Product Fact Sheet – Commercial Refrigeration: Reach in coolers

Note: The "CLASP Commercial refrigeration equipment: mapping and benchmarking" study was published after research for this report was completed. It provides a more detailed description of the comparability of reach in coolers and vending machines.

Table 27. Overview of Reach in coolers

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
China		N/A	un-known	GB/T 8059.1-1995 GB 12021.2-2008 GB 19606-2004	unknown	N/A	N/A	Multi sector refrigerator
China	N/A		un-known	GB 26920.1-2011	unknown	N/A	N/A	Remote refrigerated display cabinet
China	N/A		un-known	GB/T 21001	ISO 23953	1	N/A	Integral refrigerated display cabinet
EU	<125		EEI	based on ISO 23953, set out in 'CF Ecodesign Lot1isc (Jun2013)' p18	based on ISO 23953	1	N/A	Professional storage cabinet
EU	information requirements only		EEI	set out in 'CF Ecodesign Lot1isc (Jun2013)' p18	NF AC D40-003	N/A	N/A	Blast cabinet
EU	N/A		un-known	EN ISO 23953	**ISO 23953**	1	N/A	Retail display cabinet

Mexico	vertical cooler: C = 0,2463 * (V) - 0,4537; horizontal cooler: C = 4,5922 * (V) - 1,0162; vertical freezer: C = 0,0725 * (V) - 0,1136; horizontal freezer: C = 0,0353 * (V) - 0,2142; bagged ice: C = 0,2245 * (V) - 0,5674		un-known	NOM-022-ENER/SCFI-2008	Unknown	N/A	N/A	Commercial freezer
Mexico	C = 0,1555 * (V) - 0,2915		un-known	NOM-022-ENER/SCFI-2008	Unknown	N/A	N/A	Refriger-ated cabinet
US	N/A	Refrigerator-freezers and refrigerators other than all refrigerators with manual defrost: 7.19 * AV + 202.5	kWh/ 100 lbs. ice	10 CFR Part 431.134; (ANSI)/(ASHRAE) Standard 29-2009,	ASHRAE 72: 2005	N/A	N/A	Commercial freezer
US	(kWh/d, Volume) Refrigerator, solid door/s: 0.10V + 2.04; Refrigerator, transparent door/s: 0.12V + 3.34; Freezer, solid door/s: 0.40V + 1.38; Freezer, transparent door/s: 0.75V + 4.10; Fridge/freezer, solid doors: gtr of 0.27AV - 0.71 or 0.70			10 CFR Part 431.64; AHRI Standard 1200 (I-P)-2010 (post-January 1, 2016) and ARI Standard 1200-2006 (pre-January 1, 2016)	ASHRAE 72: 2005	N/A	N/A	Refriger-ated cabinet
India	N/A	N/A	un-known	unknown	unknown	N/A	N/A	Refrigerator - multi-sector

Indonesia	N/A		un-known	unknown	unknown	N/A	N/A	Refriger-ated display cabinets
Australia	Remote and self-contained must be purchased		un-known	AS 1731.1-13:2003	ISO 23953	1	N/A	Refriger-ated display cabinets

(*) Conversion factors

Products

1. The 'Reach-in coolers' category covers a very wide range of commercial cooling products, which can vary according to ambient, storage and processing (e.g. blast cooling, pass through) conditions, use (retail or catering), enclosure shape and volume, and refrigeration system (e.g. integral or remote condenser).

2. Reach in coolers are used all over the world and range from large freezers which line supermarket aisles to the smaller fridges used for drinks etc. in smaller stores. They are non-household cabinets whose primary function is to store foodstuffs in one or more compartments or recesses accessible by reaching (but not stepping) into the cabinet, which is cooled at between -18 and +5oC, using any energy using refrigeration system.

