

The Easy HANDBOOK

of European SDSs

SECTION 9:

Physical and chemical
properties



What information do I need to provide in section 9 of the SDS?



9.1 Information on basic physical and chemical properties



9.2 Other information

This section of the SDS describes the **empirical data** relating to the substance or mixture, **if relevant**.

Where relevant >> values that are likely to fall within a range compatible with the hazard classification of the substance or mixture must be provided in this section.

Art. 8, paragraph 2, of the CLP Regulation applies. This article imposes the obligation to test the product to classify it for physical hazards, unless adequate information to classify is already available.

The physical and chemical properties must be reported with the appropriate measurement units. The method of determination must be provided, including the measurement conditions (e.g., the method for determining the flash point, the open vessel/closed vessel method), where relevant for the interpretation of the data.

In the case of a mixture, if the information does not apply to the mixture as a whole, the entries must clearly indicate to which substance of the mixture the data apply.

Should I provide specific information in section 9 or in section 10 of the SDS?

Practice has been for section 9 to contain numerical (measured) values for chemical and physical properties, while section 10 should give a description of the intrinsic (qualitative) properties, including potentially hazardous interactions with other substances, which derive (or are related to) these values.

9.1

subsection

FIRST STEP

Information on basic physical and chemical properties

Below are the physical and chemical properties required in this subsection; for each of them it is necessary to evaluate whether it is possible to find data (from bibliography or from a test).

If it is stated that a particular property does not apply or if information on a particular property is not available, this must be clearly indicated, giving the reasons if possible. In certain cases, "not available" or "not applicable" may be indicated:



NOT AVAILABLE >> the information could not be found or does not exist. For example, if the supplier has not been able to find studies showing the odour threshold of a substance, they may write "not available".

NOT APPLICABLE >> the information is not relevant. For example, if the product is odorless, the supplier can write "not applicable" under the odour threshold.

Physical state

a) You must indicate whether the product is:

- Solid;
- Liquid;
- Gaseous.

Of course, more precise information can be reported, such as "pasty liquid" or "colloidal emulsion" etc.

Colour

b) The colour of the substance or mixture as supplied must be indicated.

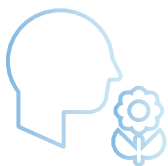
If the SDS covers variants of a mixture that may have different colors, you can use the term "various".

Odour

c) A brief qualitative description must be provided, if the odour is perceptible, well-known and/or described in the literature.

Avoid phrases such as "characteristic" or "typical", as they are not descriptive to those who have never smelled the product. It is preferable to describe the quality (e.g., fruity, almond, sweet...), the intensity (e.g., strong, weak, light) and the irritative properties, rather than the acceptability (pleasant, unpleasant).

If available, the odour threshold should be indicated (qualitatively or quantitatively). Since the information on the odour threshold is usually related to specific substances rather than a mixture, for mixtures it is possible to report the odour threshold of the substance characterizing the odour, explicitly specifying the substance.



d) **Melting point/freezing point**

It does not apply to gases.
For substances, it can be usually found from bibliography; if it is necessary to measure this value with a test, the methods based on the OECD directives can be used, as indicated in Regulation 440/2008.
If the melting point is above the measuring range of the method, you must indicate up to which temperature no melting was observed. If decomposition or sublimation occur before or during melting, this must be indicated.
For waxes and pastes, the softening point/range can be indicated instead of the melting/freezing point.
For mixtures, if it is technically not possible to determine the melting point/freezing point, this must be indicated.

e) **Boiling point or initial boiling point and boiling range**

These properties must be indicated at standard pressure, but it is possible to indicate a boiling point at a lower pressure if the value is very high or decomposition occurs before boiling at standard pressure.
If the boiling point is above the measuring range of the method, the temperature up to which no boiling point was observed must be indicated. If decomposition occurs before or during boiling, this must be indicated.
For mixtures, if it is technically not possible to determine the boiling point or range, this must be indicated, and the boiling point of the lowest boiling ingredient must also be indicated.

f) **Flammability**

It applies to liquids, solids, and gases.
It must be indicated whether the substance or mixture is ignitable, i.e., capable of catching fire or being set on fire, even if not classified for flammability.

g) Lower and upper explosion limit

It does not apply to solids.

For flammable liquids, at least the lower explosive limit must be indicated.

If the flash point is approximately $-25\text{ }^{\circ}\text{C}$ or higher, it may not be possible to determine the upper explosion limit at standard temperature; in this case, it is recommended to indicate the upper explosion limit at a higher temperature.

If the flash point is above $20\text{ }^{\circ}\text{C}$, it may not be possible to determine the lower or upper explosive limit at standard temperature; in this case, it is recommended to indicate both the lower and the upper explosion limit at a higher temperature.

h) Flash point

It does not apply to solids, aerosols, and gases.

