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Microfluidics — Vocabulary

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Foreword

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This document was prepared by Technical Committee ISO/TC 48, *Laboratory equipment*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 332, *Laboratory equipment,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 10991:2009), which has been technically revised.

The main changes are as follows:

— title has been changed;

— several terms have been added to reflect the increased uptake of microfluidic technology.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Microfluidics — Vocabulary

1 Scope

This document provides terms and definitions for micro process engineering and microfluidics applied in medical and veterinary diagnostics, chemistry, agriculture, pharmacy, biotechnology and the agrifood industry, as well as other application areas.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General terms, relevant to microfluidics

3.1.1
biocompatibility
special quality of some materials allowing them to come into contact with biological materials without changing the materials' bioactivity

3.1.2
biomarker
biological molecule found in blood, other body fluids or tissues that is used to identify a disease or monitor the progression of a disease

3.1.3
classification
method of sorting into categories

[SOURCE: ISO 5492:2008, 4.5]

3.1.4
end-user
person or persons who will ultimately be using the *system* (3.1.15) for its intended purpose

[SOURCE: ISO/IEC 19770-5:2015, 3.13, modified — Note 1 to entry has been removed.]

3.1.5
hydrophilic
characterised by affinity to water established by hydrogen bonding

3.1.6
hydrophobic
characterised by being repelled from a mass of water

3.1.7
interested party
stakeholder
person or organization that can affect, be affected by, or perceive itself to be affected by a decision or activity

[SOURCE: ISO 9000:2015, 3.2.3, modified — EXAMPLE and Note 1 to entry removed.]

3.1.8
interoperability
property permitting diverse *systems* (3.1.15) or *components* (3.4.7) to work together for a specified purpose

[SOURCE: IEC 80001-1:2010, 2.11]

3.1.9
macroscale
scale of dimensions of 0,1 mm or greater

[SOURCE: SEMI MS003:2015, 6.59]

3.1.10
microfluidics
manipulation of fluids that are confined in a small volume with at least one dimension smaller than 1 mm

3.1.11
microscale
scale of dimensions between $0{,}1 \times 10^{-3}$ m to $0{,}1 \times 10^{-6}$ m

3.1.12
miniaturization
action of making things on a smaller scale

3.1.13
plug and play
ability to work perfectly when first used or connected, without reconfiguration or adjustment by the user and thereby enabling automatic configuration

3.1.14
wettability
ability of a liquid to spread on a specific solid surface

[SOURCE: ISO 472:2013, 2.1607, modified — wording "(such as an adhesive)" has been deleted and Note 1 to entry has been removed.]

3.1.15
system
group of interacting microfluidic, optical, mechanical or electrical *components* (3.4.7)

3.1.16
actuating resolution
lowest variation of a physical parameter that can be operated by a *system* (3.1.15)

3.1.17
capacity
flow rate through a pump at its designed conditions

3.1.18
centrifugal microfluidics
subcategory of *microfluidics* (3.1.10) utilizing rotation

Note 1 to entry: The fluid flow is mainly controlled by centrifugal-, Euler- and Coriolis- forces.

3.1.19
closed system
system (3.1.15) that uses preloaded manufacturer-specific reagents only

3.1.20
digital microfluidics
subcategory of *microfluidics* (3.1.10) where discrete quantities of liquid are manipulated individually over a surface

3.1.21
droplet microfluidics
subcategory of *microfluidics* (3.1.10) manipulating discrete quantities of liquid in a continuous flow

3.1.22
lab-on-a-chip
LoC
highly integrated, microfluidic *system* (3.1.15) providing analytical or diagnostic functions

3.1.23
open system
system (3.1.15) that requires an external supply of reagents

Note 1 to entry: Such an open system requires microfluidic connection(s).

3.1.24
resolution
smallest change in a quantity being measured that causes a perceptible change in the corresponding measurement indication

3.1.25
sensing resolution
lowest variation of a physical parameter that can be detected by a sensor

3.2 Terms related to microfluidic flow

3.2.1
actual flow rate
volumetric flow rate of a gas changed to standardized conditions of temperature and pressure

3.2.2
capillarity
capillary action
flowing of liquid through a device without external actuators but only by the surface tension and the adhesive force between liquid and the wetted material

3.2.3
compliance of a fluidic system
increase of a fluidic *system's* (3.1.15) internal volume under the effect of pressure

Note 1 to entry: The compliance of a fluidic system is expressed in volume units per pressure units.

3.2.4
dead volume
portion of the internal volume of a *system* (3.1.15) that is not part of a continuous flow-path

Note 1 to entry: In this context dead signifies unmoving, stagnant, or un-swept. The dead-volume is expressed in volume units.

