HF Ballasts and dimming
Fluorescent lamps can be dimmed with dimmable HF electronic ballasts, such as the Philips HF-REGULATOR types. Philips HF-REGULATOR ballasts can be controlled by a 1-10 V DC, DALI or Touch and Dim input from various types of regulating systems. The control wiring must be dealt with like 230 V wiring. For more information on the installation of different control systems, see the Application Guide to Fluorescent lamp control gear or contact your local sales agent.

Hint:
If a 1-10 V DC signal is used, the dimming control wiring in the installation should be kept separate from the mains wiring when the length of the wires exceeds 5 m. Otherwise, interference between mains and dimming wiring might occur. This could cause light flicker or 100 Hz modulation.

Tip:
If separation of the wiring is not possible, use shielded control wiring.
6. Colour coding of the HF Matchbox ballasts

Since the HF-Matchbox ballasts are also used without housing, it is not possible to stamp on the ballast the ballast type. To solve this issue a colour coding on the mains terminals is being used. The only thing you need to know is the size of the PCB (Printed Circuit Board), whether it is an HF-Matchbox red or blue and the colour coding part at the mains terminals. The mains terminals itself are orange. In the table below (Table 4) you can find the translation from colour coding in combination with size to type.

<table>
<thead>
<tr>
<th>Type</th>
<th>Size (L x W x H)</th>
<th>Colour code</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF-Matchbox RED 109</td>
<td>56 x 36 x 20</td>
<td>Black</td>
</tr>
<tr>
<td>HF-Matchbox RED 113</td>
<td>56 x 36 x 20</td>
<td>Grey</td>
</tr>
<tr>
<td>HF-Matchbox RED 114</td>
<td>56 x 36 x 20</td>
<td>Blue</td>
</tr>
<tr>
<td>HF-Matchbox RED 118</td>
<td>56 x 36 x 20</td>
<td>Orange</td>
</tr>
<tr>
<td>HF-Matchbox RED 124</td>
<td>70 x 36 x 20</td>
<td>Red</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 105</td>
<td>120 x 18 x 20</td>
<td>Black</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 109</td>
<td>120 x 18 x 20</td>
<td>Blue</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 114</td>
<td>120 x 18 x 20</td>
<td>Grey</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 121</td>
<td>160 x 18 x 20</td>
<td>Grey</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 124</td>
<td>160 x 18 x 20</td>
<td>Orange</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 128</td>
<td>160 x 18 x 20</td>
<td>Blue</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 105</td>
<td>56 x 36 x 20</td>
<td>Black</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 109</td>
<td>56 x 36 x 20</td>
<td>Blue</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 114</td>
<td>56 x 36 x 20</td>
<td>Grey</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 118</td>
<td>56 x 36 x 20</td>
<td>Orange</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 124</td>
<td>70 x 36 x 20</td>
<td>Orange</td>
</tr>
<tr>
<td>HF-Matchbox BLUE 128</td>
<td>70 x 36 x 20</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Table 4

Size in mm
Warranty is a commercial issue and can vary according to country, production centre, product or even customer. Philips Lighting Electronics Europe warrants in general that the technology and quality of electronic ballasts have evolved tremendously over the last ten years. Together with their high efficiency this makes electronic ballasts the most economic solution to drive discharge lamps.

To demonstrate our confidence in the reliability of our products Philips now offers an extended guarantee. Philips was the first company to develop electronic ballasts. Right from the start Philips offered service and support wherever necessary and continues to do so. The high quality and technology standards of the Philips Lighting electronic ballasts of today will now be more explicitly reflected in a 3 and 5-year guarantee. This guarantee applies to all Philips Lighting electronic ballasts and will benefit the OEM, the installer and the end-user. Since Philips has always maintained a very high service and after sales support level this more explicit guarantee is really nothing new. Business as usual!

7.1. 3 year warranty
The 3-year guarantee applies to any Philips Lighting electronic ballast. No registration is necessary. An invoice that shows the number of ballasts etc. (see leaflet for further details) is sufficient. The start of the guarantee period is the purchase date of the products.

7.2. 5 year warranty
The 5-year guarantee applies to Philips Lighting electronic ballasts when used in registered projects, provided IEC compliant lamps are installed. The start of the guarantee period is the registered date of the commissioning of the lighting installation. Registration will take place via a specially designed registration form, which should be sent to the Philips office mentioned on the form, within two months of the installation of the project.

Although the 5-year guarantee is valid with all IEC compliant lamps, a Philips lamp and ballast combination will always give optimum performance because they have been designed around each other, within the IEC limits. A failure with such a tuned lamp and ballast combination is therefore less likely.

The registration form can be found via various Philips Lighting Electronics websites such as:
http://www.dimming.philips.com
http://www.philips.com/fluo-gear
http://www.lampsandgear.com
8. More information or support needed?

Readers who want further information or support on installation aspects of HF electronic ballasts, are invited to contact their local Philips support office.

Also, for further reading the following printed documentation is available on request:

- Application guide to fluorescent lamp control gear. This 120 pages counting booklet explaining all application and installation aspects in depth, ordering number 3222 635 59771 or as PDF file available at http://www.philips.com/fluo-gear.

- MultiDim Installation and Design Manual for extensive information on DALI and the MultiDim system. This 74 pages counting document can be downloaded as a PDF file from http://www.dimming.philips.com.


- Product information leaflets of the individual ballast types. Folders with technical details, ordering numbers as per item.

- OEM catalogue, which is a collection of all datasheets/product leaflets of the currently available products.
Contact details for your local Philips Lighting Office