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Technical Rules for Hazardous Substances	Storage of hazardous substances in non- stationary containers	TRGS 510
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The Technical Rules for Hazardous Substances (TRGS) reflect the state of the art, the state of occupational health and occupational hygiene as well as other sound work-scientific knowledge relating to activities involving hazardous substances including their classification and labelling. The

Committee on Hazardous Substances (AGS)

compiles or adapts the rules, and they are announced by the Federal Ministry of Labour and Social Affairs (BMAS) in the Joint Ministerial Gazette (GMBI).

These Technical Rules for Hazardous Substances make requirements from the Hazardous Substances Ordinance (GefStoffV) more concrete in the framework of its scope of application. Where the employer complies with the technical rules he can expect that the relevant requirements stipulated in the Ordinance are fulfilled. If the employer decides in favour of another solution he must at least achieve the same level of safety and occupational health for his employees.

^{*)} TRGS 510 has been extensively revised. The substantial modifications are:

The previous rules for small quantities have been moved from Annex 9 to Number 4.

The general principles can now be found in Number 4.1 and the general protective measures for the storage of hazardous substances can now be found in Number 4.2. If the quantities listed in Number 4.3.1 (1) are exceeded, the hazardous substances must be stored in a separate warehouse. The provisions have been adapted to practical requirements and stated in significantly clearer and more precise terms; this does not entail a significant modification of the level of safety.

The provisions for the storage of gases have been thoroughly revised; any missing rules for pressurised gases, aerosol dispensers and pressurised gas cartridges have now been adopted from the technical rules.

The narrative description of the storage classes in the former Annex 4 has been integrated into the classification guidance in the former Annex 5 and enclosed as the new Annex 4.

The former Annex 6 has been deleted, as the extinguishing water retention concept is based on environmental legislation and has no basis in hazardous substances legislation.

The particularly strongly oxidising and highly reactive substances in the former Annex 8 undergo an evaluation and are then included in the new Annex 6.

All other provisions have undergone a textual revision, which primarily sought to achieve a clarification of the existing requirements.

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1 Scope of application

(1) TRGS 510 shall apply to the storage of hazardous substances in non-stationary containers including the following (handling) activities

- 1. Storage and removal from storage facility,
- 2. Transport inside the warehouse,
- 3. Removal of released hazardous substances.

Storage is the keeping for later use and for delivery to others. It includes holding available for transport if the transport is not conducted within 24 hours after the items concerned have been made available or on the following working day. If this working day is Saturday, the deadline shall end at the end of the next working day.

(2) In addition to the measures described in number 4, numbers 5 to 12 shall apply to special hazardous substances listed in Table 1 where the respective threshold quantities have been exceeded. The threshold quantity shall be deemed to be the aggregate amount of hazardous substances with the respective classification or property. The table includes the classifications pursuant to Regulation (EC) 1272/2008 (CLP-Regulation), as well as pursuant to the EU Dangerous Substances Directive 67/548/EEC and/or the Dangerous Preparations Directive 1999/45/EC. Up until 1 June 2015 the employer is free to decide on which classification system he wishes to base his calculations. In order to avoid contradictions the two classification systems should not be used side by side.

(3) The threshold quantity in Table 1 indicates the aggregate quantity above which the measures specified in the individual numbers must be taken.

Table 1: Application of numbers 4 to 12 and annexes 1 to 6

Classification/property	Hazard statement according to CLP-Regulation	R-phrase according to EC Directive	Permitted storage outside of warehouses, taking into account no. 4.2	Additional and special protective measures
All hazardous substances			Up to 1,000 kg unless otherwise stated below	No. 4.3 > 1,000 kg In the case of joint storage, no. 7 > 200 kg
Acutely toxic hazardous substances	H300, H301, H310, H311, H330 or H331 ^{a)}	R23 to R28	Up to 50 kg	No. 5 and no. 8 each > 200 kg
Carcinogenic and mutagenic hazardous substances	H340, H350, H350i	R45, R46, R49	Up to 50 kg	No. 5 > 200 kg
Hazardous substances with special toxic properties	H370, H372	R39/23 to R39/28 R48/23 to R48/28	Up to 50 kg	No. 5 > 200 kg
Highly and extremely flammable liquids	H224, H225	R11, R12	Up to 20 kg, of which up to 10 kg is extremely flammable	No. 5, no. 6 and no. 12 each > 200 kg Annexes 2, 3 and 5 must also be taken into consideration

Flammable liquids	H226 ¹	R10	Up to 100 kg	No. 5, no. 6 and no. 12 each > 1,000 kg Annexes 2, 3 and 5 must also be taken into consideration
Flammable solids	H228	R11		No. 6 > 200 kg
Pyrophoric substances and mixtures	H250	R17		No. 5 and no. 6 each > 200 kg
Self-heating substances and mixtures	H251, H252			No. 6 > 200 kg
Self-reactive substances and mixtures	H242			No. 6 > 200 kg
Oxidising liquids and solids	H271, H272 stated in annex 6	R8, R9	Up to 1 kg	No. 5 and no. 9 each > 5 kg
	H272, unless stated in annex 6.	R8, R9	Up to 50 kg	No. 5 and no. 9 each > 200 kg
Gases in pressurised containers	H280, H281		Up to 2.5 l	No. 10 > 2.5 l
	H220, H221	R12	Up to 2.5 l	No. 5 and no. 6 each > 200 kg and no. 10 > 2.5 l
	H270	R8	Up to 2.5 l	No. 5 > 200 kg and no. 10 > 2.5 l
Aerosol dispensers/pressurised gas cartridges ^{b)}	H220, H221	R12	Up to 20 kg	Where applicable, Annex 2 > 0 kg No. 6 > 200 kg No. 11 > 20 kg
	H222, H223	-	Up to 20 kg	Where applicable, Annex 2 > 0 kg No. 6 > 200 kg No. 11 > 200 kg
Hazardous substances that are from experience flammable	H260, H261	R15	Up to 200 kg	No. 6 > 200 kg
Combustible liquids	Without marking: storage class 10		Up to 1,000 kg	No. 6 > 1,000 kg

¹ If only flammable liquids with a flashpoint greater than 55 °C are stored, the definition of supplementary/additional protective measures beyond the requirements of no. 4 can be dispensed with based on the results of the risk assessment in accordance with no. 3. This relates in particular to diesel fuel and heating oil.

Combustible solids	Without marking: storage class 11 as well as other solid hazardous substances that are from experience flammable		To be determined by the employer, normally on the tonne scale	To be determined by the employer, normally on the tonne scale
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- a) Within the framework of the risk assessment, the employer can disregard those substances and mixtures that are not classifiable as toxic or very toxic in accordance with Directive 67/548/EEC for the determination of protective measures for acutely toxic substances.
- b) These rules shall equally apply to unmarked aerosol dispensers and pressurised gas cartridges.

(4) The present TRGS shall not apply

1. to substances that are part of a production or work process or to the holding of non-stationary pressurised gas containers ready for use,
2. to activities as e.g. decanting and retrieval, cleaning of containers, sampling, maintenance and repair work,
3. to bulk materials stored in bulk,
4. to explosive substances and mixtures that fall within the scope of the Explosives Act; these are subject to the second ordinance to the Explosives Act (2. SprengV) with regard to storage,
5. to ammonium nitrate and mixtures/preparations that contain ammonium nitrate that fall within the scope of Annex I (5) of the Hazardous Substances Ordinance; these are subject to TRGS 511 "Ammonium nitrate",
6. to organic peroxides that fall within the scope of accident-prevention regulation BGV B4²; this shall not affect the rules laid down in numbers 3 and 4 of these technical rules insofar as they supplement BGV B4,
7. to radioactive materials that are subject to the Atomic Energy Act and/or the Radiation Protection Ordinance,
8. to infectious substances.

Where activities are carried out in the warehouse pursuant to no. 2 they shall be separately assessed in the risk assessment procedure according to TRGS 400 "Risk assessment in conjunction with the handling of dangerous substances" and the necessary protective measures shall be equally taken. Contrary to sentence 1, the provisions of number 7 "Joint storage" must be taken into consideration for radioactive and infectious substances.

(5) Requirements from other areas of law, in particular construction law, the Ordinance on Industrial Safety and Health, the Water Management Act, laws governing the transport of dangerous goods, the Immission Control Law and

² It is intended to replace the accident-prevention regulation BGV B4 with a technical rule (TRGS). As soon as the technical rule is published, it shall apply accordingly.

Hazardous Incident Reporting Ordinance shall remain unaffected.

2 Definitions

(1) These technical rules list the classifications pursuant to Regulation (EC) No. 1272/2008 (CLP-Reg.), but also pursuant to EU Directive 67/548. Terminology pursuant to the CLP Regulation shall be used for the definition of the classifications. In the following, terms are defined that are neither listed in the glossary of the Ordinance on Industrial Safety and Health nor in the Biological Agents Ordinance or Hazardous Substances Ordinance.³

(2) Warehouses within the meaning of these technical rules are buildings, areas or rooms in buildings or outdoor areas whose purpose is to store hazardous substances. Containers or cabinets shall also be deemed warehouses.

(3) A warehouse sector is the part of a warehouse that is separated from other warehouse sectors or adjoining rooms

1. in buildings by walls and ceilings fulfilling safety requirements, or
2. outdoors by reasonable distances or by walls.

Safety cabinets with a fire resistance rating of at least 90 minutes shall be deemed warehouse sectors.

(4) The part of a warehouse sector in which hazardous substances are stored shall be deemed a warehouse area.

(5) Roofed outdoor warehouses shall also be deemed warehouses provided they are open on at least two sides including warehouses that are only open on one side provided the width – measured from the open side – is not bigger than the height of the open side. A side of a room shall also be deemed to be open if it consists of a wire mesh gate or a similar material which does not significantly impede the natural ventilation.

(6) The storage quantity shall be the net mass of a stored hazardous substance. The total storage quantity shall be the sum of the storage quantities of the various substances.

(7) For the purpose of these technical rules, non-stationary containers are containers whose purpose is to transport and store hazardous substances. Non-stationary containers include, e.g.:

1. packagings (e.g. barrels, canisters, bottles, sacks),
2. intermediate bulk containers (IBCs, e.g. Big Bags or FIBCs),
3. large packagings,
4. tank containers/non-stationary tanks,
5. pressurised gas containers (e.g. transportable pressure equipment as defined by the Transportable Pressure Equipment Ordinance (ODV) or Directive

³ See http://www.baua.de/cln_137/de/Themen-von-A-Z/Gefahrstoffe/Glossar/Glossar.html

2010/35/EU (TPED) and pressure vessels as defined by the hazardous-goods legislation, such as bottles, large bottles, sealed cryogenic vessels, cylinder racks or multiple-element gas containers (MEGCs)),

6. aerosol dispensers or pressurised gas cartridges,
7. rail tank wagons, tank vehicles.

(8) Pressurised gas containers are containers for gases under pressure. A pressurised gas container includes the accessories which can affect its safety. Non-stationary pressurised gas containers include transportable pressure equipment as defined by Directive 2010/35/EU (TPED) or the Transportable Pressure Equipment Ordinance (ODV) and pressure vessels as defined by the hazardous-goods legislation, such as bottles, large bottles, sealed cryogenic vessels, cylinder racks and multiple-element gas containers (MEGCs).

(9) An aerosol dispenser is a metal, glass or plastic container that cannot be refilled, that complies with the provisions set out in section 6.2.6 of the ADR and that contains a gas that is condensed, liquefied or dissolved under pressure with or without a liquid, pasty or powdery substance. It is fitted with a retrieval device which allows an ejection of the contents as a suspension or of solid or liquid particles in a gas, as a foam, a paste or a powder or in the liquid or in the gaseous state.

(10) Pressurised gas cartridges are non-refillable containers without their own extraction valve. Every cartridge consists of a container and a locking device for the filling opening. Cartridges are emptied through a special retrieval device.

(11) Where different substances are located within one warehouse sector, container, safety cabinet or other containment area, this shall be deemed to be joint storage.

(12) The storage class is the classification of hazardous substances and mixtures intended for storage according to specific hazard indicators. The storage classes shall be used exclusively to determine the joint storage of substances.

(13) For the purpose of these technical rules, distances⁴ shall be used to:

1. protect a warehouse from incidents of damage due to external factors, e.g. mechanical damage or heating as a result of a fire load;
2. protect against interactions between the stored hazardous substances;
3. minimise as far as possible the risk posed to employees or other persons by leaks in non-stationary containers or interruptions to the proper operating procedure.

(14) Draining surfaces are surfaces that collect escaping liquids and feed them to a containment area; they form a structural unit together with the containment area but are not intended for longer-term retention of the stored substance.

(15) Potentially explosive environments are environments in which hazardous, potentially explosive atmospheres can occur.

(16) Extinguishing water retention installations are installations intended to collect any contaminated extinguishing water arising in the case of a fire until it can be disposed of.

⁴ In the previous rules, the following terms were used for this: protection distances, safety distances, separation strips and protection areas.

(17) A fire(-fighting) compartment is a part of the building that, in accordance with building law, is separate with regard to fire protection, whereby fire is not generally expected to spread to other areas of the building due to the requirements for the adjoining components,

(18) Liquids shall be deemed to be flammable if they have a flashpoint of up to 370°C.

3 Risk assessment

(1) In the framework of risk assessment pursuant to section 5 German Occupational Health and Safety Act and section 6 of the Hazardous Substances Ordinance the employer has to check, whether his employees or third persons are exposed to hazards caused by the storage of hazardous substances. For the implementation of the risk assessment see in particular TRGS 400.

(2) Hazards can be caused by the storage of hazardous substances in particular because of

1. properties and/or the aggregate state of the stored hazardous substances,
2. quantity of the stored hazardous substances,
3. type of storage,
4. activities performed during the storage process,
5. joint storage of hazardous substances,
6. working and ambient conditions, in particular the type of warehouse, room size, climatic conditions, external impacts and storage period.

Annex 1 includes further information on potential hazards.

(3) The most important information sources for the risk assessment of the hazardous substances to be stored are the marking (pursuant to EC Directives 67/548/EEC and 1999/45/EC and/or Regulation (EC) No. 1272/2008 or pursuant to the Hazardous Substances Ordinance Road, Rail and Inland Navigation) of the hazardous substances and mixtures/preparations, the Safety Data Sheet in its current version as well as supplementary information by the manufacturer. As a rule these information sources are sufficient.

(4) In case of missing or insufficient information the employer is obliged to provide further information from other sources, see TRGS 400.

(5) For the risk assessment regarding storage all activities and operational situations shall be considered from which a hazard might arise for the employees. These activities include in particular

1. storing substances and removing them from the warehouse,
2. internal transport inside the warehouse,
3. removal of released hazardous substances.

(6) Where further activities are carried out in the warehouse, e.g. decanting and retrieval, cleaning of containers, sampling, maintenance and repair work, they shall be considered within the framework of the hazard assessment and the additional protective measures above and beyond the rules laid out in these technical rules shall be taken.

