Graphical Tester for Otoplastics

With USB interface

General User's Manual

2023

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1 GENERAL

1.1 Terms

This manual uses a number of **terms** that are briefly described here.

leak tester: the device, to which the adapter and the otoplastic, by means of an air hose, are connected [also: tester, leakage tester, unit, device]

system: the physical whole consisting of leakage tester, air hose, adapter, otoplastic and ear canal (meatus)

platform: personal computer (desktop, laptop), tablet or smartphone that hosts a USB port and will make an interface connection to the leak tester

software: the software (*app*) running on the platform that controls the leak tester [also: *app*, program, user-interface, controlling software]

USB: the cable, connectors and communication protocols between the platform and the leak tester (USB 2.0 and USB 3.0+)

Together, the leakage tester, platform, software and USB interface form the "graphical tester for otoplastics".

Below is a photo of the tester showing the LED status-indicator (§1.2.2) and air hose.

Photo 1.1.1: the USB leakage tester, front and silicon hose with standard adapter

1.2 Bringing into operation

1.2.1 Power

When connecting platform and leak tester with the provided USB cable the tester is automatically activated; there is no on/off switch. The tester works with both USB 2.0 and USB 3.0 connections. The tester is provided with a USB-C receptacle (micro-B for legacy models). With this type of connector there is no need to pay attention to its position: bottom up or top down, it always works. The provided cable has two plugs: at the platform side a USB-A and on the tester side a USB-C.

Below is a photo (1.2.1.1) showing the USB cable with on the right the USB type C which should be connected to the rear of the leak tester (photo 1.2.1.2). Because there is no need to pay attention to the position there is not top/bottom indicator on the plug.

Photo 1.2.1.1: interface cable USB type A (left) to USB type C

Photo 1.2.1.2: backside of the leakage tester with USB-C cable

1.2.2 USB cable selection

1.2.2.1 General

The tester comes with a standard USB cable (USB-A > USB-C). The length of the cable can be a limitation. Shorter cables may always be used, but when choosing a longer cable, it should not be more than 5m (~15ft), and then preferably with a filter on the USB-C side.

As mentioned, the tester does not have an on/off switch: it is switched on and off with the desktop, laptop etc. If you want to disconnect the tester from the USB cable every time after use, do this preferably with the USB-A side of the cable, because this is a more robust connector. Another consideration to limit the forces on the micro-B connector is to use a magnetic (or zero-force) coupling: the connector stays in the C socket on the unit and the cable can be disconnected without force. A tested example can be seen below.

Photo 1.2.2.1: backside of the tester with *zero-force* connector

1.2.2.2 Cable for Android tablet or smartphone

If you want to use the tester in combination with an *Android* platform, there are various options to get from the USB-C on the unit to the socket on the *Android* machine, e.g.: an attachment for the USB-A side of the standard cable, this can be USB- C or micro-B, or, preferably, a special cable USB micro-B / C (Android) to USB-C (tester).

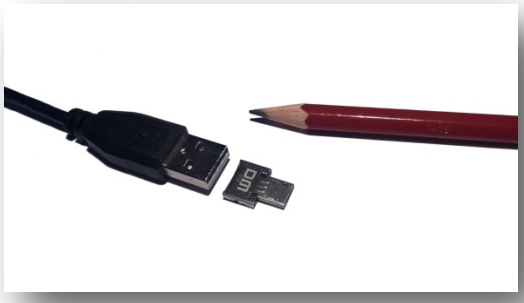

Photo *1.2.2.2*: attachment for USB-A > USB-C

Photo *1.2.2.3*: cable USB-C > USB-C

1.2.3 LED status indicator

The tricolour LED status-indicator on the tester can turn to red, orange or green.

Red:

- for an indefinite period during initialization while the tester is not jet recognized by the operating system of the platform (led is blinking)
- during approx. ten seconds right after connecting the tester to the platform (during this period of time the tester is set and the offset determined. Do not touch the testers enclosure during this period, because of this it is good practice to connect the USB cable to the tester first and then to the platform)
- up to five seconds after a fault condition during a measurement (§2.3.3)

Orange:

- after set up has been completed (and a stable offset established), the tester waits for the controlling *app* to launch
- immediately after every start of a measurement until completion
- after entering *sleep* mode for screen and/or PC
- after *app* termination [STOP]

Green:

- there is contact between the controlling *app* and the tester
- a measurement has been carried out, the leak tester is ready for a new test

1.2.4 Leakage tester

Connect an air hose (PVC or silicon) of about 1.2m (~47") long to the connector (spout) intended for it at the front. Before use, check the air hose for damages, iniquities, kinks, discolouration, etc.
Use the prescribed air hose and adapter only.