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

1. For Reach-in coolers:
   - Over 10 separate standards are identified for retail display cases/cabinets (RDC) and commercial/professional service cases/cabinets/refrigerators/freezers (CSC) coolers, however most of the market within the scope of this study is covered by ASHRAE 72 or ISO 23953
   - AHRI standards are performance-rating standards that refer to ASHRAE 72 for the test method. These include AHRI 1200 and AHRI 1320
   - ISO 23953:2005 replaces EN441:1995 and key test methods remain the same
   - The ASHRAE standard 72:2005 combines both previous version ASHRAE 117 (open type) and ASHRAE 72 (closed) together eliminating the need for two individual standards
   - Energy Star and the California Energy Commission (CEC) refer to ASHRAE 72

2. Potential Issues for Reach-in Coolers:

The impact of key differences between ASHRAE 72 and ISO 23953 is difficult to quantify, when comparing efficiencies derived from each. A study to evaluate results with changes in key requirements would be beneficial in understanding the relative impact. This could be done first with the same sample tested utilizing each of the two key standards. Additional testing to evaluate the impact of specific criteria would also be needed. This could be accomplished with back-to-back tests while changing each of the key criteria individually. Changes equal to the maximum deviation (between the test procedures) would allow each specification to be evaluated independent of the others. Key specifications may include:

- Air velocity, direction and speed
- Ambient temperature
- Internal temperature
- Door opening frequency, duration, angle
- Loading material, number of measurement sensors, and load levels

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

1. The test procedures most suitable for comparison are ASHRAE 72 and ISO 23953 (replacing EN441). Most test parameters in these procedures are dealt with differently, which makes a conversion between the two test procedures complicated and impossible to do without further research, beyond the scope of this project.

2. The "CLASP Commercial refrigeration equipment: mapping and benchmarking" study was published after research for this report was completed. It provides conversion factors for some, but not all, types of reach in coolers discussed in this study.

Notes and assumptions

China: Refrigerated display cabinets: RDCs with remote condensing units are tested according to GB 26920.1-2011 – where no association with the ISO standard is noted: however the test standard GB/T 21001.2—2007 for other RDCs is associated with ISO 23953 (the exact relationship is unclear due to language differences) – we assume therefore that this correlation relates to integral ('plug in'/self contained) RDCs only. GB/T 21001 also draws upon other standards for RDCs, including Australia's AS1731.14 and the US' ARI Standard 1200 (see sources section).

EU: Retail display cabinets: this regulation is in draft form, and it remains unclear how the efficiencies of these products will be calculated.

US: refrigerated freezers and cabinets: reference standard ARI Standard 1200– 2006 is available but has not been assessed.

Indonesia: the table entry is from the CLASP database. Indonesia has a MEPS and labeling product which covers 9 products (as at 2011), none of which cover commercial refrigeration. Standards are set by the National Standardization Agency and are based on Indonesia National standards (SNI): All of the 9 products currently regulated use SNI methods based on either EIC or ISO standards – indicating a strong preference for harmonized standards.

South Africa: SANS 60335-2-89(2003): part 2-89: stipulates particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant condensing unit or compressor, however the details are unknown: It is likely that this standard is a replication of IEC/EN 60335. Both standards appear to relate to safety requirements only.

List of sources

General: CLASP; (2012) Scoping Study for Commercial Refrigeration Equipment Mapping and Benchmarking

CLASP (2014) CLASP Commercial refrigeration equipment: mapping and benchmarking
http://www.clasponline.org/en/Resources/Resources/PublicationLibrary/2013/SEAD-Analyzes-Potentials-for-HPWH-International-Test-Standard-Alignment.aspx

China: Refrigerated display cabinets: http://219.238.178.49/FileServer/Attach/L03729.doc; relationship between GB/T 21001, ISO 23953 Australia's AS1731.14 and the US' ARI Standard 1200: http://www.puntofocal.gov.ar/notific_otros_miembros/chn793s1_t.pdf

EU: professional storage cabinets, blast cabinets: European Commission Working Document "'CF Ecodesign Lot1isc (Jun2013)"

EU: retail display cabinet: http://www.eceee.org/ecodesign/products/commercial_refrigerators_freezers/DraftWD_V1_CF23April2010 for sale (2012 edition)

Mexico: refrigerated cabinets: 'SEAD (2013) Evaluation of Commercial Refrigeration Test Methods_Final Report' p20

US: refrigerated freezer, cabinet: 10 CFR Part 431.64 and 10 CFR Part 431.134 respectively

Australia: refrigerated display cabinets: 'SEAD (2013) Evaluation of Commercial Refrigeration Test Methods_Final Report' p18

Indonesia: GEF report: http://www.thegef.org/gef/sites/thegef.org/files/documents/document/11-19-2012%20Council%20document.pdf ;

Agency, products covered: http://eneken.ieej.or.jp/data/4064.pdf ; p36

South Africa: http://www.gov.za/documents/download.php?f=64861 ; p5

Product Fact Sheet — Commercial Refrigeration: Refrigerated vending machines

Note: The "CLASP Commercial refrigeration equipment: mapping and benchmarking" study was published after research for this report was completed. It provides a more detailed description of the comparability of reach in coolers and vending machines.

