



Expert Information

HazMat Guide ***FLAMMABLES***

Edition 2.0



► ***The Ultimate Flammable
Storage Guide***



»» "Lack of awareness is still the root cause of fire-related accidents at the workplace".

Sascha Kunkel, Vice President, Global Business Development

INTRODUCTION

This is the second edition of the asecos HazMat Guide series for flammables. We have collected information from many sources and added our own content to make this an aid to help designing the safest possible workplace. This edition puts special focus on flammable storage. Look out for future HazMat Guide releases, specializing in corrosive storage, gas cylinder storage and more.

All HazMat Guides will be regularly reviewed and revised. We would be happy to receive your feedback, ideas or critiques and invite you to help us making this guide a valuable source of information in the industry. Feel free to send an email to academy@asecos.com

You will find that we sometimes refer to the German regulations (whenever we could not find an international source). Before applying this advice make sure to double-check with your local legislation and regulations. When in doubt you can always get in touch with one of our local agents or distributors. If nothing is available the German regulations might serve you as best-practice examples.

At the end of each chapter you will find „**take away pages**“, that conveniently summarize the most important elements.



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IT CAN HAPPEN TO ANYONE

Many different dangers exist when handling hazardous materials.

The use of hazardous and combustible materials is part of the daily routine in most laboratories and industries and is unavoidable. What is often quickly forgotten in daily handling: the improper storage of such materials puts people, the environment and property in danger.

- **Fires and explosions** caused, for example, by the improper storage of combustible liquids
- **Pollution of soil, groundwater and surface water**, for example, by contaminated fire fighting water or leakages
- **Downtimes**, for example, due to laboratories destroyed by fires
- **Endangerment to human life**

Hazardous materials are therefore always very much a current topic for every laboratory and industry.

Apart from the proper handling of these health-endangering substances, strict storage regulations must be observed.

The legal basis concerning the handling of hazardous materials is defined

- in global regulations (e.g. GHS – globally harmonised system)
- in directives and guidelines of state confederations (e.g. the European Union)
- and finally in rules and laws of individual countries

- ▶ ***Do you know the legislation for handling hazardous materials in your country?***
- ▶ ***Do you apply these rules wherever and whenever necessary?***
- ▶ ***Do you already use appropriate storage facilities with the highest protection level?***

Only if you have answered ‘Yes’ to all these questions can you stay safe!

The experts of asecos will be happy to assist you with all regulatory affairs in the field of hazardous material storage. Just get in touch with us.

1

HAZARDOUS MATERIALS

Terms & Definitions



1.1 WHAT ARE HAZARDOUS MATERIALS?

Hazardous materials are materials with the following properties:

- ▶ highly toxic
- ▶ toxic
- ▶ hazardous to health
- ▶ corrosive
- ▶ irritant
- ▶ sensitising
- ▶ oxidising
- ▶ explosive
- ▶ extremely flammable
- ▶ highly flammable
- ▶ flammable
- ▶ carcinogenic
- ▶ reprotoxic
- ▶ mutagenic
- ▶ dangerous for the environment
- ▶ releasing hazardous materials when handled
- ▶ chronically harmful in any other way

These terms can be explained as follows:

HIGHLY TOXIC	materials which can cause temporary or permanent damage to health or even death, even in very small quantities e.g. hydrogen cyanide, phosgene.
TOXIC	materials which can cause temporary or permanent damage to health or even death in small quantities e.g. methanol, chlorine.
HAZARDOUS TO HEALTH	materials which can cause temporary or permanent damage to health or even death, e.g. glycol, iodine.
CORROSIVE	are materials, which can cause destruction of body tissue upon contact with the skin or mucous membranes, e. g. hydrochloric acid above 25 %, sodium hydroxide above 2 %.
IRRITANT	materials which can cause inflammation upon contact with the skin or mucous membranes, e.g. hydrochloric acid between 10 and 25%, sodium hydroxide between 0.5 and 2%.

SENSITISING	materials which may cause hypersensitive reactions when inhaled or absorbed through the skin, e.g. cobalt, nickel, various diisocyanates.
OXIDISING	materials which can maintain a fire without air supply, e.g. sodium chlorate, sodium peroxide, nitric acid above 70%.
EXPLOSIVE	materials which can be brought to explode e.g. due to heat, friction, impact or initial ignition, e.g. nitroglycerine, dynamite, TNT.
EXTREMELY FLAMMABLE	gases or materials whose vapours form potentially explosive mixtures with the surrounding air and which are extremely flammable in the presence of an ignition source; with a flash point - below 0 °C and boiling point below 35 °C, e.g. acetylene, hydrogen, diethyl ether.
HIGHLY FLAMMABLE	materials whose vapours form potentially explosive mixtures with the surrounding air and which are highly flammable in the presence of an ignition source; with a flash point below 23 °C, e.g. acetone, petrol.
FLAMMABLE	materials whose vapours form potentially explosive mixtures with the surrounding air and which are flammable in the presence of an ignition source; with a flash point between 23 °C and 60 °C, e.g. styrene, turpentine oil.
CARCINOGENIC	a material which can prompt the body's own cells to form carcinomas e.g. asbestos, benzene.
REPROTOXIC	materials which cause non-heritable damage to the progeny or increase their frequency and/or which may cause an impairment of the male or female reproduction functions or capability e.g. benzo[a]pyrene, 2-ethoxyethanol.
MUTAGENIC	materials which may cause heritable genetic damage, e.g. acrylamide, diethyl sulphate, ethylene oxide.
DANGEROUS FOR THE ENVIRONMENT	materials which may damage animals, plants, microorganisms, climate, air, water or soil, e.g. diesel fuel, mercury, dichlorofluoroethane.

During the manufacture or use of materials, hazardous materials may arise or be released, e.g. welding electrodes.

Other chronically harmful materials can cause damage to health when repeated or longer exposure occurs.

1.2 HOW CAN HAZARDOUS MATERIALS BE IDENTIFIED?

Hazardous materials must be marked with hazard pictograms. In order to standardise the labelling of hazardous materials, previously different worldwide, the Globally Harmonised System (GHS) was introduced by the CLP regulation of the EU with a transitional period from 1st December 2010 for materials and from 1st June 2015 for mixtures.

During this period, both the valid orange symbols and the new red and white GHS pictograms will be seen. The allocation of the hazards partly change, as different labelling systems from different countries have to be standardised.

Instead of the previously used R codes, H codes are now used for the type and severity of the hazard, and P codes replace the S codes for the provision of safety information. Advantage: The new codes are more specific than their predecessors.



GHS/CLP

GefStoffV

(German Ordinance on
Hazardous Substances)

	Explosive		Explosive
	Compressed gases		Non-existent
	Flammable Category 1 Flammable Category 2 Flammable Category 3		Extremely flammable Highly flammable Flammable
	Oxidising Category 1, 2, 3		Oxidising
	Acute toxicity Category 1 Acute toxicity Category 2 Acute toxicity Category 3		Very toxic Very toxic resp. toxic Toxic resp. harmful
	Corrosive Category 1		Corrosive
	Acute toxicity Category 4 Corrosive Category 2 Skin irritant Specific target organ toxicity Category 3		Harmful Irritant Non-existent Non-existent
	CRM* Category 1A, 1B, 2 Respiratory sensitization Specific target organ toxicity Category 1, 2		Non-existent
	Environmental pollutant Hazardous to the aquatic environment Damaging to the ozone layer		Dangerous to the environment

CMR*: C = carcinogenic, M = mutagenic, R = toxic to reproduction

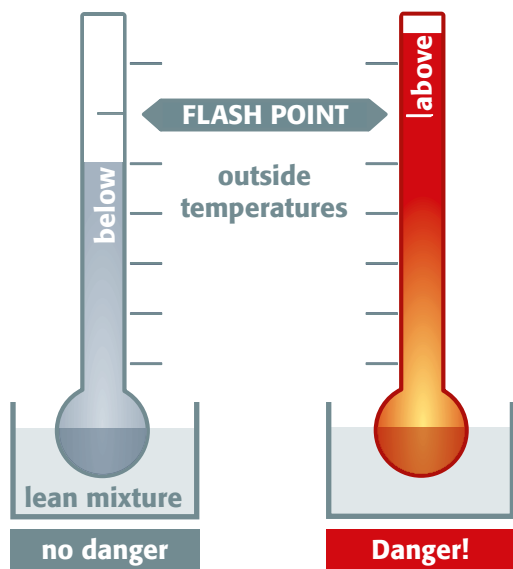
1.3 CLASSIFICATION, TERMS AND DEFINITIONS OF FLAMMABLE LIQUIDS

Definition Flash point:

The temperature at which enough vapour escapes from a liquid that an ignitable mixture is created with the ambient air (EN 1127-1).

Classification and characteristics of flammable liquids

Classification and labelling of flammable liquids depends on the flash point of the liquid.



FLAMMABLE LIQUIDS

Liquids with a flash point equal to or greater than 23 °C (73.4 °F) and less than or equal to 60 °C (140 °F) and which support combustion when tested at 60 °C (140 °F).

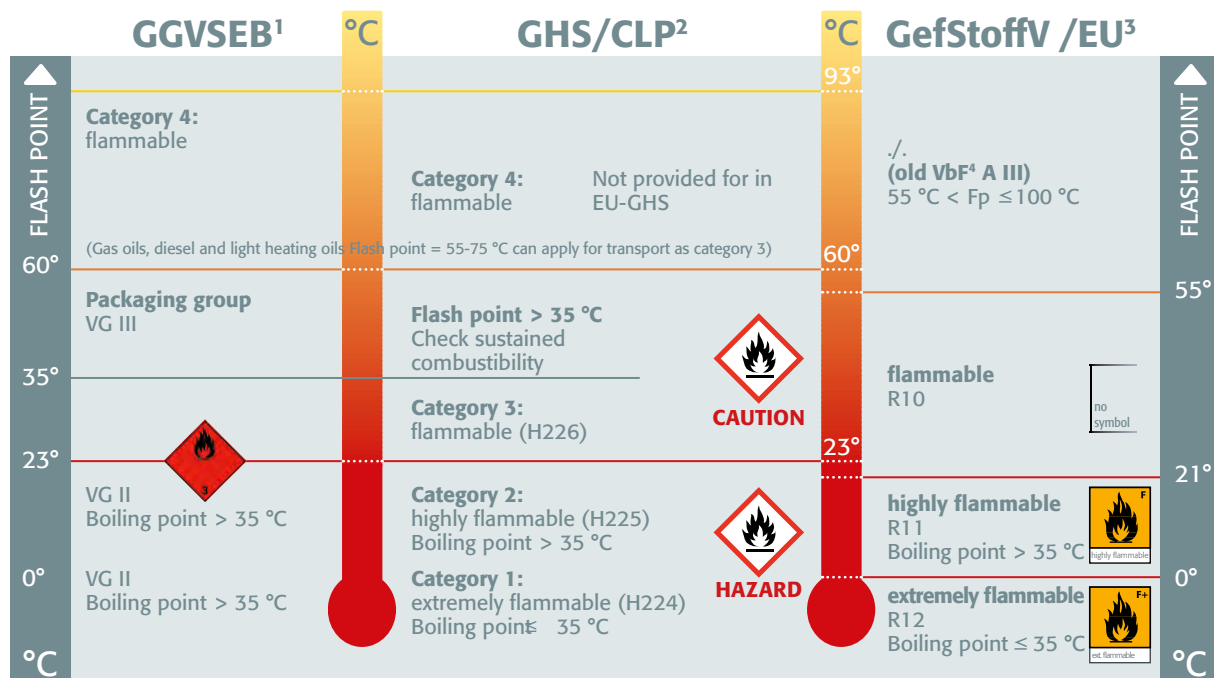
HIGHLY FLAMMABLE LIQUIDS

Liquids with a flash point lower than 23 °C (73.4 °F) and with a boiling point higher than 35 °C (95 °F).


EXTREMELY FLAMMABLE LIQUIDS

Liquids with a flash point lower than 0 °C (32 °F) and with a boiling point lower than or equal to 35 °C (95 °F).

