PRODUCT CATEGORY RULES (PCR)

For preparing an Environmental Product Declaration (EPD)
for the Product Category:

HAND DRYERS

VERSION 1 (JULY 13, 2016)

VALID THROUGH (JULY 13, 2021)

Contents

1. General Information

The intended application of this Product Category Rules (PCR) document is to provide guidance for carrying out Environmental Product Declarations (EPDs) for hand dryers and to pinpoint the underlying requirements of the LCA pursuant to ISO standards that address appropriate environmental aspects of the hand dryer life cycle. The user of this PCR will be manufacturers of hand dryers and other interested parties and will enable EPDs that support comparable, informed, and objective sustainable purchasing of hand dryers.

1.1. Committee Members

- William Gagnon, Excel
- Denis Gagnon, Excel
- Tom Koetsch, Excel
- Peter Panaretos, Excel
- Dave Fisher, World Dryer
- Susan Fan, World Dryer
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- I Chi Chen, Hokwang
- Lily Hsu, Hokwang
- Anna Nicholson, UL Environment
- Joel Hawk, UL

1.2. Identification of Hand dryer Product

Hand dryers are electric devices used to provide a hygienic method to dry hands in public washrooms. The product category included in this PCR includes both dryers with heat and without heating elements and hands-in and hand-under hand dryers.

These hand dryers are subject to the standards or technical approvals shown under Section 9.

1.1.1. UNSPSC Code

The following code covers the range of this rule: 47131707 - Restroom Supplies, Institutional Hand Dryers

1.3. Geographic Coverage

This PCR is global in scope and was developed in English.

Markets of applicability include:

- Africa
- Asia
- Caribbean
- Central America
- Europe
- Middle East
- North America
- Oceania
- South America

1.4. Period of Validity

This document is effective for five years from latest date of publication. If relevant changes in LCA methodology for the product category occur, the document will be revised. This PCR will be reviewed annually to determine whether revisions are necessary.

1.5. Public Comment

In accordance with the UL Environment General Program Instructions, this PCR is published for at least one calendar month and open to all public comments. Identifiable sources are addressed and responses will be posted.

1.6. PCR Review Panel

- Jon Dettling, Quantis (Chair)
- Jeremy Gregory, Independent Consultant
- Vincent Huang, ITRI

1.7. Public Commenters

- Dyson Ltd.
- NSF International
- SGS
- US Environmental Protection Agency

1.8. Other Hand Dryer Product Category Rules

At the time of publication, the committee is not aware of any existing published PCRs for hand dryers. The committee considered the NSF International Protocol P335, Hygienic Commercial Hand Dryers, in the creation of this PCR, as well as the Carbon Trust ETL Method for the Testing of High Speed Hand Air Dryers.

1.9. LCA Study References

In developing this PCR, the committee reviewed several LCA studies of hand dryers considered to be the most robust hand dryer LCAs conducted at the time of PCR publication:

Montalbo, T., Gregory, J., and Kirchain, R. “Life Cycle Assessment of Hand Drying Systems.” Material Systems Laboratory. Commissioned by Dyson. 2011

Dettling, J. and Margni, M. “Comparative Environmental Life Cycle Assessment of Hand Drying Systems. Commissioned by Excel Dryer. 2009.

1.10. Definitions

For the purposes of this document, the following definitions apply:

Conventional Single-Point (Hands Under) Dryer

A hand dryer where hands are placed underneath the dryer exit nozzle for drying, having a predominantly single, unfocused direction air stream at the air exit plane and having average exit air velocity of less than 70 m/s (13,780 ft/min) when supplied with nominal supply voltage at 120V or 230V consistent with the product's certified electrical rating.

DU Declared Unit

Quantity of a product for use as a reference unit in an EPD, based on LCA, for the expression of environmental information based on one or more information modules.

Example: mass (kg); volume (m3) [modified from ISO 21930]

Dry Time

After washing the hands, the length of time required to dry one's hands to a dryness threshold equaling 0.25 grams residual moisture or less using a hand dryer.

Estimated Service Life

Total years of expected service based on the product's reference service life (RSL) and an average frequency of 200 uses per day (73,000 per year). The total duration of use and standby mode over the estimated service life (ESL) is based on the observed run time during operation and RSL for the specific model hand dryer. As a working example, a hand dryer with an established 12 second run time and demonstrated RSL of 500,000 cycles would have a corresponding expected service life (ESL) of 6.85 years. The total power consumed by the dryer during the use stage would be based on 1666.7 hours in use and 58,339.3 hours in standby mode and the respective power consumption (VA) in use and in standby mode.

Feedstock Energy

Heat of combustion of a raw material input that is not used as an energy source to a product system, expressed in terms of higher heating value or lower heating value [ISO 14044].

FU Functional Unit

Quantified properties of a hand dryer for use as a reference unit description in an EPD based on LCA [ISO 14040 and 14044]. In this PCR, a functional unit of 100,000 instances of hand drying is used.

High Speed Single-Point (Hands Under) Dryer

A hand dryer where hands are placed underneath the dryer exit nozzle for drying, having a predominantly single direction air stream focused for high velocity at the air exit plane and having average exit air velocity greater than or equal to 70 m/s (13,780 ft/min) when supplied with nominal supply voltage at 120V or 230V consistent with the product's certified electrical rating.

Information Module
Compilation of data to be used as a basis for a Type III Environmental Declaration, covering a unit process or a combination of unit processes that are part of the life cycle of a product [ISO 21930].

ISO
International Organization for Standardization

LCA Life Cycle Assessment
Calculation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle [ISO 14040].

LCI Life Cycle Inventory
Phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle [ISO 14040]

LCIA Life Cycle Impact Assessment
Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product [ISO 14040]

LHV Lower Heating Value
The amount of heat released by combusting a specified quantity of fuel (initially at 25°C or another reference state) and returning the temperature of the combustion products to 150°C. The lower heating value (LHV) (net calorific value (NCV) or lower calorific value (LCV)) is determined by subtracting the heat of vaporization of the water vapor from the higher heating value. This treats any H_2O formed as a vapor. The energy required to vaporize the water therefore is not released as heat.

LHV calculations assume that the water component of a combustion process is in vapor state at the end of combustion, as opposed to the higher heating value (HHV) which assumes that all of the water in a combustion process is in a liquid state after a combustion process.

High Speed Multi-Point (Hands Under) Dryer
A hand dryer having exit air streams in at least two distinct independent air streams, intended for the left and right hands.

Process Energy
Energy input required for operating the process or equipment within a unit process, excluding energy inputs for production and delivery of the energy itself [ISO 14044].

Product Category
Group of products that can fulfill equivalent functions [ISO 14025].

RSL Reference Service Life
Service life of a product which is known to be expected under a particular set, i.e. a reference set, of in-use conditions and which may form the basis of estimating the service life under other in-use conditions.

Environment

The reference service life (RSL) of a hand dryer is expressed in cycles of hand drying instances attainable over the estimated service life (ESL) of the product.

Residual Moisture
The actual moisture remaining on one's hands after drying hands to a perceived level of dryness.

Run Time
The "dry time" of the dryer plus the "run-on time". The energy consumption during operation mode will be the total accumulated energy used during an operation cycle and is based on the "total run" time.

Run-On Time
Run-on dryer time is the time duration from when the hands are dry and removed from the dryer to when the dryer's controls stop dryer operation. Run-on time is complete when the dryer's supply current returns to normal levels in standby mode.

Specific data
Data representative of a product, product group or construction service, provided by one supplier.

Standby Mode
State of the hand dryer between instances of hand drying.

Trough Style (Hands In) Dryer
A hand dryer where the user places their hands into the drying cavity that has generally opposing air streams for drying the palm and back side of the hands concurrently

Type III Environmental Declaration, Environmental Product Declaration (EPD)
Providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information [ISO 14025].

Unit Process
Smallest portion of a product system for which data are collected when performing a life cycle assessment.

