



2007/08 Energy Label Compliance Testing – Lighting Ballasts: Post-consultation Report

Executive summary

One hundred fluorescent lighting ballasts were tested using a simplified testing regime. Of these, 93 ballasts fell within the scope of the EC Directive 2000/55/EC; the other seven operate lamp types that are still quite widely used within the UK. The ballasts covered 12 of the 25 manufacturers identified as making lighting ballasts (although not necessarily fluorescent ballasts) and all three common ballast types; magnetic, electronic and dimmable.

The initial results of tests suggested that only 69 of the 93 ballasts that fell within the scope of the Celma Energy Efficiency Index (EEI) gave results that tallied with their declared EEI. These results were sent to the manufacturers for comment.

Several manufacturers questioned the testing procedure and in particular one manufacturer suggested that the calculation from the Celma guide to EC Directive 2000/55/EC used by the test laboratory to determine the EEI of the tested ballasts was not appropriate for magnetic ballasts. The limitations of the test procedure specified by MTP (to allow a greater range of ballasts to be tested) does not allow rigorous calculation of the EEI according to BS EN 50294:1998. However, using an alternative calculation (from BS EN 50294:1998) and several 'worst case' assumptions, six of the seven magnetic ballasts that had appeared to have 'failed' were actually compliant. Only one magnetic ballast still appeared to be giving a result that was worse than the minimum standard set by the Directive.

The simplified testing procedure undertaken in this study did not allow the results for the nine electronic ballast 'failures' to be completely checked. However, eight of the nine are judged as likely to be compliant with the minimum standard in the EC Directive even if they may not comply with their declared EEI. One electronic ballast may not be performing to the minimum standard level but neither this ballast nor the magnetic ballast above are current products.

Of the products outside the scope of the Directive, six were not unduly inefficient compared with ballasts that do fall within the scope. The seventh ballast was defective at both supply voltages tried.

The fluorescent ballast market seems to be largely conforming to the requirements of the Energy Efficiency Index labelling and the EC Directive on minimum standards. There is no mechanism within the Directive to ensure that very old stock is not sold.

This study covered a large snapshot of the ballasts available for sale in the UK so it is not recommended that any further testing is done on this product family in the near future.

The minimum standard for fluorescent lighting ballasts is under review as part of the considerations under the Energy Using Products Directive. If the minimum standard is changed as a result of this Directive then it would be useful to retest a sample of products one year after the changes have taken place. Due to the uncertainties arising from the test

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results in this study, it would be important for the full testing regime, including the light output tests, to be undertaken.

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1 Introduction

The research involved one hundred fluorescent lighting ballasts from on-line suppliers, and testing them to assess whether they meet the claims on their energy labels (if any).

The scope of the project was limited to testing one sample of each ballast. All testing was carried out during August to November 2007.

Tests were carried out according to the following standards:

- Commission Directive 2000/55/EC of 18 September 2000

This Directive refers to BS EN 50294:1998 with amendments A1 and A2.

Not all the ballasts tested in this project are covered by the requirements of Directive 2000/55/EC but the project team considered that it would be useful to compare the performance of ballasts covered by the Directive with that of those that are not. The term 'outside scope' will be used in this report to refer to the ballasts that are outside the scope of the Directive.

2 Lighting ballast selection and purchase

The UK market for fluorescent lighting ballasts includes over 25 different brands each making many different models. It is not feasible for MTP to test all of these in any one year. For this project, one hundred models were selected from twelve different brands. The brands selected were purchased from three different on-line suppliers although the bulk of the ballasts (88) were purchased from one supplier who offered a good range of manufacturers' products.