Table 28. Overview of Refrigerated vending machines

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
EU	N/A		Unknown/ under developme nt	EVA: Test Protocol for the Measurement of Energy Consumption in Vending & Dispensing Machines, Version 3.0	unknown	N/A	N/A	Vending Machine - voluntary labeling
Australia	N/A		kWh/ 300 cans/ day	AS/NZS 4864.1	**ASHRAE 32.1 (2004)**	1		
US	Type A: 0.055 × V + 2.56 Type B: 0.073 × V + 3.16	0.45 [8.66 + (0.009 x C)]	kWh/ 300 cans/ day	10 CFR Part 431 Subpart Q, 10 CFR Part 431.294;	ASHRAE 32.1 (2004)	1		

(*) Conversion factors

Products

1. Refrigerated vending machines are commercial refrigerated cabinets designed to accept consumer payments or tokens to dispense chilled or frozen products without on-site labor intervention. Vending machines are most often plug-in appliances. There are three main types: can, drum and spiral. The prevalence and functionality of these types varies by economy

2. Refrigerated beverage vending machines (regulated in the US), for example, dispense cooled bottles or cans of beverages, and some of these machines also dispense other merchandise. Refrigerated beverage vending machines are installed inside or outside of commercial, residential, and public establishments, such as gas stations, hotels and motels, apartments or dormitories, and government buildings.

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

1. MEPS and mandatory labeling is currently under consideration in the EU (the EVA offers a

voluntary label), while in the US and Australia, the voluntary ENERGY STAR label is available. The US has MEPS in place, and Australia (in conjunction with New Zealand) is considering MEPS. In addition to the economies above, standards and/or labels are present in Japan and Canada.

2. A detailed comparison of test procedures is made in the SEAD (2013) report on test methods for commercial refrigeration products (see sources section, below).

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

1. Australia: The ASHRAE 32.1 test standard and AS/NZ 4864.1:2008 require a different test temperature and humidity depending on whether the product is intended for indoor or outdoor use.

2. US and Australia: The metric kWh/ 300 cans/ day applies to drink machines only. The energy efficiency of snack/drink machines may be either in kWh/l of refrigerated volume per day, or in kWh/300 snack items per day, depending upon which capacity metric is available.

3. EU: harmonized test methods for proposed Ecodesign/MEPS have yet to be finalized. It is likely that they will be based on the test method developed/used by the European Vending Machine Association (EVA EMP 3.0A & 3.0B)

4. The "CLASP Commercial refrigeration equipment: mapping and benchmarking" study was published after research for this report was completed. It confirms that conversion factors for vending machines cannot be established with currently available information.

Notes and assumptions

The 2013 SEAD comparison of vending machine test procedures does not produce conversion factors. It concludes "There are small differences in the test procedure and duration; however these are unlikely to have a significant impact on the comparability of results". Differences include variations in the 'standard package' used for tests, indoor vs. outdoor ambient conditions, type and position of internal/storage temperature measurement. However the IEA's 4E vending machine mapping document (see source below) reports EVA- tested consumption data normalized to the ASHRAE 32.1 standard. This was achieved by assuming a 3% increase (or reduction) in energy consumption for every 1oC increase (or reduction) in the difference between the storage and ambient temperatures at which the product is tested.

List of sources

Detailed comparison: SEAD (August, 2013); Technical evaluation of national and regional test methods for commercial refrigeration products; final report: http://www.superefficient.org/~/media/Files/SL%20Project%20Reports/SEAD%20Evaluation%20of%20Commercial%20Refrigeration%20Test%20Methods_Final%20Report.xls ;

CLASP (2014) CLASP Commercial refrigeration equipment: mapping and benchmarking http://www.clasponline.org/en/Resources/Resources/PublicationLibrary/2013/SEAD-Analyzes-Potentials-for-HPWH-International-Test-Standard-Alignment.aspx

IEA (2012): 4E vending machine mapping reports (separately: Australia; EU, US): http://mappingandbenchmarking.iea-4e.org/matrix

Australia: IEA 4E Vending – Australia; CLASP (Klinckenberg, Puddle) (2012); Scoping Study for Commercial Refrigeration Equipment Mapping and Benchmarking