(7) Where mixtures of air and flammable gases, vapours, mists or dusts may be generated, the formation of potentially explosive atmospheres shall be investigated, areas with high explosion risks must be organised in zones, protective measures shall be defined, and an explosion protection document shall be drafted and updated according to the provisions of the Work Equipment Ordinance.

(8) The necessary protective measures shall be determined according to the hazards identified. In this context the protective measures described in No. 4 of these technical rules shall be taken into particular consideration.

(9) Depending on the quantity and properties of the hazardous substances, not all measures of these technical rules need be applied. Derogations shall be defined in the risk assessment process, if necessary.

4 Protective measures for safety and health protection

4.1 Principles

(1) Hazards for the health and safety of employees and other persons and hazards for the environment caused by substance-related damages in connection with the storage of hazardous substances shall be eliminated or reduced to a minimum through the following measures:

1. Design of the warehouse and the storage facilities;
2. Organisation of workflows;
3. Provision of suitable equipment for activities related to the storage of hazardous substances, e.g. gripping devices for unpalletised barrels;
4. Limitation of the period and intensity of exposure;
5. Reasonable hygiene measures, in particular cleaning at regular intervals;
6. Prevention of non-intentional release of hazardous substances;
7. Provision of the resources to prevent hazards.

(2) These measures always consist of the general protective measures set out in number 4.2; they are also necessary for all hazardous substances in the event of storage outside of warehouses, regardless of whether a threshold quantity exists.

(3) If the respective small quantities (see Table 1) per closed factory building or fire(-fighting) compartment or separate building unit are exceeded, at least the excess quantities must be stored in warehouses in accordance with number 2 (2), taking additional protective measures into account. Depending on the threshold quantities and the hazardous substances' properties, other additional or special protective measures shall also apply in accordance with numbers 5 to 12 (see Table 1).

(4) Whether other (hazardous) substances/chemicals/materials may be stored in a warehouse in addition to a hazardous substance must be checked according to the rules in the numbers below, in number 7 in particular, and the information in the safety data sheet.

(5) The quantities of hazardous substances provided must be limited to the amount required for the day/shift; quantities in excess of these must be stored. Where small quantities are used regularly, the smallest commercially available pack size can also be provided.

(6) Hazardous substances must only be stored in closed packaging or containers.

(7) Hazardous substances should, wherever possible, be stored in original containers or original packaging. If hazardous substances are not stored in original containers, it must be ensured that the storage containers are suitable and are marked in accordance with number 4.2 (2).

(8) If hazardous substances are stored, a Hazardous Substances Register must be kept (see Article 6 (10) of the Hazardous Substances Ordinance), including:

1. the names of the stored hazardous substances,
2. the classification of the hazardous substance or information on the hazardous properties,
3. the tonnage levels used,
4. the warehouse area

and should be kept outside the warehouse, if possible; it could be sensible to have a storage plan indicating the storage classes and the associated stored quantities.

4.2 General protective measures for the storage of hazardous substances

(1) The packaging and containers must be suitable for ensuring that none of the contents can escape unintentionally. These requirements shall be deemed to have been met if, among other things, the packaging/containers meet the requirements for the transport of dangerous goods.

(2) The employer must ensure that all stored hazardous substances can be identified. Hazardous substances and mixtures/preparations must be provided with a marking that contains sufficient information on the classification and that either shows the hazards that are present during handling and protective measures that should be taken or allows these to be derived. TRGS 201 "Classification and marking for activities involving hazardous substances" must be applied.

(3) Hazardous substances must not be kept or stored in containers whose shape or marking could lead the contents to be mistaken for foodstuffs.

(4) Hazardous substances must not be stored in locations where they could pose a risk to employees or other persons. This includes, in particular:

1. Traffic routes; among others, these include stairwells, escape and emergency routes, passageways, thoroughfares and narrow courtyards;

2. Break rooms, duty rooms, sanitary rooms, first-aid rooms or rest rooms.

Hazardous substances may only be stored in working areas if storage can be achieved in a way that is also safe for the employees. Special equipment must be used for storage if the results of the risk assessment show this to be necessary.

(5) No effective ignition sources may be present in the direct vicinity of the storage containers containing flammable hazardous substances.

(6) Filled aerosol dispensers and pressurised gas cartridges must not be heated by more than 50°C by sunlight or other heat sources.

(7) If pressurised gas cartridges with combustible contents must be stored with a retrieval device connected, these must only be stored with additional protective measures – e.g. effective ventilation openings of at least 100 cm² in the warehouse/cabinet – to avoid the formation of potentially explosive atmospheres due to leaks in the connections.

(8) If opened containers are stored, the actual storage quantity must be used in calculating the total stored volume. Contrary to the first sentence, the nominal volume must be used for flammable hazardous substances (marked with H221, H222, H223, H224, H225, H226 or R12, R11, R10).

(9) Flammable liquids (marked with H224, H225, H226 or R12, R11, R10) may be stored outside of warehouses in:

1. fragile containers with a capacity of up to max. 2.5 l per container and

2. non-fragile containers with a capacity of up to max. 10 l per container

provided that the risk assessment does not indicate an increased risk of fire. Here, a maximum of 20 kg of extremely and highly flammable liquids may be contained, of which no more than 10 kg may be extremely flammable liquids. It is recommended that flammable liquids be stored in safety cabinets in accordance with Annex 3.

(10) Containers with liquid hazardous substances must be placed in a spill containment facility that can contain at least the capacity of the largest container. Where the generation of a hazardous, potentially explosive atmosphere cannot be ruled out, the containment facilities must have ESD protection.

(11) Hazardous substances must be neither kept nor stored in the immediate proximity of pharmaceuticals, food or forage, including their additives, or cosmetics, drink and tobacco. Where substances that are acutely toxic (category 1, 2 and 3), very toxic, toxic (according to Directive 67/548/EEC), carcinogenic, mutagenic or toxic to reproduction (category 1A or 1B according to the CLP Regulation) are kept or stored together in one room, this shall be deemed to be immediate proximity. In the case of all other hazardous substances, these should in principle be kept/stored in separate rooms; if absolutely necessary for operational reasons, they must at least be separated by a horizontal distance greater than 2 m.

(12) Substances and mixtures/preparations that are classified as toxic, very toxic, carcinogenic in category 1 or 2, mutagenic in category 1 or 2 or toxic to reproduction in category 1 or 2 pursuant to Annex VI of Directive 67/548/EEC shall be kept under seal or kept in such a manner that only knowledgeable and reliable persons have access to them.

(13) Where hazardous substances are stored that are marked with the precautionary statement P405 "Store locked up" by the person placing them on the market pursuant to Regulation (EC) No. 1272/2008 and that are not subject to the hazard indicators in paragraph 12, these shall receive the same treatment as recommended in paragraph 12.

(14) The employer shall ensure that psychotropic substances subject to the Narcotics Act are kept locked away. Only the person responsible shall be permitted to access narcotics.

4.3 Additional protective measures for storage in warehouses

4.3.1 Warehouse

(1) Hazardous substances must be stored in warehouses within the meaning of these technical rules if the following quantities per fire(-fighting) compartment/building or separate building unit are exceeded:

1. gases in pressurised gas containers with a nominal volume of 2.5 litres or more,
2. combustible liquids:
 - a) 20 kg of extremely and highly flammable liquids, of which no more than 10 kg may be extremely flammable liquids,
 - b) 100 kg of flammable liquids¹⁾,
 - c) 1,000 kg combustible liquids,
3. 20 kg of gases in pressurised gas cartridges,
4. 20 kg of aerosol dispensers (net mass),
5. 50 kg of hazardous substances that are classified as acutely toxic cat. 1, 2 or 3 or STOT cat. 1 or carcinogenic, mutagenic or toxic to reproduction category 1A or 1B,
6. 1 kg of oxidising hazardous substances of cat. 1 or packing group I in accordance with the dangerous goods legislation, as well as the hazardous substances listed in Annex 6,
7. 50 kg oxidising hazardous substances of cat. 2 or 3, unless these are listed in Annex 6,
8. 200 kg of pyrophoric hazardous substances marked with H250,
9. 200 kg of hazardous substances that release flammable gases on contact with water (H260, H261),
10. 1,000 kg net storage mass for hazardous substances with none of the above properties.

Storage in warehouses in accordance with number 2 (2) is also necessary if the total net mass of the stored hazardous substances exceeds 1,500 kg.

(2) If flammable liquids are stored in safety cabinets in accordance with Annex 3, the safety requirements laid down in number 4 shall be deemed to have been met.

- (3) More detailed rules on the storage of flammable liquids and of aerosol dispensers and pressurised gas cartridges in living spaces and sales rooms can be found in Annex 2
- (4) Sufficient lighting (see ASR A3.4) must be present in warehouses and outdoor storage areas. The lighting must be installed in such a way as to avoid heating the stored substances, which can lead to a dangerous reaction.
- (5) Sufficient ventilation must be provided in the warehouse (see ASR A3.6) where a risk can be posed to employees or other persons through unintended release of hazardous substances.

4.3.2 Warehouse organisation

- (1) Hazardous substances must only be kept or stored in an orderly fashion.
- (2) Warehouses must be kept and operated in an orderly fashion. Measures to be observed by employees must be documented in operating instructions.
- (3) Hazardous substances must be stored in such a way that released substances can be identified, collected and removed. The necessary protective measures shall be determined on the basis of the substance properties and the quantities stored.
- (4) Containers and packaging shall be checked for damage at regular intervals; the review intervals shall be determined on the basis of the substance properties, the type of packaging and the specific storage conditions (e.g. outdoors, in buildings, storage technology).
- (5) Necessary repair work on structural and technical installations required for the safe operation of the warehouse shall be carried out immediately.
- (6) The employer shall define the maximum storage quantity per warehouse area, as well as the review interval for the containers.
- (7) Smoking is strictly forbidden in the warehouse.
- (8) Food, drinks and tobacco must not be consumed in the warehouse. The employer shall set up suitable areas for this purpose. A derogation from the first sentence is possible if a hazard can be ruled out with certainty based on the results of the risk assessment.

4.3.3 Securing the stored substances

- (1) Packagings and containers with orientation arrows must be stored according to these markings.
- (2) Warehouse installations must be strong enough with regard to statics and stable for the reception of the substances stored. Measures must be taken in order to prevent the falling out or falling down of the loaded substances and sufficiently dimensioned collision bumpers have to be provided.
- (3) The substances shall be stacked in such a manner that the stability is guaranteed while observing the mechanical stability of packagings and containers.

This requirement shall be deemed to have been fulfilled provided that:

1. forklift drivers are selected appropriately so that they are qualified to drive industrial trucks and are specially instructed for the transport of dangerous goods,
2. pallet runners are positioned perpendicular to the racks' support beams,
3. unpalletised barrels are stacked vertically and jointly on top of each other,
4. in high-rise racks with loading facilities operated by automatically controlled forklifts, automatic facilities are available to control the contours of the pallet load, to control the driving range and the free space,
5. the maximum load height in the stack compartments is limited in the case of manual stacking and retrieval in stack compartments.

(4) Packagings or containers – above all fragile containers – shall be stacked or secured so that they cannot fall out of the rack compartments. In racks, cabinets and other installations they may be kept only up to a height from where they can still be retrieved and placed safely, if necessary, stepladders, ladders or podiums have to be used.

4.3.4 Employee qualification

(1) The employer may only entrust trained persons, who are aware of the hazards involved and of the required protective measures, with activities related to the storage of hazardous substances.

(2) The employer shall draft written operating instructions pursuant to TRGS 555 "operating instructions and employee information" and to instruct the employees accordingly.

4.3.5 Alert measures

(1) The employer shall take measures allowing employees to reach a safe place by immediately leaving their workplaces in case of immediate and great danger. This includes:

1. to alert the employees early enough,
2. escape routes and emergency exits must be accessible at any time,
3. an up-to-date escape and rescue plan.

(2) There have to be facilities to call help in the case of fire or accident, e.g. a permanently manned office that can be reached by telephone.

4.3.6 Personal protective equipment

(1) If in the event of a release of substances, e.g. caused by leakages in the case of container rupture or damaged packagings, a temporarily high exposure cannot be

excluded or if a danger arises from skin-resorptive, irritating, etching or sensitizing hazardous substances through skin contact the suitable personal protection equipment must be provided. Depending on the stored substances and the local situation, portable respiratory-protection equipment must be provided and/or carried.

(2) Where hazardous substances marked with H330 or R26 are stored in pressurised gas containers in warehouses, persons entering the warehouse must carry breathing apparatus. Breathing apparatus must be kept outside of the hazard areas in a manner such that the employees can access it quickly.

(3) The employer shall provide, clean and, if necessary, replace and dispose of protective clothing.

4.3.7 Hygienic measures

The resorption of hazardous substances by skin contact, orally and by inhalation shall be prevented. Where a risk assessment comes to the conclusion that this cannot be excluded the following measures shall be taken to protect employees:

1. Washing facilities shall be made available.
2. Private and work clothing shall be kept separately. The employer shall clean work clothing contaminated with hazardous substances.

4.3.8 First-aid measures

(1) The employer shall take the measures required to provide First Aid depending on the type of workplace and the activities as well as the number of employees. For this purpose he shall provide First Aid supplies and facilities and shall have them checked regularly for completeness and usability.

(2) In the framework of the risk assessment the employer shall investigate, whether eye and body showers can be dispensed with. A dispensation shall be motivated in the documentation.

4.3.9 Inspections

(1) All warehouse installations must be checked prior to their first use and subsequently at regular intervals for sufficient functionality, reliability and efficiency.

Installations to be checked include, for example:

1. Warehouse facilities for hazardous substances, e.g. compliance with max. loads of racks/shelves filled with hazardous substances containers or the intactness of rack components,
2. Collection facilities, e.g. tightness and coating of cups and tubs,
3. Disposal facilities, e.g. tight and non-corrosive containers for the disposal of solvents,
4. Ventilation facilities, e.g. intactness of ventilation channels and collection

facilities.

5. Eye baths and safety showers.

The result of the inspections shall be documented in a suitable manner. Checks pursuant to other legal provisions as e.g. construction regulations by the federal states, the Workplaces Ordinance or the Industrial Safety Ordinance shall continue to apply. Inspections can be based on the results of these checks, if appropriate.

(2) The following checks and/or procedures may be used as a supplementary measure:

1. Functional checks on every working day through, among others,
 - a) visual controls, e.g. of the undamaged openings for ventilation, personal protective equipment etc.
 - b) audio controls, e.g. regarding the familiar noise sources of technical work equipment and machinery as to their faultfree functionality.
2. Definitions in the area of work organisation concerning the implementation of functionality checks at regular intervals.
3. Checklists concerning the complete (e.g.) daily, weekly or monthly visual control of protective measures.