Different classification criteria apply for various sets of rules



Different classification criteria apply for various sets of rules

Hazard class / pictogram	Hazard Category	Signal Word	H Code
Flammable liquids 	Category 1	Hazard	H 224
	Category 2	Hazard	H 225
	Category 2	Caution	H 226

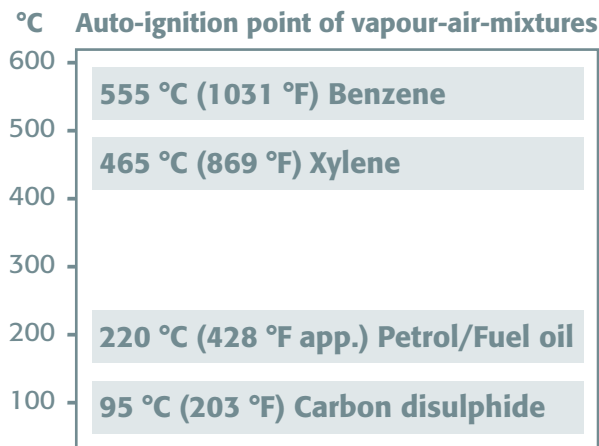
^{1/2/3/4} See page 91

Definition of auto-ignition point and explosion limits

The ignition temperature and explosion limits are also other important parameters for flammable liquids.

Auto-ignition point

The auto-ignition point is defined as the lowest temperature at which vapours, from a flammable liquid in contact with air or a hot object, ignite themselves. Many widely used chemicals (e.g. Petrol) have an auto-ignition point of 220 °C (428 °F) or greater.



Explosion limits

Explosion limits are the minimum or maximum concentration levels of vapor of a flammable or combustible material (expressed as percent by volume in air) at which an explosion will occur in a confined area if an ignition source is present.

No explosion can occur in the presence of very low or very high concentrations.



Examples of explosion limits

Substance	LEL in Vol.-%	UEL in Vol.-%
Hydrogen	4	75
Propane	2.1	9.5 - 10.1
Methane	4.4 - 5	15 - 17
Ethanol	3 - 3.3	19
Silane	1.5	98

Furthermore, the sustained combustibility plays an important role for flammable liquids with a flash point > 35 °C (95 °F).

Sustained combustibility

In order to rule out that a substance is to be classified at all as a “flammable liquid”, in accordance with the laws governing hazardous substances and dangerous goods, it must be checked to see whether the substance in question independently maintains combustion at a defined temperature (**UN Manual of Tests and Criteria Part III, Subsection 32.5.2.**). If the test substance ceases to burn after ignition, it is not to be classified as a flammable liquid.

Fire triangle – Three requirements for an explosion

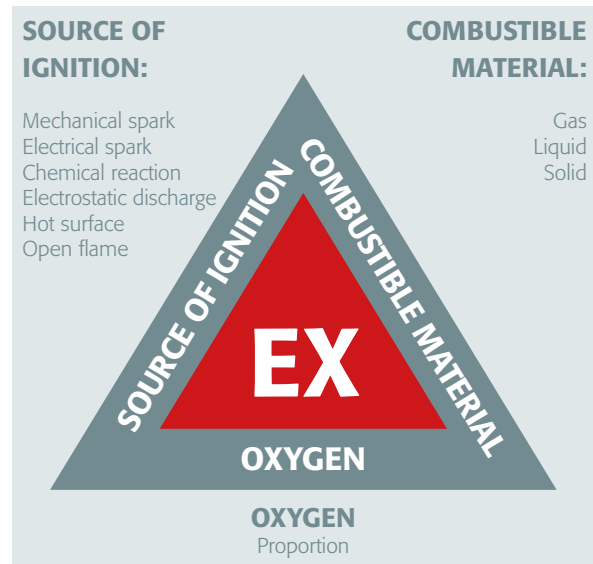
The basis for the handling of hazardous materials is knowledge of the fire triangle. This illustrates in a clear way that a fire or an explosion is only possible if three conditions are fulfilled:

Ignition source (e.g. mechanical or electrical spark, chemical reaction, electrostatic discharge, hot surface, open flame ...)

Combustible substance (e.g. gases, liquids, solids)

Oxygen (the correct mixing ratio of combustible material and oxygen)

To prevent explosions it must be made sure that at least one of the three requirements can be excluded.



1.4 MEASURES FOR THE PROTECTION OF EMPLOYEES

Substitution of hazardous materials

The rule of substitution generally applies: the substitution of hazardous materials with non-hazardous or less hazardous ones is the best way to avoid the risk of damage caused by hazardous materials.

Many hazardous materials cannot be replaced or cannot yet be replaced or turned into less hazardous forms of use. Therefore, technical measures for the protection against the influences of hazardous materials need to be predominantly taken.

Substitution of hazardous materials

Technical measures are based on the following principles

- ▶ Avoidance of the escape of hazardous materials
- ▶ Extraction, preferably at their point of origin

Organisational measures

Organisational regulations are intended to ensure that; no more employees are exposed to hazardous materials than absolutely necessary and they know and adhere to the necessary and stipulated protective measures for handling these materials.



Organisational measures are:

- ▶ the determination of tasks and responsibilities,
- ▶ the selection and deployment of suitable employees,
- ▶ the implementation and monitoring of the regulations,
- ▶ the procurement of information regarding hazardous materials,
- ▶ the preparation of operating instructions with the following emphasis:
 - Designation of the hazardous material
 - Danger for persons and environment
 - Protective measures and codes of conduct
 - Behaviour in case of danger
 - First aid
 - Proper disposal
- ▶ Regular staff training
- ▶ Check the concentration of hazardous substances in the work area,
- ▶ Check technical facilities and personal protective equipment.

Personal protective measures

If technical and organisational measures are not sufficient to ensure protection against hazardous materials, personal protective equipment must also be provided by the company, and must be used by the employees in compliance with the operating instructions. The following personal protective equipment is recommended, depending on the parts of the body that are endangered:

- ▶ Protective clothing
- ▶ Protective gloves
- ▶ Protective footwear
- ▶ Eye, face and head protection
- ▶ Respiratory protection

The safe handling of hazardous materials is one of the most important tasks for the protection of the health of a company's employees.

The employer has many obligations. He must determine the potential hazard of the respective materials applied, specify the necessary work procedures and take suitable protective measures to safeguard the employees from health risks and protect the environment from damage caused by the use of these materials.

But nothing has ever happened so far...

"Life long experience has shown that one has to face the possibility of an outbreak of a fire at any time. The fact that in most buildings there was no outbreak of a fire for decades is no proof that this danger does not exist. It is rather long-lasting luck which could end at anytime."

Quote of a decision of the higher administrative court in Münster, Germany, Az.: 10 A 363/86, 11.12.87



1.5 CONSEQUENCES OF IMPROPER STORAGE

... Improper storage of hazardous materials



... and possible consequences!



FIRE DRILL OR REAL FIRE — WHERE IS THE DIFFERENCE?





Important considerations



Smoke Emission

Quickly spreads through air flow and doors causing;

- reduced orientation.
- respiratory problems, smoke intoxication, fainting and panic.



Risk of Explosion

Huge potential of explosion through the storage of flammable liquids and compressed gases not being stored in fire resistant cabinets.



Elevator

Cannot be used in the event of a fire;

- leaving staircases as the only means of escape from upper floors.
- requires additional time for the evacuation of injured and disabled persons.



Emergency Exits

- may be difficult to locate owing to smoke emission.
- may be inaccessible due to obstruction from emission or other objects sited incorrectly.



Irrational Behavior

People are desperate to avoid dangerous situations and leave as fast as possible. These actions can increase their exposure to extreme hazards, which can be enhanced;

- by the use of sprinkler system creating wet floors and increased slip hazards.
- by tripping or falling on unsighted objects leading to severe injuries.

CONCLUSION

Real evacuation times can be considerably higher than fire drills suggest.

1.6 CHAPTER I – TAKE AWAYS:

- The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) was designed to replace the many different and sometimes contradicting classification and labelling standards used in different countries by introducing a consistent criteria on a global level – this was a milestone in the field of work safety and health protection.
- Whenever you see a GHS symbol on a can, container or bottle, special care is required when storing and handling.
- Flammable substances create one of the biggest potential dangers amongst all hazardous substances.
- Flammable liquids are less dangerous in handling than highly or extremely flammable liquids. But there is NO difference between the 3 types when storing them. In the event of a fire in the lab the flashpoints of the flammables will be reached very quickly and they will ignite, just like the highly and extremely flammable liquids.
- The fire triangle shows the conditions for a fire or an explosion – Remember that only the elements **ignition source** and the **mixing ratio / concentration** can be mitigated by technical means.
- Regular fire drills are a great way to prepare for a fire situation, but be aware that a real fire situation is very different and evacuation times are significantly longer than fire drills suggest. Refer to chart on page 20-21.
- The measures for the protection of the employees should always have the highest priority. They can be classified in 3 groups.



► **Technical measures**

1. Avoidance of the risk / danger (e.g. replacement of dangerous manufacturing processes and working methods with less dangerous methods or processes)
2. Separation of individuals from the danger (e.g. the encapsulation of a machine)

► **Organisational measures**

3. Organisational regulations (e.g. time, limits for dangerous processes, access controls, often in combination with technical and personal protective measures)

► **Personal protective measures**

4. Personal protective equipment (protective clothing, protective footwear etc.)
5. Instructions and education (training, signs, prohibitions and requirements)

Firstly the risk should be controlled by technical measures.

Secondly, organisational measures should be implemented.

Thirdly, personal protective measures should be activated (in case technical and organisational efforts were ineffective).

2

STORAGE OF HAZARDOUS MATERIALS



2.1 GENERAL – TERM DEFINITIONS

Storage

Storage is keeping materials for future use and dispensing to others. It includes the provision for transport, if the transport does not take place within 24 hours after provision or on the following working day. If the working day is a Saturday, the period ends upon expiry of the next working day.

The quantities of hazardous materials provided must be limited to the quantity required for that day/shift; all quantities beyond these must be stored. If small quantities are required regularly, the smallest standard container size can be provided.

If activities such as decanting, removal, or maintenance work are carried out in the storeroom, a separate risk assessment should be carried out.

ATTENTION

If you want to store a larger quantity than required for that day directly at your workplace, you need a fire resistant safety storage cabinet

Storage section

A storage section is the part of the storeroom that is separated from other storage sections or adjacent rooms

- in buildings by means of walls and ceilings that fulfil the safety-related requirements,
- outdoors by means of sufficient clearance or walls.

Outdoor storerooms are also roofed-over storage areas, which

- are open on at least two sides or
- are open on one side, if the depth – measured from the open side – is not greater than the height of the open side.

One side of the room is considered open if it consists of a wire or similar grating, which does not impair the natural ventilation.

IMPORTANT:

**Safety storage cabinets with at least 90 minute fire resistance are also classified as storage sections.
More information regarding safety storage cabinets is available from page 46.**

Storage class

Storage classes represent a classification of the stored materials based on specific hazardous properties and are only required in conjunction with joint storage.

Fire compartment

A fire compartment is a part of a building separated with regard to fire precautions in compliance with building law, where, as a result of the requirements on the surrounding components, spreading of the fire to other parts of the building is generally avoided.

Keeping, providing and reserving

Providing is the short-term storage for a specific intended use, usually for not longer than 24 hours or until the next working day. If the working day is a Saturday, the period ends upon expiry of the next working day.

Provision includes amongst other things:

- **Reserving** the quantities of operating materials or resources required to continue the work in or at production facilities. The required quantity must not exceed the amount needed per day.
- **Deposit** of finished or intermediate products.
- **Reserving** for company-internal transport, conveying, handling or storage.

Safety data sheet

A safety data sheet (SDS), material safety data sheet (MSDS), or product safety data sheet (PSDS) is an important component of product stewardship and occupational safety and health and spill-handling procedures. SDS formats can vary from source to source within a country depending on national requirements.