1.2.5 Control

The USB leakage tester can only be controlled from a platform that can build USB 2.0 or USB 3.0 connections. There are currently two platforms (and three *apps*) available:

- PC / laptop: Windows 10 (32- and 64-bit) with two *apps*, viz. a so-called "classic" app as discussed in this document, and a UWP *app* (Universal Windows Platform)
- Android: Tablet or Smartphone as of Android 4.1.x (Jelly Bean, API level 16), with USB *OTG* Host Mode facility (USB *On-The-Go*)

1.2.6 Acquisition, installation and use of the *app*

There is a separate *app* for each of the two platforms. Each time, a description is given of where the *app* can be obtained and how it should be *installed* next. For each *app* it is also indicated where documentation about the *use* of the *app* can be found.

1.2.6.1 Windows 10: classic app for desktop or laptop

Is chosen for the *classic* control *app* (also applicable under W7) then all is covered in **this** *General User Manual*, because the use of the USB leakage tester is explained with reference to this *app*.
The app can only be downloaded from URL: https://www.cursorengineering.nl/en/app-win-usb-en/.
It is a **.zip** file named OtoTestUSB_EN and also contains logo and installation instructions.
The *app* OtoTestUSB.exe and the supporting files can be placed in any existing or newly created directory or folder. When unpacking (extracting) the .zip file, the desired folder name can be entered directly, e.g. **C:\USBleaktester**, even if the folder does not exist yet. However, if the .zip file is unpacked in the same location where the file is currently located, then automatically a subdirectory will be created by the Windows OS. Optionally you can create a shortcut to the desktop.
There is a special English document for solving common USB (installation) problems called USBsolutionsW10_EN, URL: https://www.cursorengineering.nl/en/documentation-usb/.

1.2.6.2 Windows 10: UWP app for desktop, laptop or tablet

There is a separate manual that describes the procedure for applying an *app* on the **U**niversal **W**indows **P**latform, it is named *USBmanUWP_EN* and can be downloaded from our website under >USB >Documentation (USB), URL: https://www.cursorengineering.nl/en/documentation-usb/.

1.2.6.3 Android: app for tablet or smartphone

For application of an *app* for Android platforms, there is a special guide too. You can find this document on the website, >USB >Documentation (USB), named USBmanAndroid_EN and, as mentioned before, the URL reads: https://www.cursorengineering.nl/en/documentation-usb/.

1.3 Environment

The leakage tester consists of precision components and therefore must be handled with care and not exposed to extreme or sudden changes in temperature, moisture and/or air pressure. The environment in which the tester will be used must meet the following requirements:

- Normal relative air humidity (30...70%RH)
- Constant temperature (+10°C...+30°C)
- Stable environmental pressure (e.g. do not open/close doors during sessions)
- No direct sunlight (on the body of the tester)
- Low in dust and of course smoke-free

Allow the tester to acclimatize for some time after changing spatial conditions.
In case of major changes, disconnect and reconnect the tester (*zero-point* recalibration).
The work surface should be flat and solid. Maintain space around the tester, so that the air hose does not become kinked or trapped. If the air does not have free access, measurement errors can occur.
During the measurements, do not press or deform the housing or hose.

1.4 Maintenance

The tester requires no specific maintenance. The enclosure can be cleaned with a soft, if required, slightly moistened cloth. The housing is made of PMMA (acrylic) therefore do not use solvents to clean it. **No regular calibration is required**, the pressure sensor is *LASER* calibrated and has an extremely short drift over time. Before each measurement, check that the end of the air tubing is free from foreign matter and lies loose. Occasionally take a measurement with the end of the air hose closed to check that the tester and hose themselves are still airtight and check if air is coming out of the tester at all. If considered necessary, replace the air hose with one of the prescribed type. Do not lose the rubber feet and store the leakage tester whenever possible, and certainly when it is being transported, in a suitable storage system.

2 MEASUREMENTS

2.1 Getting started

Connect the tester and wait until the LED indicator turns orange.
In this example we assume the use of the so-called *classic* Windows *app*. Activate the *app* (OtoTestUSB.exe) and the following window will be displayed: the measurement window. The leakage tester will make an audible beep and the LED in the *app* will be green.

