

Transport classification of hazardous substances: test methods for potentially explosive substances (Explosives)

We showed in our last consiLetter how to quickly and easily assess whether a substance, mixture or product can be classified as non-explosive. If this hazard characteristic cannot be excluded by the aforementioned preliminary analysis, the UN manual prescribes a comprehensive series of tests that consist of a total of eight test series.

In the test series 1 and 2 described here, tests are carried out to determine whether the test substance has explosive properties and must therefore be classified in Class 1 as explosive (Series 1), or whether its explosion potential is too low to be classified as Class 1 (Series 2). For this purpose, the behavior of the test substance in the event of intense warming and ignition by means of a detonator is tested under confinement.

In the Koenen test, a steel tube with a defined relief cross section is filled with the test substance and exposed to high thermal energy. The test is used to determine the sensitivity of the test substance (solid and liquid) to intense heat under strong confinement. If the steel tube splits into at least three parts during the test, the test is considered positive ("+", explosion).

The time/pressure test provides evidence as to how quickly gas is released after ignition of the test substance under confinement and whether the resulting pressure leads to deflagration with explosive severity. The test determines the time period during which a pressure increase from 690 kPa to 2070 kPa is achieved. The result can be either "yes, fast," "yes, slow" or "no." If a pressure of 2070 kPa is not reached, the test is also considered negative.

If the Koenen test and the time/pressure test provide a negative result, the test substance can be classified as non-explosive and thus excluded from Class 1 explosives according to the UN Transport Manual and GHS/CLP.

If decomposition energy ≥ 800 J/g is detected in the preliminary analysis by means of DSC, the detonation propagation must also be tested in addition to the two tests mentioned. In test series 1 and 2, the UN manual stipulates the UN Gap Test. In this test, a 40 cm long steel tube ($\varnothing = 5$ cm) is completely filled with the substance to be tested and its ability to propagate a detonation is determined with a booster charge. However, since the UN Gap test is both material- and cost-intensive, the Trauzl test can usually substituted. For this method, approximately 10 g of the test substance is enclosed in a defined hole in a lead block and ignited with initial explosive. The bulging of the lead block varies according to the explosive power of the test substance. The result of the explosive force test is "not low" (positive), "low" (positive) or "no" (negative).

If the three tests (Koenen, time/pressure and Trauzl) are negative, no further tests are necessary and the test substance can be classified as non-explosive.

In the event that one or more of the tests described here delivers a positive result, we will be happy to support you in contact with the competent authority for explosive substances in Germany.

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