5 Additional measures for special hazardous substances

5.1 Scope of application

(1) The following rules shall apply to the storage of hazardous substances with the following properties that are stored in quantities of more than 200 kg each:

1. acutely toxic properties (marked with H300, H301, H310, H311, H330 or H331) and/or very toxic or toxic substances (marked with one of the R(isk)-phrases R23 to R28, including the corresponding combined R-phrases),
2. specific toxic properties (marked with H370, H372 with the exception of non-combustible solids that only cause damage in the case of inhalative exposure, or R39 and/or R48),
3. carcinogenic properties (marked with H350, H350i, R45 or R49),
4. mutagenic properties (marked with H340 or R46),
5. oxidising liquids or solids (marked with H271 or H272) and/or oxidising properties (marked with R8 or R9),
6. flammable gases (marked H220 or H221 and/or R12) or oxidising gases (marked H270 and/or R8),
7. flammable liquids (marked with H224, H225 or H226¹⁾) and/or flammable properties (marked with R12, R11 or R10); contrary to this, a threshold quantity of 1,000 kg shall apply to liquids marked with H226¹⁾ or R10,
8. pyrophoric liquids and solids (marked with H250 and/or R17).

For quantities between the quantity limit defined in 4.3.1 and 200 kg, the measures

shall be defined as a result of the risk assessment.

5.2 Constructive requirements

- (1) The warehouse must be separated from adjoining rooms in at least a fire-retardant manner (fire-resistance period: at least 30 minutes).
- (2) The containment room must be impermeable to the stored substance and must be made of non-combustible materials. The material requirements with regard to the quality and size of the containment area are regulated by the provisions of the water management legislation.
- (3) The containment room shall be adjusted to the quantities of the stored liquids (including liquefied gases) and should be able to hold at least the volume of the largest container without additional measures.
- (4) The containment room must consist of materials which do not cause hazards when stored liquids and/or liquefied gases are released.
- (5) The warehouses must not have floor drains if these can cause a hazard to persons or the environment. This can be the case when there is, for example, a direct connection to the public sewers or to receiving watercourses.

5.3 Access restrictions

- (1) The employer shall take organisational measures to ensure that only authorised persons have access to the warehouse. Authorised persons shall be appointed and instructed by the employer at regular intervals.
- (2) The prohibition shall be clearly and permanently indicated by means of the prohibition sign D-P006 "No access for unauthorized persons" pursuant to ASR A1.3.
- (3) In a warehouse requiring official approval pursuant to number 9.34 (Installations for storing 20 tonnes or more of highly toxic substances and preparations) and 9.35 (Installations for storing 200 tonnes or more of highly toxic, toxic, oxidising or explosive substances or preparations) of the Annex to the Fourth Federal Immission Control Ordinance, special storage security shall be provided in buildings by, for example:
 1. building the storage facility in a solid manner (e.g. stones over 120 mm, concrete over 100 mm wall thickness, suitable hazardous substances containers) with windowless outer walls or barred windows with burglar retardant doors secured by security locks.
 2. building the storage facility as above, but with windows and doors monitored by burglar alarm systems or by motion detectors behind the openings; the burglar alarm systems must then notify a permanently manned alarm centre,
 3. 24/24 monitoring by a company security service or a security company or security personnel,
 4. fencing the warehouse area with a security fence with features preventing people from climbing over the fence and a height of at least 2.5 m as well as

sufficient lighting of the facility and permanent monitoring by a company security service or a security company or security personnel,

5. fencing off the storage facility as stated under no. 4, but electronic monitoring with notification of a permanently manned alarm centre, or
6. securing containers by preventing any retrieval from the container as well as fencing of the container and/or the company premises.

5.4 Arrangements in the case of incidents involving fires and leakages

(1) An alarm plan including information on what to do in the event of

1. fire,
2. accident,
3. incidents,
4. substance emissions/leakages

shall be drawn up and displayed at several easily accessible places in the warehouse area.

(2) It must contain the following minimum information:

1. Phone numbers to make emergency calls to the fire brigade, rescue service, doctor, hospital, ambulance, police,
2. Phone numbers to call the operations manager, master craftsman and other responsible persons,
3. Information on alarm signals, gathering place and attendance check for the workforce, shutdown of energies, use of escape and emergency routes, fire fighting.

(3) Fire brigade plans shall be drawn up and kept updated in cooperation with the relevant fire-protection authority.

(4) Substance-specific information (e.g. safety data sheets) shall be kept ready in order to help fire fighters to take the right action in the event of a release of substances stored in the warehouse; this shall include the following details:

1. name of the stored hazardous substances,
2. name and address of the manufacturer, importer or distributor,
3. references to the specific hazards,
4. protective measures in order to deal with the hazards,
5. measures to be taken in the event of breakage or other damage to the packaging,
6. measures to be taken and services to be provided where persons have been in touch with the stored substance,
7. measures to be taken in the event of fire, in particular the resources or groups of resources to be used or not to be used,

8. measures to be taken in the event of environmental damages.

(5) The employer must ensure that drills are carried out at regular, appropriate intervals of the procedure for moving employees to safety or rescuing employees in the event of a release of the hazardous substances stored in the warehouse or in the event of a fire or another emergency. The intervals of the emergency exercises and drills shall be defined in the hazard assessment.

6 Special fire-protection measures

6.1 Scope of application

(1) The following provisions shall apply in the case where hazardous substances with the following properties are stored in quantities of more than 200 kg (a larger quantity shall be assumed, typically in the tonne range, for solids of storage class 11):

1. flammable liquids (marked with H224, H225 or H226¹⁾) and/or flammable properties (marked with R12, R11 or R10),
2. flammable gases (marked with H220 or H221 and/or R12),
3. flammable aerosols (marked with H222 or H223),
4. flammable solids (marked with H228),
5. pyrophoric liquids and solids (marked with H250 and or R17),
6. self-heating substances and mixtures (marked with H251 or H252),
7. self-reactive substances and mixtures (marked with H242),
8. substances and mixtures that release flammable gases on contact with water (marked with H260 or H261 and/or R15),
9. other hazardous substances and/or materials that have been shown to be combustible.

For liquids marked with H226 and/or R10, as well as other hazardous substances or materials that have been shown to be combustible, a threshold quantity of 1,000 kg shall apply by way of derogation.

(2) Materials that have been shown to be combustible can be:

1. liquids of storage class 10 (up to a flashpoint of max. 370 °C),
2. solids of storage class 11 that are not covered by the above criteria, but have been shown to be combustible (including paper, wood, polyethylene, polystyrene).

The measures set out in number 6 shall also be taken in the case of storage that falls within the scope of number 5.1 when, although no combustible hazardous substances are stored, a fire hazard is present due to packaging or the encroachment of fire from outside.

(3) Further fire-protection measures are listed in number 8.3 for acutely toxic liquids and solids, number 9.3 for oxidising liquids and solids, number 10.3 for gases under

pressure, number 11.2 for aerosol dispensers and pressurised gas cartridges, and number 12 for flammable liquids.

6.2 Measures

- (1) The constructive fire protection shall – according to its type and extent – be determined on the basis of the local and operating conditions where hazardous substances according to number 6.1 are stored.
- (2) Roofing shall be made resistant for a sufficient period against fires encroaching on the roof from the outside by way of flying sparks and radiant heat (hard roofing).
- (3) The following shall be determined depending on the type and size of the warehouse and in agreement with the responsible authorities, in particular the fire protection authority:
 1. fire brigade access and alternative access routes as well as fire brigade areas,
 2. smoke and heat flues.
- (4) Escape and emergency routes must meet the following requirements:
 1. From every place in the warehouse it must be possible to reach at least one exit at a distance of no more than 35 m which either leads outdoors, into a necessary stairwell and landing, or another fire compartment. Depending on the result of the hazard assessment pursuant to No. 3 escape/emergency routes may have to be shortened, see also ASR A 2.3. They can be extended provided the conditions of IndBauRL [Regulation on industrial construction] No. 5.5.5 are fulfilled.
 2. Every storage room with an area of more than 200 square metres shall have at least two exits facing each other, if possible.
 3. Storage rooms above the ground level with an area of over 1,600 square metres must have on every floor level at least two escape and emergency routes, opposite one another if possible. One of these emergency routes may lead via external stairs without stairwells and landings and via rescue balconies, terraces etc. to the premises as an emergency exit provided this route would not be too dangerous on account of fire and smoke in the event of the outbreak of a fire.
- (5) Doors and gates must fulfil the requirements pursuant to ASR A2.3 “Escape routes and emergency exits, escape and rescue plan” and ASR A1.7 “Doors and gates”.
- (6) Warehouses shall be equipped with sufficient and suitable fire fighting installations (e.g. fire extinguishers, wall-mounted hydrants, fire extinguishing systems etc.) (see ASR A 2.2 “Fire protection measures”). Fire extinguishing systems shall – unless they work automatically – be marked, easily accessible and easy to handle. Fire fighting routes must be constructed and marked to make access for extinguishing and operating equipment speedy and free from obstacles.
- (7) A sufficient quantity of extinguishing water must be available in order to fight fires with water. The quantity of extinguishing water required shall be determined by the authority responsible for fire protection while taking into account the areas of the

fire compartments or fire-fighting compartments and the quantity and type of fire loads. For this purpose the DVGW work sheet W405 may be used.

(8) Where the stored hazardous substances require the use of other extinguishing agents than water or where for operational reasons and with the consent of the competent authority (fire brigade) other extinguishing agents than water are to be used, these agents shall be provided in sufficient quantity. Areas where water must not be used for fire extinguishing purposes shall be marked by the prohibition sign P011 "Do not extinguish with water" pursuant to ASR A1.3.

(9) In warehouses and buildings with storage areas, automatic extinguishing systems shall be installed for stored substances whose height exceeds 7.5 m (upper edge of stored object).

(10) Where warehouses are equipped with automatic extinguishing systems (e.g. fire sprinkler or water spray extinguishing systems) it must be guaranteed that the stored substances can be directly reached by the extinguishing agent.

(11) Instead of automatic fire extinguishing systems, partly mobile (semi-stationary) fire extinguishing systems, where the extinguishing agent generally has to be provided by the fire brigade, are permissible if a certified plant fire brigade exists that can be on the spot within 5 min of the alarm being raised and if early fire detection and immediate alerting of the plant fire brigade are ensured.

(12) Extinguishing water pipes, sprinkler nozzles or smoke detectors must be fixed in such a manner that they are not damaged when substances are brought into or are removed from the warehouse.

(13) Mobile fire extinguishing vehicles and/or devices can – with the consent of the authority responsible for fire protection – be equivalent to partly mobile fire-extinguishing systems, provided they are similar to them with respect to the rate of their extinguishing agent and provisioning as well as their alarm concept and intervention period.

(14) Whether an extinguishing water retention installation is necessary and how it has to be designed and dimensioned is governed by the "Guideline governing the dimensions of extinguishing water retention installations in the framework of the storage of water-hazardous substances (LÖRÜRL)" of the Laender (federal states). Where extinguishing water retention devices are installed, measures must be defined with regard to explosion protection based on the risk assessment and taking account of TRGS 720/TRBS 2152 "Hazardous explosive atmosphere – General –".

(15) Ignition sources that may lead to the starting of fires shall be avoided. Auxiliary or waste material (e.g. oil-soaked cleaning cloths) can act as ignition sources.

(16) In the event of activities that can cause hazards through interaction (e.g. welding), a work clearance system shall be applied including special written instructions by the employer. Work clearance shall be provided by the responsible person before the beginning of the activities.

(17) Buildings should have a suitable lightning protection system.

(18) Areas in which more than 200 kg of extremely flammable, highly flammable or flammable hazardous substances (R 12, R 11, R 10) are stored must be marked with the warning sign W021 "Warning; Flammable material".

7 Joint storage

7.1 Basic rules

(1) Hazardous substances may only be stored jointly if this does not increase the risk.

(2) In order to define the possibilities for joint storage, hazardous substances are assigned to storage classes in these technical rules. Their only purpose is to control the joint storage of substances. Storage classes must be defined according to the procedures stipulated in Annex 4.

(3) Separate storage means separating different stored substances in different warehouse areas of the same warehouse sector by sufficient distances or using barriers (e.g. walls, cabinets made of non-combustible materials, products made of non-combustible substances of storage class 12 or 13) or by storing them separately in structurally separate containment areas.

(4) Separate storage within one warehouse sector may be necessary in order to reduce hazards related to specific stored substances of the same storage class or substances of different storage classes. This can be achieved by sufficient distances or by barriers (e.g. walls, cabinets made of non-combustible materials, products made of non-combustible substances of storage class 12 or 13) or by storing them separately in separate containment areas. Indications for the need to store substances separately may result from, for example:

1. danger features and safety indicators that supplement the risk indicators (R- and S-phrases and/or H-, EUH- and P-sentences) of the marking (this applies in particular to R29, R31, R32, S14, S17, S50, EUH014, EUH029, EUH031, EUH032, P220, P223 and P420) and
2. product-related safety information, such as:
 - a) safety data sheets (No. 5 Fire fighting measures and No. 7 Handling and Storage; less detailed are data in Safety Data Sheet No. 10 Stability and Reactivity) as experience has shown, or
 - b) information leaflets issued by the accident insurance funds (example: cyanides shall not be stored jointly with substances – e.g. acids – with which they may produce hydrogen cyanide).

(5) Separate storage means storing substances separately in different warehouse sectors with a fire resistance rating or capability of at least 90 minutes.

(6) Derogations from joint storage rules are allowed, provided that:

1. no more than 400 kg of hazardous substances are stored of which max. 200 kg may belong to one storage class,
2. hazardous substances of up to 200 kg are additionally stored in a warehouse for storage classes 6.1 C, 6.1 D, 8A, 8B and 10 to 13, and
3. there is no need to fear an increase in the risks encountered.

(7) Stored substances of different storage classes must not be stored in the same warehouse sector if the joint storage table pursuant to No. 7.2 prescribes separate

storage in different warehouse sectors with a fire resistance rating or capability of at least 90 minutes (separate storage).

(8) Stored substances from the same storage class or stored substances from different storage classes for which no separate storage is prescribed, must also not be stored jointly if this can cause a substantial increase in risk. This is the case if they, for example:

1. require different extinguishing agents,
2. require different temperature conditions,
3. react with each other while producing flammable or toxic gases or
4. react with each other while causing a fire.

(9) In individual cases it is possible to deviate from the rules in the joint storage table on account of suitable fire protection concepts or risk assessment results.

(10) Exemptions from the rules for joint storage are permissible regarding the storage of hazardous substances in railway tank wagons certified according to dangerous goods rules or tanks on closed company premises if

1. this does not increase the risks,
2. the storage period does not exceed three months,
3. the transport containers are not opened during this time (they may be opened briefly solely for sampling purposes, taking account of the protective measures required for this activity), and
4. the transport containers are regularly, at least daily, inspected to see whether they are kept in good condition.