VA Volt Ampere
The unit used for the apparent power in an electrical circuit, equal to the product of root-mean-square (RMS) voltage and RMS current. In direct current (DC) circuits, this product is equal to the real power (active power) in watts.

2. Goal and Scope

The intended application of this Product Category Rules (PCR) document is to give guidance for carrying out Environmental Product Declarations (EPD) for hand dryers and to pinpoint the underlying requirements of the LCA pursuant to ISO standards that address appropriate environmental aspects of these materials. The user of this PCR will be manufacturers of hand dryers and other interested parties.

This PCR addresses the cradle to end of life environmental impacts of hand dryers and complies with ISO 14025, Environmental labeling and declarations – Type III environmental declarations – Principles and procedures. Additional information as shown under Section 5 is permitted. No life cycle stages are excluded with the exception of capital such as manufacturing machinery, and personnel impacts.

An EPD prepared under this PCR will present data that has been aggregated over the following life cycle stages: raw material acquisition, production, use, maintenance and end of life.

Table 1. Hand dryer product EPD type

EPD type	Declared Unit or Functional Unit	Life Cycle Stages and modules	Reference Service Life (RSL)	Primary audience
Cradle to grave	Functional unit	Product stage (including raw material supply and manufacturing), Installation, Use, and End of Life	Required	Business to business (B to B) and/or Business to consumer (B to C)

Comparability of EPD of hand dryer products will be in accordance with the requirements for comparability as described in ISO 14025, Sections 4, 5.6, and 6.7.2.

2.1. System Function

The function of a hand dryer is to dry hands after washing in a public restroom. This PCR uses a cradle to grave scope and functional unit. Section 2.2 discusses these units and defines them for the hand dryer product category.

2.2. Functional unit

The functional unit of a product provides the basis for quantitative normalization when comparing products of equivalent function. Where there is an applicable standard contributing to calculating functional unit, that standard will be referenced per Section 9.

For declaration and reporting purposes only, it is acceptable to report the functional unit and LCA results in SI units as described in Section 4.8 of this PCR.

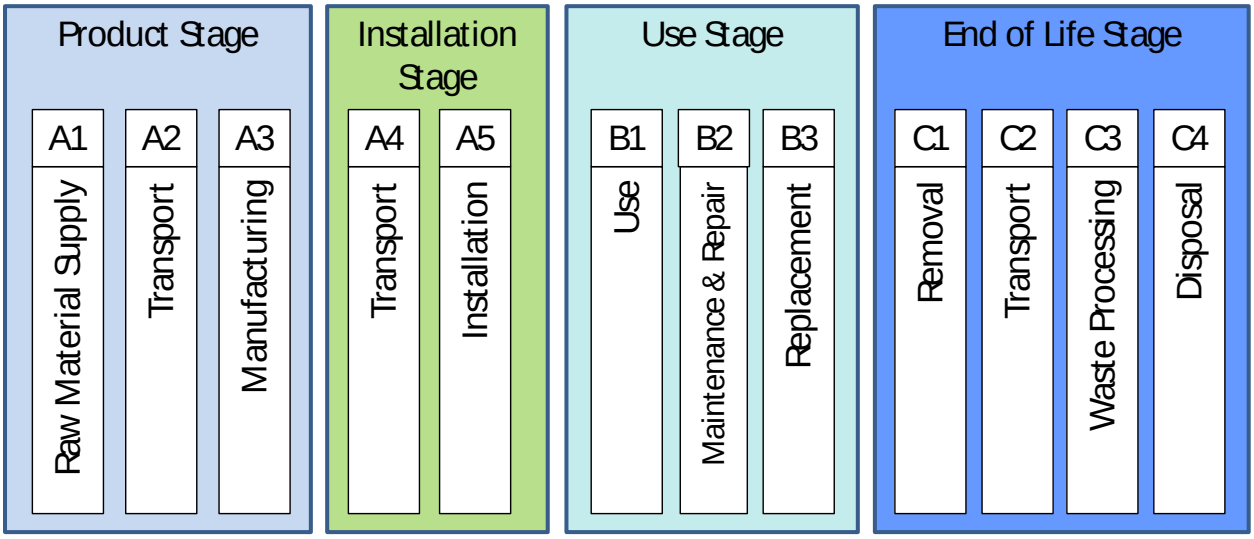
The functional unit is 100,000 instances of hand drying. See Section 8.1 - Dry Time Testing for the Drying Testing Method that shall be used to determine a hand drying instance.

2.3. System boundaries

This PCR follows the approach established by EN15804 for categorizing the various life cycle stages. This standard is designed to harmonize EPDs for products and services in the building and construction sector. Although EN15804 is designed for EPDs for building and construction products, the organization and reporting in that standard lends itself well to other products. Consistency with EN15804 will increase the utility of this PCR by allowing contextualization of the hand dryer results with building and construction products.

The hand dryer life cycle is broken into the various "information modules" shown in Figure 1. Each information module is described in more detail in the following sub-sections.

Figure 1. Hand dryer life cycle system boundaries



3. Requirements for the Underlying LCA

3.1. Product Stage (A1, A2, and A3)

The product stage is a set of information modules required to be included in all EPDs. Together, these represent the cradle-to-gate impacts of a hand dryer. As illustrated in Figure 1, it includes the information

modules A1 to A3. The system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing and transport processes up to the factory gate as well as the processing of any waste arising from those processes.

In the case of input of secondary materials or energy recovered from secondary fuels, the system boundary between the system under study and the previous system (providing the secondary materials) is set where outputs of the previous system, e.g. materials, products, building elements or energy, reach the end-of-waste state.

Flows leaving the system at the end-of-waste boundary of the product stage (A1-A3) shall be allocated as co-products. As a general rule, such processes as collection and transport before the end-of-waste state are included as part of the waste processing of the system and additional processing is excluded. Loads and benefits from allocated co-products shall not be declared. If such a co-product allocation is not possible, other methods may be chosen and shall be justified. Therefore, as a general rule, potential loads or benefits from the product stage do not appear in life cycle calculations or reporting.

At the discretion of the LCA practitioner, modules A1, A2, and A3 may be summed together and reported as a group (i.e., A1-A3), rather than as distinct modules.

3.1.1. Raw material supply (A1)

The raw material supply module (A1) includes the provision of all raw materials and energy and includes waste processing or disposal of final residues during the material acquisition stage. It also includes all flows related to electricity generation of all processes in the product stage. However, production of capital goods, infrastructure, production of manufacturing equipment and personnel-related activities are not included.

The raw material supply stage will account for:

- Extraction and processing of raw materials (e.g., mining and refining processes) and biomass production and processing (e.g., agricultural or forestry operations);
- Reuse of products or materials from a previous product system;
- Processing of secondary materials used as input for manufacturing the product, but not including those processes that are part of the waste processing in the previous product system
- Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;
- Energy recovery and other recovery processes from secondary fuels, but not including those processes that are part of waste processing in the previous product system;

3.1.2. Transport (A2)

The transport module (A2) includes the transportation of raw materials to manufacturing.

3.1.3. Manufacturing (A3)

The manufacturing module (A3) includes the manufacturing of raw materials into the finished, packaged hand dryer. This includes all materials, products, and energy and includes waste processing or disposal of final residues during the product stage. However, production of capital goods, infrastructure, production of manufacturing equipment and personnel-related activities are not included. HVAC (heating, ventilation, and air conditioning), artificial lighting and transport within the manufacturing site will only be considered if they do not meet the cut-off criteria.

The manufacturing will account for:

- Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;
- Energy recovery and other recovery processes from secondary fuels, but not including those processes that are part of waste processing in the previous product system;
- Production of ancillary materials or pre-products (i.e., lubricants);
- Manufacturing of products and co-products;
- Manufacturing of packaging;
- Waste processing or disposal, including any packaging waste.

Note: the impacts associated with fuels and generation of the electricity consumed during manufacturing shall be assigned to the manufacturing module (A3).

3.1.4. Installation Stage (A4 and A5)

The installation stage, including transport to the building site (A4) and mounting/installation (A5) are optional reported elements.

