

Product Fact Sheet – Lighting products: Compact Fluorescent Lamps (CFLs)

Table 5. Overview of CFLs

Country	MEPS	High label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
Australia	56		Efficacy = luminous flux / lamp power	AS/NZS 4847.1	IEC 60969	1	1	
China	56	Efficacy requirement varies based on lamp power and color temp	Efficacy = luminous flux / lamp power	GB 19044-2013	IEC 60969	1	1	
EU	56	Efficacy requirement varies based on lamp flux	Efficacy = luminous flux / lamp power	EN 60969	IEC 60969	1	1	
US	60	Efficacy ≥ 55 lm/W (lamps < 15 W), ≥ 65 (lamps ≥ 15 W).	Efficacy = luminous flux / lamp power	10 CFR Part 430.23(y)	IEC 60969	1	1	
Mexico	60.5	Efficacy requirement varies based on lamp power	Efficacy = luminous flux / lamp power	NOM-017-ENER/SCFI-2008	IEC 60969	1	1	
Indonesia		Efficacy requirement varies based on lamp power	Efficacy = luminous flux / lamp power	IEC 60969	IEC 60969	1	1	

(*) Conversion factors

Product

1. Compact fluorescent lamps (CFLs) or bulbs are the often curly, screw-in versions of the long tube fluorescent lights consisting of fluorescent lamp tubes. Ballasts are integrated into the lamp, not sold as a separate item as for large tubes. This makes CFLs a standalone retrofit solution to replace incandescent lamps. CFLs are available in a range of light colors, including incandescent-like "warm" tones. Some CFLs are encased in a bulb-shaped cover to further diffuse the light. These can be used with clamp-on lampshades. CFLs can provide the same lighting as traditional

incandescent bulbs for reading and room lighting.

2. CFLs are fluorescent lamps that include all the components necessary for starting and stable operation of the lamp.

Overview of international situation with regards to S&L for this product category

1. All but one of the countries in the table above set mandatory MEPS for CFLs, and many countries have had MEPS for some time. These are typically set by national Governments, or the European Commission in the case of the EU. These MEPS all cover efficacy, and in most cases many other performance parameters are also subject to MEPS, such as lifetime, start time, color rendering index, etc.

2. All these countries base their CFL test procedure on IEC 60969.

3. The test procedures, at least for efficacy, are well harmonized between the IEC and North American standards bodies.

General description of conversion for test procedures and metrics/ efficiency metrics and standards

1. No conversion necessary for CFL test procedures (efficacy) or metrics (efficacy).

2. The referenced test procedure is IEC 60969 which references globally-accepted CIE photometry methods.

3. Representative products (e.g., 1000lm CFL, 6500K color temperature) were used in order to compare MEPS limits, as the MEPS limit varies depending on product parameters such as lamp power and in some cases lamp color temperature.

4. This product type is very comparable, noting the above point.

5. The only materially specific issue relates to the EU MEPS limit, as described above.

Notes and assumptions

None other than those mentioned above.

List of sources

Regulations and standards from each country, as listed in CLASP's Global S&L Database http://www.clasponline.org/en/Tools/Tools/SL_Search.aspx



Product Fact Sheet – Lighting products: Lamp / Filament Directional Lamps

Table 6. Overview of Lamp / Filament Directional Lamps

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
Australia	$\geq (2.8 \ln(\text{flux}) - 4.0)$. And MR16 lamp power capped at 37W		Efficacy = luminous flux / lamp power	AS/NZS 4934.1	CIE 84	1	1	
EU	Minimum efficacy as a function of flux (complex table of formulae)	Minimum efficacy as a function of flux (complex table of formulae)	Efficacy = luminous flux / lamp power	EN 50285	CIE 84	1	N/A	
US	Minimum efficacy as a function of lamp power and lamp diameter	Minimum efficacy as a function of lamp power and lamp diameter	Efficacy = luminous flux / lamp power	10 CFR Part 430 Appendix R to Subpart B	CIE 84	1	1	

(*) Conversion factors

Product

1. Filament lamps are lamps in which light is produced by means of a threadlike conductor which is heated to incandescence by the passage of an electric current. The lamp may or may not contain gases influencing the process of incandescence. Incandescent filament lamps produce radiant power as a result of electric current passing through a tungsten filament, which is surrounded by an inert atmosphere or vacuum within a glass or quartz envelope. Some lamps contain halogens that are employed to maintain a clean bulb wall. Such lamps may also employ bulb coatings that redirect infrared energy back to the filament for improved efficacy or to filter radiation for color control.