(11) Joint storage prohibitions shall not apply if packed hazardous substances are kept ready for transport in closed freight containers, e.g. in container berths and in container terminals, and if the closed freight containers are not stacked vertically or placed directly next to each other, and provided the rules for joint storage in the Dangerous Goods Ordinance Road, Railway and Inland Waterways are observed. This requirement shall be deemed to have been complied with if the minimum distance is 0.5 m in all directions.



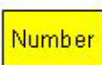
7.2 Joint storage table

(1) The Joint Storage Table (Table 2) indicates for each storage class: whether joint storage with any of the other storage classes is allowed in principle; whether separate storage in different warehouse sectors with a fire resistance rating or capability of at least 90 minutes is present; or whether a restriction for joint storage must be observed (e.g. separate storage required in the event of storage in different warehouse areas in the same warehouse sector). (The Joint Storage Table also includes stored substances that do not come under the scope of application of these technical rules.)

(2) For the purpose of this joint-storage concept, combustible materials shall be stored substances to which no physical hazard is assigned pursuant to the CLP Regulation but that are known from experience to be combustible.

Table 2: Joint storage table according to storage class, explanations see subsequent pages

Storage class		10-13	13	12	11	10	8 B	8 A	7	6.2	6.1 D	6.1 C	6.1 B	6.1 A	5.2	5.1 C	5.1 B	5.1 A	4.3	4.2	4.1 B	4.1 A	3	2B	2A	1			
Explosive substances	1																										1		
Gases	2 A	2			2			2								1										2	3		
Aerosol packages	2 B															1													
Flammable liquids	3	5			5							6					4												
Other explosive substances	4.1 A	1	1	1	1	1	1	1							1							1	1						
Flammable solid or desensitizing explosive substances	4.1 B											6		4	1		4		6	6									
Pyrophoric or self-igniting substances	4.2	6			6	6	6	6				6	6						6										
Substances producing oxidizing gases with water	4.3	6		6	6	6	6	6				6	6																
Highly oxidizing substances	5.1 A																												
Oxidizing substances	5.1 B	7			7	7		7				6	6	4	4		1												
Ammonium nitrate and mixtures containing ammonium nitrate	5.1 C	1	1	1	1	1	1	1								1													
Organic peroxydes and self-reactive substances	5.2	1			1	1																							
Combustible, acutely toxic substances	6.1 A	5			5																								
Non-combustible acutely toxic substances	6.1 B	5			5																								
Combustible acutely toxic or chronic substances	6.1 C																												
Non-combustible acutely toxic substances or substances with chronic effects	6.1 D																												
Infectious substances	6.2																												
Radioactive substances	7																												
Combustible corrosive substances	8 A																												
Non-combustible corrosive substances	8 B																												
Combustible liquids	10																												
Combustible solids	11																												
Non-combustible liquids	12																												
Non-combustible solids	13																												
Other combustible and non-combustible substances	10-13																												

 Separate storage is required
 Joint storage permitted
 Number Joint storage is only permitted with restrictions (see Number)

Explanations with regard to Table 2

1 Specific statutory storage rules must be observed.

Storage class 1 and storage class 4.1.A 2. Explosion Ordinance (SprengV);

Storage class 5.1 C: Dangerous Substances Ordinance (GefStoffV) Annex III
No. 5 Ammonium nitrate and TRGS 511;

Storage class 5.2 BGV B 4 "Organic peroxides"; attention: the joint storage
rules quoted here shall also be applied by analogy to self-
reactive hazardous substances;

Storage class 7 Radiation Protection Ordinance (StrlSchV) and DIN 25422.

2 Joint storage in rooms is only allowed if:

1. max. 50 filled pressurised gas containers are stored, of which no more than 25 contain gases that are flammable, oxidising, acutely toxic, marked with H331 or toxic, and if these
2. are separated by a wall that is at least 2 m high and made of non-combustible materials and if
3. a distance of at least 5 m is observed between the wall and the combustible substances.

3 Pressurised gas cylinders filled with different gases may only be jointly stored in the same warehouse room under the following conditions.

1. Pressurised gas containers containing gases that are flammable, oxidising, acutely toxic, marked with H331 or toxic, provided the total number of 150 pressurised gas containers or 15 pressure barrels is not exceeded. In addition, pressurised gas containers filled with inert gases may be stored in any quantity.
2. Pressurised gas containers with flammable and pressurised gas containers with inert gases may be stored in any quantity.
3. Pressurised gas containers with oxidising gases and pressurised gas containers with inert gases may be stored in any quantity.
4. Pressurised gas containers with acutely toxic hazardous substances of categories 1, 2 or 3/very toxic, toxic and pressurised gas containers with inert gases may be stored in any quantity.
5. In the cases 1 to 3, an additional 15 pressurised gas containers or a pressure barrel containing gases that are acutely toxic, marked with H330, and/or very toxic may be stored. Larger quantities of pressurised gas containers with acutely toxic gases must be stored in a special storage room.
6. There must be a distance of at least 2 m between pressurised gas containers containing flammable gases and pressurised gas containers containing oxidising gases. .
7. There are no restrictions as to outdoor storage.

- 4 Joint storage shall be permitted if the restrictions of:
1. Table 3 are observed for storage classes 3, 5.1B, 6.1A and 6.1B,
 2. Table 4 are observed for storage class 4.1B with storage class 6.1A.

Table 3: Preconditions for joint storage of storage classes 3, 5.1B, 6.1A and 6.1B

Total quantity	Restrictions
up to 1 t	without restrictions
up to 20 t	in buildings if: <ul style="list-style-type: none"> - an automatic fire extinguishing installation exists or - an automatic fire detection system exists in combination with a non-automatic fire extinguishing installation and a certified plant fire brigade.

Table 4: Preconditions for joint storage of storage class 4.1B with 6.1A

Total quantity	Restrictions
up to 10 t	without restrictions,
up to 20 t	if <ul style="list-style-type: none"> - in buildings: an automatic fire detection system exists, - outdoors: fire detection and fire alarm are guaranteed by <ul style="list-style-type: none"> - hourly controls with alert possibilities (e.g. via telephone, fire alarm, radio equipment, etc.) or if - there is evidence that an appropriate automatic fire alarm/detection system exists.
up to 50 t	if <ul style="list-style-type: none"> - an automatic fire detection system exists and - the fire brigade can reach the scene of the fire within 10 minutes of the alarm being raised.
up to 100 t	if <ul style="list-style-type: none"> - an automatic fire extinguishing installation exists or - an automatic fire detection system exists in combination with a non-automatic fire extinguishing installation and a certified plant fire brigade.

- 5 Materials that may contribute to the outbreak or rapid expansion of a fire due to their nature and quantity, as e.g. paper, textiles, wood, wood wool, hay, straw, packagings, combustible packaging filling materials, must not be stored in the warehouse sector unless they form a unit with the non-stationary containers for storage or transport.
- 6 Different stored substances may only be stored together or jointly with other materials provided that this will not lead to a substantial increase in risk. A substantial increase in risk can be prevented through separate storage.

- 7 Oxidising hazardous materials may be stored jointly with combustible materials:
1. in quantities of up to a total of 1 tonne without restrictions,
 2. in quantities of more than 1 tonne according to the restrictions under explanation no. 1.

The requirements under explanation 5 must also be observed.

8 Storage of fluids and solids of acute toxicity

8.1 Scope of application

(1) The following provisions shall apply to liquids and solids of acute toxicity (marked with H300, H301, H310, H311, H330 or H331) and/or toxic or very toxic liquids and solids stored in quantities in excess of 200 kg. Within the framework of the risk assessment, the employer can disregard those substances and mixtures that are not classifiable as toxic or highly toxic pursuant to Directive 67548/EEC when defining protective measures for acutely toxic substances.

(2) For quantities of more than 50 kg and up to and including 200 kg, the measures shall be defined based on the results of the risk assessment.

8.2 Organisational measures

(1) Hazardous substances pursuant to number 8.1 shall be kept under seal or must be stored in such a manner that only experts and reliable persons have access to them. This can be fulfilled through, among other measures:

1. storage in a suitable, lockable cabinet,
2. storage in a lockable building or lockable room if the building is used by different groups, or
3. storage on fenced-off company premises with access control, including industrial parks.

(2) For warehouses with a floor space of 800 m² and more, fire alarm systems – e.g. loudspeakers – shall be provided in order to warn persons who might be in the warehouse or in its direct vicinity.

(3) Outdoor storage areas shall be organised in such a manner that they are located at least 5 m from openings in the building.

(4) Access to specified processing areas in which highly toxic or toxic substances are readied for transport may also only be granted to persons that are required for loading the packages and for transport. Such persons shall be instructed and supervised.

8.3 Structural requirements and fire protection

(1) Where substances are stored in buildings, the warehouse sectors shall be separated from other warehouse sectors and other rooms or buildings by fire resistant components made of non-combustible building materials (fire resistance rating: at least 90 minutes); where the storage sectors cover more than 1,600 m², they shall be separated by fire walls.

(2) Storage rooms in buildings with a storage quantity of more than 10 tonnes but no more than 20 tonnes per warehouse sector, shall be equipped with automatic fire alarm systems if specific non-stationary or operational conditions (e.g. neighbouring residential buildings) require this.

(3) Storage rooms in buildings with a storage quantity of more than 20 tonnes per warehouse sector shall be equipped with automatic fire alarm systems.

(4) In the event of outdoor storage of substances, the storage sectors shall be separated from other storage sectors or buildings by fire-resistant components made of non-flammable building materials (fire resistance rating: at least 90 minutes) or by sufficiently large distances according to paragraph 6.

(5) The walls pursuant to paragraph 4 must be at least 1 m higher than the stored substances themselves and shall exceed the width of the stored substances at the open side by at least 0.5 m.

(6) Where outdoor storage sectors are not separated by walls they shall generally comply with the following minimum distances insofar as no other requirements can be derived from other laws:

1. five metres between warehouse sectors including combustible or non-combustible containers with a volume of more than 200 l and a maximum storage height of four metres,
2. five metres if an automatic fire alarm system and a plant fire brigade exist,
3. five metres where an automatic fire extinguishing system exists,
4. ten metres in all other cases.

(7) In the event of outdoor storage with a storage capacity of more than 20 tonnes per storage sector, fire detection and fire alerting shall be guaranteed by hourly controls, including the possibility to set off an alarm, or by suitable technical measures, unless there is evidence that an appropriate automatic fire alarm system has been installed.

(8) In warehouses requiring certification pursuant to number 9.34 or 9.35 of the Annex to the 4th Federal Immission Control Ordinance), automatic fire alarm systems and fire extinguishing installations are required if it is to be expected that the stored hazardous substances will release toxic fire gases in the event of a fire whose consequences present a serious hazard within the meaning of the Major Accidents Ordinance.

(9) Paragraphs 2, 3, 4, 6 and 7 shall not apply provided only non-combustible substances and materials are stored in this warehouse sector.

9 Storage of oxidising liquids and solids

9.1 Scope of application

(1) The following provisions shall apply in the case of storage of oxidising liquids and solids (marked with H271 or H272, category 1, 2 or 3) and/or oxidising liquids and solids (marked with R8 or R9) and where substances with flammable (oxidising) effects of class 5.1 pursuant to the dangerous goods legislation are stored in quantities of more than 200 kg. By way of derogation from the first sentence, they shall be applied in the case of storage of highly oxidising hazardous substances of category 1 pursuant to the CLP Regulation or of packing group 1 pursuant to the dangerous goods legislation, as well as other highly reactive oxidising hazardous substances pursuant to Annex 6 for quantities of 5 kg or more.

(2) In the case of quantities of more than 1 kg or 50 kg, up to and including 200 kg, the measures shall be defined based on the results of the risk assessment.

9.2 Organisational measures

(1) Leaked or spilt hazardous substances must not be wiped up with combustible materials. They have to be removed immediately and safely.

(2) A safe removal is as a rule possible by dissolving the substance in lots of water or by wiping it up with suitable binders, as e.g. diatomaceous earth, sand, cement. Contaminated water has to be properly removed.

(3) No equipment or vehicle operated with a combustion engine may be placed in the warehouse. Leaked fuels or lubricants must be removed immediately.

(4) Flammable materials that are being kept in a warehouse and whose type and quantity can contribute to an outbreak or rapid expansion of fires, such as packagings, filling materials, pallets and sawdust, must not be stored in the warehouse.

9.3 Structural requirements and fire protection

(1) Where substances are stored in buildings, the warehouse sectors shall be separated from other warehouse sectors and other rooms or buildings by fire resistant components made of non-combustible building materials (fire resistance rating of at least 90 minutes); where the storage sectors cover more than 1,600 m², they shall be separated by fire walls.

(2) Strongly oxidising hazardous substances of category 1 pursuant to the CLP Regulation or of packing group I pursuant to the dangerous goods legislation, as well as other highly reactive oxidising hazardous substances pursuant to Annex 6, may be stored in multi-storey buildings, provided that this does not give rise to an increased risk to employees and other persons in comparison to storage in single-storey buildings. This can be achieved, for example, with an automatic fire detection system, an automatic or partly mobile fire extinguishing system or special emergency routes or doors and must be documented within the framework of the risk

assessment pursuant to number 3. Otherwise, these substances must be stored in single-storey buildings.

(3) In derogation of paragraph 1, warehouses which are exclusively used to store oxidising substances of category 1, marked with H217, and which are at a distance of least at 10 m from other buildings, may also be built by using building materials that do not have a defined fire resistance rating but are non-combustible, such as (prefabricated) garages (provided that the modified use adheres to building laws). The distance may be reduced in agreement with the authority responsible for fire protection, taking account of the local and operating conditions. The substances may also be stored in containers if they are located at least 10 m from any building.

(4) When hazardous substances are stored outdoors, the storage sectors shall be separated from other storage sectors or buildings by fire-resistant walls made of non-combustible building materials (fire resistance rating at least 90 minutes) or by a distance of at least 5 m.

(5) The walls pursuant to paragraph 4 must be at least 1 m higher than the storage itself and shall exceed the width of the stored substances at its open side by at least 0.5 m.

10 Storage of pressurised gases

10.1 Scope of application

The following rules shall apply to the storage of gases (marked with H220, H221, H270, H280 or H281) in quantities of more than 2.5 l.

10.2 Organisational measures

(1) Pressurised gas containers must be secured against toppling over or falling down. Valves shall be protected with a suitable protective device, e.g. with a protective cap or a protective cage/collar. Special protection against toppling over or falling down is not necessary if e.g. due to the design of the pressurised gas containers, the placement in large groups or the type of storage a sufficient degree of protection is achieved.

(2) In the warehouse, gases must not be refilled and repair work on pressurised gas containers must not be carried out either. For this purpose special rooms have to be provided.

(3) Acutely toxic gases of categories 1 to 3 or very toxic/toxic gases (marked with H330 or H331 and/or R23 or R26) shall be kept locked away or kept or stored in such a manner that only competent and reliable persons have access to them.