3.2. Use Stage (B1, B2, and B3)

The use stage (B1, B2, and B3) includes the information modules covering the period from the installation of the hand dryer until it reaches its end-of-life. The duration of the use stage of is dependent on the reference service life.

The use stage includes the use of hand dryer products, including standby mode, and service during its proper function. It also includes maintenance (excluding cleaning), repair, and replacement.

3.2.1. Reference Service Life and Estimated Service Life

The reference service life (RSL) of a hand dryer is expressed in cycles of hand drying instances attainable over the estimated service life (ESL) of the product and is based on several types of tests to ensure the safety, durability, and performance of the product. The total duration of use and standby mode over the estimated service life (ESL) is based on the observed dry time and RSL for the specific model hand dryer. As a working example, a hand dryer with an established 12 second run time and demonstrated RSL of

500,000 cycles would have a corresponding expected service life (ESL) of 6.85 years. The total power consumed by the dryer during the use stage would be based on 1666.7 hours in use and 58,339.3 hours in standby mode and the respective power consumption (VA) in use and in standby mode. The RSL is calculated from the test procedures in Section 8.3, Appendix II. Note that RSL shall be third party verified as required in Section 7, Appendix I.[1]

The use module (B1) includes operational impacts associated with energy consumption according to specific drying methodology outlined in Section 8.1 and 8.2, Appendix II, and also includes standby mode. Hands shall be dried according to the manufacturer's recommended practice. If no practice is recommended, or ambiguous, the default drying method presented in Section 8.1 shall be used. Note that the hand dry time shall be third party tested and verified and the reference service life shall be third party verified and documented as presented in Section 7, Appendix I.

Total power consumption during the use stage (B1) is the sum of operational power consumption and standby power consumption. Operational power consumption is the power required by a hand dryer in the process of drying hands. Standby power consumption is the power required by a hand dryer during "off" times – when not drying hands.

To identify full environmental impact during use stage (B1), power consumption is defined to include the total power demand required from the electric utility grid to power the hand dryer and includes reactive power losses from ineffective utilization of electricity. Total power demand including reactive power losses, operational power consumption and standby power consumption will be calculated from the Section 8.2, Appendix II test procedures. For each product platform, the average operational power consumption and average standby power will be calculated and used as the basis for total power consumption during the use stage.

Average operational power consumption for a product platform may differ from the product's certified electrical rating. Electrical ratings reflect the maximum current/power a product has been certified for sustainable safe operation. In contrast, average operational power consumption as determined with this standardized testing reflects the average power demand to supply representative samples of the product.

3.2.2. Maintenance (B2)

The maintenance module (B2) includes maintenance of the hand dryer over the reference service life. This includes standard repair processes. In the case of a hand dryer model including replaceable motor brushes from the manufacturer, motor brushes can be replaced one time only to extend service life.

[1] EN 15804 defines B1 is a generic category for emissions directly from the product, such as off-gassing, and category B6 as for operational energy use. This PCR deviates from this approach by using B1 for reporting operational energy use.

3.2.3. Replacement (B3)[2]

The replacement module (B3) includes replacement of the hand dryer over the reference service life. Replacement is necessary when the RSL is smaller than the functional unit. This includes standard replacement processes.

3.3. End-of-life Stage (C1, C2, C3, and C4)

The end-of-life stage of the hand dryer product starts when it is removed from the building and does not provide any further operational function. The end-of-life stage begins at the end of the reference service life.

3.3.1. Removal (C1)

The removal module (C1) includes the removal of the hand dryer from the building, including on-site sorting of materials. This module is optional.

3.3.2. Transport (C2)

The waste transport module (C2) includes the transportation of the hand dryer to the end-of-life processing facility, such as a landfill, incineration, or recycling center.

3.3.3. Waste processing (C3)

The waste processing module (C3) includes the waste processing of material flows intended for reuse, recycling and energy recovery. Waste processing shall be modeled and the elementary flows shall be included in the inventory. For hand dryers, emissions from incineration of hand dryers for the purposes of energy recovery (energy recover greater than 60%) should be reported under module C3.

3.3.4. Disposal (C4)

The waste disposal module (C4) including physical pre-treatment and management of the disposal site.

3.4. Cut-off rules

A process or activity that contributes no more than 1% of the total mass and 1% of the total energy use may be omitted from the inventory analysis, except that: Omissions of any material flows that may have a relevant contribution to the selected impact categories of the products underlying the Environmental Declaration will be justified, if applicable, by a sensitivity analysis.

[2] [2] EN 15804 defines B4 as the module for reporting product replacement impacts. This PCR deviates from this approach by using B3 for reporting replacement energy use.

The sum of the excluded material flows must not exceed 5% of mass, energy and environmental relevance.

3.5. Allocation rules

In a production process where more than one type of product is generated, it is necessary to allocate the environmental impacts (inputs and outputs) from the process to the different products in order to obtain product-based inventory data. Allocation rules should reflect the goal of the production process.. For production of hand dryer products, allocation shall be carried out according to the most appropriate allocation identified for the facility in question following the principles regarding allocation in ISO 14044 Section 4.3.4, presented below. In such facilities, an ability to allocate based on physical properties of the products is a preferable basis to allocation based on economic flows, where feasible.

The LCA study shall identify the processes shared with other product systems and deal with them according to the stepwise procedure presented below.

a. Step 1: Wherever possible, allocation should be avoided by:
    i. Dividing the unit process to be allocated into two or more sub-processes and collecting the input and output data related to these sub-processes, or
    ii. Expanding the product system to include the additional functions related to the co-products, taking into account the requirements of ISO 14044 Section 4.2.3.3.

b. Step 2: Where allocation cannot be avoided, the inputs and outputs of the system should be partitioned between its different products or functions in a way that reflects the underlying physical relationships between them; i.e. they should reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system.

c. Step 3: Where physical relationship alone cannot be established or used as the basis for allocation, the inputs should be allocated between the products and functions in a way that reflects other relationships between them. For example, input and output data might be allocated between co-products in proportion to the economic value of the products.

When allocation is used, aspects such as economic conditions will be considered to determine if other allocation criteria would be more appropriate. A sensitivity analysis shall be initiated if a deviation of greater than 10% is foreseen from the prescribed allocation method. Different data sets will be documented and reported, if different allocation options are relevant.

3.6. Transportation

Allocation associated with transport will be based on weight or volume, depending on expected filling limitations of the transport vehicle.

4. Data Quality and Considerations

4.1. Data sources

Primary data related to the facilit(ies) where the dryer is manufactured shall be collected by the manufacturer of the hand dryer. It shall include the facility location, the quantity and source location of all materials and energy used to manufacture the product, any emissions to air and water, any waste produced and how it is managed (e.g. recycled, landfilled, incinerated) and the distance traveled to disposal. When primary data for waste streams are unavailable, a distance of 50km shall be assumed and standard national disposal rates for recycling, landfilling and incineration shall be used and cited.

When developing the LCA for the purpose of publishing an EPD, companies shall seek primary data from first tier suppliers whenever possible for technosphere inflows. Only when primary data is not available may secondary data sources be used. Where secondary data is used, the most relevant data shall be used, in the following order of preference, from most to least desired: same locality> global> other locality. Where ISO 14040 and 14044 reviewed national LCI databases or other national or regional datasets are available, they shall be used for national data. Secondary data in the form of publications from peer reviewed literature, government publications, and peer reviewed life cycle databases is preferred to data from meta-analyses such as economic input-output models.

The LCA and EPD shall disclose the percent of primary data versus secondary data on the basis of number of datasets. When secondary data are used, they shall be documented as to the name of the database and the age of the data. If consensus data is used for primary materials, it shall be documented.

All data sources shall be specified, including database and year of publication. Sources of data for transport models and thermal energy production shall be documented. Any changes or alterations to information from the LCI libraries in the LCA software shall be documented with the reasons for making the alteration. For example, if the EU electric grid information on a substance from the EU ELCD was replaced by the average US electric grid information to make it relevant to the US geography, then this action shall be documented.

