

Transport classification of hazardous substances: explosive substances in accordance with the CLP Regulation and UN transport regulations (explosives)

Substances, mixtures or products intended for transport must be classified according to their hazard characteristics. Explosive substances are a class of substances that get special attention. To deal with this problem uniformly on an international level, common test guidelines for the transport of hazardous goods have been established by the United Nations and defined in the UN Model Regulations "Recommendations on the Transport of Dangerous Goods." According to these regulations, the presence of any explosive properties must be determined for all substances, mixtures or solutions. In the case of potentially explosive substances, it must be checked whether they may be transported at all and what quantities can be handled safely under transport conditions.

According to the UN regulations, an extensive series of tests is required to determine whether explosive properties may be present. However, preliminary analysis is also permitted. For example, the test series must be used only if a potential hazard arises from a preliminary analysis or if the substance was explicitly produced for an explosive or pyrotechnic effect.

Preliminary analysis:

The test series does not have to be performed if:

- The molecule does not contain any chemical groups with which explosive properties are associated. These groups include unsaturated C-C compounds, C-Metal or N-Metal compounds, O-O or N-N compounds, N-O compounds, N-halogen and O-halogen compounds, or
- The substance does not meet the above criterion, but the oxygen balance is $\leftarrow -200$. This is calculated for the chemical reaction $C_xH_yO_z + \left[x + \left(\frac{y}{4}\right) - \left(\frac{z}{2}\right) \right] O_2 \rightarrow x CO_2 + \left(\frac{y}{2}\right) H_2O$ according to the following formula:
oxygen balance = $-1600 \times \frac{(2x + \frac{y}{2} - z)}{\text{Molecular weight}}$; or
- In a calorimetric measurement of the substance or mixture up to a temperature of 500 °C, the total energy of exothermic decomposition is $\leftarrow 500$ J/g.

The experimental determination of the decomposition potential can be conducted with only a small amount of substance using [differential scanning calorimetry \(DSC\)](#) (see consiLetter No. 5), which is one of consilab's standard tests. If the decomposition energy exhibited by the substance at a temperature of up to 500 °C is less than 500 J/g, explosive properties can no longer be excluded during the preliminary examination and the test series that we will present to you in the next consiLetter must be carried out.

There are further exclusion criteria for mixtures of substances containing both organic and inorganic substances classified as oxidizing. For compounds of substances containing known explosive substances, the test series must be used independently of the preliminary analysis.

Incidentally: Handling of explosive substances within a plant is also of particular interest and requires a special permit. In Germany, the law on explosive substances, also frequently referred to as the Explosives Act (Sprengstoffgesetz), is authoritative here.

If you have any questions about the transport or classification of (potentially) explosive substances, please contact us. Our experts will be happy to advise you.