The SDS follows a 16 section format i.e. **SECTION 1: Hazards identification, SECTION 4: Firefighting measures , SECTION 7: Handling and storage** which is internationally agreed and for substances especially, the SDS should be followed with an annex which contains the exposure scenarios of this particular substance.

2 STORAGE OF HAZARDOUS MATERIALS

Joint storage is when various materials are stored in a

- storage section,
- container,
- **safety storage cabinet** or
- collection room

Separate storage is when various stored goods are separated from one another within a storage section by means of

- sufficient distances,
- barriers, e.g. walls, cabinets made of non-combustible material, products made of non-combustible materials of storage class 12 or 13 or
- separated collection rooms.

Separate storage may be required to reduce hazards when storing goods of the same storage class or materials of different storage classes. Information regarding the requirement for separate storage is given in

- the hazard information labelling (H or R codes), complementary hazard properties (EU H codes) and safety information (P or S codes)
- the product-specific safety information, for example, the safety data sheets (Section 5 Fire-fighting measures and Section 7 Handling and storage; the information in Section 10 Stability and reactivity is usually provided in less detail)
- the leaflets from the accident insurance companies.

Partitioned storage is separate storage in different storage sections. These must be separated from other storage sections or adjacent rooms:

- in buildings by means of walls or ceilings with at least 90 minute fire resistance, or
- outdoors by means of sufficient clearance or walls.

The distances serve to

- protect a storeroom from external harmful incidents such as mechanical damage or heating as a result of fire,
- protect against interactions between the stored hazardous materials,
- keep the risk for the employees or other persons, of leaks from portable containers and/or malfunctions in the proper operational procedure, as low as possible.

IMPORTANT: **Safety storage cabinets with at least 90 minute fire resistance are also classified as storage sections.**
More information regarding safety storage cabinets is available from page 46.

IS IT ALLOWED TO STORE CHEMICALS TOGETHER?

Hazardous materials may only be stored together if there is no increase in the risks involved. This is possible, for example, as a result of the risk assessment or the limitation of quantities.

In order to determine the possibilities for joint storage, the hazardous materials are divided into storage classes (LGK) (see Table 1, page 30). This formal classification serves to control the joint storage of different hazardous materials.

Detailed information on the joint storage of chemicals and the procedure for the classification is available for download from www.asecos.com/TRGS510⁵.

A statement is made for each storage class in Table 2 (page 31), whether in the case of hazardous materials from another storage class

- joint storage is generally allowed (green),
- partitioned storage is required (red) or
- restrictions in joint storage need to be observed (yellow).

Storage goods of different classes may not be stored in the same storage section if partitioned storage is stipulated. Storage goods of the same class or storage goods from different classes for which partitioned storage is not stipulated may also not be stored together if this would imply a substantial increase of the hazard risk. This is given, for example, if they

- require different extinguishing agents,
- require different temperature conditions,
- interact forming flammable or toxic gases or
- interact causing a fire.

Other hazardous materials can additionally be stored in quantities of up to 200 kg in storerooms for classes

- 6.1 C and 6.1 D (acutely toxic materials category 3 resp. toxic or chronically acting hazardous materials),
- 8 A and 8 B (combustible and non-combustible corrosive substances) and
- 10 to 13 (solids and liquids without further storage class allocation).

⁵ See page 91

Joint storage of chemicals in 90 minute fire resistance safety storage cabinets

Deviations from the joint storage regulations are permissible if no more than 400 kg of hazardous materials are stored, at the most 200 kg for each storage class.

These quantities are not reached in a safety storage cabinet.

Joint storage of various chemicals in safety storage cabinets is therefore basically possible, as shown in Table 1.

Please note:

Flammable liquids may not be stored in safety storage cabinets together with hazardous materials that may lead to the occurrence of fires (e. g. pyrophoric materials).

Due to the risk of corrosion, it is basically recommended not to store mineral acids and alkalis together in one safety storage cabinet, but in a separate acid or alkali cabinet respectively. Non-flammable toxic and highly toxic materials must be kept in a separate, locked chemical storage cabinet*.

Table 1: Joint storage of chemicals in 90 minute fire resistance safety storage cabinets

Properties / labelling of the hazardous materials		Cat. 1+ 2 max. 50 kg allowed 	Cat. 3 max 200 kg allowed 	Only Cat 2+3 max. 200 kg allowed  	 max. 200 kg allowed		 	
	✓	✓	✓	✓	✓	✓	✓	✓
Cat. 1+ 2 max. 50 kg allowed 	✓	✓	✓	✓	✓	✓	✓	✓
Only Cat. 2+3 max. 200 kg allowed 	✓	✓	✓	✓	✓	✓	✓	✓
 	✓	✓	✓	✓	✓	✓	✓	✓
 max. 200 kg allowed	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓
 	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓
Aerosols Aerosol cans	✓	✓	✓	✓	✓	✓	✓	✓
Cardboards, paper and similar as outer packaging	✓	✓	✓	✓	✓	✓	✓	✓

*Please observe local legislation and regulations.

Table 2: Description of storage classes

LGK 1	Explosive hazardous materials
LGK 2 A	Compressed, liquefied, or pressure-dissolved gases (not aerosols and lighters)
LGK 2 B	Pressurised gases (aerosols and lighters)
LGK 3	Flammable liquids
LGK 4.1 A	Other potentially explosive hazardous materials
LGK 4.1 B	Flammable hazardous solids
LGK 4.2	Spontaneously combustible or self-heating hazardous materials
LGK 4.3	Hazardous materials developing flammable gases upon contact with water
LGK 5.1 A	Highly oxidising hazardous materials
LGK 5.1 B	Oxidising hazardous materials
LGK 5.1 C	Ammonium nitrate and preparations containing ammonium nitrate
LGK 5.2	Organic peroxides and self-reactive hazardous materials
LGK 6.1 A	Flammable, acutely toxic materials categories 1 and 2/highly toxic hazardous materials
LGK 6.1 B	Non-flammable, acutely toxic materials categories 1 and 2/highly toxic hazardous materials
LGK 6.1 C	Flammable, acutely toxic materials category 3/toxic or chronically acting hazardous materials
LGK 6.1 D	Non-flammable, acutely toxic materials category 3/toxic or chronically acting hazardous materials
LGK 6.2	Infectious substances
LGK 7	Radioactive materials
LGK 8 A	Flammable, corrosive hazardous materials
LGK 8 B	Non-flammable corrosive hazardous materials
LGK 9	not assigned
LGK 10	Flammable liquids not assignable to any of the above
LGK 11	Flammable solids not assignable to any of the above
LGK 12	Non-flammable liquids not assignable to any of the above
LGK 13	Non-flammable solids not assignable to any of the above

A statement is made for each storage class in Table 3 below, whether in the case of hazardous materials from another storage class

- joint storage is generally allowed (green),
- partitioned storage is required (red) or
- restrictions in joint storage need to be observed (yellow).

Table 3:

Storage class		13	12	11	10	8B	8A	6.1D	6.1C	6.1B	6.1A	5.2	5.1B	5.1A	4.3	4.2	4.1B	3	2B	2A	1
Gases	2A			b			b												b	b	
Aerosol packages	2B																				
Flammable liquids	3			e				f					c								
Flammable solid substances	4.1B							f			d	a				f	f				
Pyrophoric or self-igniting substances	4.2				f	f	f	f	f							f					
Substances producing oxidizing gases with water	4.3			f	f	f	f	f	f												
Highly oxidising substances	5.1A																				
Oxidizing substances	5.1B				c	c		c	f	f	c	c									
Organic peroxides	5.2				a	a															
Combustible, acutely toxic substances	6.1A				e																
Non-combustible acutely toxic substances	6.1B				e																
Combustible acutely toxic or chronic substances	6.1C																				
Non-combustible acutely toxic substances or substances with chronic effects	6.1D																				
Combustible corrosive substances	8A																				
Non-combustible corrosive substances	8B																				
Combustible liquids	10																				
Combustible solids	11																				
Non-combustible liquids	12																				
Non-combustible solids	13																				

Separate storage is required

Joint storage permitted

letter

Joint storage is only permitted with restrictions (see letter)

Source: Adapted from BG RCI (2013), M 063

 Separate storage is required

 Joint storage permitted

 Joint storage is only permitted with restrictions (see letter)

Source: Adapted from BG RCI (2013), M 063

a) the company must ensure that organic peroxides are only stored or placed together with other substances and materials if this cannot lead to a substantial increase in the hazard.

If organic peroxides from different hazard groups are stored or placed together, the company must take as the basis the entire quantity of the organic peroxides of all hazard groups and, for the determination of the distances, that hazard group that necessitates the greatest distance to the endangered objects. Quantities of hazard group OP III are ignored here unless a significant increase in the hazard can occur. Organic peroxides of the hazard group OP IV are ignored.

When storing or placing organic peroxides together with Class 4.1 flammable solids or with flammable materials, the company must check in the individual case whether the safety distances for avoiding a possible increase in the hazard for the area surrounding the store or set-down place are sufficient or whether they need to be increased.

b) If no other properties need to be primarily considered according to the procedure, gases technically fall under storage class 2 A. If gases are to be stored together with other hazardous materials, the regulations contained in Table 3 must be observed from a total quantity of 400 kg (maximum 200 kg for each storage class).

Gases may only be stored together with

- non-combustible corrosive substances (Class 8 B) and
- non-combustible liquids and solids of Class 12 or 13.

c) up to 1000 kg without restrictions

d) up to 10,000 kg without restrictions

e) no materials of Class 11 that contribute to the breakout or spread of fire,
e.g. paper, wood, straw, flammable packaging filling materials

f) only after a hazard assessment

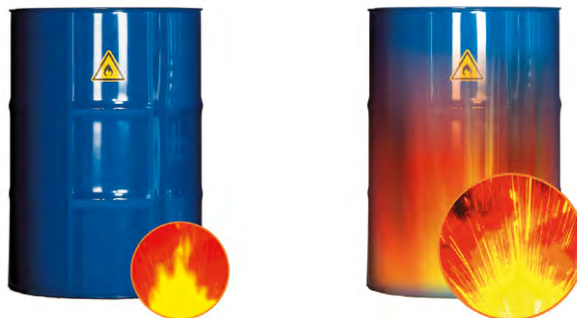
How do empty containers need to be handled?

Empty, uncleaned containers must be handled in the same way as full containers in terms of protective measures. For the storage of empty containers, 0.5 % of the total volume is applied to determine the storage quantity. This presumes that the remaining content of the containers is no more than this amount (this means 1 kg at the most in a 200 litre drum).

A clear example:

In a full container, the mixture of vapour and air is too rich, and the contents would burn.

20 ml of a highly inflammable liquid is enough to generate an explosive atmosphere in an empty 200 litre container.



The following quantities of inflammable liquids can evaporate to form an explosive mixture:

- 4 drops to 500 ml
- 20 ml to 200 litres
- 1 litre to 10,000 litres

2.2 BASIC OBLIGATIONS FOR THE STORAGE OF HAZARDOUS MATERIALS, IRRESPECTIVE OF QUANTITY

What are the general requirements for hazardous material packaging and containers?

Hazardous materials may only be stored in closed packaging units or containers. This should take place, as far as possible, in the original containers or packaging. Otherwise it must be ensured that the storage containers are suitable and labelled. Hazardous materials may not be kept or stored in containers when the shape or design could lead to the contents being mistaken for foodstuffs.

Packaging and containers must be designed in such a way that the contents cannot accidentally escape. These prerequisites are regarded as fulfilled if the packing or containers meet the requirements for the transport of hazardous materials.

All stored hazardous materials must be identifiable. Labelling must contain sufficient information about the classification of the hazard involved in handling and the appropriate protective measures that need to be observed are evident or can be derived.



What needs to be observed when dealing with hazardous liquids?

Containers holding hazardous liquids must be placed in a spill containment sump, which can at least accommodate the volume of the largest container. The spill containment sump must be resistant to the liquids in the containers. If a dangerous, potentially explosive atmosphere cannot be ruled out, the spill containment sump must also be electrostatically conductive.

What needs to be observed when dealing with flammable materials?