As a matter of principle, consistent and equivalent generic data shall be used, such as for background processes to support comparability of results. The representativeness of the datasets with respect to time, location, and technology shall be documented, and deviations from the actual time, location, and technology relevant to the product shall be disclosed. When data from comparable processes must be used as proxy to cover gaps, the technological similarity shall be documented. Handling of data gaps and the use of data models shall be explained.

Data quality requirements shall be treated according to the provisions of ISO 14044:2006, Section 4.2.3.6, as referenced in ISO 14025 in Section 6.7.1 and 6.7.2.

4.2. Period under consideration

All foreground technosphere data shall be primary data, collected over the most recent calendar year of operation or measurement year where the start date is not more than two years prior. The measurement dates shall be disclosed in the LCA study. If primary data for more than one location is averaged for a unit process, a sensitivity analysis shall be performed using a plus or minus one standard deviation.

4.3. Electricity Grid

The following applies in selecting the power mix:

- For the United States, regionally specific inventory data on electricity during the manufacturing stage shall be based on subnational consumption mixes such as eGRID that account for physical power trade between the regions. If such regional data are not available, production mixes of the three continental interconnections (East, West, and Texas) as well as those of Hawaii and Alaska may be used. The sources for electricity and the calculation procedure shall be documented.
- For other regions than the United States, country-specific processes shall be used for the manufacturing stage provided they are representative. For production facilities in multiple countries, the applicable power mixes shall be assessed specifically for each country or combined, weighted by production volumes in the respective countries.
- For all regions, use phase electricity calculations shall be based on average national or regional grid supply mixes and include transmission and distribution losses, which shall be reported.
- Credits may not be applied to LCA baseline when “green” power certificates are used, but certificates may be reported in Additional Environmental Information. Green power certificates must be available and provided to the program operator for the entire period of EPD validity.

4.4. Transport

Transportation distances and methods shall be documented, as far as they are relevant. In addition, the average hauling distance for the distribution chain in specific country (gate to site) can be used.

4.5. Recycled waste streams

Recycling and recycled content shall be modelled using the cut-off rule, also known as the recycled content rule. All materials recycled from unit processes (including those sent to energy recovery) are considered to have left the system boundary. Recycled content can only be modelled in the system where there is primary data showing that the percent of recycled content was specified in the purchase of materials. Where the product system has specified recycled content, all the environmental burdens of recycling shall be included in the raw material portion of the inventory. The impact of recycling shall be calculated from the point of discard, either at the discarding facility or at the waste management center. Captive recycling is within the system boundary.

Where the manufacturer has an active recycling program in place for the replacement or demolition of the product, that information may be used for the product, but only to the extent which the manufacturer's program actually recycles hand dryers. For example, if the manufacturer produces 100,000 hand dryers per year, and recycles 10,000 hand dryers per year, then the 10,000 hand dryers are removed from the life cycle waste calculations, and the 90,000 hand dryers are modelled in accordance to the average disposition of demolition waste for that location (e.g., landfill or incinerator).

4.6. Renewable energy

Where the unit process is powered by methane from solid waste or wastewater, wind, biomass, hydro or solar power and no electricity leaves the facility (i.e., the system is not linked to a grid), renewable electricity produced from wind or solar may be accounted for within the system boundary. If a surplus of renewable electricity is generated on-site, this may not count towards additional credits in the product system boundary.

If "green" power is used from outside the facility, it must be specified separately and not reported in inventory or impact assessment results. If there is a transparent path, such as in the EU, where chain of custody of green power can be traced by kWh and origin (not just CO_2e attributes), these certificates may be reported as additional information but not used in LCI or LCIA calculations. Certificates must be available for the entire period of EPD validity. If certificates cannot be provided for the full five (5) years when issuing the EPD, the program operator must request the certificates for the preceding five (5) years in order to extend the Declaration

CO_2 credits shall be specified separately and not reported in inventory or impact assessment results. There shall be clear delineation between the product life cycle impacts and then any carbon offsets or credits used to mitigate this impact. If there is a transparent path where chain of custody of green power can be traced by kWh and origin (not just CO_2e attributes), this information may be reported as additional information.

CO_2 certificates shall not be included in the Life Cycle Assessment but may be reported separately, apart from LCA results.

4.7. Impact and inventory results

Table 2 through Table 7 present the selected impact categories, energy and resource inventories to be reported in the EPD. In North America, all impact categories shall be calculated using the TRACI 2.1 set of impact assessment methods. For European markets, impact categories shall be calculated using the ILCD impact assessment methods.[3] Additional environmental impacts recommended by ILCD may be reported

[3] As of 2016, this ensures consistency with the EC Product Environmental Footprint (PEF) guidelines: "COMMISSION RECOMMENDATION of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental

as additional environmental information.

For all other regions, the CML methodology from the University of Leiden shall be used. Table 5 through Table 7 present the selected energy and resource inventories to be reported in the EPD for each region.

Table 2. Impact categories (TRACI, with exception of GWP)

Impact category	Unit	Source
Global Warming Potential	kg CO_2 equiv	IPCC (2013 AR5), 100 years, excluding biogenic CO_2)
Acidification Potential	kg SO_2 equiv	US EPA TRACI v2.1 (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts)
Eutrophication Potential	kg N equiv	
Smog Creation Potential	kg O_3 equiv	
Ozone Depletion Potential	kg CFC-11 equiv	
Fossil Depletion Potential	MJ surplus	

Table 3. Impact Categories (ILCD)

Impact category	Method	Unit	Source
Global Warming Potential	IPCC 2013, GWP100a	kg CO_2 equiv	EU Recommendation 2013/179/EU Recommended per ILCD v1.0.6
Acidification Potential	Accumulated Exceedance (Seppala et al. 2006, Posch et al, 2008)	kg SO_2 equiv	
Eutrophication Potential	Accumulated Exceedance (Seppala et al. 2006, Posch et al, 2008)	kg PO_4 equiv	
Smog Creation Potential	1999 WMO assessment	kg O_3 equiv	
Ozone Depletion Potential	LOTOS-EUROS (Van Zelm et al, 2008) as applied in ReCiPe	kg CFC-11 equiv	
Abiotic depletion potential for mineral, fossil, and renewable	CML 2002 (Guinee et al, 2002)	kg Sb equiv	

performance of products and organisations" EU Recommendation (2013/179/EU) - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:124:0001:0210:EN:PDF

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resources			
Abiotic depletion potential for fossil resources	CML v 4.2, April 2013	MJ	CML v 4.2, April 2013

Table 4. Impact Categories (CML)

Impact category	Unit	Source
Global Warming Potential	kg CO_2 equiv	CML v 4.2, April 2013
Acidification Potential	kg SO_2 equiv	
Eutrophication Potential	kg PO_4 equiv	
Smog Creation Potential	kg C2H4 equiv	
Ozone Depletion Potential	kg CFC-11 equiv	
Abiotic depletion potential for fossil resources	MJ	
Abiotic depletion potential for non-fossil resources	kg Sb equiv	

4.7.1. Parameters Describing Resource Use

The following parameters derived from LCI describing resource use shall be calculated and assigned to the declared or functional unit of product.

Table 5. Life Cycle Inventory Analysis parameters describing the use of resources

Parameter	Unit
Use of renewable primary energy excluding the renewable primary energy used as raw materials (PERE)	MJ, net calorific value (LHV)
Use of renewable primary energy resources used as raw materials (PERM)	MJ, net calorific value
Total use of renewable primary energy (primary energy and renewable primary energy resources used as raw materials) (PERT)	MJ, net calorific value
Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials (PENRE)	MJ, net calorific value
Use of non-renewable primary energy resources use as raw materials (PENRM)	MJ, net calorific value
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (PENRT)	MJ, net calorific value
Use of net fresh water resources (FW)	m^3

Secondary fuels are all combustible materials which were recovered from a previous use or from waste from a previous product system and are used as fuel in a following product system.

