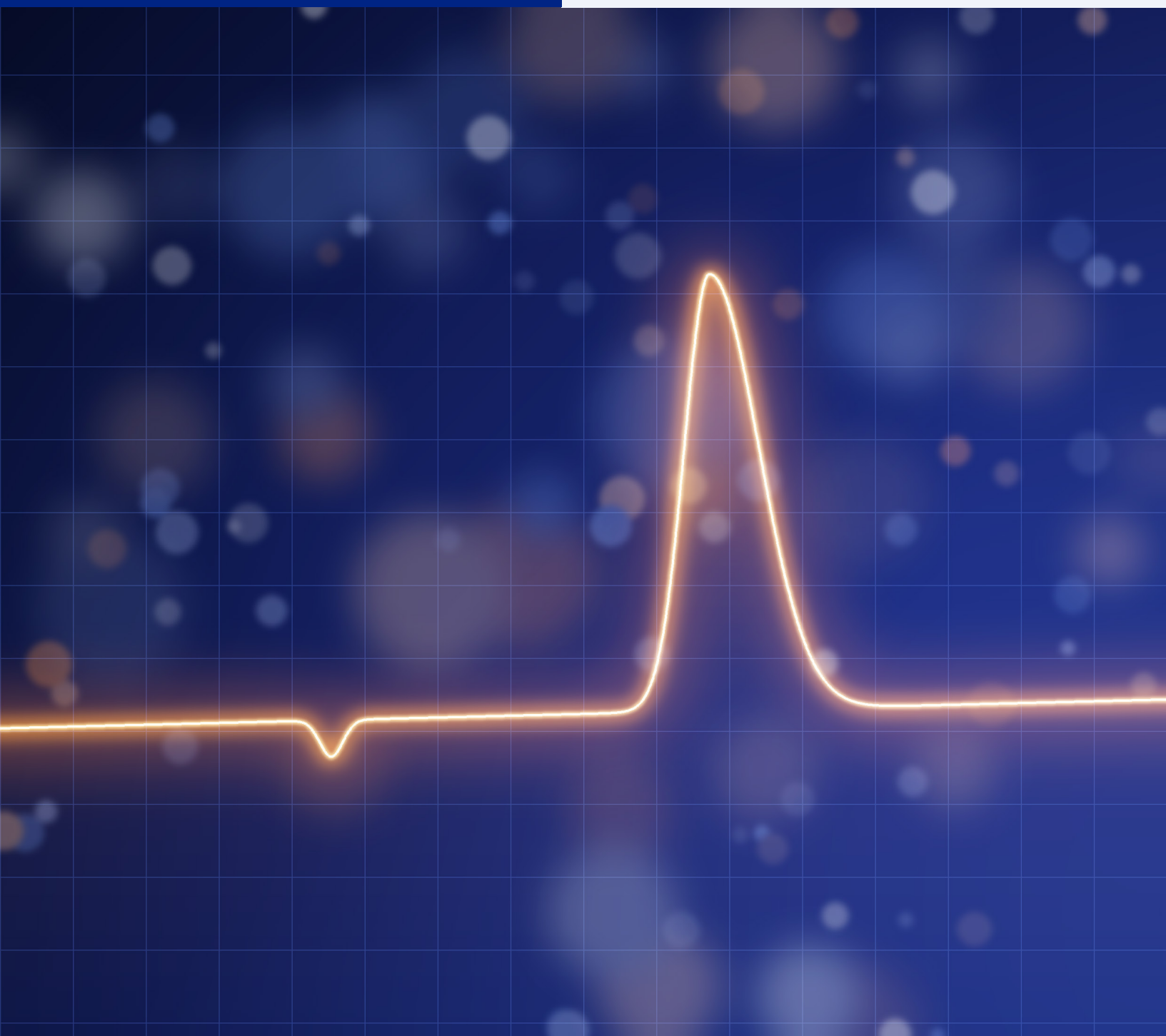


Testing hazardous materials

TNO innovation
for life

An overview of the tests we run to classify explosives, peroxides, fertilizers and other dangerous goods.



Our test capabilities

TNO tests and classifies hazardous materials with dedicated infrastructure, specialized equipment and experienced staff. We cover the UN Manual of Tests and Criteria, EU fertilizer testing and a broad set of thermal analysis methods. Below is a short overview of our capabilities.

UN Manual Part I: explosive substances and articles

- Series 1 and 2: UN gap test (a), Koenen test (b), time/pressure test (c)(i)
- Series 3: BAM Fallhammer 3(a)(ii), BAM friction apparatus 3(b)(i), thermal stability test at 75 °C 3(c)(i), small-scale burning test 3(d)
- Series 4, 5 and 7: most tests possible, contact us for details
- Series 6: single package 6(a), stack 6(b), external fire (bonfire) 6(c) and unconfined package 6(d) tests on packaged explosives
- Series 8: thermal stability of AN emulsions, suspensions or gels 8(a), ANE gap test 8(b), Koenen test 8(c)

UN Manual Part II: organic peroxides and self-reactive substances

- Detonation: UN detonation test (A.6), detonation test in package (B.1)
- Deflagration: time/pressure test (C.1), deflagration test (C.2), deflagration test in package (D.1)
- Heating under confinement: Koenen test (E.1), Dutch pressure vessel test (E.2)
- Explosive power: modified Trauzl test (F.4)
- Thermal explosion: thermal explosion test in package (G.1)
- Thermal stability: US SADT test, size limits apply (H.1), isothermal storage test by heat flow calorimetry (H.3), heat accumulation storage test, HAST (H.4)

UN Manual Part III: other dangerous materials

- Readily combustible solids (N.1)
- Pyrophoric solids (N.2) and pyrophoric liquids (N.3)
- Self-heating substances, modified Bowes-Cameron cage test (N.4)
- Substances that emit flammable gases in contact with water (N.5)
- Oxidizing solids: visual test (O.1), gravimetric test (O.3)
- Self-sustaining decomposition of nitrate fertilizers, trough test (S.1)

UN Manual appendices

- Appendix 5: vent sizing test methods (10-litre vessel)
- Appendix 6: screening procedures

Ammonium nitrate based fertilizers

- 4-inch detonation test under Regulation (EU) 2019/1009
- Oil retention test under Regulation (EU) 2019/1009
- Indentation test (screening for detonative properties)
- TNO is a Notified Body for Regulation (EU) 2019/1009 (Part II, Module A1, 4.1–4.4)

Thermal stability and reactivity

- Mini-autoclave (modified closed pressure vessel test)
- Advanced reactive system screening tool (ARSST)
- Differential scanning calorimetry (DSC)
- Differential thermal analysis (DTA)
- Thermogravimetry (TG)
- Thermomechanical analysis (TMA)
- Heat flow calorimetry (HFC)

Some techniques can run under pressure or in different atmospheres. Decomposition products can be analyzed by direct coupling to FTIR or MS, and samples can be observed in real time under a microscope.

About Process Safety Solutions

TNO is an independent organisation for applied scientific research. The Process Safety Solutions (PSS) group is part of the Energetic Materials department: a multidisciplinary team specialized in customized testing and product qualification.

Test not on this list?

This overview is not complete. Ask us about other tests or a customized test setup.

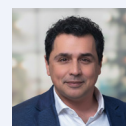
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