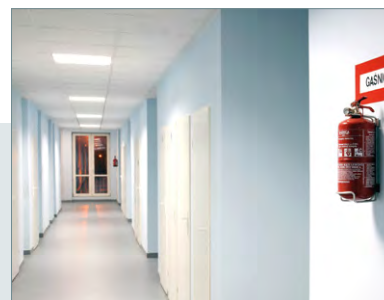
There should be no effective ignition sources in the immediate vicinity of containers with flammable materials.

Pressurised gas cylinders containing flammable materials with connected withdrawal devices may only be stored with additional protective measures (e.g. effective ventilation openings in a storeroom or cabinet with an area of more than 100 cm²) in order to avoid the formation of a potentially explosive atmosphere.

Is the storage of hazardous materials in stairways or corridors allowed?

Hazardous materials may not be stored in areas where they may pose a risk to employees or other persons. These include in particular

- ▶ access routes, such as stairways, escape and rescue routes, corridors, passageways and narrow courtyards
- ▶ Break rooms, on-call rooms, sanitary areas, first aid areas or daytime accommodation rooms



Are chemicals allowed to be stored in workrooms?

Hazardous materials may only be stored in workrooms if such storage is suitable for the protection of the employees. Here, the principle of minimisation in accordance with the Ordinance on Hazardous Substances (German GefStoffV) must be taken into account.

Storage of hazardous materials exceeding the quantity limits as in workrooms may only take place in special facilities, e.g. safety storage cabinets. This may be necessary even for small quantities as a result of the risk assessment.

Hazardous materials may not be kept or stored in the immediate vicinity of pharmaceutical products, foodstuffs and fodder, cosmetic products and stimulants. They should generally be kept/stored in separate rooms. If joint storage is essential for operational reasons, a horizontal distance of at least two metres must separate them.



2.3 BUILDING REQUIREMENTS FOR STOREROOMS

What building requirements apply for storerooms?

Storeroom walls, ceilings and doors must be manufactured from non-flammable building materials. For a storage quantity of up to 1000 kg, storerooms must be separated from adjacent rooms with fire-retardant protection (at least 30 minute fire resistance), and for larger storage quantities with fire-resistant protection (at least 90 minute fire resistance). Wall and ceiling openings leading to adjacent rooms must be secured against the spread of fire by means of suitable partitions with corresponding fire resistance in the wall or ceiling containing the opening. If the adjacent rooms are included in a fire protection system, doors in the fire-resistant walls do not need to be fire-resistant, only fire-retardant (at least 30 minute fire resistance).

Storerooms must be designed as collection rooms or be equipped with sumps. Collection rooms can be formed by the provision of recesses, thresholds, walls or barriers. Walls and floors may also be part of the storeroom. Collection sumps must be non-permeable for the stored liquids and must be made of non-flammable materials.



► CONCLUSION

Safety storage cabinets with at least 90 minute fire resistance are also classified as storerooms/storage sections.

ATTENTION

If you want to store a larger quantity than required for that day directly at your workplace, you need a fire resistant safety storage cabinet

Safety Storage Cabinets according to EN 14470-1

Statement extracts of Jun.- Prof. Dr. Ing. Marcus Marx, state-certified safety engineer and junior professor for fire and explosion protection at the Otto-von-Guericke-University Magdeburg.

...safety storage cabinets with a proven fire resistance class in accordance with EN 14470 enable modern laboratories – depending on the tested fire resistance of the cabinet – a less risky, local storage of

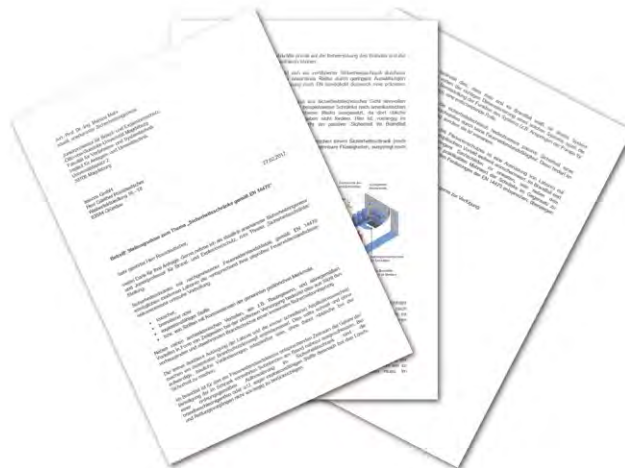
- toxic,
- flammable or
- potentially explosive substances
- and/or of substances with combinations of the stated dangerous characteristics.

Apart from the purely architectonic advantages, such as additional space, and the laboratory-specific benefits like time saving in the supply of materials, the use of safety storage cabinets according to EN 14470 also signifies an immense safety advantage regarding preventive and defensive fire protection. The increasingly flexible design of laboratories and the fast change of applications makes a decentralised fire protection system desirable.

This concept should be quickly adaptable without any complex structural changes and without downgrading safety...

...in case of fire, the risk which could arise from the substances stored in the cabinet is almost non existent during the fire resistant time of the cabinet. If the substances are stored properly in the safety storage cabinet, there is no need for preferential consideration of the fire accelerating or even potentially explosive substances during the fire-fighting and rescue operations. Thus, the emergency services can primarily concentrate efforts to control the fire and rescue injured persons...

...also from the point of view of insurance, a certified safety storage cabinet has positive aspects. The anticipated risk in case of fire is minimized by less severe consequences. Therefore the classification according to EN-standards makes a more precise risk assessment possible...

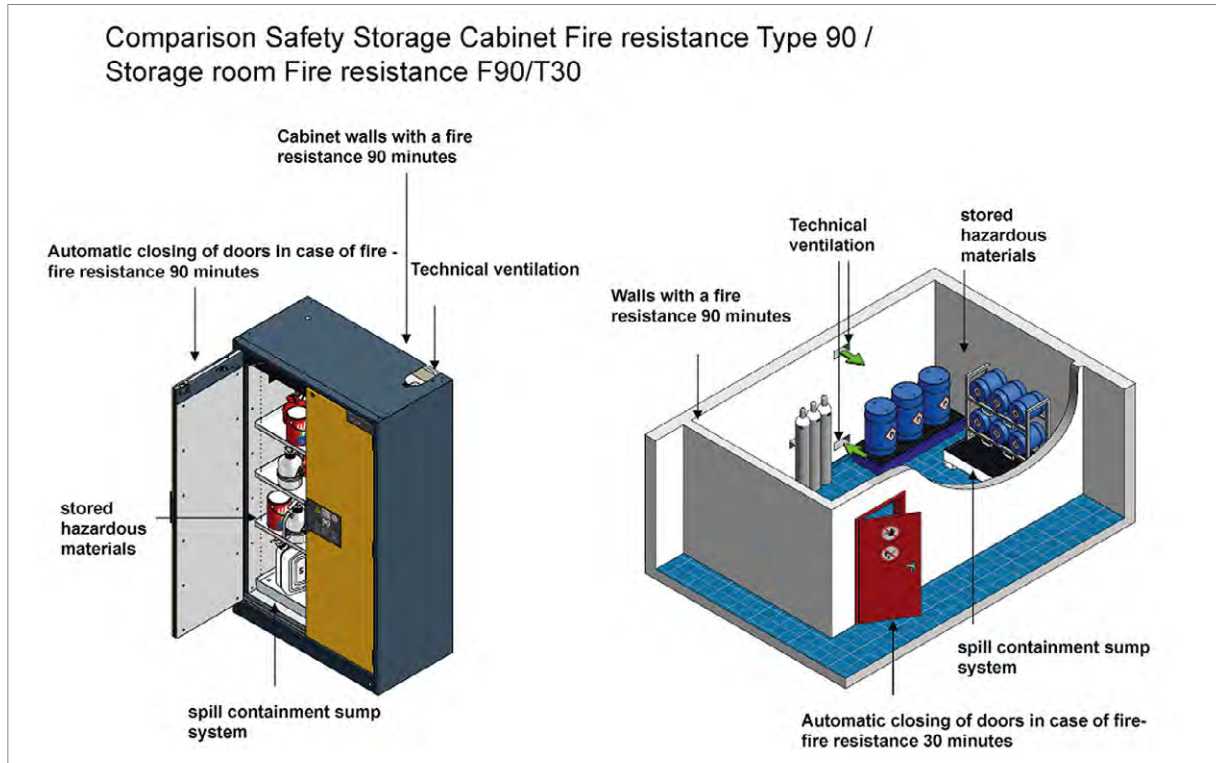


...these safety-related statutory specifications do not exist in all countries. Laboratory staff using double wall steel cabinets are exposed to a higher risk, as these cabinets do not fulfil strict European specifications...

...the illustration shown on the next page demonstrates the comparison between a safety storage cabinet (according to EN 14470) and a storage room for hazardous materials and flammable liquids designed in accordance to European standards.

This illustration clearly shows that the safety storage cabinet has comparable safety-related characteristics to the storage room.

According to European standards, the safety storage cabinet thus becomes the "storage room within the laboratory". On the one hand the substances are protected according to the fire resistance time and on the other hand the laboratory is protected against the substances stored in the cabinet...



...the insulated safety storage cabinet according to EN regulations helps to restrict local damage. Safety storage cabinets with other construction standards often have no insulation, but there are sprinkler systems in the rooms where they are installed to limit the temperature if there is a fire. In this example the rapid control of the fire is contradicted not only by typical water damage, but also by the potential spread of hazardous materials mixing with the fire fighting water. Furthermore, the sprinkler installation is a so-called active safety system, which only reacts in the event of fire. This means that you only know in the event of fire, whether the system is working or not...

...the European safety storage cabinet excels with its more significant passive safety, provided by its fire resistance...this system does not require activation in the event of a fire, as it is intrinsic...

... Safety storage cabinets in accordance with European safety standards for laboratory equipment are desirable, not only for personal safety but in the event of a fire, far less property damage can be expected. This emphasises the added value of the cabinets compared to less expensive cabinets which do not comply with the requirements of EN 14470...

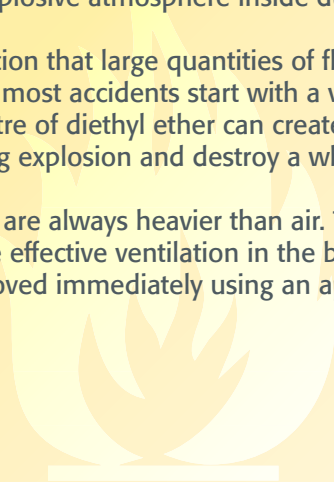
What advantages are there for storage in 90 minute fire resistance safety storage cabinets?

- Compliance with the requirements of fire and explosion protection,
- Installation in workrooms allowed,
- Installation in corridors in coordination with the local fire brigades generally possible if the width of the escape routes is still adhered to,
- Reduction of company-internal transportation of hazardous materials and also of the associated risks



2.4 CHAPTER II – TAKE AWAYS:

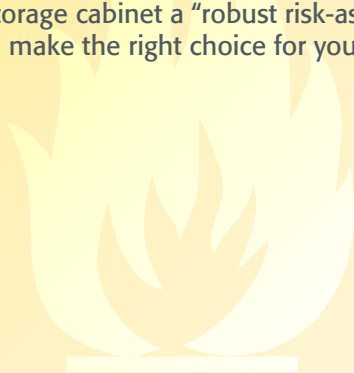
- Every hazardous material comes with a safety data sheet (SDS) in which you can find clear guidance on storing and handling requirements.
- The recommendations for joint storage can be found on our website www.asecos.com/TRGS510. This will help you to determine which materials can be stored together. Not all hazardous materials can be stored together safely. Please refer to table 3 on page 32 for guidance on what can be stored together and what has to be kept separated.
- It is not the flammable liquid itself, which burns but its vapours. A container might seem empty, but there can still be an explosive atmosphere inside due to remaining vapours.
- It is a widespread misconception that large quantities of flammable liquids are necessary to cause big accidents. In reality most accidents start with a very small quantity of hazardous materials. As an example, 1 litre of diethyl ether can create 10,000 litres of explosive vapours. Enough to cause a devastating explosion and destroy a whole building.
- Vapours of flammable liquids are always heavier than air. They hover on the ground, that is why it is so important to have effective ventilation in the bottom area of the cabinet or store room. Spillages must be removed immediately using an appropriate absorbant.