4.7.2. Other Environmental Information Describing Different Waste Categories and Output Flows

The following parameters derived from product LCI describing different waste categories and output flows shall be calculated and assigned to the declared or functional unit of product.

Table 6. Life Cycle Inventory parameters describing various waste categories

Parameter	Unit
Disposed-of hazardous waste[4]	kg
Disposed-of non-hazardous waste	kg

Table 7. Life Cycle Inventory parameters describing output flows

Parameter	Unit
Components for reuse	kg
Materials for recycling	kg
Materials for energy recovery	kg
Exported electrical energy (waste to energy)	MJ, net calorific value per energy carrier
Exported thermal energy (waste to energy)	MJ, net calorific value per energy carrier

The above parameters quantify the material flows once they have both reached the End-of-waste State and left the System Boundary. The "materials for energy recovery" parameter does not include materials for waste incineration. Waste incineration is regarded as a waste processing process and remains within the System Boundary.

4.8. Units

The following units shall be used for all reported information and life cycle calculations:

- SI units
- Preferred basic units:
  - kg (kilograms)
  - MJ (mega Joule) for thermal energy

[4] According to hazardous waste classifications provided in Section 10.

- kWh (kilowatt-hour) or MJ (mega Joule) for electrical energy

5. Content of the EPD

All Type III environmental declarations in a product category will include the parameters as identified in this PCR.

5.1. General information to be declared

The following general information will be declared:

- The name and address of the manufacturing company/organization as well as the place(s) of production. The EPD may include general information about the company/organization, such as the existence of quality systems or environmental management systems, according to ISO 14001 or any other environmental management system in place.
- Product identification by name (including model number), material composition (e.g. ferrous metals, non-ferrous metals, technical plastics, bulk plastics, electronics), by production code (if applicable), and by simple visual representation, which may be by photograph or graphic illustration;
- Geographic region of EPD applicability;
- A description of the product's use and the functional unit of the product to which the data relates;
- A graphical depiction of a flow diagram illustrating main production processes according to the scope of the declaration;
- A description of the installation of the hand dryer product;
- The reference service life (RSL; in cycles) and estimated service life (ESL; in years) of the product;
- Statement of conformance with relevant product safety standards, according to Section 9, and including pertinent physical properties and technical information.
- The following designation information:
  - Power Consumption / Power Rating (VA)
  - Dry Time (seconds)
  - Standby Power Consumption (VA)
  - Energy use per operational cycle (MJ)
- A general specification for the composition of the products given by component
- A statement of third party verification of reported dry time and reference service life as required by 25 7, Appendix I.
- Content of the product as identified by % material contribution;
- PCR identification;
- Name and contact information of program operator;
- LCA software used and version number;

- LCI databases used, version number (e.g. Ecoinvent, ELCD, USLCI);
- Date the declaration was issued and period of validity;
- A statement that environmental declarations from different programs (ISO 14025) may not be comparable;
- A statement that this declaration represents an average performance, in such cases
- Where an EPD declares an average performance for a number of products or manufacturing plant locations, the site(s), manufacturer or group of manufacturers for whom the results of the LCA are representative;
- Where an EPD declares an average performance for a number of products in the same product line, the method of averaging, maximum, minimum and standard deviation of data used.
- Information on where explanatory material may be obtained;
- Completion and inclusion of Table 8 (below):

Table 8. Demonstration of verification

This PCR review, was conducted by: < name and organization of the chair, and information on how to contact the chair through the Program Operator >
Independent verification of the declaration and data, according to ISO 14025 □ external or □ internal Note: if internal, then verifier must not have been connected in any manner with the EPD or LCA.
(Where appropriate[a]) Third party verifier: < name of the third party verifier >

5.2. Declaration of environmental aspects

- Impact category indicators will include, but not be limited to, results for reported impact categories in Section 4.7
- Use of material and energy resources as specified in Section 4.7
- Generation of waste as specified in Section 4.7
- Additional environmental information related to environmental aspects

6. References

CML v 4.2, April 2013. Center of Environmental Science of Leiden University Impact Assessment Method.

ILCD v 1.0.6. International Reference Life Cycle Data System. Recommendations for Life Cycle Impact Assessment in the European context.

ISO

ISO 14025 Environmental labels and declarations –Type III environmental declarations – Principles and procedures

ISO 14040 Environmental management -- Life cycle assessment -- Principles and framework

ISO 14044 Environmental management - life cycle assessment - Requirements and Guidelines

US EPA

RCRA regulations, 40 CFR Part 261

TRACI (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts)

Standards

CAN/CSA C22.2 No. 36-08 Hairdressing equipment

CAN/CSA-E60335-1 Household and similar electrical appliances – Safety - Part 1: General requirements

CAN/CSA-60335-1 Household and similar electrical appliances – Safety – Part 2-23: Particular requirements for appliances for skin or hair care

Carbon Trust - ETL Method for the Testing of High Speed Hand Air Dryers", October 2014.

Directive 2011/65/EU RoHS 2 -- Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Directive 2012/19/EU WEEE -- Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

EN 55014 Electromagnetic compatibility – Requirements for Household Appliances, electric tools, and similar apparatus

IEC EN 61000-3-2 Electromagnetic compatibility (EMC) - Part 3-2 - Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

IEC 60335-1 Household and similar electrical appliances – Safety – Part 1: General requirements

IEC 60335-2-23 Household and similar electrical appliances – Safety – Part 2-23: Particular requirements for appliances for skin or hair care

NSF International Protocol P335 – Hygienic Commercial Hand Dryers

UL 499 Standard for Safety – Electric Heating Appliances

UL 507 Standard for Safety – Electric Fans

7. Appendix I – Project documentation/report requirements

The project documentation will include the following information, which shall be made available to the LCA and EPD verifier to demonstrate the relevant requirements of ISO 14025 have been met:

- Input and output environmental data of the unit processes that are used for the LCA calculations;
- Documentation (measurements, calculations, estimates, sources, correspondence, traceable references to origin, etc.) that provides the basis from which the process data for the LCA is formulated;
- Documentation demonstrating that the verification and review requirements of ISO 14025 have been followed.

This includes documentation for:

- The material specification to which the hand dryer product conforms;
- Energy consumption figures
- Emission data to air, water and soil across entire product life cycle
- Waste production
- Data demonstrating the information is complete. If applicable standards or quality regulations are available, reference should be made to them
- Referenced literature and databases from which data have been extracted
- Demonstrating the hand dryer product can meet the desired function(s) and deliver desired performance
- In cases where applicable, data used to carry out the sensitivity analyses
- Substantiating the percentages or figures used for the calculations in the waste scenario
- Substantiating the percentages and figures (e.g., number of cycles) used for the calculations in the allocation procedure
- Information showing how averages of different reporting locations have been calculated in order to obtain generic data
- Substantiating any qualitative information in the additional environmental information
- Procedures used to carry out the data collection (questionnaires, instructions, informative material, confidentiality agreements, etc.)
- The characterization factors, normalization factors used
- The criteria and substantiation used to determine the system limits and the selection of input and output flows
- Substantiating other choices and assumptions, and
- The results, comments and recommendations from a critical review per ISO 14025.
- Third party verification by a certified body testing laboratory (CBTL) recognized in the IECEE CB Scheme, with direct third party testing or on-site third party testing of 1) Dry Time Testing in Section 6 used to determine reported dry time, and either direct third party testing or on-site

third-party witnessing of 2) operational and standby power consumption determined using the test procedure in Section 8.2 and 3) the reported Reference Service Life of the hand dryer determined using the test procedure in Section 8.3.

If a certified body testing laboratory (CBTL) is not located within 300 miles or 500 km of a manufacturer's principal location of business, the third party verification should be conducted by a nationally recognized testing laboratory associated with testing for product safety in accordance with nationally recognized standards for safety.

