



Department for
Business, Energy
& Industrial Strategy



Energy Technology List

The Energy Technology List for Energy Saving Technologies

ETL Method for the Testing of High Speed Hand Air Dryers

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1 Introduction

This document provides the method that should be used to test high speed hand air dryers and prepare test data for an application for inclusion in the Energy Technology List. The method presented should be followed in its entirety to ensure the accuracy, repeatability and reproducibility of the tests.

2 Equipment requirements

The following equipment is required to complete the tests:

- a) A test room that is maintained at a temperature of $23 \pm 5^{\circ}\text{C}$ and a humidity of $55 \pm 5\%$. *
- b) A standard 230 Volt ac, single phase, 50 Hz electrical power supply to operate the hand dryer.
- c) A stop watch that is able to measure the operating time of the hand dryer to an accuracy of $\leq \pm 0.1$ seconds. This will be used to record the hand dryer operating time to the nearest 0.5 seconds.
- d) A bucket containing water heated to, and maintained at, $37 \pm 2^{\circ}\text{C}$. The bucket should be large enough to allow volunteers to immerse their hands in the water up to the wrist crease without touching the sides.
- e) A pack of paper hand towels. The type and size of paper towel used during product testing must be declared in the test report. One of the following types of towel (or equivalents) must be used:
 - Scott ® 6633 single ply m-fold hand towel (Product code KC01114: 315 x 206mm)
 - Scott ® Multi-Fold Towels (Product Code 01804, 238.8 x 236.2 mm).
- f) A digital scale that is able to measure the weight of a paper towel to an accuracy of $\leq \pm 0.01\text{g}$.
- g) Measuring equipment to record:
 - Test room air temperature to $\pm 1^{\circ}\text{C}$ and humidity to $\pm 1\%$.
 - The temperature of the water in the bucket to $\pm 1^{\circ}\text{C}$,
 - The power consumption of the hand dryer in Watts to an accuracy of $\leq \pm 1\%$ at 1 second intervals.
 - The voltage of the mains power supply used by the hand dryer to an accuracy of $\leq \pm 1\%$ at 1 second intervals.
- h) A video recorder. This must be used to record of all aspects of the testing procedure, including:
 - The physical layout of the test equipment.
 - The measurement of volunteer's hand sizes.
 - The initial hand washing in soap and warm water.
 - The wetting of hands before each test and the movement to the hand dryer.
 - The entire hand drying process from insertion into, or under, the hand dryer to removal of hands and drying any excess water from the hands with a paper

towel.

- The individual weighing of each paper towel used, before and after each test.
- The environmental conditions (temperature/humidity) and water temperature.
- The instructions given by the test operators to the volunteers during the testing.
- All 120 hand drying tests as required by the procedures in sections 6 and 7.

Note: The video recordings of each test, and preparatory actions, must be clearly labelled (so that they can be matched with the written test results) and submitted with the Product Application.

If the total size is less than 40MB please upload as a zip file to your online application, if the total footage exceeds 40MB please copy this onto a CD and post to the ETL Co-ordinator using the address at the end of the application checklist.

3 Test setup

- a) The hand dryer should be mounted on (or in) a wall at a height that allows volunteers to insert their hands into its drying zone without bending at the waist, or lowering their arms below waist level or raising them above mid-chest. The mounting height must be declared in the test report.
- b) The bucket of water should be located immediately to one side of the hand dryer and raised to a level similar to that of a hand basin so that the volunteers are able to fully immerse their hands and step across to the hand dryer within 3 seconds without significant twisting or bending.
- c) The digital scale should be located immediately on the other side of hand dryer at waist height, so that the volunteers can pick up a paper towel without having to take more than one step.
- d) The hand dryer must be configured to start automatically when hands are inserted into it.
- e) The video camera should be located so that all aspects of the testing process are clearly visible. Where necessary, a camera operator may be used to ensure the video records the entire hand drying process, or a second camera may be used to simultaneously capture the measurements. The instructions given by the test operator to the volunteers should be clearly audible on the recording.

Note: A container may be placed on the scales to assist with the collection of used towels, provided it is present on the scales when the towel is first weighed. Where necessary, a wind shield should be used to prevent the paper towels from being blown off the scales during testing.

4 Selection of volunteers

- a) A panel of six volunteers, consisting of 3 adult males and 3 adult females, is required to complete the testing procedure. The volunteers can be drawn from the personnel available at the test location, and need not be selected at random. Persons recording the tests may not act as volunteers.
- b) The middle finger height and maximum hand spread of each of the volunteers' hands must be measured in according with the procedures set out in "*ADULTDATA – The Handbook of Adult Anthropometric and Strength Measurements – Data for Design*"

Safety", Department of Trade and Industry, London, UK, 1998 (Measurements 141 and 185).