- The two key aspects for the safe internal storage of flammables
 1. Auto-ignition points of the flammable liquids must not be reached. (Protection of the contents over a specific period of time = **fire resistance**)
 2. Lean mixtures must be kept inside the cabinet. (Prevention of explosive atmospheres inside = **ventilation**)

Every safety cabinet or store room must fulfill these two aspects.

- Safety storage cabinets help to avoid “secret storage spaces”. Quantities which exceed the daily amount can be safely stored in the safety cabinet directly at the workplace.
- In order to select the right storage cabinet a “robust risk-assessment” is essential. The following chapters will help you to make the right choice for your workplace.



3

STORAGE OF FLAMMABLE
LIQUIDS IN FIRE-RESISTANT
SAFETY STORAGE CABINETS



3.1 TYPES OF SAFETY STORAGE CABINETS

Globally there are three types of cabinets used for the storage of flammable hazardous materials.

1. Single wall steel cabinets

How long will the stored flammables remain safe? The illustration makes the difference very clear: the double wall steel cabinet offers no more than 3 minutes of safety before the temperature increase exceeds 180 °C (356 °F) inside the cabinet, when subjected to a fire test according to the European standard.

2. Double wall steel cabinet

A double wall steel cabinet is able to protect the stored materials for about 10 minutes before the temperature exceeds 180 °C (356 °F) inside the cabinet, when the cabinet is tested in a fire chamber.

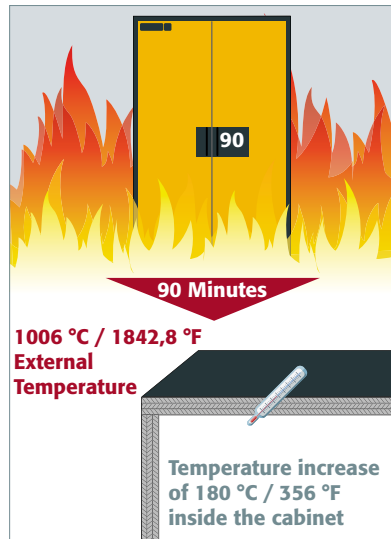
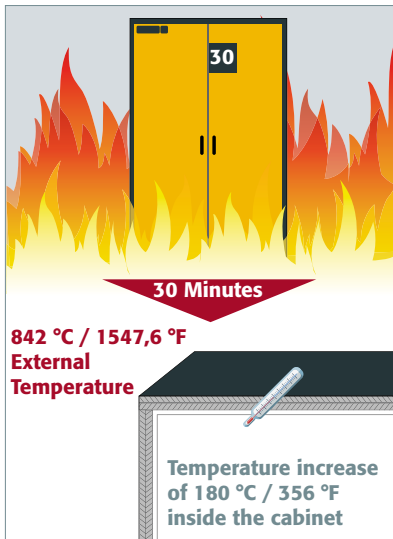
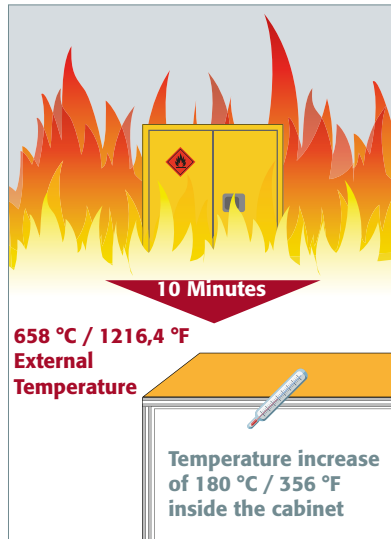
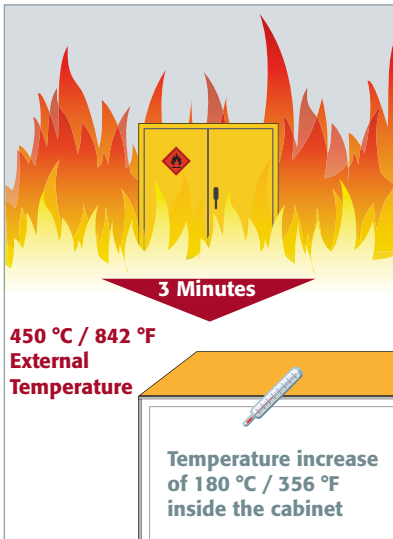
3. Safety storage cabinets according to European Standard (EN 14470-1)

Safety storage cabinets complying with EN 14470-1 are available with different fire resistance classes.

Type	Measured time in minutes for the rise in temperature by 180°C	Fire resistance
15	> 15	15 minutes
30	> 30	30 minutes
60	> 60	60 minutes
90	> 90	90 minutes

A Type 30 EN cabinet, for example, guarantees 30 minutes of safety before the temperature increase on the inside becomes critical. 10 times the amount of safety time provided by a single wall steel cabinet!

A Type 90 EN cabinet offers maximum safety. It takes more than 90 minutes of exposure to a fire before the temperature inside rises by more than 180 °C (356 °F). This gives sufficient time to evacuate the building and to enter the building for fire-fighting measures and rescue operations.



The following cabinet comparison is intended to help understanding the advantages and disadvantages of the different standards and aid in making the right decision for a safer workplace.

CABINET COMPARISON

OVERVIEW

*Storage of flammables**Insulation**Certification**Fire resistance (Minutes)**Disaster risk**Legal consequences and
personal liability*

NOT SUITABLE
Safety containers mandatory

NO INSULATION

NONE



VERY HIGH



NO SAFETY



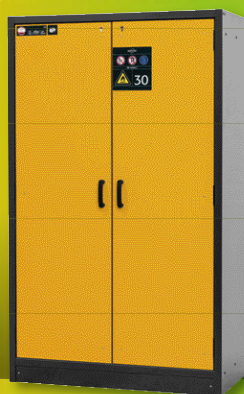
SUITABLE
Safety containers recommended

AIR INSULATION

THIRD PARTY CERTIFICATION
(FM 6050, UL 1275, e.g.)

10

MEDIUM



SUITABLE
NO RESTRICTIONS

FIRE RESISTANT BOARDS

EN 14470-1

30

LOW



90

NONE

EN GS FM



MAXIMUM SAFETY

Please observe local legislation & regulations

PROTECTION/MIN



STRUCTURE

Single-walled sheet steel

TECHNOLOGY

OBsolete

SAFETY ASPECTS

- | | |
|---|-------------|
| 1 Sealed door gaps | X NO |
| 2 Self-closing doors | X NO |
| 3 Insulation | X NO |
| 4 Defined air flow | X NO |
| 5 Similar fire performance as a store room | X NO |
| 6 Maximum flexibility when choosing point of use | X NO |

YOUR SAFETY CHECKLIST

1. Type of building

NONE

2. Location

NONE

3. Evacuation time

0 minutes fire resistance gives no chance at all

- to evacuate the building
- for rescue forces to enter the building

4. Legal consequences

NO
PROPERTY
INSURANCE

- Unlimited personal liability

ADDITIONAL POINTS TO CONSIDER

DO NOT USE
SUCH CABINETS
FOR STORING FLAMMABLES



PROTECTION/MIN



STRUCTURE

Double-walled sheet steel
third party certified

TECHNOLOGY

BASIC



SAFETY ASPECTS

1 Sealed door gaps

X NO

2 Self-closing doors

✓ YES • Either permanent self-closing or self-closing in case of fire in combination with door holding mechanism

3 Insulation

✓ YES • Air insulation

4 Defined air flow

X NO

5 Similar fire performance as a store room

X NO

6 Maximum flexibility when choosing point of use

X NO

YOUR SAFETY CHECKLIST

1. Type of building

SMALLER / MIDSIZE

- Production facilities
- Factory buildings
- Shop floors

2. Location

GROUND FLOOR

- Easy to escape

3. Evacuation time

10 minutes fire resistance gives

- little time to evacuate the building
- no time for rescue forces to enter the building

4. Legal consequences

ONLY SOME PROPERTY INSURANCES

- Personal liability

ADDITIONAL POINTS TO CONSIDER

+ Minor quantities

+ Safety cans highly recommended

+ Fire department close by

+ Sprinkler system

PROTECTION/MIN

30

SAFETY ASPECTS

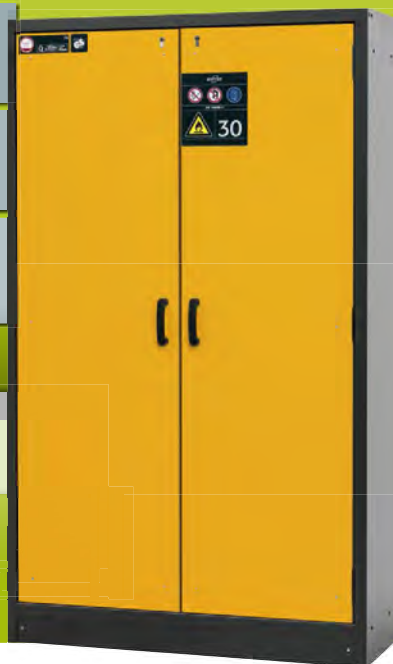
1	<i>Sealed door gaps</i>	✓ YES
2	<i>Self-closing doors</i>	✓ YES
3	<i>Insulation</i>	✓ YES
4	<i>Defined air flow</i>	✓ YES
5	<i>Similar performance as a store room</i>	✗ NO
6	<i>Maximum flexibility when choosing point of use</i>	✗ NO

STRUCTURE

Fire-resistant boards

TECHNOLOGY

ADVANCED



YOUR SAFETY CHECKLIST

1. Type of building

MIDSIZE / LARGER

- Laboratories small and medium sized



2. Location

UP TO FIRST FLOOR

- Fire brigade close by



3. Evacuation time

30 minutes fire resistance
gives limited time to

- evacuate the building
- for rescue services to enter the building



4. Legal consequences

ACCEPTED BY MOST INSURANCE COMPANIES

- Reduced personal liability



ADDITIONAL POINTS TO CONSIDER

- + Larger quantities permissible
- + One cabinet per work room (recommended)

PROTECTION/MIN

90

SAFETY ASPECTS

1	<i>Sealed door gaps</i>	✓ YES
2	<i>Self-closing doors</i>	✓ YES
3	<i>Insulation</i>	✓ YES
4	<i>Defined air flow</i>	✓ YES
5	<i>Similar performance as a store room</i>	✓ YES
6	<i>Maximum flexibility when choosing point of use</i>	✓ YES

STRUCTURE

Highly-insulated
calcium sulfate boards

TECHNOLOGY

LATEST



YOUR SAFETY CHECKLIST

1. Type of building

ANY SIZE AND TYPE

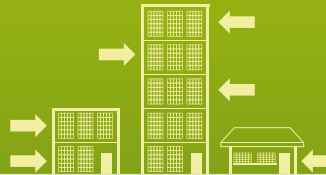
- Open space laboratories
- High risk areas



2. Location

ANYWHERE

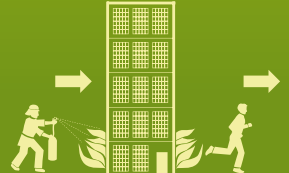
- High rises
- Remote areas



3. Evacuation time

90 minutes fire resistance gives sufficient time to

- evacuate the building
- enter the building for fire-fighting measures and rescue operations



4. Legal consequences

FULL ACCEPTANCE BY INSURANCE COMPANIES

- Reduces personal liability as much as possible

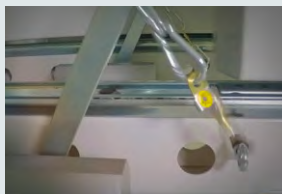
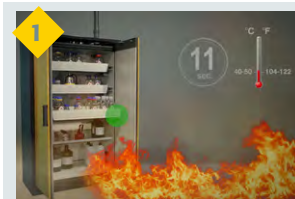


ADDITIONAL POINTS TO CONSIDER

NONE

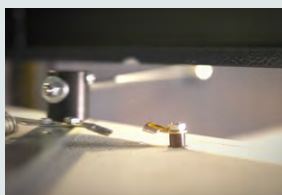
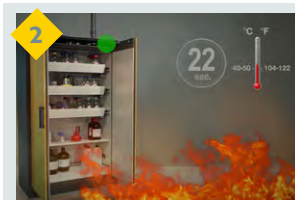


3.2 SAFETY FEATURES OF A FIRE RATED SAFETY STORAGE CABINET ACCORDING TO EN 14470-1



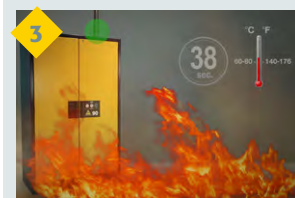
Self-closing drawer in the event of a fire

Drawers, which have not been manually pushed back into the cabinet, have to close safely in the event of a fire at 104 °F and at the latest of 122 °F (approx. 40 – 50 °C).