The Dry Time Testing in Section 6 is a short term test relying on human precision and shall be performed in full by the certified third party, either on-site at the manufacturer or at a third-party location. Use of manufacturer's employees, vendors and affiliates are prohibited as hand drying test panelists. Testing multiple test subjects in parallel is permitted provided sufficient supervision is available to ensure adherence. Specifically, the following shall be verified and documented for the Dry Time Test:

- Manufacturer hand dryer model(s) and brand(s)
- Product's certified electrical ratings
- Test Date
- Test Equipment (description, calibration expiration date)
- Test Environment Conditions (temperature, humidity)
- Product Category Rule (edition / revision date)
- Test Method (Reference clauses of Product Category Rule)
- Test Results (by individual test panelist)
- Minimum Published Dry Time (derived using Section 6)

The operational and standby power consumption is determined with the procedure in Section 8.2 and is a short term test that should be witnessed by the certified 3rd party. The following should be verified and documented:

- Manufacturer
- Hand dryer model(s) and brand(s)
- Product's certified electrical ratings
- Product Category Rule (edition/revision date) Test Date
- Test Method (Reference clauses of Product Category Rule)
- Product Test Equipment (description, calibration expiration date)
- Product sample serial number, manufacturing date code or other identification
- Observed input voltage (V) and current (A) for each measurement of operational and standby power.

- Published operational and standby power consumption as calculated as the product of input voltage and input current expressed in VA.

The Reference Service Life (RSL) Test is a long term test requiring at a minimum certified third party witness and verification of initial test setup and final test results. Testing should be performed with means of automated activation of the tested dryers with precision controls for timing ON/OFF durations and automated counting of cycles of operation. The cycle counter should be sealed upon test initiation, and the testing should be performed in a manner consistent with Section 8.3 and include:

- Physically reviewing and documenting the test units each business day to observe operation is normal as expected.
- Testing the units according to the test procedure in Section 8.3, recording the operational cycles, and monitoring and recording supply voltage on a daily basis.
- Recording the replacement of serviceable parts performed prior to test completion, if any, according Section 8.3, Step 11 and provide documentation stating the date the service need was identified; the number of test cycles at which the service need was identified; specifics (part number, description) of the required service part replacement; the date service was completed and unit was placed back into normal testing. Any service parts replaced shall be retained by the manufacturer until test is completed.
- Recording completion dates for each test unit and the final attained cycles of operation.

Verification by a certified 3rd party shall include, at a minimum:

- Documenting initial setup of test samples and test equipment prior to beginning test.
- Documenting final attained cycles of operation for each test unit and sealed status of cycle counter.
- Reviewing daily inspection records maintained for test units, service part replacement and automated controls servicing.
- Declaration for published RSL for the product including:
  - ⊡ Manufacturer
  - ⊡ Hand dryer model(s) and brand(s)
  - ⊡ Product's certified electrical ratings
  - ⊡ Nominal test supply voltage for the life test units (120V/230V)
  - ⊡ Product Category Rule (edition/revision date)
  - ⊡ Test Method (Reference clauses of Product Category Rule)
  - ⊡ Test completion date
  - ⊡ Published RSL identified through the average observed test life. Where a product is tested at both 120 and 230 supply voltages, RSL's will be determined and reported individually.

8. Appendix II – Hand Dryer Testing Methods

8.1. Dry Time Testing

8.1.1. Dry Hands Panel

A panel of three adult men and three adult women all within the ages of 18-60 will be randomly selected. This age group is intended to keep skin characteristics as consistent as possible within reason. The hand dimensions (average value for both left and right hand rounded to the nearest whole number) for each panel member shall be represented by the 50th percentile mean +/- one standard deviation presented by *AdultData – The Handbook of Adult Anthropometric and Strength Measurements – Data for Design Safety (ref. Country – UK).*

- Maximum hand spread: measured from the outer border of the tip of the little finger to the outer tip of the thumb. Male 194 – 231 mm; Female 185 -216 mm.
- Middle finger height: measured from the tip of the middle finger to a line through the wrist crease: Male 182 – 204 mm; Female 166 – 184 mm.

8.1.2. Testing Equipment

- Hand dryer; with installation and mounting instructions along with a drying procedure (if available)
- Digital weigh scale with readability and minimum accuracy to 0.01 g; Ruler with minimum accuracy to 1 mm;
- Paper towels (Scott® Multi-Fold Towels, Product Code 01804, size 23.88 cm x23.62 cm or equivalent C-fold paper towels with similar size, weight and composition);
- Plastic bucket with warm water (at a temperature of 37 ± 3°C, 98.6 ±5 °F);
- Thermometer with a minimum accuracy to 1°C;
- Stopwatch with minimum accuracy to 0.01 sec.;
- Voltage meter with minimum accuracy to 1V;
- Hygrometer with a minimum accuracy of 2.5% relative humidity

All electrical, electronic and mechanical test equipment is to be within an active calibration period not exceeding a frequency of one year (12 months).

The test is to be carried out under standard room temperature (23 ± 3°C, 73 ± 5°F) and humidity (50 ±20% humidity) conditions with climatically conditioned equipment that had been stored in standard room conditions for a minimum of 24 hours.

For conventional or high speed single-point “hands under” dryers, the hand dryer shall be tested at a mounted height of 44 +/- 2 inches (112 +/- 5 cm) from the floor. Trough style “hands in” dryers shall be mounted at the average height of adult men and women’s mounting heights recommend by the

manufacturer +/- 2 inches (5 cm).
The unit is to be operated at the test voltage and tolerance identified in Table 9.

Multi-voltage models to be operated at the most common test voltage and frequency appropriate for the global region in which the unit is intended for sale according to Table 9.

Where a global region includes both 50/60 Hz frequency, the unit may be tested at either frequency consistent with the product's electrical rating (e.g. a product rated at 50/60 Hz can be tested at either frequency; a product with a single frequency rating must be tested at that frequency).

Table 9. Global Regions, Electrical Distribution and Test Conditions

Global Region	Regional Electrical Distribution	Test Voltage(s) and Frequency	**Test Voltage Tolerance(s)
Africa	220 – 240V 50 Hz	230VAC 50 / 60 Hz	±4.6VAC
Asia	100 – 230V 50 / 60 Hz	120VAC 60 Hz *230VAC 50 / 60 Hz	±2.4VAC ±4.6VAC
Central America	110 – 120V 60 Hz	120VAC 50 / 60 Hz	±2.4VAC
Europe	220 – 240V 50 Hz	230VAC 50 / 60 Hz	±4.6VAC
Middle East	220 – 240V 50 Hz	230VAC 50 / 60 Hz	±4.6VAC
North America	120 – 240V 60 Hz	*120VAC 50 / 60 Hz 230VAC 60 Hz	±2.4VAC ±4.6VAC
Oceania	220 – 240V 50 Hz	230VAC 50 Hz	±4.6VAC
South America	110 – 220V 50 / 60 Hz	120VAC 50 / 60 Hz *230VAC 50 / 60 Hz	±2.4VAC ±4.6VAC
Caribbean	120 - 240V 50 / 60 Hz	120VAC 50 / 60 Hz	±2.4VAC

→| The test voltage for the most common regional electrical distribution should be used when testing multi-voltage models.

** Tolerances shown are only applicable to Section 8.1 - Dry Time Testing and Section 8.2 - Energy Consumption Testing.

For each test, the tester shall keep track of time with a stopwatch or other time keeping device to alert the user when to switch tasks bulleted in the test procedure.

For each iteration, hand dimensions, gender, voltage, humidity, water temperature, air temperature, dry paper towel weight and wet paper towel weight need to be recorded. If using a digital scale with a tare weight, zeroing feature, it is sufficient to tare the weight of dry paper towels prior to testing and recording the resulting residual moisture.

For the timed movements required in the test procedure, it is sufficiently accurate when completed within +/- 1 second of the nominal time requirement (i.e. for a 5 second specified duration, it is acceptable when completed between 4 – 6 seconds).

8.1.3. Test Procedure

1. Measure the panelist's hand and compare against allowable measurements. Panelists with hands that do not fit the criteria shall be disqualified.

2. The user shall remove jewelry (rings, bracelets, watches, etc.) and thoroughly wash their hands using a readily-available hand soap and warm water prior to the start of the test. There shall be no trace or feel of residual soap preceding the test.