The ballasts covered all the energy efficiency classes currently allowed to be placed on the market i.e. from Energy Efficiency Index (EEI) B2 to A1¹. In addition there were seven ballasts that fell outside the scope of the Directive and energy labelling scheme. The ballasts that were outside the scope were mostly designed to operate T12 (38mm) fluorescent lamps or were designed to operate small T2 lamps (13W or lower). There is still thought to be a significant stock of T12 fittings in the UK (current MTP estimate ~5 million), so there is still a significant potential for sales of replacement ballasts for these fittings.

¹ See Celma guide for the application of Directive 2000/55/EC on energy requirements for ballasts for fluorescent lighting.

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The number of ballasts chosen from each manufacturer was determined by their prominence in the UK market. One manufacturer supplies up to 80% of the UK market, so 21 of their ballasts were included in the test programme. The next four largest suppliers contributed 16, 14, 13 and 10 products to the programme, with seven smaller suppliers contributing between one and six products. Seven of the twelve manufacturers are members of the Lighting Industry Federation.

There are three main types of ballasts sold at present; magnetic, electronic and dimming electronic. A selection of each type of ballast was made from each manufacturer, where possible. Overall, 20 magnetic, 60 electronic and 20 dimming electronic ballasts were tested. Although electronic ballasts do not represent much more than 50% of the UK market, the trend is towards the use of these ballasts and many more electronic ballast models are available on the market than magnetic ballasts.

3 Performance testing

3.1 Test procedure

All ballasts were tested in accordance with BS EN 50294:1998 with amendments A1 and A2. MTP testing was limited to the performance of the ballasts in terms of the amount of electrical power consumed by the lamp / ballast combination. MTP did not test the other factors covered in the standard. Products were tested to clause 5.2 ONLY although note that EN 60920 has now been replaced by the appropriate parts of EN 61347 (Part 2-8 for wire-wound and part 2-3 for a.c.supplied electronic).

Note that MTP did not require full safety checks of the ballasts and EN 61347 was only used where necessary to set up for measurements according to clause 5.2 of EN 50294. (Although where there were any concerns over the safety of the ballast, thermal or electrical, these are noted on the results sheet). All measurements were made at 230V. MTP did NOT require that the measurements specified in clauses 5.3 or 5.4 were made.

Note that the primary aim of this work was to confirm (or not) that the ballast / lamp combination is consuming the appropriate power for the CELMA class claimed.

One results sheet was supplied per ballast tested.

3.2 Test house

The ballasts were tested by the Lighting Association, a UKAS-accredited test house.

3.3 Summary of results

3.3.1 Lighting Association results overview

The ballast losses were calculated by Lighting Association (LA) by applying the CELMA guide on the application of EC Directive 2000/55/EC using the following equations:

$$\text{Ballast loss} = \text{Total circuit input power} - \text{Ballast output power} \quad (1)$$

$$\text{Allowable ballast loss} = \text{Max allowable power for ballast class} - \text{Nominal power for lamp alone} \quad (2)$$

Table 1.1 Summary of initial fluorescent lighting ballast results by manufacturer from Lighting Association report

Manufacturer reference	Number of passes	Number of 'failures'	Other results
1	16 ²	3	2 OS
2	9	3	3 OS; 1 UL
3	12	1	1 OS
4	11	1	1 UL
5	6	2	1 OS; 1 UL
6	4	1	1 UL
7	2	1	2 UL
8	2	2	1 UL
9	2	0	2 UL
10	2	1	
11	2	0	
12	1	0	
Total	69	15	7 OS; 9 UL

3.3.2 Notes

- For energy label classes, a pass means that the test result gave the same class as claimed or better.
- For energy label classes, a fail means that the test result gave a lower class than claimed according to equation (2) – no measurement tolerances have been taken into account at this stage.
- In 'other results' column, OS indicates outside scope of the Directive; UL indicates that no energy efficiency index (EEI) was marked on the product so the EEI was unknown at the point of purchase.

² Included one result where ballast gave a better result than the indicated energy efficient index.