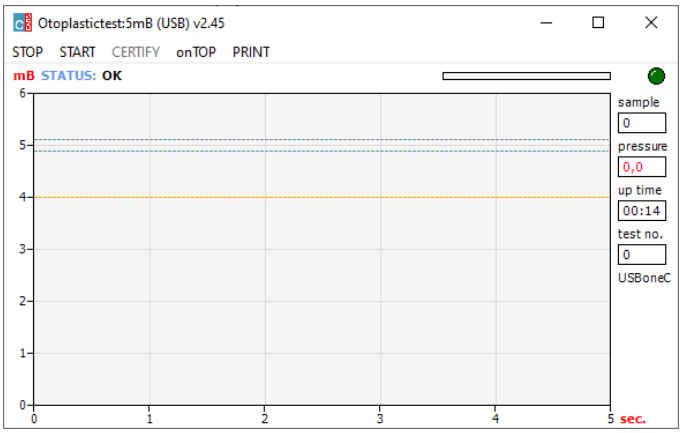

Figure 2.1.1: The *classic* measurement window

The size of the *app* screen can be adjusted within certain limits.
By clicking on white parts outside the graph, a small screen appears with extra information.
It is not (any longer) allowed, with this *app*, to connect multiple USB testers to the same platform; an error massage [10] will follow.

2.2 Standard measurement

Measurements can start when the measurement window is visible and the adapter and the otoplastic are correctly connected. Use the mouse to click [START] (or press F5), the air pump in the tester will raise the pressure in the tester in a few moments to 5mB. The actual leak measurement will take five seconds. In this period, ideally the pressure must remain at 5mB, but a lower limit of (arbitrary.) 4mB (the orange line) is adhered to. The figure below shows an ideal result of a measurement.

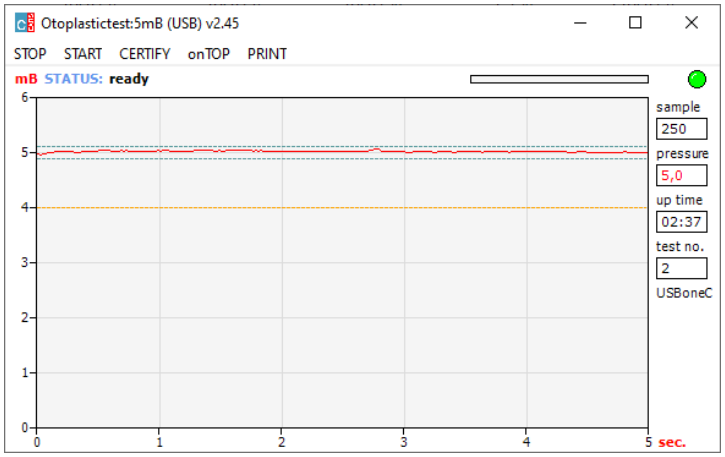

Figure 2.2.1: A measurement result

2.3 Screen legend

2.3.1 Menu

- **STOP or [F4]:** a measurement that is in progress will be interrupted, if no measurement is being taken the program will be terminated
- **START or [F5]:** a new measurement will start
- **CERTIFY or [F6]:** if the result of the measurement is within the norm, a certificate can be generated; only available on PC platforms
- **onTOP or [F7]:** when onTOP is clicked, the *app* window will always be displayed on top of all of the other windows, handy when using spreadsheets etc., **onTOP** switches to **offTOP**!
- **PRINT or [F8]:** generate a hardcopy of the measurement result with a date/time stamp.

2.3.2 Graph

- **mB:** the y-axis shows the relative pressure in millibar [mB] with respect to the ambient air pressure, in the example, the measurement is will be made at a pressure of 5mB. The dashed lines above and below the measured value show the upper and lower extreme limits within which a perfect measurement result is or will be achieved (5mB ± 0.1mB). SI unit for pressure: Pascal [Pa] (5mB ≡ 500Pa).
- **sec.:** the x-axis shows the total measurement time in seconds. The measurement time can only start when an *initial* pressure of 5mB has been reached.

2.3.3 Status

The status of the leak tester is shown to the right of 'STATUS' on the status line (which is displayed immediately above the graph). Further to the right is a status bar that shows the duration (a maximum of five seconds) for a changed status, therefore, at the transition to another status.
The leak tester has a number of states, the most important ones (in OtoTestUSB) are shown below.

- **ok:** the leak tester is ready for the first measurement
- **air in:** the air pump will try to pressurise the system
- **pressure low:** the system pressure cannot be reached*
- **stabilizing:** the pressure has been reached and the system will check for a short time whether it is stable enough
- **measuring:** the actual measurement starts, the graph will be drawn
- **ok, air out:** the measurement has been taken and the system will be depressurised
- **blocked?:** the air cannot leave or only with difficulty leave the system*
- **terminate!:** displayed if [STOP] is clicked during a measurement
- **connecting:** the software is trying to establish a connection with the leak tester
- **ready (rejected):** the measurement is complete with an unsatisfactory outcome (arbitrary)
- **ready:** the measurement is finished and the leakage tester is ready for a new measurement

* condition is discussed in more detail in paragraph 3.2.2.