3. Weigh two individual folded paper towels (Scott® Multi-Fold Towels, Product Code 01804, size 23.88 cm x23.62 cm or equivalent based on size, weight, and composition) on a digital scale and record weight.

4. Place both hands in a bucket containing water (at a temperature of 37 ± 3°C, 98.6 ± 5°F) up to the hand-wrist crease level for 5 sec. The tester shall start timing as soon as the panelist's hands enter the water. Gently move hands in water to remove air traps and bubbles; making sure not to splash any water above the hand-wrist crease level.

5. Immediately remove both hands from the bucket of water in a movement that minimizes splashing. Allow the hands to drip dry over the bucket for an interval of 5 sec. with the fingers spread slightly. Do not shake, wave or make any hand movements promoting loss of water from the hands other than normal dripping while traveling to the drying position.

6. Activate the dryer and begin drying hands within 5 sec. after the hands drip dry.

7. Dry hands as recommended by the hand dryer manufacturer. If the manufacturer's instructions are unavailable, use the following instructions depending on hand-dryer type. The tester shall stop timing once the desired time interval is reached.

8.1.3.1. Drying Instructions for Conventional (Hands Under) Single-Point Dryer

a. Instruct user the goal is to dry hands as quickly as possible.

b. Ensure the air nozzle is pointing vertically down prior to the start of testing.

c. Place hands under hand dryer approximately 4±1 inches below the hand dryer's air outlet to activate drying cycle. Once activated, do not move hands too far in any direction putting them outside of the sensor range to keep the unit from deactivating.

d. After the cycle is activated, rub hands back and forth in a linear motion, palms facing each other, fingers spread slightly, parallel to the flow of air, so that the middle fingertip of one hand touches the wrist crease of the other hand, and reverse to the middle fingertip of the opposite hand touches the wrist crease of the opposite hand. This is one cycle. Repeat for 4-6 cycles, with each cycle taking approximately 2 sec.

e. *After (d), roll hands back and forth in a rotational sequence, so that initially the palms receive the airflow from the hand dryer, then rotate so that the backs of the hands receive the airflow, with the palms or back of hands perpendicular to the flow of air. This is one cycle. Repeat for two cycles, with each cycle taking approximately 2 sec.*

f. *After (e), spread fingers and interlock and unlock hands, with the palms facing each other and perpendicular to the flow of air. Repeat for two cycles, with each cycle taking approximately 2 sec.*
g. *Repeat steps (d), (e) and (f) until the desired time interval is reached.*

8.1.3.2. Drying Instructions for High Speed (Hands Under) Single-Point Dryer

a. *Instruct user the goal is to dry hands as quickly as possible.*

b. *Place hands under hand dryer at approximately a 45 degree angle 3±1 inches below the hand dryer air outlet to activate the drying cycle. Once activated, do not move hands too far in any direction putting them outside of the sensor range to keep the unit from deactivating.*

c. *Keep hands together in or as close to the airstream as possible at all times during the drying process.*

d. *After the cycle is activated, rapidly move hands through air stream across all surfaces of each hand from the wrist crease to finger tips then finger tips back to wrist crease on both sides of hands to blow off large water droplets. This is one cycle taking approximately 4-5 sec.*

e. *After (d) spread and interlock your fingers with the palms facing each other perpendicular to the flow of air then rub between them from the finger crease to the fingertips of each hand and end by rubbing palms together in circular motion. This is one cycle taking approximately 2-3 seconds.*

f. *After (e) focus on areas of hands that still have water on them or "feel wet" and place them directly into center of the air flow perpendicularly. This is one cycle taking approximately 1-2 seconds.*

g. *Repeat steps d, e and f until the desired time interval is reached.*

h. *Remove hands from the airflow by pulling towards oneself, through the center of airflow.*

8.1.3.3. Drying Instructions for Trough Style (Hands In)

a. *Instruct user the goal is to dry hands as quickly as possible.*

b. *Place hands side by side, with the thumbs approximately four (4) inches from each other, palms facing user, fingers spread slightly. Place hands into hand dryer to activate drying cycle. Once activated, do not move hands too far in any direction putting them outside of the sensor range to keep the unit from deactivating.*

c. *After the cycle is activated, move hands downward in 1-2 seconds so that the air ports blow onto the user's hands beyond the wrist crease. Move hands up until the air ports blow onto the user's middle fingertip in 4-5 sec., so that one back-and forth motion lasts 6 ± 1 sec. This is one cycle.*

d. *Repeat (c) until the desired time interval is reached.*

8.1.3.4. Drying Instructions for Multi-Point (Hands Under) Dryer

a. *Instruct user the goal is to dry hands as quickly as possible.*

b. *Activate the drying cycle by placing hands into the air streams with hands side by side, palms or backs of hands facing airstreams, fingers spread slightly. Once activated, do not move hands too far in any direction taking them outside of the sensor range to keep the unit from deactivating.*

c. *Slowly move hands through the - air streams - keeping the backs or palms of the hands within 10mm (+/- 5mm) of the air exit ports - until reaching the wrist crease. Complete this movement in 1.25 secs (+/- 0.25 secs).*

d. *Reverse hand direction extending hands through the air streams - keeping the backs or palm side of the hands within 10mm (+/- 5mm) of the air exit ports - until reaching the middle finger tip. Complete this movement in 1.25 secs (+/- 0.25 secs).*

e. *Repeat (c) and (d) until the desired time interval is reached.*

8. Grab the already unfolded paper towel within 3 sec. of the end of the drying cycle.

9. Immediately start drying residual water from hands with the paper towel. Do this by wiping down the palms, tops of hands, wrists, each finger, each thumb, and each of the eight crevices between the fingers and thumbs with the pre-weighed paper towel for 8 ± 2 sec.

10. Within 3 sec., the panelist shall roll the paper towel into a ball and place the paper towel on the scale.

11. Weigh the towel and record the total weight within 5 sec.

12. Wait a minimum of 60 sec. before conducting a replicate so that the hand dryer can cool down.

13. Record the residual moisture (the difference in paper towel weight before and after drying).

Notes

This procedure shall be replicated six times per panelist; the highest value and lowest residual moisture measurements shall be discarded and the average of the remaining four values shall be used. If at any time the procedure is not followed accurately, the test must stop and be restarted.

An audio or visual device may be used that produces a signal at each specified event interval.

To define dry time:

1. The dryness threshold is defined as a dryness equaling 0.25 grams of residual water or less.

2. The dryer will be tested in two (2) second increments over the range of duration required to bound and contain the dry time - residual moisture of 0.25 grams or less. The range of duration tested should be a minimum of eight (8) seconds or five (5) data points (maximum tested value – minimum tested value).

3. The data for all panelists will be averaged for each increment of duration tested. An X-Y graph of the averaged data will be created as shown in Figure 2, with the Y axis representing the residual moisture measured at each increment of duration tested and the X axis representing the range of drying durations tested.

4. The minimum published dry time will be defined as the intersection of the Average Residual Water graph with the horizontal line representing the Dryness Threshold (0.25 grams of residual water). Use the quadratic formula to solve for the lower x value (there will be two answers given the equation is quadratic). The published dry time shall be rounded to the nearest whole integer, with 0.51 or greater rounding up.

8.2. Energy Consumption Testing

Total power demand for the product use stage (B1) including reactive power losses, operational power consumption (including consumption during dry time and "run-on time" and standby power consumption will be determined through the following standardized test conditions:

Test Procedure

1. Units will be tested at the standardized test voltages and frequencies applicable to the targeted geographic region in Table 9: Global Regions, Electrical Distribution and Test Conditions. Where a targeted region involves power supplies at both 50 and 60 Hz, units will be tested at both frequencies if applicable to the product's certified electrical rating.

2. Universal voltage models, accommodating both 120V and 230V service voltages, will be tested at 120 and 230V input as applicable for the intended geographic market.