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3.3.3 Re-evaluation following manufacturer's comments

Suppliers of the tested fluorescent lighting ballasts were sent their test results as tabled in Table 1.1 in January 2007. Follow up was necessary for most suppliers to confirm that they had reviewed the results and to receive any comments.

Several manufacturers queried the test method and one manufacturer pointed out that for magnetic ballasts, the calculation above (Equations (1) and (2)) was not correct according to BS EN 50294:1998. They referred to section 5.3 of the standard; the calculation required is shown in equations (3) and (4) below.

For magnetic ballast

$$P_{\text{tot ref}} = P_{\text{tot meas}} \times ((P_{\text{L ref. meas}} / P_{\text{L meas}}) \times 0.95) - (P_{\text{L ref meas}} - P_{\text{L nom}}) \quad (3)$$

and they further assumed that

$$P_{\text{tot meas}} = P_{\text{L meas}} + \text{Ballast losses} \quad (4)$$

This calculation refers to some factors that were not measured in the 'real world' testing regime requested by MTP from the test house e.g. $P_{\text{L ref meas}}^3$, but if we simply assume that this factor is equal to $P_{\text{L nom}}$, we still get significantly higher allowable losses from magnetic ballasts than those calculated by equation (2) to section 3.3.1⁴. Applying these equations and the above assumption to the seven magnetic ballasts that 'failed' the testing according to the earlier analysis, all but one ballast now passes.

One magnetic ballast still appears to have ballast losses higher than allowed by equations (3) and (4) with the assumptions above; with losses of 7.1W where the maximum allowable according to equations (3) and (4) is 5.2W.

For electronic ballasts, the non-compliance is rather more difficult to check. BS EN 50294:1998 shows the following equation for these ballasts:

$$P_{\text{tot ref}} = P_{\text{tot meas}} \times (P_{\text{L nom}} / P_{\text{L ref. meas}}) \times (\text{Light}_{\text{ref}} / \text{Light}_{\text{test}})$$

LA has assumed that $P_{\text{L nom}} = P_{\text{L ref. meas}}$ and that $\text{Light}_{\text{ref}} = \text{Light}_{\text{test}}$. No photometric measurements were made in order to reduce the costs of testing and to allow more ballasts to be evaluated. Therefore it is not possible to be definitive about the non-compliance of the electronic ballasts tested.

³ Testing the ballasts to the letter of BS EN 50294:1998 would have required the purchase of expensive reference ballasts and would have severely restricted the number of ballasts that could have been assessed within the project budget. As the aim of the project was to provide a broad snapshot of the market, it was decided not to pursue this course but to adopt a 'real world' test regime according to clause 5.2 of the standard only.

⁴ Lighting Association questioned the validity of equation 4 (which does not appear in the Standard) but agreed that by applying equation 3 and comparing with the CELMA guide, some of the ballasts that did not appear to comply with the stated EEI using the analysis in 3.3.1 may do so.

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All but one of the electronic ballasts in question certainly do comply with EEI A3 and are, therefore, appropriate for sale in the EC; it is not possible to say with any certainty whether the ballasts do or do not comply with their rated EEI of A2.

One electronic ballast appears to be operating very poorly in our tests with ballasts losses of 6.96W when the allowable losses according to equation (2) are 4W for EEI A2 (its rated EEI) and 6W for EEI A3.

The revised results have been put into table 1.2 with a new category of 'Dir compliant' for those electronic ballasts that certainly comply with the minimum standards of the Directive but do not necessarily comply with their labeled EEI values.

The EEI of the unlabelled ballasts have been ascertained either directly from the manufacturer or by visiting the manufacturer's website and the results have been included in the appropriate column of table 1.2.