- c) The average of each volunteer's left and right hand middle finger height, and left and right hand maximum hand spread must be within the following limits:
 - Middle finger height: Male: 193.3 mm \pm 5%, Female: 174.9 mm \pm 5%
 - Maximum hand spread: Male: 212.9 mm \pm 10%, Female: 200.2 mm \pm 10%
- d) The gender and hand dimensions of each volunteer must be recorded in the test report, in a manner that enables the test data for each volunteer to be related to these measurements.
- e) Each volunteer should sign a consent form giving permission for the tests to be recorded on video and included with ETL application.

Note: The video recordings will only be used to assess whether this testing protocol has been followed correctly, and will not be published.

5 Hand wetting and drying procedure

- a) Each volunteer should thoroughly wash their hands in soap and warm water immediately prior to participating in product testing. Rings and other jewellery should be removed from hands and wrists.
- b) The volunteer's wrist crease should be marked with a black pen line so it is clearly visible.
- c) At the start of each test, volunteers should immerse their hands up to the wrist crease (i.e. the black line) and rub their hands together for 5 seconds to remove trapped air and bubbles.
- d) The volunteer should then remove their hands slowly from the water, pausing for 5 seconds with their hands immediately above the bucket to allow excessive moisture to drip from their hands prior to drying. The hands (and fingers) should not be moved or shaken during this pause.
- e) At the end of the permitted dripping period, the volunteer should immediately move to the hand dryer without shaking their hands and insert them into the hand dryer within 3 seconds.
- f) The stopwatch should be started at the point when the volunteer starts to insert their hands into or under the dryer, and stopped when their hands are fully removed. The stop watch operator should instruct the volunteer to remove their hands just before the specified drying time.
- g) The volunteer should follow the manufacturer's instructions in respect of rubbing their hands together, (or rotating them) in the product's air flow to ensure that as much moisture is removed from their hands as quickly as possible. However no more than 2 rubs per second are acceptable.
- h) At the end of the specified drying time, the volunteer should pick up a pre-weighed towel from the scales, within 5 seconds of removing the hands from in/under the hand dryer. They should remove any moisture remaining on their hands by thoroughly rubbing both sides of the hands, and between the fingers with the paper towel. The same thorough hand rubbing process must be used for each test regardless of drying time and whether the volunteer considers their hands are dry.
- i) The used towel should be folded up or scrunched and carefully placed back on the

scales and weighed.

A total of **no more than 25 seconds** should be taken from when the hands are removed from the hand dryer to when the towel is placed back on the scales (including the maximum of 5 seconds to get from the dryer to picking up the paper towel and the time taken to remove any moisture remaining on the hands with the paper towel).

Note: If the volunteer removes their hands from the dryer before the specified time or exceeds the time limits for each part of the testing procedure, the test is void and must be restarted.

6 Determination of standard drying time

- a) The product's drying profile must be established by measuring the residual moisture on each of the six volunteers' hands after intervals of 10, 15, and 20 seconds spent in (or under) the hand dryer.
- b) Each volunteer must complete 5 hand drying tests at each time interval, and the results for each test need to be recorded in the test report. The average value for the residual moisture at each time interval plotted on a standard X-Y graph with error bars shown.
- c) The average time taken to dry each volunteer's hands to a residual moisture level of less than 0.15g should be calculated using a least squares method of interpolation of the result at the 3 time intervals.
- d) The test results for the two volunteers with the highest and lowest average drying times should be disregarded, and the maximum average drying for the remaining 4 volunteers' hands reported as the product's **standard drying time**.

Note: A separate calculation of average drying time must be made for each volunteer.

7 Measurement of product performance

- a) Once the standard drying time has been determined the product performance must then be measured. This is the product's electrical power consumption measured and recorded at 1 second intervals during 30 additional tests at the standard drying time. The average electrical power consumption of the product during the 30 tests should be determined by analysis of the data logs. During these tests, each of the 6 volunteers must complete 5 hand drying tests and the data must be recorded and presented as set out in the first sentence of 6b).
- b) The average residual moisture over 5 tests on 4 out of 6 volunteers' hands must be less than 0.15g, otherwise the standard drying time should be increased by 0.5 seconds and the tests repeated.
- c) Where the product is fitted with an air heater, this must be switched on during the tests.
- d) Where the product uses a heat store to warm the air passing into or through the dryer, the electricity used to maintain the heat store at the output air temperature specified in the manufacturer's literature should be measured and must be added to the electricity consumed per standard drying cycle. The calculation of additional electricity use should be based on 1 drying cycle every 2 minutes.

Note: The product's standard drying time must be less than, or equal to, (\leq) 15.5 seconds.

* For the avoidance of doubt, all references to $x \pm y$ mean a range from $x - y$ to $x + y$.

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