3. Six (6) units will be tested at each applicable test voltage.

4. Input voltage and current will be measured using digital meters with minimum accuracy of 0.1 VAC and 0.1 amps respectively. Meters will be within an active equipment calibration period not exceeding a frequency of one year (12 months).

5. Where product platforms include variable speed or heat controls, testing will be conducted with product settings at the maximum level of power consumption.

6. Nominal power supply frequency will be recorded and input voltage and current will be measured/ recorded for three (3) instances of operation and standby mode for each unit tested.

7. For each instance of operation mode tested, power consumption will be calculated as the product of input voltage and current and expressed in volt-amperes (VA).

8. For each of the six (6) units, measure “run-on time” (i.e. after hands are removed from the dryer until the dryer’s controls stop dryer operation and supply current has returned to normal levels in returns to standby mode power consumption) and calculate an average “run-on time” for all six (6) units.

9. The total “run time” of the dryer is the sum of the dryer’s dry time determined in Section 6 and the average “run-on time”.

   The energy consumption during operation mode is the total accumulated energy of an operation cycle (i.e. “run time”) and includes dry time from Section 6 and the average “run-on time” from Step 8.

10. For each instance of standby mode tested, power consumption will be calculated as the product of input voltage and input current and expressed in VA.

8.3. Reference Service Life Testing Procedure

1. Where individual product platforms comprise voltage-specific models, units will be tested at 120V and 230V input as applicable for the intended geographic market identified in Table 9: Global Regions, Electrical Distribution and Test Conditions.

2. Where individual product platforms comprise universal voltage models accommodating both 120V and 230V service voltages, units will be tested at both 120 and 230V input for separate reporting of results applicable to the respective input voltages.

3. The units may be tested at either 50 or 60 Hz service frequency consistent with the product’s certified electrical rating and indicated in the background report.

4. The units will be tested with a duty cycle defined as:
   a. “ON” time is defined as the “run time” determined through the test methods identified in this PCR with an accuracy of +/- 1 second
   b. “OFF” time will be 15 seconds with an accuracy of +/- 1 second.

5. Six (6) units will be tested at each applicable test voltage, and the reported RSL will be the average test service life of the six units tested.

6. Adequate supply circuits will be provided for the testing. Acceptable supply voltage variation is +/- 4% of the nominal supply voltage (120V +/- 5 V or 230 +/- 9V). During cycles of operation, the supply voltage is permitted to drop consistent with normal voltage drop for that hand dryer model supplied on a dedicated supply circuit of adequate size.

7. Where product platforms include variable speed or heat controls, testing will be conducted with product settings at the highest level of power consumption.

8. The test life of an individual test unit is complete when end of natural motor service life is observed. Life test results will not include motors concluding in abnormal end of life conditions. Test units experiencing

abnormal end of life conditions will be replaced.

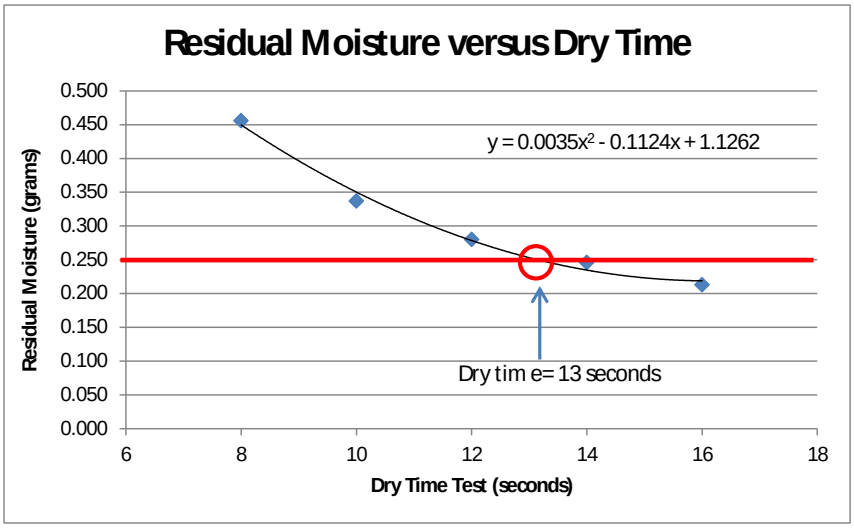
9. A test unit involving brushed universal motors is considered to have reached completion when normal motor function ceased due to motor brush or commutator wear. In the case of a hand dryer model including replaceable motor brushes from the manufacturer, motor brushes can be replaced one time only to extend service life.

10. A test unit involving brushless motors is considered to have reached completion when the motor ceases to function normally due to end of service life of bearings or integrated non-replaceable electronic controls.

11. Normal servicing consistent with manufacturer's recommendations for replacement of electronic control assemblies, sensors, timers, motor brushes and intake air filters is permitted during life testing.

Figure 2. Example dry time calculation

Dry time (seconds)	Residual Moisture (g)
8	0.456
10	0.337
12	0.280
14	0.246
16	0.213



9. Appendix III – Relevant product safety standards[5]

Geographic Market	Safety Standards for Sale in Market
USA	UL 499 Standard for Safety – Electric Heating Appliances
	UL 507 Standard for Safety – Electric Fans
Canada	CAN/CSA-C22.2 No. 60335-1 Safety of household and similar appliances – Part 1: General requirements
	CAN/CSA-C22.2 No. 60335-2-23 Household and similar electrical appliances – Safety – Part 2-23: Particular requirements for appliances for skin or hair care
Member countries of the IECEE CB Scheme	IEC 60335-1 Household and similar electrical appliances – Safety ; Part 1: General requirements
	IEC 60335-2-23 Household and similar electrical appliances – Safety – Part 2-23: Particular requirements for appliances for skin or hair care
	EN 55014-1 Electromagnetic compatibility – Requirements for household appliances, electric tools, and similar apparatus – Part 1: Emission
	EN 55014-2 Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity
	IEC 61000-3-2 Electromagnetic compatibility (EMC). Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
	IEC 61000-3-3 Electromagnetic compatibility (EMC). Limitations of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
	Directive 2011/65/EU RoHS 2
	Directive 2012/19/EU WEEE

[5] The most current version of the referenced performance standards shall be used.

10. Appendix IV – Hazardous Waste Classification by Region

Region	Classification
China	China: Solid wastes included in the national catalogue of hazardous waste or solid wastes which, according to the identification standards of hazardous wastes, are determined as having a hazardous property.
Europe	Annex 3 of European Waste Framework Directive (2008/98/EC)
Japan	Japan: Hazardous wastes defined by the Basel Law are as follows: A. The following materials which are exported or imported for the disposal operations listed in Annex IV of the Basel Convention. 1. Materials listed in Annex I of the Convention and having one or more hazardous characteristics listed in Annex III of the Convention; 2. Materials listed in Annex II of the Convention; 3. Materials to be notified to the Secretariat of the Convention by the Government of Japan through the designation by the Cabinet Order in accordance with Section 1 or 2 of Article 3 of the Convention; and 4. Materials informed by the Secretariat of the Convention in accordance with Section 3 of Article 3 of the Convention. B. Materials, exportation, importation, transportation (including storage) and disposal of which must be regulated based on bilateral, multilateral or regional agreements or arrangements defined in Article 11 of the Convention.
Korea	Waste Control Act with some regulation under the Act on the Promotion of Saving and Recycling of Resources.
Latin America	Hazardous Waste - Class I – material categories listed in the Annex 1-A to 1-C of the CONAMA Resolution no 23, from December 12, 1996, unless they do not present any characteristics listed in Annex II of the same legislation. Furthermore, all wastes listed in Annex 10-A (Hazardous Wastes - Class I - Importation Prohibited) of the CONAMA Resolution no 235, from January 7, 1998, and as 'controlled' all the wastes listed in Annex 10-B (Non-Inert Wastes – Class II - Controlled by IBAMA) of the Resolution.
North America	North America: US: Resource Conservation and Recovery Act (RCRA), Subtitle III, Clause C; Canada: Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations, 2005.