Self-closing doors in the event of a fire

Doors left open or those featuring a door open arrest system have to close safely in the event of a fire at 104 °F and at the latest of 122 °F (approx. 40 – 50 °C).



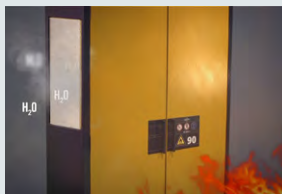
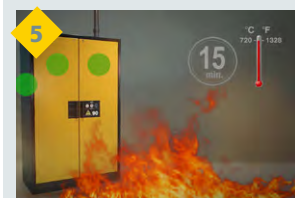
Self-closing ventilation openings in the event of a fire

Ventilation openings to close safely in the event of a fire latest at 158 °F (70 °C).



Seals

All gaps become totally sealed between door and frame. Special intumescent seal protection strips which, when exposed to a fire, expand and seal hermetically to avoid heat entering the cabinet.



Insulation

Special fire resistant plates and/or multiple layers of fire-proof mineral fibre insulation material (calcium sulphate). All gaps become totally sealed between door and frame. Special intumescent seal protection strips which, when exposed to a fire, expand and seal hermetically to avoid heat entering the cabinet.



Watch our Video:
 "Safety Features of fire resistant Safety Storage cabinets"

3.3 ADVANTAGES OF FIRE RATED SAFETY STORAGE CABINETS

What advantages does storage in a fire-resistant safety storage cabinet offer?

The central store for hazardous materials – the disadvantages and possible risks and hazards in the workplace without regulated safety storage cabinets in accordance with EN 14470-1 ...

Transport / working hours

- increased risk during daily in-house transportation of hazardous materials from the central store for hazardous materials to the workplace
- hazardous materials stored at the workplace without protection are not all returned to the storeroom when the work is finished
- valuable working time is lost by the daily transportation of hazardous materials
- hazardous material containers required in the workplace have to be unnecessarily located from storage areas which are not always clearly organised
- Cost implication – higher consumption, higher disposal rate of 'opened' containers



Hazardous substances have to be taken to the workplace



Only the quantity required for that day can be stored at the workplace

Hazards, lack of fire protection

- The actual allowed quantity of hazardous material needed at the workplace is quickly exceeded.
- Various storage areas for hazardous materials occur in the workroom, which may then contribute to an uncontrolled spreading of fire. Therefore, in the event of a fire, the protection of employees and rescue teams can no longer be guaranteed.
- Flammable vapours can escape from open or not tightly closed containers, thus forming a potentially explosive atmosphere in the workroom.

Improper storage and its consequences

- ▶ You are violating applicable regulations
- ▶ Insurance cover for damage to goods becomes void
- ▶ The company directors are held personally liable for any resulting damage to persons and property
- ▶ Non-calculable production losses may arise if damage occurs



Hazardous substances have to be taken back to the storage room after work is done

Safety storage cabinets with 90 minute fire resistance are also classified as a separate fire compartment. Therefore storage in safety storage cabinets offers the following advantages:

Transport / working hours

- Minimisation of the in-house transportation of hazardous materials from the storeroom to the workplace
- All hazardous materials in the workplace are generally stored in the safety storage cabinet when work is finished
- Effective use of working hours by the avoidance of daily transportation of hazardous materials to the workplace
- Quick access to required containers due to clearly arranged storage in a safety storage cabinet

User safety

- Only the quantity of hazardous materials required for daily work is used
- The remaining hazardous materials are centrally and safely stored in the safety storage cabinet
- Minimum or maximum fire protection due to the use of safety storage cabinets (type 30 or type 90 – EN 14470-1 / TRGS 510 -Appendix 3) for central storage of hazardous materials in the workroom
- Avoidance of potentially explosive atmospheres by storing hazardous materials in technically ventilated safety storage cabinets



Hazardous substances are stored directly at the workplace



The needed materials can be easily taken out of the cabinet

Safety storage cabinets in accordance with EN 14470-1...

- ▶ provide maximum safety for your investment
- ▶ provide legal safety for the company and those responsible in case of damage
- ▶ guarantee tested fire protection
- ▶ prevent explosions
- ▶ prevent fires from spreading
- ▶ prevent unpleasant odours due to containers unnecessarily 'standing around'
- ▶ provide sufficient time for personnel to leave the building and for rescue teams and the fire brigade to evacuate and initiate extinguishing measures
- ▶ are flexible in use/installation according to requirements



After work is done the hazardous substances can be quickly put back into the cabinet

Storage of hazardous materials in laboratories / European EN standard vs. double wall steel cabinets



Statement extracts of Klaus Söhngen, CEO of the international active HVAC and laboratory planning office ERETEC, regarding the topic "storage of hazardous materials in laboratories / European EN standard vs. double wall steel cabinets"

... During our international planning activities, we observe that the opinion concerning safe storage of flammable liquids and pressurised gases is often different to our opinion, particularly outside European countries ...

... due to our European understanding of safety, it is incomprehensible for us that flammable liquids, hazardous materials and pressurised gases are stored in presumably safe double wall steel cabinets. On closer examination, these cabinets, guarantee only insufficient to no fire protection in the event of an emergency. Laboratory users and operators are led to believe that safety is provided, but in case of emergency it is not...

... in the following illustration (ground plan of a laboratory) one can easily see, that nowadays laboratories are planned with open workplaces and service areas. Especially in the area of core facilities, continuous areas of several hundred square metres are common...

...these types of ground plans are not limited to Europe. Especially in American-influenced countries, these types of laboratories are also planned and operated. From our point of view, it is highly questionable to use steel cabinets in laboratories where many people work. These single-walled resp. double-walled cabinets including an air insulation system do not provide a fire resistance classification and offer only a few minutes of fire protection applying European-Standard criteria...

...apart from automatic fire extinguishing systems and other efforts to raise fire protection, an intelligent and reliable safety concept for laboratories should always include equipment with fire-resistant cabinets (type 90)...

From the point of view of the HVAC planner and architect

...as hazardous materials can be stored safely in fire-resistant cabinets (type 90) directly at the workplace, the planning of a central storage room is no longer necessary in all cases. Therefore, the investment cost for such rooms and their equipment can be saved.

If the architectural concept includes these rooms anyway, additional space can be gained, as the rooms can be used for other purposes...

...as safety storage cabinets can be planned and flexibly installed within the ground plan, a higher flexibility of availability is guaranteed for the workflow...

...the use of fire-resistant (type 90) cabinets can also contribute to a leaner and less extensive constructional fire protection, as the required fire protection is already integrated in the cabinet. The costs for more expensive constructional fire protection components, such as sprinkler systems, for instance, can be completely saved...



From the point of view of the user, fire protection and emergency staff

...Due to the use of fire-resistant cabinets (type 90) the employees of a laboratory have on the one hand much more time to leave the danger zone in case of fire. On the other hand, they can be sure that the protection mechanism of the cabinets will avoid an acute or short-term deterioration of the situation. The fire brigades and paramedics also gain from this, as the fire-resistant cabinets (type 90) avoid an additional risk regarding an uncontrolled or accelerated fire spread during the fire resistance time of the cabinet. Therefore, the emergency-services are faced with an easier situation on-site, as the circumstances and risks can be assessed more reliably...

...thus the installation of fire-resistant cabinets (type 90) causes a minimized economic risk (risk of total damage). Especially, in countries where the cabinets according to European standards are not obligatory, this fact can lead to reduced insurance costs...in addition, the use of fire-resistant cabinets directly at the workplace (type 90) drastically reduces the transportation of hazardous materials and gases and transport-accidents are almost non-existent...

3.4 REQUIREMENTS OF FIRE RATED SAFETY STORAGE CABINETS IN ACCORDANCE WITH EN14470-1

How must safety storage cabinets according to EN 14470 be marked?

The following inscriptions shall be mounted on the front of the cabinet in a suitable and visible place:

- advice that door(s) must remain closed when not in use
- the appropriate warning sign for “Caution: risk of fire” and appropriate prohibition sign for “Fire: open light and smoking”, according to ISO 3864 (all parts)
- the fire resistance capability, specified in minutes, e.g. Type 15, 30, 60 or 90
- name and/or trademark of the manufacturer
- model number and year of production
- maximum volume of a single container, in relation to the sump capacity, to be stored in the cabinet
- maximum shelf load, evenly distributed

What safety-related requirements are necessary for safety storage cabinets?

Safety storage cabinets must be designed, installed, operated and maintained in such a way that the safety of employees and third parties is ensured, in particular, hazards resulting from fire or explosion.

The safety requirements of safety storage cabinets for flammable liquids are deemed to be fulfilled if they have at least 90 minute fire resistance (type 90) and meet EN 14470-1 requirements.

Depending on the place of installation and the storage quantities, safety storage cabinets with at least 30 minute fire resistance (type 30) can be used.



Can flammable liquids be stored in safety storage cabinets together with other chemicals e.g. acids, alkalis or toxins?

Flammable liquids must not be stored in safety storage cabinets together with hazardous materials that may lead to the occurrence of fires (e.g. pyrophoric materials).

Further joint storage exclusions usually apply above a quantity threshold of 200 kg. These quantities are not reached in a safety storage cabinet.

Due to the risk of corrosion, mineral acids and alkalis should not be stored in a safety storage cabinet in accordance with EN 14470-1, but in an acids and alkalis cabinet especially designed for the purpose. Toxic and highly toxic materials, which are not flammable, must be kept in a separate, locked chemical storage cabinet.

Guideline for the storage of hazardous materials in fire-resistant EN safety storage cabinets

1. Prepare a list of hazardous materials
2. Determine the quantities of the respective individual hazardous materials
3. Check whether the hazardous material can be stored in the cabinet due to its properties
4. What container sizes are used

Should gas cylinders be stored in a safety storage cabinet for flammable liquids?

No.

Do safety storage cabinets have to be equipped with technical ventilation?

Within the scope of the risk assessment, it must be determined whether a safety storage cabinet must be equipped with technical ventilation for the storage of flammable liquids.

It must be observed that certain hazardous materials may only be stored in technically ventilated safety storage cabinets with at least 90 minute fire resistance. These are flammable hazardous materials labelled with H224 and/or R12, and with ignition temperatures below 200 °C (diethyl ether or carbon disulphide, for instance).

What does the safety storage cabinet operating instructions need to contain?

The operating instructions must stipulate

- that the deposited containers must not be contaminated with product residues,
- that decanting must not be carried out inside the cabinet,
- the measures needed to be taken after a fire, to ensure there is no danger involved when opening the cabinet, for example.

The employees must be instructed in compliance with the operating manual. An explosion protection document is also required if a potentially explosive atmosphere can occur in the safety storage cabinet, in the surrounding area and in the ventilation line.