(4) Gases marked with H330 or R26 must only be stored in rooms that have a gas detection system that triggers an acoustic and optical alarm when permissible workplace limit values are exceeded. Necessary safety measures, e.g. the carrying of breathing apparatus, must be defined in the operating instructions. Breathing apparatus must be kept outside of the hazard areas in a manner such that the

employees can access it quickly.

(5) Storage rooms for non-stationary pressurised gas containers containing flammable gases (marked with H220 or H221 and/or R12) or acutely toxic gases of category 1 or 2 that are marked with H330 or R26 and that are adjacent to a public right of way must be designed with a wall with no doors and with no openable windows or other openings up to a height of 2 m on the side that is directly adjacent to the public right of way. This shall not apply to doors that are self-closing and that are at least fire-retardant (fire resistance rating: at least 90 minutes). It must be possible to exit these storage rooms quickly.

10.3 Structural requirements and fire protection

(1) In the case of storage in storage rooms:

1. the storage rooms must be separated from adjoining rooms by fire-retardant components (fire resistance rating: at least 30 minutes),
2. components must be fire-resistant (fire resistance rating: at least 90 minutes) if there is the risk of fire or explosion in adjoining rooms not used for the storage of gases,
3. the outer walls of warehouses must be at least fire-retardant (fire resistance rating: at least 30 minutes); where the distance to adjoining installations and facilities that could present a hazard is at least 5 m, the outer wall may consist of non-combustible materials,
4. the roof covering must be sufficiently resistant to spreading fire and radiated heat,
5. floor coverings in storage rooms for non-stationary pressurised gas containers must be at least flame-resistant.

(2) Outdoor storage areas must observe a distance of at least 5 m from the pressurised gas containers to adjoining installations and facilities that can present a fire hazard. The safety distance may be replaced by a protection wall of at least 2 m in height and sufficient width and made of non-combustible building materials.

(3) Pressurised gas containers may only be stored in working areas in suitable safety cabinets with a fire resistance rating of at least 30 minutes. In particular safety cabinets that meet the requirements of EN 14470-2 shall be deemed to be suitable. Here, acutely toxic gases of categories 1 to 3 and/or highly toxic or toxic gases (marked with H330 or H331 and/or R23 or R26) may only be stored in safety cabinets with ventilation systems achieving an air-change rate of 120 per hour. Oxidising gases (marked with H270 and/or R8) or flammable gases (marked with H220 or H221 and/or R12) may only be stored in safety cabinets with ventilation systems achieving an air-change rate of 10 per hour.

(4) For the purpose of avoiding a hazardous accumulation or spread of gases, no pits, channels or drains to channels without a liquid seal, or cellar entrances or other open connections to cellar rooms, may be present in the warehouse; likewise, no openings to other rooms may be present in walls and ceilings. Furthermore, no cleaning holes or other holes in flues may be present at this location. In the case of outdoor storage, the first sentence shall only apply to the area of possible hazards

due to non-stationary pressurised gas containers containing gases that are heavier than air and liquefied gases.

(5) A maximum of 50 filled pressurised gas containers may be stored in rooms below ground level if:

1. in the case of a ventilation system: an air-change rate of 2 per hour is ensured. This must either be constantly active or be switched on automatically by a gas detection system when a defined limit value is exceeded. An alarm must be triggered in the event of a failure in the ventilation system;
2. in the case of natural ventilation: the ventilation openings have a total cross sectional area of at least 10% of the floor area of this room, they achieve proper ventilation, and the floor is no more than 1.5 m below ground level; or
3. they are stored in safety cabinets that meet the requirements of EN 14470-2.

By way of derogation from sentence 1, pressurised gas containers containing oxygen or compressed air may be stored without meeting the requirements stated therein. Emptied, uncleaned non-stationary pressurised gas containers may be present in twice this number.

(6) Rooms in which pressurised gas containers are stored must be sufficiently ventilated and vented. Natural ventilation shall be deemed to be sufficient if there are ventilation openings leading directly to the outdoors with a total cross-sectional area of at least 1/100 of the floor area of the storage room. The arrangement of the ventilation openings must take account of the density of the gases. If sufficient natural ventilation cannot be ensured, protective measures pursuant to paragraph 5 (1) must be provided. The size of the ventilation opening required in sentence 2 can be based on the floor area provided for the storage of non-stationary pressurised gas containers, provided that the ventilation opening is located directly at the storage area.

(7) When more than five pressurised gas containers containing oxidising gases (marked with H270 and/or R8) or flammable gases (marked with H220 or H221 and/or R12) are stored, the floor must be made of non-combustible materials.

(8) Storage rooms used to store more than 25 pressurised gas cylinders or two filled pressurised gas barrels containing flammable gases or more than five filled pressurised gas cylinders or even just one pressurised gas barrel containing acutely toxic gases of category 1 or 2/highly toxic gases must not be below or above rooms that are used for permanent occupation by persons. Connections to adjoining rooms shall only be permitted if these rooms have their own emergency routes. Emptied, uncleaned non-stationary pressurised gas containers may be present in twice this number.

10.4 Special protective measures

(1) In the case of acutely toxic gases (marked with H330 and/or R26) or flammable gases (marked with H220, H221 and/or R12), safety areas must be set up around pressurised gas containers; the size of these areas shall depend on the density of the gas(es). Particular account must be taken of these areas in the risk assessment; e.g. explosion-protection measures might be necessary.

(2) The safety area defined in number 10 is a three-dimensional space around pressurised gas containers containing combustible or acutely toxic gases in which the occurrence of gas or gas–air mixtures cannot be ruled out due to leaks in connections and valves or the connection or removal of pipe connections during the course of operation or as a result of mishandling.

(3) Explosion protection measures (see TRGS 720 ff.) must be taken for flammable gases in these safety areas; in the case of acutely toxic gases, these safety areas must not extend into emergency/escape routes. In addition to valve protection, the valves must be fitted with a lock nut for acutely toxic gases of category 1 or 2 and pyrophoric gases.

(4) The dimensions of the safety areas for non-stationary pressurised gas containers shall be 2 m in each direction in the event of storage in storage rooms. For gases that are heavier than air, the safety area can be reduced to 1 m in the upward direction. Outdoors, the dimensions of the safety areas can be halved. In the event of storage rooms with a floor area $\leq 20 \text{ m}^2$, the entire room must be designated as a safety area.

11 Storage of aerosol dispensers and pressurised gas cartridges

11.1 Scope of application

(1) The following rules shall apply to the storage of aerosols in aerosol dispensers, (marked with H222 or H223) and of gases in pressurised gas cartridges (marked with H220 or H221) in a net mass of more than 20 kg.

(2) These rules shall apply equally to aerosol dispensers and pressurised gas cartridges that are not marked as dangerous and that have a mass of 200 kg or more, unless these are stored in closed wire-mesh boxes that prevent release in the event of rupturing.

(3) The storage of aerosol dispensers and pressurised gas cartridges in sales rooms and the associated storerooms shall be subject to the provisions set out in Annex 2.

11.2 Structural requirements and fire protection

(1) Where aerosol dispensers or pressurised gas cartridges are stored in storage rooms for non-stationary containers, the stored quantity of combustible liquids and the net volume of the content indicated on the aerosol dispensers or pressurised gas cartridges must, together, not exceed the maximum permissible storage quantity of 100 t per storage room.

(2) Storage rooms must:

1. not be in residential buildings;
2. be separated from other rooms by fire-resistant components (fire resistance rating: at least 90 minutes),
3. have floors made of non-combustible materials, and

4. have sufficient ventilation and satisfy the explosion-protection requirements set out in Annex 5.
- (3) Areas greater than 500 m² are only permitted if a fire protection concept is in place that has been agreed with the competent authority.
- (4) Storage rooms with an area of more than 1,600 m² must be separated from one another by fire walls.
- (5) Especially within workrooms, pressurised gas cartridges that have been opened must only be stored in safety cabinets.

12 Storage of flammable liquids

12.1 Scope of application

- (1) The following rules shall apply when flammable liquids (marked with H224, H225 or H226¹⁾) or flammable liquids (marked with R12, R11 or R10) are stored in quantities of more than 200 kg (1,000 kg for hazardous substances marked with H226¹⁾ or R10).
- (2) In the case of quantities of more than 10 or 20 kg, respectively, up to and including 200 kg (1,000 kg if marked with H226¹⁾ and/or R10), the measures shall be defined according to the results of the risk assessment with special consideration of the substance properties, the packaging materials and the local conditions.
- (3) Where flammable liquids are stored in safety cabinets according to Annex 3, the requirements of number 12 shall be deemed to have been met.
- (4) Protective measures with regard to ventilation and explosion protection can be found in Annex 5.
- (5) Emptied, uncleaned containers shall be regarded as filled containers with regard to the protective measures.
- (6) The storage of flammable liquids in sales rooms and the associated storerooms shall be subject to the provisions set out in Annex 2.

12.2 Permissible storage quantities

- (1) Non-stationary containers without protective measures in excess of those set out in number 12 and with a total storage quantity of max. 100 t may be placed in one storage room.
- (2) Where non-stationary containers or tank containers are stored together with stationary tanks in a storage room, the total storage quantity of 150 t must not be exceeded.
- (3) Where combustible liquids with flashpoints between 60 °C and 100 °C are stored together with flammable liquids, these quantities shall be included in the risk assessment. Here, 5 kg of combustible liquids shall be regarded as corresponding to 1 kg of flammable liquids.

(4) In the determination of the storage quantity for emptied containers, it is assumed that the residual contents of these containers amount to less than 0.5% of their capacities; 0.5% of the containers' capacity is then used as an estimate for the determination of the storage quantity.

12.3 Structural requirements and fire protection

(1) Walls, ceilings and doors of warehouses must be made of non-flammable building materials.

(2) Warehouse rooms with a storage quantity of up to 1,000 kg must be separated from adjoining rooms by fire-retardant materials (fire resistance rating: at least 30 minutes); beyond this quantity, the separation must be effected by fire-resistant materials (fire resistance rating: at least 90 minutes).⁵

(3) Wall and ceiling breaches leading to adjoining rooms must be secured by fire resistance partitions in the wall and/or ceiling breached to protect them against fire transmission. In derogation of this provision doors in fire resistant walls need not be fire-resistant (e.g. fire resistance period of at least 30 minutes) provided the adjoining rooms are included in a fire protection concept.

(4) Containment tubs must consist of a material which is impermeable for the stored liquids and must be made of non-combustible building materials.

(5) Drains, openings and ducts to rooms at a lower level, cellars, pits, shafts and channels, e.g. for cables or pipelines, must be protected against penetration by the liquids and their vapours.

(6) Chimneys must not have any openings inside the warehouse even if they can be locked by sliders, flaps or in any other way.

(7) Warehouses must not be used for other purposes.

(8) Warehouses must neither be located next to living rooms or bedrooms or any other type of sleeping room.

(9) Warehouses for the storage of more than 10 t must not be located next to rooms used for anything but temporary stays of persons, with the exception of warehouse staff. Any person involved in the storing and filling of liquids shall be deemed warehouse staff.

(10) In derogation of para. 9, warehouses may be located next to staff or working rooms which are not only used by warehouse staff, provided that:

1. these rooms are separated from each other by a wall without any opening and, if necessary, by fire-resistant ceilings (fire resistance rating: at least 90 minutes) and
2. the outer warehouse wall including windows, doors and other openings is at least built in such a way that it is at least fire resistant, if staff and working rooms with window openings are located above the warehouse.

⁵ By way of derogation, the permitted storage quantity can be increased to 10 t for flammable liquids (marked with H226 and/or R10).

(11) Deviations from paragraphs 7 to 9 are permissible based on the results of the risk assessment and in cooperation with the authority responsible for fire protection if it can be guaranteed that persons in these rooms will be alerted in the case of product leakages or fire by automatic fire alarm systems.

(12) Storage rooms with a storage quantity of more than 20 t of flammable liquids must be equipped with an automatic fire extinguishing system; number 6.2 (11) shall apply accordingly. Rooms for storage of less than 20 t must be equipped with automatic fire alarm systems if the risk assessment so requires.

12.4 Containment spaces

(1) Storage containers must be installed in containment spaces. The containment spaces must be able to sufficiently resist the liquids stored and must also be impermeable for the duration of the storage of escaped substances to be expected in the event of fire. This requirement shall be deemed to have been fulfilled if the materials and components used correspond to the respective building authority certificate of suitability, which must also consider use in the case of fire. The duration of exposure to fire on which this shall be based must at least meet the requirements of the structural components that enclose the space. The following minimum requirements must be observed:

1. the load-bearing components of containment spaces must be made of non-combustible materials,
2. the suitability of the joint-sealing construction in the case of fire must be taken into consideration,
3. the coatings used to achieve the containment space's resistant properties must exhibit at most normal flammability.

They can be formed by indentations, thresholds, walls or earth banks. Walls and floors may also be part of the warehouse. Proof of stability of the containment areas must be furnished.

(2) Containment areas in warehouses must always be open at the top (no insulation, sufficient ventilation) and must not have any drainage. If a containment space is sealed at the top, the process of zoning the space must take account of the ventilation, which might no longer be sufficient for the removal of potentially explosive atmospheres, as well as taking account of possible insulation. Outdoors, the natural ventilation is generally sufficient.

(3) (deleted)

(4) The capacity of containment areas has to be dimensioned in such a way that the substances stored cannot expand beyond the containment area in a hazard situation. A containment area must at least be able to hold the quantity of

1. the volume of the biggest container located inside the containment area (here, the volume of the respective container up to the upper edge of the containment space may be included), or
2. depending on the total capacity
 - a. up to 100 m³: 10 per cent of the volume
 - b. from 100 m³ to 1,000 m³: 3 per cent of the volume, but at least 10 m³,
 - c. over 1,000 m³: 2 per cent of the volume, but at least 30 m³

of all containers stored in the containment area.

(5) When storing carbon disulphide, the capacity of the containment area must equal the volume of all containers placed inside this area.

(6) Containment areas and draining surfaces not made of fire-retardant or fire-resistant components must be located below the lowest storage level.

(7) Walls of the building limiting the containment area must be fire-resistant (fire resistance rating: at least 90 minutes) at all levels in warehouses; the same applies outdoors for the enclosing walls of the building.

(8) Walls of containment areas may have breaches for pipelines if this does not affect the leak-tightness of the containment area in the event of fire.

(9) The design of drainage surfaces must be such that leaking liquids are drained off to the associated containment area. They must be sufficiently resistant against short-term impacts caused by the stored substance, but this resistance does not have to last for hours or days.

(10) Outdoor containment areas must have installations that can be locked or switched off in order to remove water and must be used for this purpose only. Drainages are generally not permissible. Polluted water shall be treated according to water law provisions.