US: Market and technology assessment: https://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/bvm_final_fr_tsd_chapter_3.pdf ‘ CLASP (Klinckenberg, Puddle) (2012); Scoping Study for Commercial Refrigeration Equipment Mapping and Benchmarking

Product Fact Sheet — Commercial Refrigeration: Walk-in cold rooms

Table 29. Overview of Walk-in cold rooms

Country	MEPS	High Label	S&L metric	Test procedure	Reference test procedure & metric	Test Procedure (*)	Energy Performance Metric (*)	Notes
EU	0.35 medium temp ; 0.2 low temp		U value / ψ value / x value	References of ETAG016 and EN14509 (to be translated into EN standard);	none	N/A	N/A	Walk in cold room
US	Too detailed		U value, door closers/similar; motors/fans; anti-sweat control; lighting	ANSI/AHRI Standard 1250P (I-P) (2009)	ASTM C1363-05; NFRC-100 - 2010; DIN EN 13165:2009; DIN EN 13164:2009	N/A	N/A	Walk in cooler
Australia	0.22 [4.5] / 1.67 [6.0]		U value/R value; motors/fans; anti-sweat control; lighting; seals & air tightness; defrost control; compressor efficiency	unknown	unknown	N/A	N/A	Walk in cold room

(*) Conversion factors

Products

1. Walk-in cold rooms temporarily store refrigerated or frozen food or other perishable goods and are used primarily in the food service and food sales industry. They are commercial enclosed storage spaces that can be walked into, and generally do not include products designed and marketed exclusively for medical, scientific, or research purposes.

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

1. The US is the only economy with MEPS in place: EU requirements are under development and Australia and New Zealand (jointly) have initial proposals. There are significant challenges associated with applying MEPS and/or labeling to these ‘products’. They vary greatly in size, level of customization and on-site assembly, and operating conditions (ambient and cooling temperatures, humidity, frequency of use). Efficiency gains cannot easily be captured in a single metric, and so tend to be dealt with elementally: levels of insulation, thermal bridging and air tightness; lighting and control; refrigeration plant (which comes in various configurations) — all of which render comparison and harmonization of test standards more challenging.

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

1. **EU:** Maximum heat transmission values for products sold as pre-assembled insulated envelopes or as prefabricated kits are likely to be determined by ETAG021 Guideline for European technical approval of cold storage premises kits, to be translated into an EN standard. Current standards being considered: EN ISO 10211 and prEN ISO 14683 are at this stage considered appropriate standards for thermal bridge (ψ and x values) measurement. U values for customized walk-in cold rooms are likely to be determined by ETAG016 and EN14509 (updated and translated into suitable harmonized standards for the purpose of the Ecodesign regulation). EN 13829 and EN ISO 12569 are considered candidate procedures for testing air permeability (see ETAG 021 document, listed in sources section below).

2. **U values:** EU and US U-value test methods have not been accessed, but it is likely that these values are broadly comparable.

Notes and assumptions

EU: Proposals exclude consideration of the cooling plant - central refrigeration equipment (e.g. compressor racks) or mono-block units. The EC is considering separate Ecodesign/MEPS proposals for remote condensing units[6], which may be used in conjunction with walk in cold rooms.

Australia: There is a proposal from the Equipment Energy Efficiency Committee (E3) of the Australian and New Zealand Ministerial Council on Energy to regulate elemental parts of WIC systems

List of sources

EU: EC Working Document: 'Part 3 - WICR official Dec 2011'; http://www.eceee.org/ecodesign/products/cold_appliances/resolveuid/f637ba6a01d377d7c3588899da91759c TAG 021 document; http://www.ue.itb.pl/files/ue/ETAG021_1.pdf (esp. p33); CLASP; (October, 2012) Scoping Study for Commercial Refrigeration Equipment Mapping and Benchmarking Project

US: http://www.law.cornell.edu/cfr/text/10/431.64 refers to the ARI standard; http://www.gpo.gov/fdsys/pkg/PLAW-110publ140/pdf/PLAW-110publ140.pdf

Australia: '200912b-in-from-the-cold-technical-vol2 WICRs…' p23

[6] Defined as "a piece of refrigeration equipment including at least one compressor and one condenser placed on the EU market as a package and intended to provide cooling to at least one refrigeration appliance or system"; ref: (includes draft MEPS) http://www.taitconsulting.co.uk/Ecodesign_Consultation_files/Adhoc%20Questionnaire_Condensing%20units_intro_2012-04-04.pdf