Number: M3-00 Company:
Processing status: 09/13

Operating Instructions

Workplace / Area of activity: Storage of flammable liquids

1. Range of applications

Safety storage cabinet for flammable liquids in accordance with DIN 14470-1

2. Danger to people and the environment



Danger to health due to hazardous materials (inhaling and skin contact)
Increased risk of fire in the case of extremely and highly flammable liquids
Risk of explosion when operating without technical ventilation
Possible risk of crushing in the case of automatically closing doors

3. Protective measures

Clean contaminated packaging and containers before storing in container
Only store closed containers
Do not store flammable liquids together with self-reactive and pyrophoric materials
Safety storage cabinet should always be kept closed
Do not decant inside the cabinet
Zone separation for operation without technical ventilation – see explosion protection document
Regular function test of doors and ventilation

4. Response to malfunctions



Immediately dispose of escaped product in the base of the cabinets and sump
Emergency call in case of fire: 999 / 112
After a fire, the safety storage cabinet may be opened only after six times the duration of the fire. An ignitable vapour-air mixture may have formed depending on the duration of the fire. Remove all ignition sources within an area of 10 metres. Open doors with extreme caution. Only use spark-free tools to open the doors

5. First aid



Consult the safety data sheet when coming into contact with hazardous materials

6. Maintenance

The safety-related properties of the cabinet must be checked at least once a year. Inform the supervisor immediately if doors do not close automatically and for ventilation failure; have defective seals replaced by the manufacturer immediately if doors do not close automatically and for ventilation failure; have defective seals replaced by the manufacturer immediately

Date:
Next inspection:

Signature
of management:

When do safety storage cabinets for flammable liquids require a zoning and an explosion protection document?

Zoning in safety storage cabinets depends on the information in BGR 104.

Zoning safety storage cabinets

in accordance with BGR 104 EX-RL – collection of examples 2.2.8

Technical ventilation:

no zone

Conditions:
Containers locked
No dispensing/decanting
No wetting



If no:
Zone 2

Natural ventilation:

Zone 2

Conditions:
Containers locked
No dispensing/decanting
No wetting



If no:
Zone 1 inside
Zone 2 outside
r=2.5 m
h=0.5 m

Safety storage cabinet technical ventilation prevents the formation of a potentially explosive atmosphere inside the cabinet by means of approx. 10 air changes per hour. This means zoning and explosion protection documents are not required for ventilated safety storage cabinets.

Exhaust air must be directed to a safe point. This may take place by means of connection to an existing ventilation system, a ventilation motor installed on the safety storage cabinet with an outdoor connection or by means of a recirculating air filter system according to the absorption principle. Practical examinations have shown that, when recirculating air filter systems are used, fires in the absorption filters – as identified in large industrial plants – cannot occur whilst safety storage cabinets are in operation, as the recirculating air filter system on a safety storage cabinet is equipped with a continuously acting safety facility.

Safety storage cabinets without technical ventilation should be earthed via equipotential bonding.

There must be no ignition sources inside the safety storage cabinet. If this cannot be ruled out, measures for the avoidance of ignition sources must be taken depending on the risk assessment, which must at least comply with zone 2 according to TRBS 2152 Part 3. Therefore, an explosion protection document must be prepared.

Always remember

Two key aspects for safe internal storage of flammables

1. Auto-ignition points of the flammables must not be reached
(Protection of the contents over a specific period of time ► fire resistance)
2. Lean mixtures must be kept inside the cabinet
(Prevention of explosive atmospheres inside ► ventilation)

Example of a simple explosion protection document

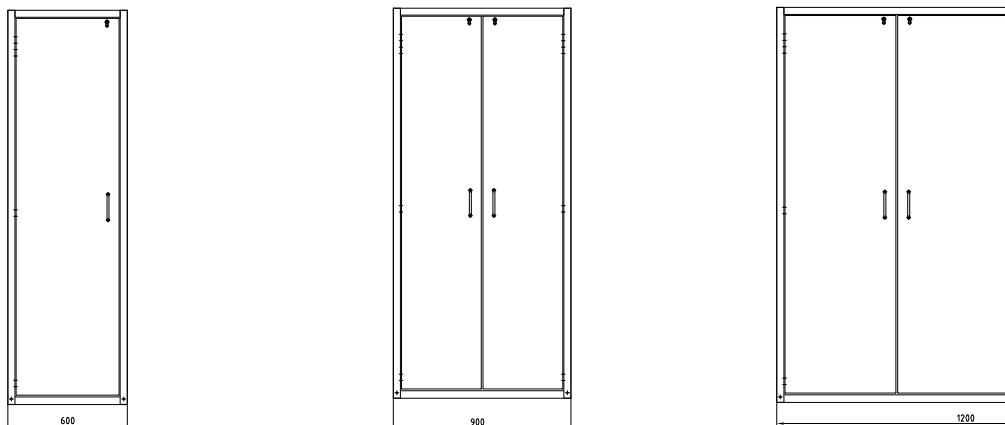
Explosion protection document in accordance with § 6 BetrSichV (Ordinance on Industrial Safety and Health) Safety storage cabinet	
Company name:	<div style="display: flex; justify-content: space-between;"> <div>Date: Signature:</div> <div>Person responsible:</div> </div>
Contents	Description or reference to relevant documents
1. Location/workplace	<div style="display: flex; justify-content: space-between;"> <div>Building: see also site plans, floor plans, ventilation plan</div> <div>Room:</div> </div>
2. Procedural description, e.g. <input type="checkbox"/> Relevant activities <input type="checkbox"/> Materials used <input type="checkbox"/> Quantities used	<input type="checkbox"/> Storage and removal of containers with flammable liquids in workrooms <input type="checkbox"/> max. 200 litre
3. Materials used and their safety-related key figures: <input type="checkbox"/> extremely flammable R12 / H224 flammable cat. 1 <input type="checkbox"/> highly flammable R11 / H225 flammable cat. 2 <input type="checkbox"/> flammable R10 / H226 flammable cat. 3	<input type="checkbox"/> See overleaf hazardous materials list for safety storage cabinet
4. Assessment of explosion risk and zoning Ex-RL (explosion prevention regulations), collection of examples 2.2.8 <input type="checkbox"/> Inside the cabinet <input type="checkbox"/> In the surrounding area <input type="checkbox"/> Inside the cabinet <input type="checkbox"/> In the surrounding area	<div style="text-align: center;">Ventilation</div> <div style="display: flex; justify-content: space-around;"> <div> YES Zone - * Zone - * </div> <div> NO Zone 2 * Zone - * </div> </div> <p>* No decanting inside the cabinet, passive storage if * not fulfilled:</p> <div style="display: flex; justify-content: space-around;"> <div>Zone 2</div> <div>Zone 1</div> </div> <div style="display: flex; justify-content: space-around;"> <div>Zone -</div> <div>Zone 2</div> </div>
5. Explosion protection measures <input type="checkbox"/> Avoidance of potentially explosive atmosphere <input type="checkbox"/> Avoidance of effective ignition source	<input type="checkbox"/> Connected to ventilation yes/no see above <input type="checkbox"/> No open fire, avoidance of electrostatic charging on the cabinet by earthing zone 1, Fan motors: ATEX II 3 G
6. Organisational measures <input type="checkbox"/> Instruction <input type="checkbox"/> Inspections / Inspection periods <input type="checkbox"/> Checks - daily - monthly	<input type="checkbox"/> See instruction documentation <input type="checkbox"/> Annually in accordance with the BetrSichV (Ordinance on Industrial Safety and Health), see test records <input type="checkbox"/> Check the collection sump (leaks must be repaired immediately) <input type="checkbox"/> Check doors operate correctly, correct seating and condition of the door seals

3.5 VARIATIONS OF SAFETY STORAGE CABINETS

Variety of cabinet sizes for different purposes

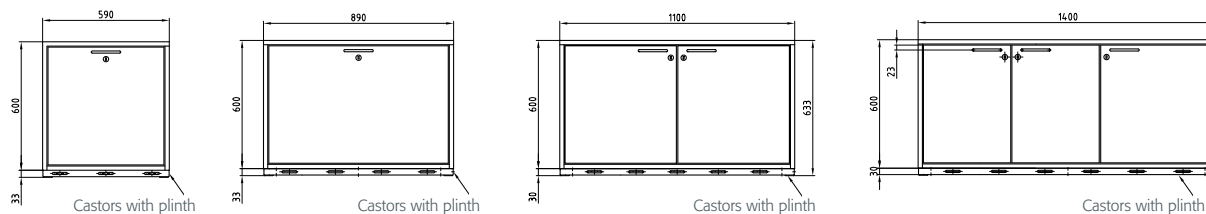
Flammable liquid storage cabinets are available in different heights and widths, making the integration into any new laboratory very easy.

EN approved **tall cabinets** are available in: 3 widths: 120 cm, 90 cm and 60 cm (47.24 in, 35.43 in, 23.26 in) 2 heights: 129 cm, 196 cm (50.79 in, 77.17 in)



Ideal for storing larger quantities of flammable liquids

EN approved **underbench cabinets** are available in: 4 widths: 140 cm, 110 cm, 89 cm and 59 cm (55.12 in, 43.31 in, 35.04 in, 23.23 in)



Use the space underneath the fume cupboard perfectly

The number of available models and sizes are increasing constantly. Make sure to check the asecos website regularly or sign up for the newsletter.

Wing Doors vs. Folding Doors

For Type 90 safety storage cabinet you should also keep doors closed when not in use, only then can maximum safety be guaranteed.

Compared to double-walled steel cabinets the cabinets in accordance with European Standard offer considerably more protection – up to 90 minute fire resistance – and ease of use.

Beginning with the doors: Wing doors or space saving folding doors can be chosen.

Folding doors are the best choice whenever space is limited, for example in the laboratory. They make it possible to pass the cabinet even when the doors are fully open. Cabinets are also available where you can open both doors with just one hand and even fully-automatic cabinet doors with sensor detection, which means containers can be held with both hands at all times, a real advantage with regard to safety.



Interior equipment options

Safety storage cabinets are not only available in different widths, heights and depths, with different door variants, they can also be individually equipped with a multitude of different interior fittings, enabling them to meet all laboratory requirements. Some manufacturers of single-wall cabinets specify the maximum storage capacity in litres or gallons. Although this corresponds to the internal volume of the cabinet, it does not say anything about the actual possible storage capacity. It is a theoretical value that is never achieved in practice. With EN cabinets it is possible, using fully extractable drawers and taking into account customer-specific height settings, to efficiently use the interior space without any waste.

When planning cabinets for the storage of combustible liquids, the following fittings are among those available:

- Shelves
- Fully extractable drawers
- Heavy-duty drawers
- Storage boxes
- Spill containment sumps
- Perforated metal plate inserts
- Insertable sumps
- Rubber mats
- Bottle racks
- Different door closing alternatives



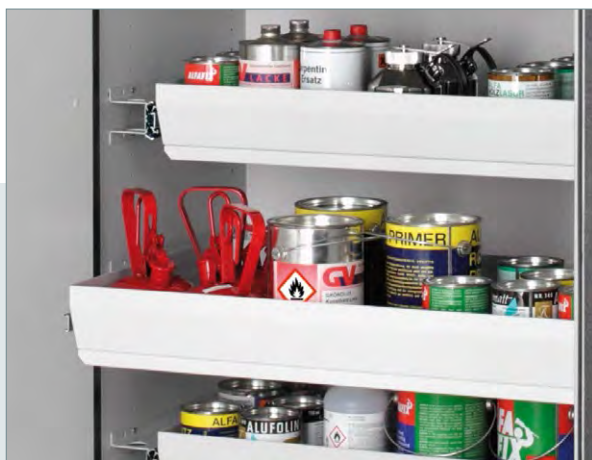
HIGHLIGHT Metal-free interior equipment

ideal for the storage of flammable, aggressive hazardous substances. Tray shelves with chemical resistant surface lamination and removable sump made of PP, bottom collecting sump made of PP

You want more?**Comparison of shelves and drawers**

Safety storage cabinets with shelves are the ideal choice when storing bulk containers. The shelves can easily be height-adjusted in standardised increments within the cabinet. Often only small quantities of a certain hazardous substance are required. In order to accommodate small bottles and containers in an efficient and space saving way, EN safety storage cabinets can be equipped with fully-extractable drawers.