2. The directional element refers to a lamp having at least 80% light output within a solid angle corresponding to a cone with angle of 120).

Overview of international situation with regards to S&L for this product category

1. Australia, the EU and the US have MEPS for these lamps. These are typically set by national governments, or the European Commission in the case of the EU. MEPS typically cover efficacy, and in some cases other performance parameters are also subject to MEPS, such as lifetime, lumen maintenance.

2. All testing is based on CIE 84.
3. The test procedures, at least for efficacy, are well harmonized.

General description of conversion for test procedures and metrics/ efficiency metrics and standards

1. No conversion necessary for test procedures (efficacy) or metrics (efficacy).
2. For the EU (MEPS) it is not possible to convert the MEPS metric because EU MEPS (directional lamps) only considers light in a 90 or 120 degree cone (depending on lamp type) whereas most other economies (e.g. US, Australia) consider the light in 180 degree hemisphere. Converting between "cone" approach and the "hemisphere" approach is difficult because there is not likely to be a linear relationship between these (i.e. the relationship is likely to vary for various lamp types). Developing a relationship would require in-depth examination of "light distribution" data from many lamps. Note that the test method is the same (measure the light output) but the EU MEPS only considers a certain amount of light that you measured - the light within the "cone"
3. Note also that lower US mains voltage means filament lamps can be more efficient (hotter filament).
4. The referenced test procedure is CIE 84 which is the globally-accepted CIE photometry method.
5. This product type is quite comparable, noting the points above point.
6. The only material specific issues relate to EU MEPS and the US mains voltage, as described above.

Notes and assumptions

None other than those mentioned above.

List of sources

None other than those mentioned above.



Product Fact Sheet – Lighting products: Lamp / Filament Non-Directional Lamps

Table 7. Overview of Lamp / Filament Non-Directional Lamps

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
Australia	14.6 lm/W		Efficacy = luminous flux / lamp power	AS/NZS 4934.1	CIE 84	1	1	
China			N/A - eliminates incandescent lamps by technology definition, rather than MEPS					
EU	16.3 lm/W	22 lm/W**	Efficacy = luminous flux / lamp power	EN 50285	CIE 84	1	1	
US	23 lm/W			10 CFR Part 430 Appendix R to Subpart B	CIE 84	1	1	

(*) Conversion factors

** Represents the “B” label class. The EU uses one label for all non-directional lamps, which has a highest class limit of 118 lm/W (for a 1000 lm lamp). The highest class practically achievable with a filament lamp, however, is the “B” class which runs from 22 to 54 lm/W.

Product

1. Filament lamps are lamps in which light is produced by means of a threadlike conductor which is heated to incandescence by the passage of an electric current. The lamp may or may not contain gases influencing the process of incandescence. Incandescent filament lamps produce radiant power as a result of electric current passing through a tungsten filament, which is surrounded by an inert atmosphere or vacuum within a glass or quartz envelope. Some lamps contain halogens that are employed to maintain a clean bulb wall. Such lamps may also employ bulb coatings that redirect infrared energy back to the filament for improved efficacy or to filter radiation for color control.

2. The non-directional element differentiates these lamps from their directional counterparts. Non-directional lamps distribute their light more or less evenly in all directions, whereas directional ones have at least 80% of their light output in one direction, a cone with angle of 120 degrees.

Overview of global situation with regards to S&L for this product category

1. Australia, the EU and the US have MEPS for these lamps. China and Russia are eliminating

incandescent lamps using a technology definition, rather than a performance specification. These are typically set by national Governments, or the European Commission in the case of the EU. MEPS typically cover efficacy, and in some cases other performance parameters are also subject to MEPS, such as lifetime, lumen maintenance.

2. All testing is based on CIE 84.
3. The test procedures, at least for efficacy, are well harmonized.

General description of conversion for test procedures and metrics/ efficiency metrics and standards

1. No conversion necessary for test procedures (efficacy) or metrics (efficacy).
2. Note also that lower US mains voltage means filament lamps can be more efficient (hotter filament).
3. The referenced test procedure is CIE 84 which is the globally-accepted CIE photometry method.
4. Representative products were used in order to compare MEPS limits, as the MEPS limit varies depending on product parameters such as lamp power and in some cases lamp color temperature.
5. This product type is very comparable, noting the above point.
6. The only material specific issues relates to the EU MEPS limit and US mains voltage, as described above.
7. Results are intended to be used for high-level comparisons of high volumes of products - not individual products.

Notes and assumptions

None other than those mentioned above.