2.3.4 Information panel

Details are displayed at the right of the graph and provide information about the progress of a session:

- **LED lamp:** [green]: last measurement completed, result within specification
  [orange]: last measurement completed, but result does not meet specification
  [red]: measurement started, but not completed
- **sample:** the number of measurement moments during the entire measuring time
- **pressure:** the measured pressure, or the last measured pressure (in mB)
- **up time:** the time (mm:ss) elapsed since the program was started (max. one hour)
- **test nr.:** number of completed measurements since the program was started

Note: opening the *app* and every time after starting a session the *led* (in the app) will always turn [dark green] until the tester is back in *ready* state.

2.4 After use

It is good practice, once all of the measurements have been taken, to exit the software first (to ensure proper termination of the USB connection). Although the energy use is low, after termination remove the USB cable (see also §1.2.2 USB cable selection).
Make a habit of immediately removing the otoplastic and to lay the hose down loosely.
Store the leakage tester whenever possible, and certainly when it is being transported, in a suitable storage system.

3 ADDITIONAL INFORMATION AND ERROR MESSAGES

3.1 Communication

Immediately after activating the *app*, the platform tries to establish a USB connection with the tester. Problems that occur during this phase are shown in a separate window; these problems nearly always lead to the program being terminated after [OK] is clicked. The program must be restarted and/or the tester reconnected.

An overview of the most important error messages:

1. *No USB leakage tester detected*
    - The software cannot detect a leakage tester on any USB port.
      Check whether the tester is properly connected.
2. *Erroneously received operating settings (Leak Tester USBxxxx)*
    - The tester with s/n USBxxxx has not received or processed operating settings correctly.
3. *Cannot connect to Leak Tester USBxxxx*
    - The tester is present, but the software has not received a proper response from the tester within the set time
4. *Processing error in Leak Tester USBxxxx*
    - The status information (§2.3.3) from the tester cannot be received or is received with errors.
5. *Cannot connect to leak tester(USB)*
    - Tester appears not to be present anymore, the USB communication seems down. Check whether there is another instance of the controlling software already running.
6. *Connection with Leak Test USBxxxx lost*
    - When starting a new measurement, it seems that the connection has been broken: status report "connecting". Check whether the tester is still connected.
7. *Missing USB driver on your computer*
    - A system driver file is missing on your computer; the USB port cannot control the leak tester. Please consult the installation guide (USBsolutionsW10_EN) chapter 3, URL: https://www.cursorengineering.nl/en/documentation-usb/ and try to uninstall the drivers and start the installation process again.

3.2 Leakage tester

3.2.1 Switching on

After connection with the provided USB cable the tester, as mentioned, becomes active.
The LED in the front will initially shine red and then become orange when the unit is ready for the activation of the operating software; a short beep will be audible.
Problem indications can be:

1. the red LED does not light or lights very briefly:
    - the platform is not able to provide sufficient power to the tester, or platform is not able to act as (OTG) USB-host
2. the red LED keeps blinking relatively slow:
    - the installation procedure did not finish yet (the system did not recognize the tester, or the tester is mistakenly connected to a USB *power adapter*
3. the red LED keeps blinking relatively fast:
    - a system driver file is missing on your computer; the USB port cannot control the leak tester. Please consult the installation guide (USBsolutionsW10_EN) in chapter 3, URL: https://www.cursorengineering.nl/en/documentation-usb/ and try to uninstall the drivers and restart the installation process.
4. the red LED did not turn to orange within approx. ten seconds after power up:
    - the pressure in the system does not become stable enough within the available time; check the environment (hose unblocked? etc.)

3.2.2 Status messages

A number of states were mentioned in paragraph 2.3.3, some are explained in more detail here.

1. pressure low:
    - The system looses so much air that the pressure cannot be raised sufficiently. Before drawing any conclusions, the system should always be checked for leaks without an otoplastic. Also check whether the air pump operates and if the otoplastic fits correctly.

2. blocked?:
    - After several measurements, the air will be released from the system until the overpressure is more or less 0mB. If the message disappears when the otoplastic is disconnected or the message "stabilizing" remains displayed for a relatively long time, this could indicate a defective valve or a blockage in the internal filters (bear this in mind in dusty, damp conditions). This problem cannot be solved by the user, service is required.