Literature

Hazardous Substances Ordinance (GefStoffV, Ordinance on protection against hazardous substances)

Technical Rules for Hazardous Substances

TRGS 201 “Classification and labelling for activities involving hazardous substances”

TRGS 400 “Risk assessment for activities involving hazardous substances”

TRGS 511 “Ammonium nitrate”

TRGS 555 “Working instruction and information for workers”

TRGS 720/TRBS 2152 “Hazardous, potentially explosive atmospheres – Assessment of the explosion hazard”

TRGS 800 “Fire protection measures”

CLP Regulation (CLP-Reg, Regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures)

Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances

Directive 1999/45/EC concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations

Industrial Safety Ordinance (BetrSichV, Ordinance on safety and health protection in the provision of work equipment and its use at work, on safety in the operation of plants subject to mandatory inspection and on the organisation of corporate occupational safety and health)

Technical Rules for Workplaces

ASR A1.7 Doors and gates

ASR A2.2 Fire protection measures

ASR A2.3 Escape routes and emergency exits, escape and rescue plan

Second Ordinance on the Explosives Act (2. SprengV)

Industrial Buildings Directive (IndBauRL, Directive on structural fire protection in industrial construction)

Ordinance on installations for the handling of substances hazardous to water and on specialist companies (VAwS)

Transportable Pressure Equipment Ordinance (ODV)

Directive 2010/35/EU on transportable pressure equipment (TPED)

European Agreement concerning the International Carriage of Dangerous Goods by Road – ADR

Fourth Ordinance on the Implementation of the Federal Immission Control Act (4. BImSchV – Ordinance on installations requiring a permit)

Ordinance on the Transport of Dangerous Goods by Road, Rail and Inland Waterways (GGVSEB, Ordinance on the domestic and international transport of dangerous goods by road, rail and inland waterways)

BGV B4 Organic peroxides

BGR 234 Storage facilities and equipment

Annex 1 to TRGS 510: Additional information on risk assessment

- (1) When substances are stored in unsuitable packagings, leakages may occur for instance through corrosion, embrittlement or rupture of the packaging. Moreover, the properties or the chemical composition of the stored substances may change, e.g. when they are exposed to light, heat or humidity as a result of unsuitable packing.
- (2) The storage of larger quantities of substances may entail additional risks as compared to the storage of smaller quantities. In case of fire or leakage, for instance, it may happen that the risks associated with the storage of toxic substances or flammable/inflammable liquids cannot be kept within the storage area, but may spread and substantially affect the neighbourhood and the environment (as a result of noxious gases for example).
- (3) Additional risks arise for humans when substances stored at elevated temperatures are released, come into contact with the skin and release heat while solidifying. A release of the substances into the insulation material produces a larger surface with the risk of lowering the ignition temperature.
- (4) When substances with different hazardous properties are stored together, substances, when released, may mix and thus produce dangerous reactions. By reacting with each other the substances may, for instance, release poisonous gases (e.g. action between acids and cyanide); combustible and oxidizing substances may cause fire and even explosions.
- (5) Releases may entail hazardous reactions between the substance released and the packaging material or the material-handling equipment. For instance, reactions between packaging consisting of combustible material and oxidising substances may cause fires, and a release of corrosive substances may damage other containers, warehouse equipment and even the building.
- (6) Using the wrong fire extinguishing agent when fighting a fire may produce hazardous reactions between the extinguishing agent and the substance itself. Problems may arise when several substances requiring different extinguishing agents are stored together and no extinguishing agent suitable for all these substances is available.
- (7) Special attention should be given to the hazards arising from a possible reaction between the stored substances since possible reactions are not apparent from the classification/labelling.
- (8) Numerous substances are unstable so that the eventual decomposition and decay processes produce reaction products. For other substances there is the risk of decomposition or other chemical reactions when exposed to air, humidity and other foreign matter or excessive storage temperatures. This may release considerable amounts of heat, it may lead to a rise of pressure and produce dangerous substances. Stabilising additives may prevent decomposition and decay reactions of substances. There is no labelling under the Hazardous Substances Ordinance that would indicate a substance's ability to react in the course of decomposition or decay. Such indications are given in the safety data sheet. Under transport law some of these substances or groups of substances have to be marked as being self-reactive/spontaneously combustible.

Annex 2 to TRGS 510: Storage of certain hazardous substances in sales areas and residential premises

This Annex shall apply to the storage of flammable liquids as defined in item 5.1 (1)(7) and of aerosol dispensers and pressurised gas cartridges as defined in item 11 of TRGS 510 in sales areas and residential premises.

1 Storage of flammable liquids

(1) Flammable liquids may be stored in quantities not exceeding the limits specified in Table 1 of this annex. The specified quantities refer to the overall quantities of liquids with the respective classification and not to the individual hazardous substance.

(2) Containers are considered fragile if they are made of glass, porcelain, stoneware or similar materials. Under the provisions for the carriage of dangerous goods they may only be transported as inner containers of combination packagings or composite packagings.

(3) Other containers are made of metallic materials, plastics or other materials that are type tested, approved and marked or are permissible under the dangerous goods regulations for small quantities. The remaining containers count as fragile containers.

Table 1: Storage quantities for flammable liquids in kg

		Extremely flammable (H224), extremely flammable (R12)	Highly flammable (H225), highly flammable (R11)	Flammable (H226 ¹⁾), flammable (R10)
1.	Basements of residential buildings (overall basement) other containers	10		20
2.	Retail sales rooms and storerooms with a floor space of			
2.1	up to 200 m ²	fragile containers	10	20
		other containers	60	120
2.2	200 m ² to 500 m ²	fragile containers	20	40
		other containers	200	400
2.3	over 500 m ²	fragile containers	30	60
		other containers	300	600

- (4) The storage quantities allowed for extremely/highly flammable liquids and flammable liquids can be used cumulatively. Allowed quantities for extremely/highly flammable liquids that are not used may be added on to the quantities allowable for flammable liquids, but not vice versa.
- (5) When flammable liquids in fragile containers are stored together with flammable liquids in other containers, the maximum storage quantities permitted are those relevant for other containers. However, the quantities stored in fragile containers must not exceed the maximum quantities prescribed for containers of this kind.
- (6) It is not allowed to store flammable liquids in
1. dwellings,
 2. rooms which are directly connected to dwellings and which cannot be closed off in a fire resistant way, and
 3. in fragile containers in the basements of residential buildings.
- (7) Containers with flammable liquids must not be displayed for sale near the exits of the sales areas.
- (8) Higher quantities may be stored in storage and sales areas provided these areas are divided into fire compartments and have an automatic fire extinguishing system in place.
- (9) When kept in safety storage cabinets as defined in Annex 3, higher quantities may be stored in sales areas.

2 Storage of aerosol dispensers and pressurised gas cartridges

- (1) In sales areas not more than the quantities of aerosol dispensers and pressurised gas cartridges that are required on one day or needed for displaying the range of products should be present. In storage areas they may not cover more than 20 square metres. In agreement with the authority responsible for fire protection, ground-floor, single-storey supermarkets may store higher quantities of aerosol dispensers and pressurised gas cartridges than those specified in the first sentence.
- (2) Aerosol dispensers and pressurised gas cartridges must not be displayed for sale near the exits of the sales areas.
- (3) Sales areas must have fire extinguishers for Class A, B and C fires with a minimum capacity of 6 kg in the vicinity of each display case for aerosol dispensers and pressurised gas cartridges. The same applies to storage areas.
- (4) Substances that may readily catch fire, such as pyrotechnical items, may not be kept in storage areas and display cases for aerosol dispensers and pressurised gas cartridges.
- (5) Practical demonstrations of open flame devices must not take place in the vicinity of aerosol dispensers or pressurised gas cartridges.
- (6) Filled aerosol dispensers and pressurised gas cartridges must not be placed in shop windows.

Annex 3 to TRGS 510: Storage of flammable liquids in safety cabinets⁶

1 General remarks

- (1) This Annex details the safety requirements of items 4 and 12, as well as Annex 5, for the storage of flammable liquids in safety cabinets.
- (2) Safety cabinets must be designed, installed, operated and maintained in such a way as to guarantee the protection of employees and third persons, particularly against hazards due to a fire or explosion.
- (3) The safety requirements for the design of safety cabinets shall be deemed to have been met if the cabinets at least satisfy the requirements under DIN EN 14470-1 and have a fire resistance rating of at least 90 minutes.
- (4) The fire resistance may be less than 90 minutes, but must be at least 30 minutes, if:
 1. only one cabinet is installed per separate building unit/fire(-fighting) compartment; if the area of the separate building unit/fire(-fighting) compartment is greater than 100 m², one cabinet may be installed per 100 m²; or
 2. the separate building unit/fire(-fighting) compartment is protected by an automatic fire detection system and a plant fire brigade with a response time of at most 5 minutes from the alarm being raised, or an automatic extinguishing system is in place.
- (5) Alternatively, any existing safety cabinets that meet DIN 12925-1 with a fire resistance of 20 minutes may continue to be operated (according to the principle of *Bestandsschutz*, or existing protection).
- (6) Operating instructions for storage in the safety cabinet shall be prepared using the details contained in the manufacturer's information; the employees shall be trained using these instructions. The operating instructions shall also specify the following:
 1. that no other activities, e.g. decanting, may be carried out in the cabinet,
 2. that no contamination may be present on the outside of packaging to be placed in the cabinet,
 3. the protective measures to be taken if potentially explosive atmospheres can be formed in the safety cabinet, in its surroundings or, if applicable, in the ventilation line, and
 4. the measures to be taken after a fire to ensure that, on opening the cabinet, for example, no further danger is present inside.
- (7) Flammable liquids must not be stored in safety cabinets together with hazardous substances that can cause fires to start. This applies, for example, to self-reactive or pyrophoric substances.
- (8) Hazardous substances with ignition temperatures of less than 200 °C (e.g.

⁶ Please refer to Example 2.2.8 in the collection of examples in BGR104 Part 2 for further details.

carbon disulphide) and hazardous substances classified as R12 or H224 may only be stored in ventilated safety cabinets with a fire resistance of at least 90 minutes; in this case, early fire detection and firefighting must be ensured.

2 Ventilation of safety cabinets⁷

2.1 Safety cabinets with technical ventilation systems

(1) The technical ventilation of safety cabinets prevents the development of dangerous explosive atmospheres inside the cabinet during normal operation.

(2) The exhaust air must be carried to a safe place. This is usually achieved by connecting it to an exhaust system that leads to the outdoors.

2.2 Safety cabinets without technical ventilation

(1) Safety cabinets without technical ventilation are supposed to protect the stored substances from inadmissible heating in case of fire and to prevent ignition, if necessary, of any potentially explosive mixtures that occur.

(2) No sources of ignition may be present inside the safety cabinet. If this cannot be ruled out, measures must be taken to avoid sources of ignition based on the risk assessment; these shall at least correspond to Zone 2 as defined in TRBS 2152, Part 3.

(3) The safety cabinets without technical ventilation shall be earthed via equipotential bonding.

⁷ In accordance with TRGS 720 ff. and BGR 104

Annex 4 to TRGS 510:

Methodology for classification of storage classes (classification guidance)

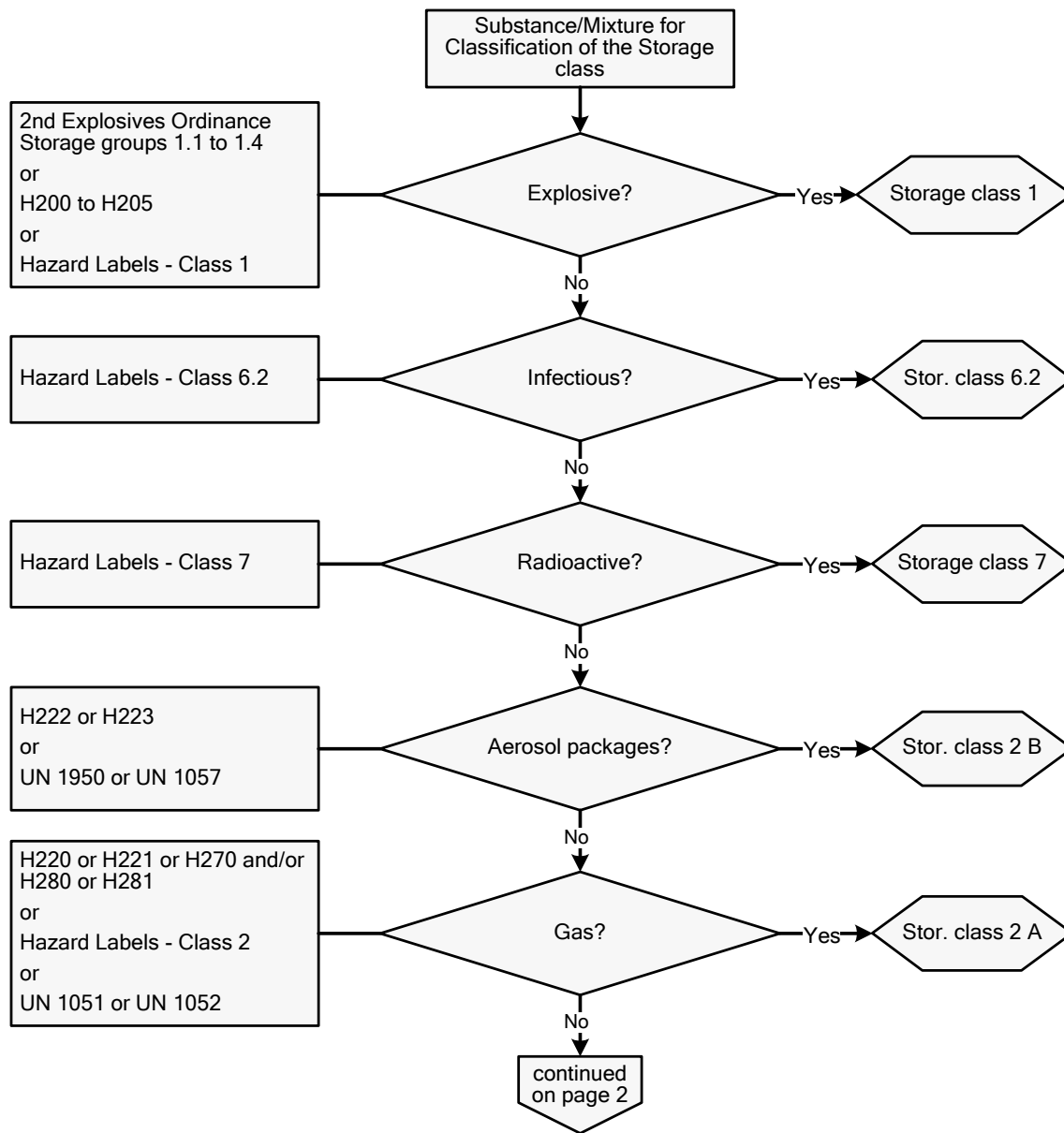
1. The hazardous substances can be divided into storage classes to allow the possibilities for joint storage to be determined. They are used exclusively for the management of joint storage.
2. The definition of storage classes is primarily based on the classification according to Regulation (EC) No. 1272/2008 (CLP Regulation), the Hazardous Substances Ordinance, EC Directives 67/548/EEC and 1999/45/EC and the regulations for the carriage of dangerous goods. Further differentiations based on other legal provisions, the Technical Rules for Hazardous Substances (TRGS) and the general product properties are also taken into account.
3. A hazardous substance is assigned to a storage class using the available information. Such information is derived, in particular, from details in the safety data sheet, the markings specific to the hazardous substance or the markings according to dangerous goods legislation. In the case of hazardous substances that are not marked as dangerous, information from the supplier or knowledge obtained from practical experience can be used.
4. The classification guidance lists the hazard indicators from the marking that govern the classification of the storage class.
5. Hazardous substances are grouped into a storage class if their hazard indicators are deemed to be similar and therefore necessitate similar protective measures.
6. Each hazardous substance shall be classified into one storage class only.
7. The storage class is determined by the first applicable hazard in the flow chart.
8. During the transition period of the CLP Regulation, it is up to the warehouse keeper to decide whether to take account of the present labelling (hazard symbol and R-phrases) or the GHS labelling (pictogram and H-statements) when assigning the storage class.
9. In cases of labelling under the dangerous goods legislation, both the primary hazard and the subsidiary hazards must be taken into account.
10. For the purposes of joint storage, combustible substances are substances to which no physical danger is assigned under the CLP Regulation, but which experience has shown to be combustible or which have a flashpoint or an ignition temperature.
11. Where fire barriers are formed with non-combustible substances/products during joint storage, these substances must be assigned to storage classes 12 or 13.