List of sources

Regulations and standards from each country, as listed in CLASP's Global S&L Database http://www.clasponline.org/en/Tools/Tools/SL_Search.aspx



Product Fact Sheet – Lighting products: Ballast / HID

Table 8. Overview of Ballast / HID

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
China	Ballast efficiency of 85%	N/A	Ballast Efficiency = corrected lamp power / total circuit power		IEC 60923	1	1	
EU	Ballast efficiency of 85%		Ballast Efficiency = corrected lamp power / total circuit power	EN 50294	IEC 60923	1	1	
Mexico		N/A	Ballast Efficiency = corrected lamp power / total circuit power	NMX-J-503-ANCE NMX-J-230-ANCE	IEC 60923	1	1	

(*) Conversion factors

Product

- High intensity discharge lamps are lamps in which the light is produced, directly or indirectly, by an electric discharge through a gas, a metal vapor or a mixture of several gases and vapors; and in which the light producing arc is stabilized by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimeter.
- Ballasts are lamp control gear which serves to limit the current of lamps to the required value in case it is connected between the supply and one or more discharge lamps. It may also include means for transforming the supply voltage, dimming the lamp, correcting the power factor and, either alone or in combination with a starting device, providing the necessary conditions for starting the lamps.

Overview of international situation with regards to S&L for this product category

- Three of the economies in the table above have S&L programs for HID ballasts. These are typically set by national Governments, or the European Commission in the case of the EU. These MEPS all cover ballast efficiency.
- With the exception of Mexico, these countries base their test procedure on IEC 60923.

General description of conversion for test procedures and metrics/ efficiency metrics and standards

- There is no conversion necessary for test procedures and metrics.

2. The referenced test procedure is IEC 60923.
3. Representative products were used in order to compare MEPS limits, as the MEPS limit varies depending on product parameters such as lamp power.
4. This product type is relatively comparable.
5. Results are intended to be used for high-level comparisons of high volumes of products - not individual products.

Notes and assumptions

None other than those mentioned above.

List of sources

Regulations and standards from each country.



Product Fact Sheet – Lighting products: Lamp / HID

Table 9. Overview of Lamp / HID

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
China	75 (high pressure sodium) 72 (metal halide)	Efficacy requirement based on lamp power	Efficacy = luminous flux / lamp power	GB/T 13434 GB/T 13259 GB 20054 GB 18661 QB/T 2515	IEC 61167 IEC 60662 IEC 60188	1	1	
EU	100 (high pressure sodium) 85 (metal halide)		Efficacy = luminous flux / lamp power	EN 61167 EN 60662 EN 60188	IEC 61167 IEC 60662 IEC 60188	1	1	
Mexico	75 (high pressure sodium) 65 (metal halide)		Efficacy = luminous flux / lamp power	NMX-J-530-ANCE	IEC 61167 IEC 60662 IEC 60188	1	1	

(*) Conversion factors

Product

1. High intensity discharge lamps are lamps in which the light is produced, directly or indirectly, by an electric discharge through a gas, a metal vapor or a mixture of several gases and vapors; and in which the light producing arc is stabilized by wall temperature and the arc has a bulb wall loading in excess of 3 watts per square centimeter.

Overview of international situation with regards to S&L for this product category

- Only three of the countries in the table above have S&L programs for HID lamps (metal halide, sodium and mercury vapor lamps). These are typically set by national Governments, or the European Commission in the case of the EU. These MEPS all cover efficacy, and in some cases other performance parameters are also subject to MEPS, such as lumen maintenance.
- The test procedures are globally consistent and rely on CIE photometry methods.
- The test procedures, at least for efficacy, are also well harmonized between the IEC and North American standards bodies.

General description of conversion for test procedures and metrics/ efficiency metrics and standards



1. No conversion necessary for test procedures (efficacy) or metrics (efficacy).
2. The reference test procedures are held in IEC standards which rely on globally-accepted CIE photometry methods.
3. Representative products were used in order to compare MEPS limits, as the MEPS limit varies depending on product parameters such as lamp power and in some cases lamp color temperature.
4. This product type is very comparable, noting the above point.
5. The only material specific issue relates to the EU MEPS limit, as described above.
6. Results are intended to be used for high-level comparisons of high volumes of products - not individual products.

Notes and assumptions

None other than those mentioned above.

List of sources

Regulations and standards from each country.

US DOE Test Procedures and Regulations, high-intensity discharge lamps.

http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/60



Product Fact Sheet – Lighting products: Ballast / Linear Fluorescent

Note: A CLASP benchmarking study focusing on linear fluorescent lighting is forthcoming in late 2014. It will provide a more detailed description of the comparability of linear fluorescent ballasts.