Drawers can be installed with much less clearance than shelves because the containers can be accessed from the top as the drawers can be fully pulled out, meaning there is no wasted space. In addition every drawer is a collecting sump thus making a bottom-collecting sump unnecessary.



Have you got space to waste?

... **probably not.**

This is exactly the reason why we want to introduce you to the benefits of safety storage cabinets with full drawers.



THE TASK

A situation known to many users:

- Which conditions should be used when clearing the containers in the cabinet?
- Which containers are on the front of the shelves, which are to the rear?
- Which hazardous materials should be placed on one storage level if possible?
- How can it be guaranteed that the containers from the rear rows can be easily and safely removed?

THE SOLUTION

Safety storage cabinets with drawers make these questions redundant!

- Logical storage of small containers
- Easily accessible for storage and removal
- Storage options for waste containers
- Safe and simple collection of waste materials in waste containers



Configure the required number of full drawers according to the quantity and dimensions of containers to be stored. We can offer you the option of storing up to **9 full drawers** in one safety cabinet.

Safety when placing and removing the containers - no accidental knocking or upsetting of other containers when they are placed in the cabinet or removed.

Convenient - no awkward removal of containers from the rear storage area







The question of whether containers should be at the front or rear does not arise. The full drawer always gives you the **complete overview** of the storage level.

Hazardous materials that should be placed together on a storage level can be easily and **logically arranged in a full drawer**. **Double your possible storage capacity** in the safety cabinet!



For your information

The following 3 comparisons show the possible storage volume with drawers compared to shelves.

Width	Container	3 Shelves	6 Drawers	Advantage	You save
1200 mm	1 and 2 litre	 approx. 95 litre	 approx. 190 litre	100 % more storage volume	up to 800,00 €*
900 mm	1 and 2 litre	 approx. 60 litre	 approx. 130 litre	115 % more storage volume	up to 500,00 €*
600 mm	1 and 2 litre	 approx. 35 litre	 approx. 75 litre	105 % more storage volume	up to 600,00 €*

* Saving compared to 2 cabinets with shelves

3.6 TECHNICAL VENTILATION OF SAFETY STORAGE CABINETS

In Germany, the law allows the operation of safety storage cabinets without permanent effective technical ventilation. In this instance, however, other measures must be taken to guarantee comparable protection against explosion. If corrosive or toxic materials are to be stored in the safety storage cabinet, for example, or in the case of the employees being disturbed by unpleasant odours, then technical ventilation should always be provided.

There are various possibilities to implement the necessary technical extraction:

Plug-in extraction units

These need only be placed on the roof of the safety storage cabinet and connected to the existing extraction system. A wide range of extraction units are available with and without exhaust air monitoring, with potential-free alarm contact, for wall mounting, etc.

Radial ventilators

Powerful radial fans can be integrated into exhaust air systems and provide reliable extraction from the safety storage cabinets.

Recirculating air filter systems

Recirculating air filter systems are simply mounted on top of the safety storage cabinet and connected to its exhaust ducts. They are equipped with an active carbon filter, which removes the hydrocarbons contained in the exhaust air within the cabinet. The cleaned air is returned to the installation room. No customer exhaust air system is required.



Extraction unit



Recirculating air filter system



Radial ventilator

Pro**... without technical extraction from the safety cabinet?**

- + no cost-intensive exhaust air ducts necessary

... with technical extraction (min. 10 times/h) and exhaust air fed outside?

- + no danger to the health of the employees
- + all hazardous substances (including acid and alkali vapours) are eliminated

... with technical extraction (min. 10 times/h) with a recirculating air filter system without feeding the exhaust air to the outside?

- + no danger to the health of the employees
- + no cost-intensive exhaust air ducts necessary
- + flexible installation of the safety storage cabinet
- + no loss of energy due to feeding the exhaust air to the outside
- + permanent electronic monitoring of the exhaust air quantity
- + tested and certified system

and cons...

- definition of explosion zones in and around the safety storage cabinet
- possibly dangerous to the health of the employees
- cost-intensive exhaust air ducts with possible wall/floor breakthroughs are necessary
- installation of the safety storage cabinet is no longer flexible
- high energy consumption due to heat loss in the exhaust air
- annual filter replacement

3.7 SPECIAL PURPOSE-BUILT SOLUTIONS

Safety storage cabinets for supply and disposal

Apart from standardised cabinet models and interior fittings, asecos also specialises in special and individual solutions for laboratories.

The versatility of asecos underbench cabinets makes them particularly suitable for solving problems with the supply and disposal of flammable liquids underneath fume cupboards. A variety of fitting options are available.

Supply and waste disposal pipes/hoses can be directly connected to the stored containers. The installation of the tested pipes and hoses offer the highest flexibility and maximum safety ensuring safe supply and waste disposal of flammable liquids in connection with the fume cupboard.

Including tested fire protection!

Just give us a call! +49 6051 - 9220-0
info@asecos.com



Example individual solution

Type 90 - Underbench cabinet
with disposal system



3.8 CHAPTER III – TAKE AWAYS:

Benefits of fire-rated asecos cabinets in accordance with EN 14470-1

- They provide sufficient time for users to escape and rescue services to enter.
- The cabinet contents do not increase the fire load of the building.
- The cabinets offer a similar performance as a brick-built store room.
- The extraction ducts are at the back or on top of the cabinet making it easy to connect to ventilation systems.
- Quality limitations per storage area can be overcome. Details have to be discussed with the authority having jurisdiction.
- Excellent durability and low maintenance costs.
- Ideal for open space laboratory plans. Cabinets can be positioned freely, with no changes to the building structure necessary.
- Latest technology for flammable storage based on the requirements of 21st century laboratories.

Only 90 minutes fire-resistant cabinets according to EN 14470-1 provide state-of-the-art safety without compromising on flexibility.

BE ON THE SAFE SIDE ALWAYS CONSIDER:

When purchasing a safety storage cabinet **ALWAYS CONSIDER**

1 Distance

How long does it take for the fire fighters to reach your premises?

2 Surroundings

Where is your company located?

3 Evacuation Times

How long does it take for the employees to leave the building?

4 Economic Impact

What economic damage will your company suffer if the building is completely destroyed? (value of your installations, downtimes etc.)



4

ABOUT ASECOS





4

ABOUT ASECOS

30 service engineers
cover more than **1.000.000**
kilometres per year

1.900 m²
offices

1.600 m²
planned

Products and services delivered
to more than **80** countries

250
employees

9.000 m²
factory

35.000 m²
premises

Own photovoltaic
plant **344 kW**
peak

5.000 m²
warehouse

Safer workplaces worldwide

In 1994 asecos has set a new standard for the safe storage of flammables indoors.

Since then it is our continuous mission to develop innovative safety solutions and to promote a high safety culture in laboratories and industrial spaces worldwide to minimize the risks and accidents caused by improper storage of hazardous materials.

Today the asecos range comprises more than 3,000 articles: Hazardous material workplaces, pharmaceutical exhausts, air circulation filters, extraction units and ventilators, tray systems of all kinds, hazardous material containers and depots, shelves, handling systems, sorbents, emergency showers, safety containers, smokers' cabins, as well as air purifiers.

250 asecos employees in Germany are driven by creating innovative products for safer workplaces worldwide.

In order to ensure that we are always close to the market and our customers, asecos operates in more than 80 countries. Subsidiaries in the Netherlands, France, Spain, UK, as well as representatives in major regions and a global distribution network are continuously developing in a fast pace.

Today asecos is the worldwide leading manufacturer of safety storage cabinets according to the European standard EN 14470 Part 1 and Part 2.

PROVEN SAFETY - YOU CAN RELY ON

The quality and safety of our products are recognized and certified by all leading institutes. Products manufactured inhouse by asecos are benchmarks for maximum safety and quality.

Our safety storage cabinets burn in the cause of safety

Every single model type of our fire-resistant safety storage cabinets from asecos must be successfully tested in a fire chamber by an independent material testing laboratory. It is thus tested according to the stringent requirements of the European standard EN 14470 Part 1 or 2 in order to demonstrate its fire protection rating.



Safety in daily use

Safety storage cabinets from asecos are tested according to the requirements of those safety regulations in force. By successfully passing GS testing, an independent organization documents and certifies that asecos products are tough enough and of the highest quality with now an extended GS test program since 31.12.2012.

The GS mark is only granted if, for example, the products under test have undergone a continuous mechanical test of 50,000 cycles without damage. The safety storage cabinets from asecos have easily proved themselves so successfully.



On-going quality control

Production of asecos safety storage cabinets are subject to voluntary and permanent external monitoring by an accredited and independent materials testing institute. Without any forewarning, safety storage cabinets from the current production process are taken and subjected to retesting in the fire chamber.





A reliable partner throughout

Once again the asecos GmbH was awarded the coveted „CrefoZert“ seal for an „outstanding“ creditworthiness in 2015. The price is awarded by the leading rating company Creditreform Hanau Leibrock KG.



Quality and environmental management

Our certified quality management system complies with the international standard ISO 9001 and thus proves that the quality orientation of every sub-process of asecos confirms the company philosophy and all its activities.

Furthermore it is our target to offer you products which make your daily work safer and to raise awareness for a responsible attitude towards the environment and its resources. Therefore an energy-efficient and climate-friendly action top priority for us. The certification ISO 14001 confirms that environmental management is an established part of our business processes.



Ventilation - protection and safety at work

For over 20 years asecos has been manufacturing ventilation equipment for working with hazardous materials. All asecos hazardous material workplaces (including all special versions) have been thoroughly tested over time on the basis of German (e.g. DIN 12924-1) and European standards (e.g. EN 14175-3 Para. 5.4.4). Also in the field of ventilation of safety storage cabinets, asecos offers a wide, ever-expanding range of different solutions. With all its products, asecos is supported by renowned test institutes such as infraser Höchst, IFI Institute for Industrial Aerodynamics, Tintschl Engineering and others from the development of the perfect solution right up to the serial production of certified products.



REFERENCES

A selection of our references



BASF Shanghai
China



University Graz
Austria



Siemens AG Frankfurt
Germany



Friedrich Schiller University Jena
Germany



Acibadem
Turkey



University of South Africa
South Africa



Actelion Pharmaceuticals Ltd.
Switzerland



Clinical Centre Fulda
Germany

REFERENCES



Charles Perkins Centre
Australia



Endress + Hauser
Switzerland



Bayer CropScience AG
Germany



MEET Münster
Germany

Explanation of Abbreviations from page 13 and 27

Page 13:

- | | | |
|--------------|---|---|
| 1) GGVSEB | = | Gefahrgutverordnung Straße, Eisenbahn und Binnenschifffahrt
Ordinance on the Transport of Dangerous Goods by Road, Rail and Inland Waterways |
| 2) GHS/CLP | = | Globally harmonised system / Classification Labelling Packing |
| 3) GefStoffV | = | Gefahrstoffverordnung
German Ordinance on Hazardous Substances |
| 4) VbF | = | Verordnung brennbare Flüssigkeiten
German Flammable Liquids Ordinance |

Page 29:

- | | | |
|---------|---|--|
| 5) TRGS | = | Technische Regeln für Gefahrstoffe
Technical Regulations for Hazardous Substances |
|---------|---|--|

Explanations with regard to Table 3, page 32

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 substances; | BGV B 4 "Organic peroxides"; attention: the joint storage rules quoted here shall also be applied by analogy to selfreactive hazardous |
| Storage class 7 | Radiation Protection Ordinance (StrSchV) 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 noncombustible 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.

Visit our YouTube channel



www.youtube.com/asecoschannel



Safety features of a type 90 fire rated safety storage cabinet



Fire performance demonstration of three types of safety storage cabinets for flammables



It can happen so easily



**Q-LINE safety storage
cabinets (EN 14470-1)**

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This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

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Sources: EN 14470-1, TRGS 510, TRGS 800, TRBS 2152/TRGS720, German Act on Protection Against Hazardous Substances (ChemG), GefStoffV, GGVSEB, GHS/CLP

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