It is required for liquids that have a flash point within the range for the classification of flammable liquids imposed by the CLP Regulation.

For mixtures, a value must for the mixture be indicated, if available. Otherwise, the flash point(s) of the substance(s) with the lowest flash point(s) must be indicated.

i) Auto-ignition temperature

Only applies to gases and liquids.

For mixtures, the auto-ignition temperature for the mixture must be indicated, if available. Otherwise, the auto-ignition temperature(s) of the substance(s) with the lowest auto-ignition temperature(s) must be indicated.

Decomposition temperature

j)

Only applies to self-reactive substances and mixtures, organic peroxides, and other substances and mixtures which may decompose.

The self-accelerating decomposition temperature (SADT) and the volume to which it applies or the decomposition onset temperature must be indicated.

If no decomposition was observed, it must be indicated up to which temperature no decomposition was observed, for example "no decomposition observed up to x°C".

For the determination of the SADT see test series H in section 28 of the UN Manual of Tests and Criteria, and for the decomposition onset temperature see also section 20.3.3.3 of the UN Manual of Tests and Criteria.

This is important information for substances subject to exothermic decomposition (therefore thermally unstable).

k)
pH

It does not apply to gases.

The pH of the substance or mixture must be indicated, as supplied or in aqueous solution for solid products (in this case the concentration must also be indicated).

If the product is not soluble in water, "Not applicable" must be indicated.

The reason for a lack of a pH value is particularly important, as this information is also required in the PCN notification dossier of the product, if it is subject to Article 45 of the CLP Regulation. In this case, it is advisable to use one of the reasons for the absence of pH acceptable for the compilation of the PCN dossier:

- Mixture is a gas;
- Mixture is non-polar/aprotic;
- Mixture is non-soluble (in water);
- pH above 15;
- pH below -3;
- Mixture reacts violently with water;
- Mixture not stable.

l) Kinematic viscosity

Applies only to liquids.

The unit of measurement must be mm²/s, as the classification criteria for aspiration hazard (H304) are based on this unit.

Dynamic viscosity is not required in the SDS but can be indicated in addition. Kinematic viscosity is linked to dynamic viscosity by density:

$$\text{Kinematic viscosity (mm}^2/\text{s)} = \frac{\text{Dynamic viscosity (mPa}\cdot\text{s)}}{\text{Density (g/cm}^3\text{)}}$$

For non-Newtonian liquids, thixotropic or rheopectic behaviour must be indicated.

For mixtures containing hydrocarbons in an overall concentration of 10 % or more, the flow-time or kinematic viscosity at 40 °C should be specified in accordance with Section 3.10 of Annex I to the CLP Regulation in order to allow an assessment of the possible aspiration hazard (H304). The exclusion of the H304 classification for this type of product must be supported by a test that demonstrates a kinematic viscosity greater than 20.5 mm²/s when measured at 40°C.

m) Solubility

Solubility in water at standard temperature must be indicated, but solubility in other polar and non-polar solvents can also be included.

For mixtures, it must be specified whether the mixture is fully or only partially soluble in or miscible with water or other solvent.

For nanoforms, the dissolution rate in water or in other relevant biological or environmental media must be indicated, in addition to water solubility.

n) Partition coefficient n-octanol/water (logarithmic value)

It does not apply to inorganic liquids and generally does not apply to mixtures.

It is a fundamental parameter for PBT and chemical risk classification, labelling and assessment.

It is the logarithm of the ratio of how much substance dissolves in octanol compared to how much dissolves in water (log Kow):

- If $\log Kow > 0$ the substance is more soluble in oils and fats than in water (hydrophobic substance);
- If $\log Kow < 0$ the substance is more soluble in water than in oils and fats (hydrophilic substance).

You must specify whether the reported value is based on tests or calculations.

Of course, the risk of bioaccumulation is much greater for hydrophobic substances, i.e., those which mainly dissolve in oils and fats.

For nanoforms of a substance for which the n-octanol/water partition coefficient does not apply, the dispersion stability in different media must be indicated.

o) Vapour pressure

It must be indicated at standard temperature. For volatile fluids, it must be indicated at 50°C.

The saturated vapour concentration (SVC) may be indicated, and can be estimated as follows:

$$\text{SVC in ml/m}^3: \text{SVC} = VPc_1$$

$$\text{SVC in g/m}^3: \text{SVC} = VP \cdot MWc_2$$

where VP is the vapour pressure in hPa (= mbar), MW is the molecular weight expressed in g/mol, and c_1 and c_2 are conversion factors ($c_1 = 987.2 \text{ ml/m}^3 \cdot \text{hPa}$ and $c_2 = 0.0412 \text{ mol/m}^3 \cdot \text{hPa}$).