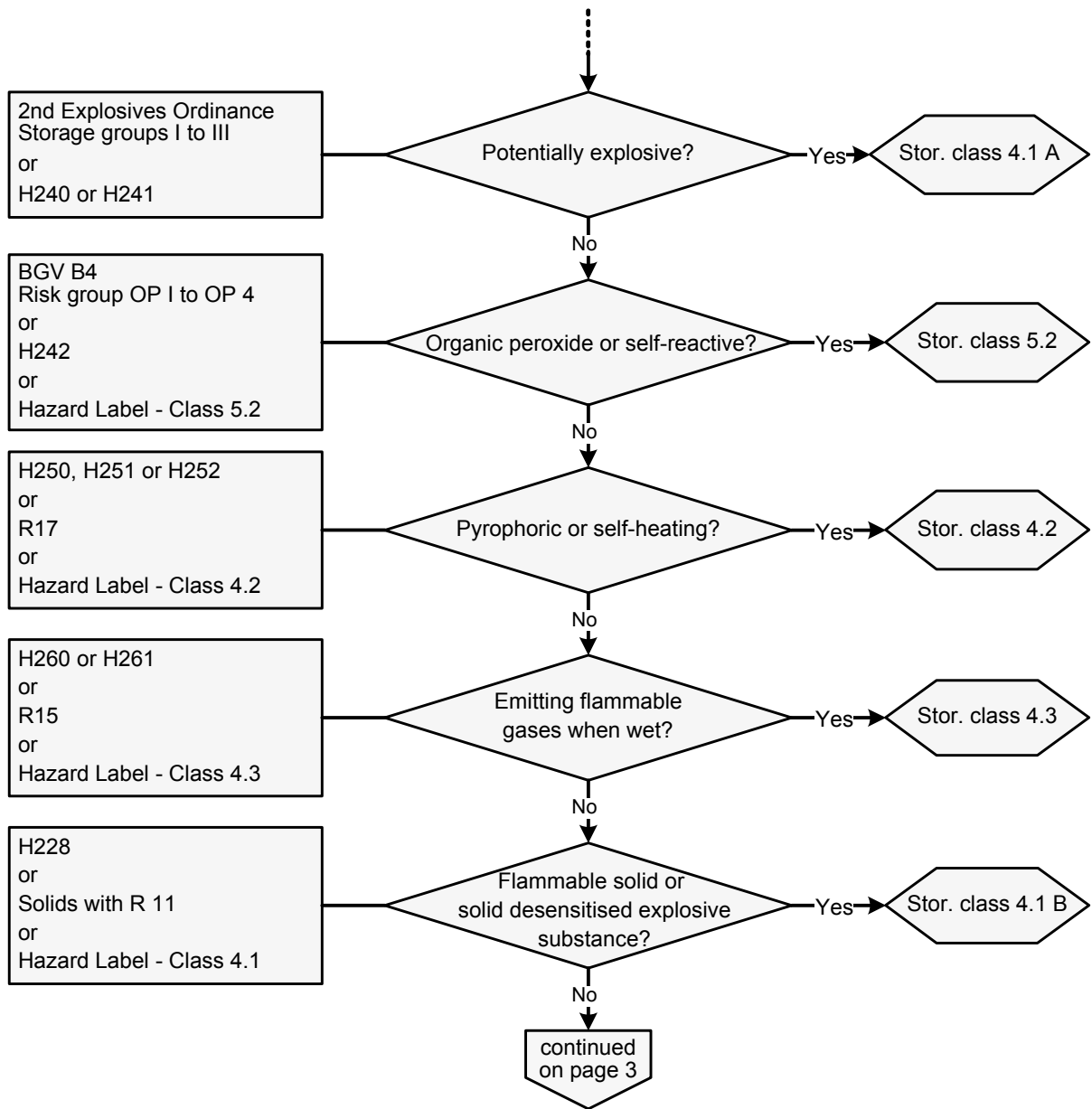
Description of the storage classes:

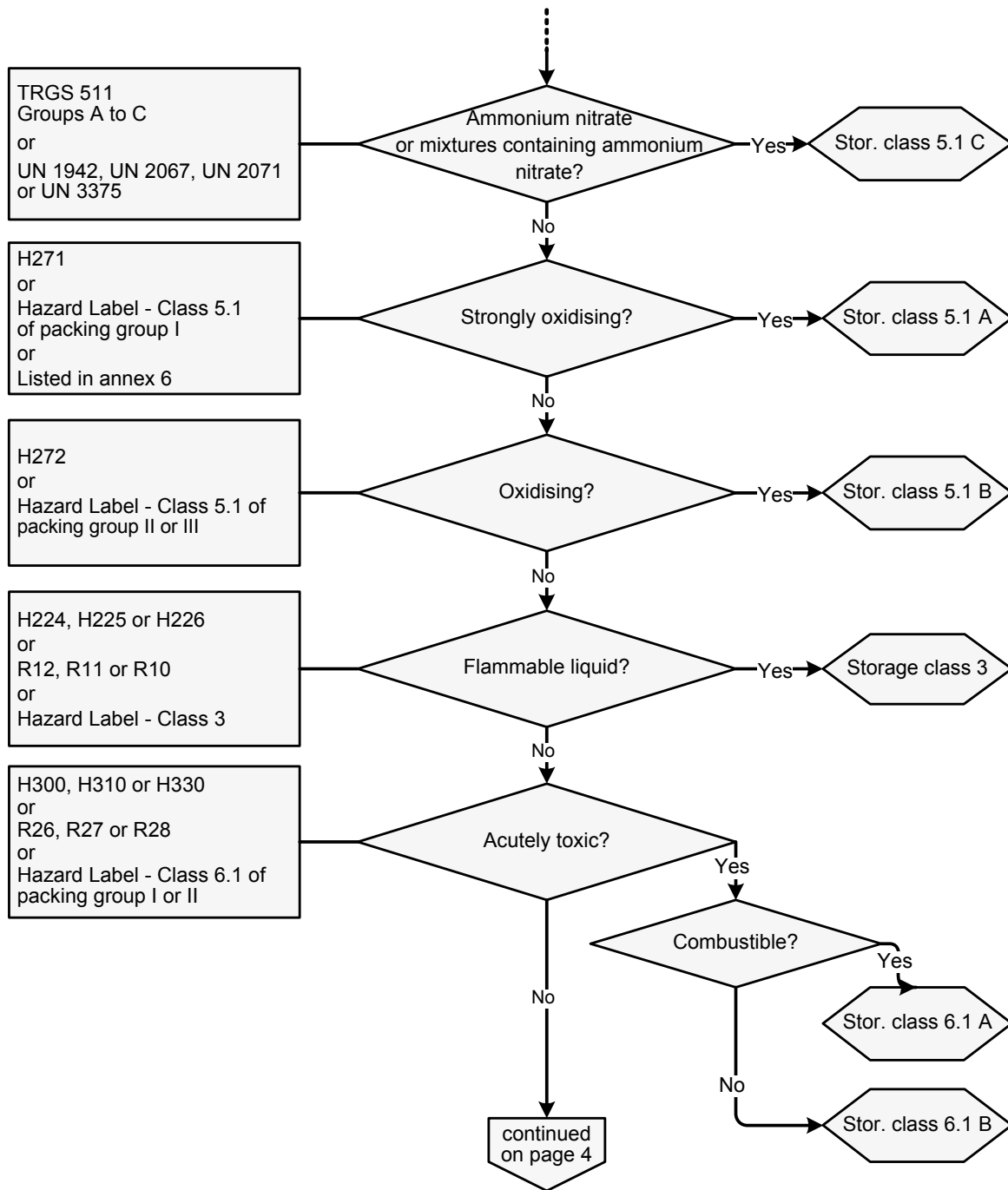
Storage class 1:	Explosive hazardous substances
Storage class 2A:	Gases (except aerosol dispensers and lighters)
Storage class 2B:	Aerosol dispensers and lighters
Storage class 3:	Flammable liquids
Storage class 4.1A:	Other potentially explosive hazardous substances
Storage class 4.1B:	Flammable solids
Storage class 4.2A:	Pyrophoric or self-heating substances
Storage class 4.3:	Hazardous substances that release flammable gases when in contact with water
Storage class 5.1A:	Highly oxidising substances
Storage class 5.1B:	Oxidising substances
Storage class 5.1C:	Ammonium nitrate and preparations containing ammonium nitrate
Storage class 5.2:	Organic peroxides and self-reactive substances
Storage class 6.1A:	Combustible substances of acute toxicity, categories 1 and 2/very toxic substances
Storage class 6.1B:	Non-combustible substances of acute toxicity, categories 1 and 2/very toxic substances
Storage class 6.1C:	Combustible substances of acute toxicity, category 3/hazardous substances that are toxic or produce chronic effects
Storage class 6.1D:	Non-combustible substances of acute toxicity, category 3/hazardous substances that are toxic or produce chronic effects
Storage class 6.2:	Infectious substances
Storage class 7:	Radioactive substances
Storage class 8A:	Combustible corrosive substances
Storage class 8B:	Non-combustible corrosive substances
Storage class 9:	no classification
Storage class 10:	Combustible liquids that cannot be assigned to any of the above storage classes

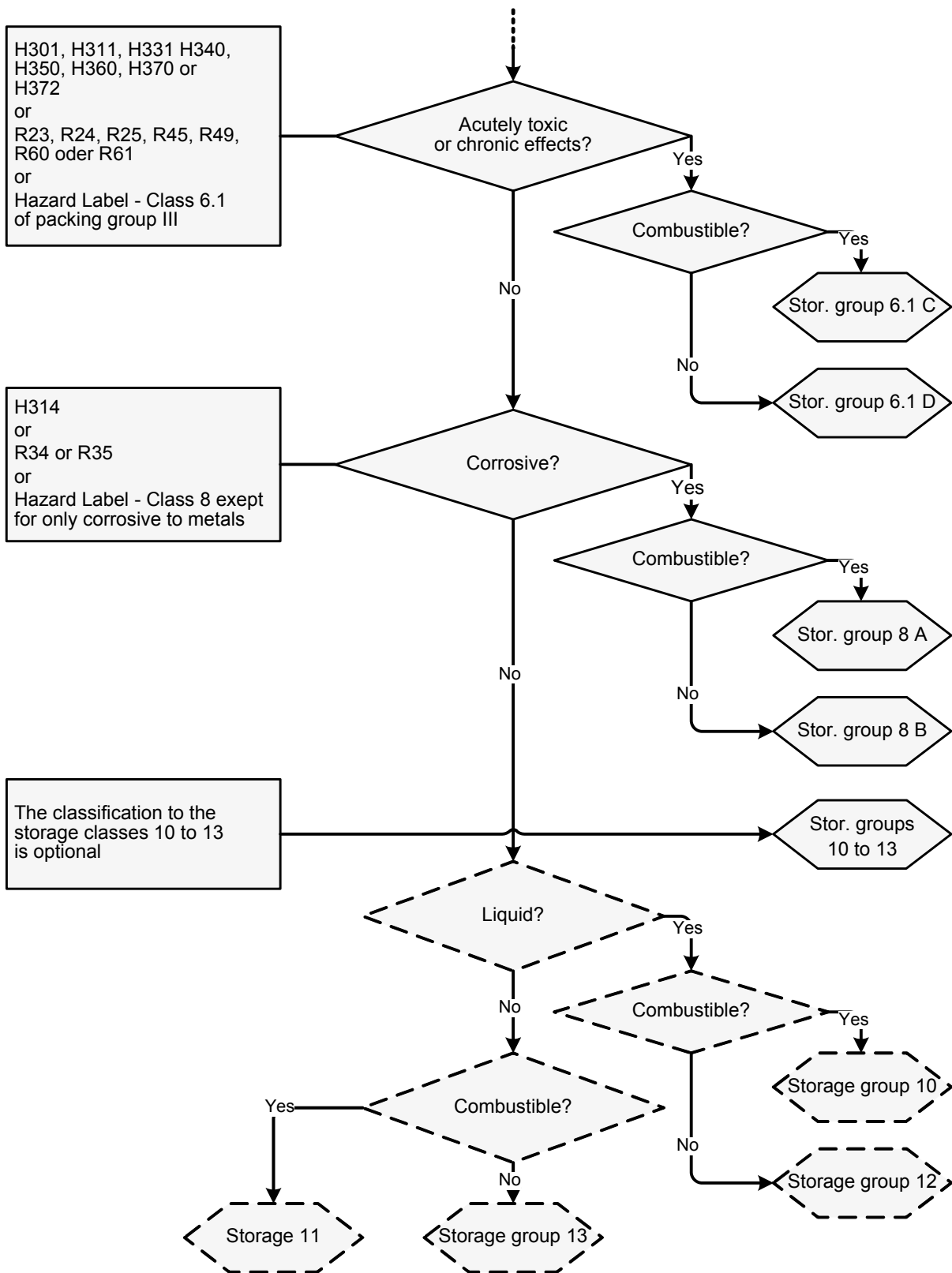
- Storage class 11: Combustible solids that cannot be assigned to any of the above storage classes
- Storage class 12: Non-combustible liquids that cannot be assigned to any of the above storage classes
- Storage class 13: Non-combustible solids that cannot be assigned to any of the above storage classes

Procedure for assigning storage classes:









Additional information:

(1) Self-reactive substances of hazard class 4.1 have properties comparable to those of the organic peroxides in storage class 4.1A or storage class 5.2 and must therefore likewise be assigned to these classes rather than to storage class 4.1B. Hazardous Substances of class 4.1 according to the dangerous goods legislation and which are not, for example, classified with R11 or H228 require a case-by-case analysis (for example sulphur, naphthalene, paraformaldehyde).