3.2.5
fall time
time required for a flow to change from a specified high value to a specified low value

Note 1 to entry: Typically, these values are 10% and 90% of the step height. The fall time is expressed in time units.

3.2.6
final steady-state value
average value of the *actual flow rate* (3.2.1), after the effects of the input transient have faded to a value equal to or below the intrinsic drift and noise

Note 1 to entry: The final steady-state flow rate value is expressed in volume units or mass units over time units.

[SOURCE: SEMI E17-0600:2000, modified — “flow rate” and "mass units" have been added in Note 1 to entry.]

3.2.7
hold-up volume
volume of fluid required to fill a device before a flow is observed at the point of interest or the outlet

Note 1 to entry: The hold-up volume is expressed in volume units such as mm^3 or microlitre.

[SOURCE: SEMI MS003:2015, 6.51, modified — “units” has been added in the Note 1 to entry.]

3.2.8
hydrodynamic resistance
ratio of pressure drop over flow rate for a certain *component* (3.4.7) or *system* (3.1.15)

Note 1 to entry: The hydrodynamic resistance is expressed as pressure units per flow rate units.

3.2.9
hydrostatic pressure
pressure that is exerted by a fluid contained within a *system* (3.1.15) due to the force of gravity

Note 1 to entry: The hydrostatic pressure is expressed in pressure units.

3.2.10
internal volume
maximal total available volume comprised within a fluidic *component* (3.4.7), device or *system* (3.1.15) under normal atmospheric pressure

Note 1 to entry: The internal volume is expressed in volume units such as mm^3 or microlitre.

3.2.11
mass flow rate
mass of fluid which passes per unit of time

Note 1 to entry: The mass flow rate is expressed in mass units per time units.

3.2.12
micropump
miniaturized liquid or gas pumping equipment with a *capacity* (3.1.17) of lower than 1 ml/min

3.2.13
minimal actuating pressure
input pressure required to start moving a fluid through the fluidic *component* (3.4.7)

Note 1 to entry: Minimal actuating pressure is expressed in pressure units.

3.2.14
pressure drop
difference of pressure between two positions in the flow path

Note 1 to entry: The pressure drop is expressed in pressure units.

3.2.15
reaction time
time interval between the moment of the set point step change and the moment at which the flow reaches x % (below 20 %) of its intended value of rise or fall

Note 1 to entry: Typically, x = 10. The reaction time is expressed in time units.

Note 2 to entry: See also Figure 1.

3.2.16
relative flow stability
coefficient of variation
standard deviation of the flow rate divided by the average flow rate

Note 1 to entry: The relative flow stability is expressed as a percentage.

3.2.17
response time
time interval between the moment of the set point step change and the moment at which the flow reaches y% (above 80 %) of its intended value of rise or fall

Note 1 to entry: Typically, y = 90. The response time is expressed in time units.

Note 2 to entry: See also Figure 1.

3.2.18
rise time
time required for a flow to change from a specified low value to a specified high value

Note 1 to entry: Typically, these values are 10 % and 90 % of the step height. The rise time is expressed in time units.

Note 2 to entry: See also Figure 1.

3.2.19
set point
target flow rate value

Note 1 to entry: See also Figure 1.

3.2.20
settling time
time elapsed from the application of an ideal step input to the time at which the output has been entered and remained within a *specified (error) band* (3.2.21)

Note 1 to entry: The settling time is expressed in time units.

Note 2 to entry: See also Figure 1.

3.2.21
specified error band
specified band
the difference between the specified most negative and specified most positive deviation from the set point

Note 1 to entry: See also Figure 1.

3.2.22
step response time
time between the *set point* (3.2.19) step change and the instant when the actual flow first enters the specified band

[SOURCE: SEMI E17-0600:2000, modified — "the instant" has been added.]

3.2.23
swept volume
portion of a volume that is part of the flow path

Note 1 to entry: The swept volume is expressed in volume units.

Note 2 to entry: The swept volume is the internal volume minus the dead volume.

3.2.24
transient overshoot
maximum change in actual flow minus the steady-state change in actual flow expressed as a percentage of the *set point* (3.2.19) step change

Note 1 to entry: See also Figure 1.