For liquid mixtures or for liquefied gas mixtures, a vapour pressure range or at least the vapour pressure of the most volatile ingredient(s), if the mixture's vapour pressure is mainly determined by this or these ingredient(s), must be indicated.

If one SDS is used to cover variants of a liquid mixture or liquefied gas mixture, a vapour pressure range must be indicated.

p) Density and/or relative density



It only applies to liquids and solids.

The SDS must specify whether the reported value is the absolute density, with its measurement unit (e.g., g/cm³ or kg/m³), and/or the relative density. Relative density is the ratio between the weight of a given volume of the product, and the same volume of water; as a result, it is dimensionless. As a rule, density and relative density are indicated at standard conditions of temperature and pressure.

If the density is variable, for example due to batch manufacturing or if the SDS is used to cover several variants of a product, a range of values may be indicated.

q) Relative vapour density



It only applies to liquids and gases.

The relative vapour density is given in relation to air's density, which is assumed equal to 1. If the vapor density is > 1, it means that the steam collects at the bottom of the container or room, if it is < 1 the steam tends to rise to the ceiling.

For gases, the relative density based on air at 20 °C must be indicated.

For liquids, the relative vapour density based on air at 20 °C must be indicated. The relative density D_m of the vapour/air mixture at 20 °C may also be indicated. It can be calculated as follows:

$$D_m = 1 + (VP_{20} \cdot (MW - MW_{air}) \cdot c_3)$$

where VP_{20} is the vapour pressure at 20°C expressed in hPa (= mbar), MW is the molecular weight in g/mol, MW_{air} is the molecular weight of air (= 29 g/mol) and c_3 is a conversion factor ($c_3 = 34 \cdot 10^{-6} \text{ mol/g} \cdot \text{hPa}$).

r) Particle characteristics

It only applies to solids.

The particle size must be indicated, specifying the median equivalent diameter, the method of calculation of the diameter (based on number, surface, or volume) and the range within which the median value varies.

Other properties can also be indicated, such as size distribution (e.g., as a range), shape and aspect ratio, aggregation and agglomeration, specific surface area and dustiness.

If the substance is in nanoform or if the mixture contains a nanoform, these characteristics must be indicated in this subsection, or referred to if already specified elsewhere in the SDS.

9.2

subsection

STEP TWO

Other information

If relevant for the safe use of the product, other physical and chemical parameters must be indicated, divided into two subsections:

9.2.1.

Information with regard to physical hazard classes

This subsection lists the relevant properties when the substance or mixture is classified for one or more physical hazard(s) (H2xx). Data relevant for physical hazard classification may also be provided when the product is not classified for that hazard (e.g., negative test results). You can indicate the name of the hazard class which the data refer to, for example: explosives, flammable gases, flammable liquids, pyrophoric liquids, etc.

Regulation 2020/878 provides examples of data that can be compiled by type of physical hazard, and the ECHA Guide "Guidance on the compilation of safety data sheets" sets out the test methods applicable for certain classes of physical hazard.

9.2.2.

Other safety characteristics

This subsection may list additional properties of the substance or mixture, if their indication is relevant for the safe use of the product. For example: mechanical sensitivity, evaporation rate, oxidation-reduction potential, conductivity...

Regulation 2020/878 lists the properties that may be reported in this subsection, and the ECHA Guide "Guidance on the compilation of safety data sheets" provides guidance on how some of these properties are determined or expected to be described.

Focus on ... nanomaterials

Further guidance on available information on nanomaterials put on the market and their redox potential, radical formation potential and photocatalytic properties can be found in the Guidance Manual for the Testing of Manufactured Nanomaterials of the OECD Working Group on Synthetic Nanomaterials (see: <https://www.oecd.org/env/ehs/nanosafety/testing-programme-manufactured-nanomaterials.htm>).

Focus on... consistency with other sections

The data in section 9 are indicative of many of the hazardous properties of the product. For this reason, there must be consistency between the indications given in the various sections of the SDS and this section. In particular, an assessment of the consistency of Section 9 with the following sections is necessary:

- **SECTION 2:** Hazards Identification;
- **SECTION 5:** Firefighting measures;
- **SECTION 6:** Accidental release measures;
- **SECTION 7:** Handling and Storage;
- **SECTION 11:** Toxicological information: (i.e., extreme pH/ corrosive properties);
- **SECTION 12:** Ecological information: (i.e., log Kow/bioaccumulation);
- **SECTION 13:** Disposal Considerations;
- **SECTION 14:** Transport Information.