3.3.4 Revised summary of results

Table 1.2 Revised summary of fluorescent lighting ballast results by manufacturer

Manufacturer reference	Number of passes	Directive compliant	Probable failures	Other results
1	16 ⁵	3		2 OS
2	12		1	3 OS
3	12	1		1 OS
4	11	2		
5	9			1 OS
6	4	1 UL	1	
7	4	1		
8	5			
9	4			
10	2	1		
11	2			
12	1			
Total	82	9	2	7 OS

3.3.5 Pass/fail summary and consultation outcome

Several of the ballasts purchased are no longer current stock for the manufacturers. One ballast from manufacturer 2 that is registered as a 'pass' above has been obsolete for three years.

⁵ Included one result where ballast gave a better result than the indicated energy efficient index.

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82 of the 93 ballasts within the scope of the EC Directive are compliant with the EEI marked on the product or available through the manufacturers' literature.

Nine electronic ballasts may not be performing as well as their declared EEI of A2 but they are definitely at least EEI A3 and hence are acceptable for sale within the EC at present. Manufacturer 1 supplied MTP with copies of their test results for the three ballasts questioned in this report; all the results showed compliance with the EEI quoted.

Six of the seven ballasts that fell outside the scope of the EC Directive were not unduly inefficient compared with ballasts that do fall within the scope.

One magnetic, one electronic and one T12 ballast performed particularly badly in our tests; the T12 ballast did not operate the lamp properly either at 230V or 240V.

3.4 Energy Label points to note

3.4.1 Products outside minimum standard

Two products, one magnetic and one electronic ballast, appeared to be performing below the minimum standard performance levels. As the full test range of measurements were not carried out in this 'snapshot' test programme, and because only one sample of each ballast was tested, it is not possible to determine whether these results would be typical of the product. Neither of these products appears to be a current product according to the manufacturers' websites.

3.4.2 Products outside scope of Directive

Seven ballast products were tested that fall outside the scope of the directive, they were six products for T12 lamps and one for a small T2 (3mm diameter) lamp. Five of the six T12 ballasts which were operating 100W or 125W nominal power lamps gave ballast losses of between 11.5 and 13W. The nearest lamp to these that lies within the scope of the Directive is the 70 W T8 lamp. This lamp is allowed ballast losses of 10W or 14.3% of the nominal lamp wattage; all the T12 ballasts tested have ballast losses within 13% of the nominal lamp wattage.

This study concludes that although the T12 high wattage ballasts fall outside of the scope of the ballast Directive, they are not unduly inefficient compared with ballasts that do fall within the scope. The exception was one ballast that

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did not operate correctly at all. It did not ignite the lamp at 230V and did not operate correctly when the voltage was increased to 240V.

The T2 lamp had 1.75W of loss in the ballast for a 6W lamp. The nearest equivalent lamp (6W T8) within the scope of the Directive is allowed ballast losses of 3.9W so this ballast far outperforms the minimum standard in the Directive.

This study therefore concludes that the quality of lighting ballasts being sold in the UK at present is largely consistent with the minimum standards of the EC Directive whether or not the ballast is contained within its scope.

3.4.3 Indeterminate product

EEL information could not be determined for one product from a manufacturer in the USA. The product does not form part of the manufacturer's current product family. The result for the electronic ballast in question was EEL A3 which can be legally sold within the EC, so this ballast is compliant with the Directive although we cannot determine whether it is compliant with any published EEL figure.

3.5 Suggestions for future activity

The fluorescent ballast market seems to be largely conforming to the requirements of the Energy Efficiency Index labelling and the EC Directive on minimum standards. There is no mechanism within the Directive to ensure that very old stock (in this case product that was placed on the market prior to November 2005) is not sold.

This study covered a large snapshot of the ballasts available for sale in the UK at this time so it is not recommended that any further testing is done on this product family in the near future.

The minimum standard for fluorescent lighting ballasts is under review as part of the considerations under the Energy Using Products Directive. If the minimum standard is changed as a result of this Directive then it would be useful to retest a sample of products one year after the changes have taken place.

Due to the uncertainties arising from the test results in this study, it would be important for the full testing regime, including the light output tests, to be undertaken.