(2) Storage class 9 is empty.

(3) All liquids that are not assigned to one of the storage classes 1 to 8 are assigned to storage class 10 (flammable liquids).

(4) Storage class 11 (flammable solids) covers solids that experience has shown to be combustible. Combustibility may also be determined by the assignment of a combustion class of 2, 3, 4 or 5 (at room temperature) as defined in VDI 2263 Part 1.

Examples:

Combustion class 2: Tartaric acid

Combustion class 3: Lactose

Combustion class 4: Tobacco

Combustion class 5: Metamizole

(5) Storage class 12 (non-combustible liquids) includes:

1. liquid preparations containing ammonium nitrate in subgroups D I and D II of Annex I (5) to the Hazardous Goods Ordinance,
2. liquids that are not combustible or with a low ignition tendency.

(6) Storage class 13 (non-combustible solids) includes solids that experience has shown not to be combustible and that do not meet the criteria of storage class 11. Combustion class 1 is assigned to substances such as table salt that do not burn in the determination according to VDI 2263 Part 1.

(7) Storage classes 10 to 13 primarily relate to liquids and solids that do not require labelling under the dangerous goods legislation. They may also cover hazardous substances that are marked with the hazard symbols Xn, harmful; Xi, irritant; or N, dangerous to the environment, as well as solids or liquids classified as class 9 according to the dangerous goods legislation.

(8) The storage classes 10 to 13 can be summarised and then treated according to the joint-storage rules for storage class 11.

Annex 5 to TRGS 510: Special fire- and explosion-protection measures for the storage of flammable liquids⁸

1 General

(1) Measures shall be taken to largely rule out the occurrence of hazardous, potentially explosive atmospheres. If local or operating conditions mean that the occurrence of such atmospheres cannot be prevented, areas subject to an explosion hazard must be defined and divided into zones; corresponding measures must then be taken to prevent the ignition of potentially explosive atmospheres pursuant to TRBS 2152 Part 3 and to limit the effects of an explosion pursuant to TRBS 2152 Part 4.

(2) Warehouses according to number 12.3 (1) that do not otherwise satisfy any fire-protection requirements (e.g. fire resistance rating of at least 30 minutes) and that simply act as weatherproofing (profiled sheet metal) shall be equivalent to outdoor storage with regard to protection against reciprocal exposure to fire. Ventilation and explosion-protection measures shall be defined and implemented for such storage areas in accordance with number 2 of this annex, unless the requirements for outdoor storage areas under number 2 (5) of TRGS 510 are met.

2 Storage rooms

(1) Storage rooms must have adequate ventilation to prevent the formation of hazardous explosive atmospheres. Ventilation must be effective near the floor level.⁹

(2) In storage rooms for flammable liquids in containers with a volume of up to 1,000 litres:

1. at least 0.4 air changes per hour are required when the room volume is 100 m³ or less; the entire room is classified as Zone 2¹⁰,
2. at least 0.4 air changes per hour are required when the room volume is above 100 m³; Zone 2 applies up to a height of 1.5 metres above the floor,
3. no potentially explosive atmosphere needs to be identified if the storage room has a fixed gas detection system as provided for in paragraph 9 which immediately increases the ventilation rate to 2 air changes per hour in a hazard situation,
4. when the room volume is above 100 m³, at least 2 air changes per hour are required when no potentially explosive atmosphere was identified.

In storage rooms according to items 3 and 4, any fixed apparatus up to a height of 0.8 m above ground level must, moreover, conform to equipment category 3 G as defined in Directive 94/9/EC¹¹. In derogation of subparagraphs 3 and 4, storage

⁸ Please refer to the collection of examples in BGR 104 for further details.

⁹ Please refer to TRGS 722/TRBS 2152 Part 2 No. 2.4.4 for further details on ventilation measures.

¹⁰ Please refer to TRBS 2152 for the definition and zoning of potentially explosive atmospheres.

¹¹ TRBS 2152, Part 3, item 5.1 (3) applies to the selection of equipment for use in potentially explosive

rooms shall be zone 2 up to a height of 1.5 m when storing flammable liquids of temperature classes T5 and T6 and diethyl ether; the requirement according to sentence 2 shall apply to these storage rooms accordingly.

(3) The necessary measures with regard to explosion protection can be determined through zoning. If storage takes place only in closed, technical tight containers and if no activities pursuant to number 1 (4) (2) are carried out, the storage area can be classified as Zone 2.

(4) If activities pursuant to number 1 (4) (2) are also carried out in warehouses, air-change rates must be determined within the risk assessment. If filling or decanting activities take place additionally in the warehouse, the employer can assume that an air-change rate of at least 5 per hour is necessary, unless divergent determinations have been made in the risk assessment.

(5) Storage rooms for the storage of flammable liquids in containers with a capacity of up to 1,000 litres, in which

1. pure liquids with a flash point above 35 °C or
2. mixtures with a flash point above 45 °C

are stored are, by derogation from paragraphs 2 and 3, not considered to be a potentially explosive atmosphere unless the liquids can heat to temperatures above 30 °C during storage. In derogation from paragraphs 2 and 3 such storage rooms do not require ventilation for explosion protection purposes.

(6) Ventilation provided for in paragraph 2 can take the form of natural or technical ventilation. Storage rooms requiring at least 5 air changes per hour have to be equipped with technical ventilation. In storage rooms with at least 2 air changes per hour according to paragraphs 2 or 3, the effectiveness of the ventilation has to be monitored (e.g. by means of a flow rate indicator).

(7) In storage rooms as defined in paragraph 2 (1) or (2) the use of equipment of category 3 is not imperative in derogation from paragraph 12, provided that any inappropriate equipment is shut down and any sources of ignition are eliminated as soon as the fixed gas detection system reports a hazardous condition. Notwithstanding sentence 1, any fixed equipment within a height of 0.8 m above ground level must conform to at least equipment category 3.

(8) Notwithstanding paragraph 2 (1) and (2), storage rooms are not considered to be a potentially explosive atmosphere when the containers are stored in such a way that

1. the test drop height is not exceeded, and
2. it is not possible for industrial trucks used for stacking to damage containers (e.g. by walk behind trucks, special track attachments such as drum grabs) and that no unintended releases are to be expected.

(9) Potentially explosive areas have to be identified in adjoining rooms or units with

atmospheres. As provided for in Directive 94/9/EC, the instructions supplied by the manufacturers of the equipment, the safety, controlling and regulating devices have to be taken particularly into account in this context.

openings that connect or may connect them to areas with potentially explosive atmospheres.

(10) It must be verified that the gas detection systems according to paragraph 2 (3) and paragraph 6 detect the formation of explosive atmospheres early and reliably. Gas detection systems ¹² must conform to TRGS 722/TRBS 2152, Part 2, item 2.5 ¹³.

(11) Where areas that might have explosive atmospheres are identified even outside of the storage rooms, premises must be available for implementing the required protection measures.

(12) The provisions of TRBS 2152, Part 3, item 5.1 (3) must be respected in the selection of equipment for use in potentially explosive atmospheres. Particularly the instructions supplied by the manufacturer of the equipment and the safety, controlling and regulating devices according to Directive 94/9/EC must be taken into account in this context. Reference is made to paragraphs 3 and 7.

3 Outdoor storage

(1) When storing flammable liquids outdoors in containers allowable under the dangerous goods legislation, the containment areas and the pertinent discharge areas are considered to be Zone 2 up to a height of 0.2 metre above their upper edge.

(2) The area outside an outdoor containment area is considered to be Zone 2 up to a height of 0.2 metre above ground level and up to a distance of 2 metres from the containment area.

(3) If no outdoor containment area is required, the area within a distance of 2 metres from non-stationary containers and up to a height of 0.2 metre above ground level is considered to be Zone 2.

(4) When selecting equipment for use in potentially explosive atmospheres the provisions of TRBS 2152, Part 3, item 5.1 (3) have to be respected.

(5) Notwithstanding paragraphs (1) and (2), outdoor storage areas are not considered to be potentially explosive atmospheres when the containers are stored in such a way that

1. the test drop height is not exceeded, and
2. it is not possible for industrial trucks used for stacking to damage containers (e.g. by using walk behind trucks with special track attachments such as drum grabs).

(6) Where areas that might have explosive atmospheres are identified even outside of the storage rooms, premises must be available for implementing the required protection measures.

¹² Reference is made to EN 50073

¹³ Gas detection systems that comply with the safety requirements and show the "properties required for fixed gas detection systems to protect against explosions" while satisfying the "principles for testing the functioning of fixed gas detection systems to protect against explosions" are suitable for these purposes.

4 Special fire-protection measures for outdoor storage

(1) To prevent fire interaction between non-stationary containers stored outdoors and plants and buildings in the vicinity, containers must be located at a safe distance beyond a separation strip defined on the basis of the type of containers and the quantity and class of the liquids stored. Separation strips are areas that are intended to protect the storage area from external ignition hazards.

(2) Non-stationary containers must be located at least 10 metres away from buildings. When the storage quantity does not exceed 200 kg in total, a distance of 3 m is sufficient; when the total storage quantity is more than 200 kg and less than 1,000 kg, a distance of 5 m to the next building is sufficient.

(3) Safety distances provided for in paragraphs 1 and 2 are not required if:

1. the external walls of the buildings facing the containers, including any openings, are fire-resistant up to a height of 10 metres above the upper edge of the pile of containers and up to a distance of 5 metres from both sides of the containment area (e.g. fire-resistance rating of at least 90 min), or
2. when there are fire separation elements of sufficient height and width between the building and the pile of containers rather than fire-resistant external walls, or
3. when adjacent plants or buildings are included in a common fire control concept developed in coordination with the fire authorities that permits reduced safety distances.

(4) Paragraphs 2 and 3 shall apply accordingly to the storage of empty, uncleaned transport containers; here, it is assumed that the residual material/contents in the container amount to less than 0.5 % of its volume, and 0.5 % of the container's volume is taken as the basis for determining the storage quantity.

(5) Pursuant to item 12 (3) of these technical rules, the determination of the necessity of a separation strip is based on the contents of the containers that might be present in a containment area. For the purposes of determining whether separation strips are required, directly adjacent containment areas for non-stationary containers are considered as one containment area unless structural fire protection measures prevent an interaction of containment areas in case of fire. This is for instance the case when the distance between adjacent containment areas is less than 10 metres.

(6) Adjacent containment areas must be surrounded by one common separation strip whenever the separation strip for one of the containment areas would stretch to an adjacent containment area for non-stationary containers which in itself would not need to have a separation strip.

(7) Notwithstanding the provisions of paragraph 6 a common separation strip is not required in those cases where adjacent containment areas are separated by a fire-resistant wall of adequate dimensions.

(8) Enough land must be available to comply with the requirements for separation strips. Unless the operator of the facility has enough company-owned land to accommodate the separation strips, he or she must make contractual arrangements to ensure that the applicable requirements are met. Separation strips may cover lakes, rivers and canals as well as non-public railway tracks and roads.

(9) The dimensions of the separation strip are based on the overall volume that may be present in a containment area. The following chart shows the relevant data. For the determination of the storage quantity for emptied containers, it is assumed that the residual material/contents of these containers amount to less than 0.5 % of the container's volume; 0.5 % of the container's volume is therefore taken as the basis for determining the storage quantity.

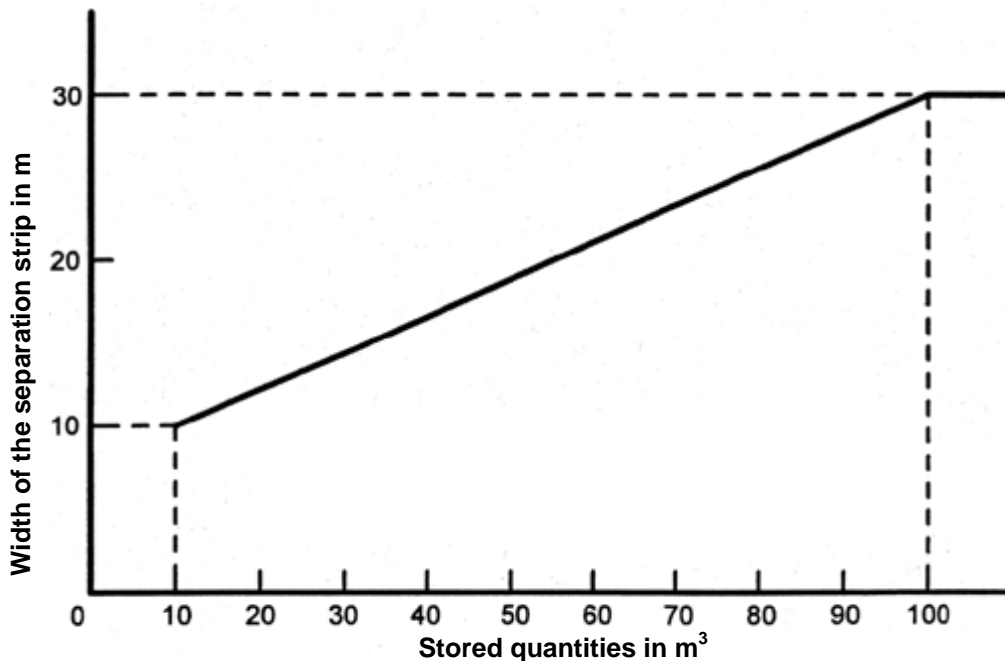


Chart showing the required dimensions of separation strips

(10) In derogation from paragraph 8, the separation strip may end at fire-resistant walls (e.g. with a fire-resistance rating of at least 90 minutes) or embankments of sufficient height and length. These walls or embankments may, in part or in full, be identical with the walls or embankments of the containment area.

(11) The separation strips must be kept free of any substances which, due to their nature or quantity, could enhance the risk or spread of fire. The substances mentioned in the first sentence do not include flammable liquids in non-stationary containers including their packaging and/or material handling and transportation equipment (such as pallets, shrink wrap, secondary packaging).

**Annex 6 to TRGS 510:
Other strongly oxidising or highly reactive substances**

Annex 6 lists strongly oxidising or highly reactive substances that are not classified as oxidising liquids or solids of category 1, marked with H271, or in packing group I of class 5.1 under the dangerous goods legislation.

Note:

The substances to be listed are defined according to property criteria that are yet to be defined. Until this definition is in place, Annex 6 shall contain no substances.