Table 10. Overview of Ballast / Linear Fluorescent

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
Australia	Minimum energy efficiency index (EEI) of B2	Energy efficiency index (EEI) of A2	Energy Efficiency Index (EEI) = a discrete value (looked up from a table) based on ballast efficiency	AS/NZS 4783.1	EN 50294	1	1	Australian, EU and Chinese metrics are quite comparable, as EEI and Ballast Efficiency Factor are related (lookup table).
China	Minimum energy efficiency index (EEI) of B2	Energy efficiency index (EEI) of A2-BAT	Ballast Efficiency Factor = corrected lamp power / total circuit power	EN 50294 (Chinese equivalent of)	EN 50294	1	1	Australian, EU and Chinese metrics are quite comparable, as EEI and Ballast Efficiency Factor are related (lookup table).
EU	Minimum energy efficiency index (EEI) of B2	Energy efficiency index (EEI) of A2-BAT	Energy Efficiency Index (EEI) = a discrete value (looked up from a table) based on ballast efficiency	EN 50294	EN 50294	1	1	Australian, EU and Chinese metrics are quite comparable, as EEI and Ballast Efficiency Factor are related (lookup table).
US	Requirement for "ballast luminous efficiency (BLE)" is a complex function		Ballast luminous efficiency (BLE) = lamp power / total circuit power	ANSI C82.2	EN 50294	1	1	US "ballast luminous efficiency" is difficult to compare with test methods and parameters used in most other

List of sources

Regulations and standards from each country.

US DOE Test Procedures and Regulations, fluorescent lamp ballasts.

http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/62



Product Fact Sheet – Lighting products: Lamp / Linear Fluorescent

Note: A CLASP benchmarking study focusing on linear fluorescent lighting is forthcoming in late 2014. It will provide a more detailed description of the comparability of linear fluorescent lamps.

Table 11. Overview of Lamp / Linear Fluorescent

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
Australia	e.g. 80		Efficacy = luminous flux / lamp power	AS/NZS 4782.1	IEC 60081	1	1	
China	e.g. 62	Minimum initial efficacy 75-88 lm/W depending on lamp power and color temperature	Efficacy = luminous flux / lamp power	GB 10682	IEC 60081	1	1	
EU	e.g. 92	Initial efficacy requirement based on lamp power	Efficacy = luminous flux / lamp power	EN 60081	IEC 60081	1	1	
US	88		Efficacy = luminous flux / lamp power	IESNA LM-9	IEC 60081	1	1	
Mexico		Minimum initial efficacy 46-90 lm/W depending on lamp power and color temperature	Efficacy = luminous flux / lamp power	NMX-J-295-ANCE	IEC 60081	1	1	
India		>=92 lm/W	Efficacy = luminous flux / lamp power	IS 2418	IEC 60081	1	1	

(*) Conversion factors

Product

1. Fluorescent lamps are discharge lamps of the low pressure mercury type in which most of the light is emitted by one or several layers of phosphors excited by the ultraviolet radiation from the discharge. Fluorescent lamps are supplied either with or without integrated ballasts. The linear aspect refers to the shape of the bulbs which are straight.

Overview of international situation with regards to S&L for this product category

1. All but two of the countries in the table above set mandatory MEPS for Linear fluorescent

lamps, and many countries have had MEPS for some time. These are typically set by national Governments, or the European Commission in the case of the EU. These MEPS all cover efficacy, and in many cases other performance parameters are also subject to MEPS, such as lumen maintenance and color rendering index.

2. With the exception of the US and Mexico, these countries base their linear fluorescent test procedure on IEC 60969.
3. The test procedures, at least for efficacy, are well harmonized between the IEC and North American standards bodies.

General description of conversion for test procedures and metrics/ efficiency metrics and standards

1. No conversion necessary for test procedures (efficacy) or metrics (efficacy).
2. The referenced test procedure is IEC 60081 which references globally-accepted CIE photometry methods.
3. Representative products were used in order to compare MEPS limits, as the MEPS limit varies depending on product parameters such as lamp power and in some cases lamp color temperature.
4. This product type is very comparable, noting the above point.
5. The only material specific issue relates to the EU MEPS limit, as described above.
6. Results are intended to be used for high-level comparisons of high volumes of products — not individual products.

Notes and assumptions

None other than those mentioned above.

List of sources

Regulations and standards from each country.

US DOE Test Procedures and Regulations, general service fluorescent lamps.

http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/70