[SOURCE: SEMI E17-0600:2000]

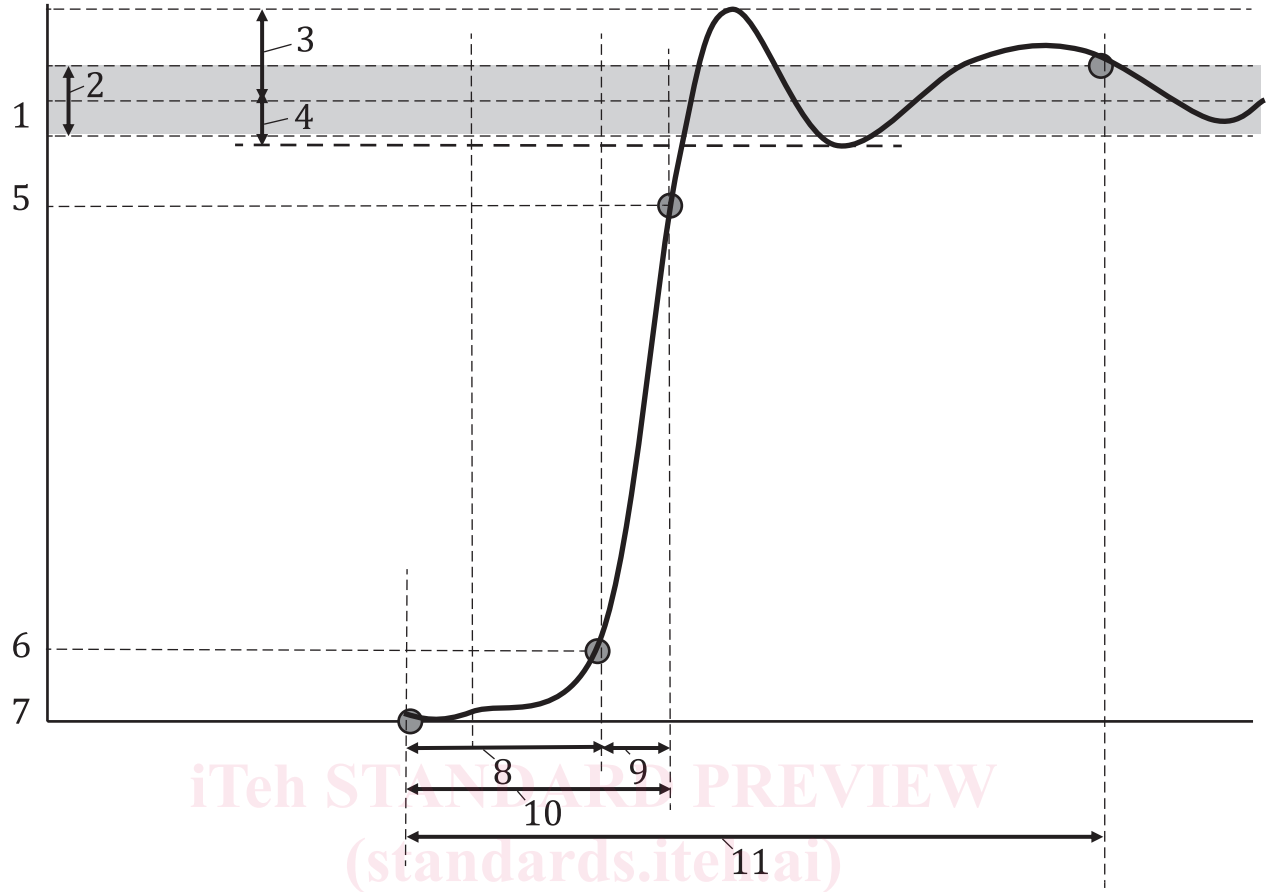
3.2.25
transient undershoot
maximum amount that the actual flow passes beyond the *final steady-state value* (3.2.6), in the opposite direction of overshoot, expressed as a percentage of the *set point* (3.2.19) step change

Note 1 to entry: See also Figure 1.

[SOURCE: SEMI E17-0600:2000, modified — "beyond" added.]

3.2.26
volumetric flow rate
volume of fluid which passes the *system* (3.1.15) per unit of time

Note 1 to entry: The volumetric flow rate is expressed in volume units per time units.



Key

1	set point (100 % rise)	7	initial set point (0 %)
2	specified (error) band	8	reaction time
3	transient overshoot	9	rise time
4	transient undershoot	10	response time
5	y % rise	11	setting time
6	x % rise		

Figure 1 — Schematic showing flow control terms related to a step change in flow

3.3 Terms related to microfluidic interfacing

3.3.1
first-level connection
direct connection
connection enabling liquid transfer between two parts through direct contact (without *tubes* (3.4.24))

3.3.2
second-level connection
indirect connection
connection enabling liquid transfer between two parts using *tubes* (3.4.24), syringes, O-rings, *gaskets* (3.3.13) and other type of connections (chip to tube)

3.3.3
adhesive connection
connection by a length of tubing bonded to a port on the microfluidic device with epoxy or another suitable adhesive