Storage Cabinets According to BS EN 14470; Fire-protected Storage of Hazardous Materials in 21st Century Laboratories

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In laboratories where people work with various types of hazardous materials, flexible and safe storage of these materials is extremely important. Inappropriate storage of hazardous materials can not only lead to serious environmental and property damage, but, in the worst case, can even cause loss of human life.

Cabinets with a proven fire resistance class designed and manufactured in accordance with BS EN 14470 enable modern laboratories a virtual fail safe method of storing hazardous and flammable chemicals:

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

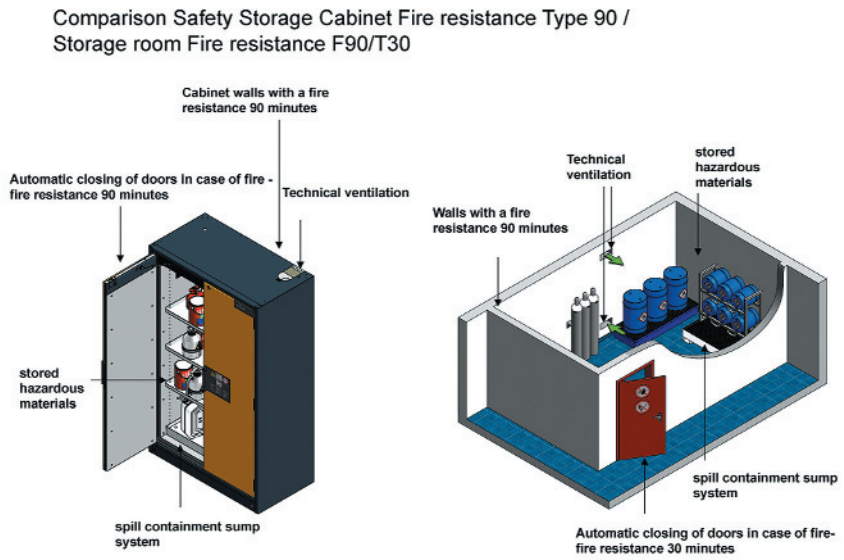
Apart from space saving advantages and the laboratory-specific benefits like time saving in the supply of materials, the use of safety storage cabinets according to to BS EN 14470 also signifies an immense safety advantage regarding preventive and defensive fire protection. The increasingly flexible design of laboratories and the fast change of applications make a decentralised fire protection concept very desirable. This concept can 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 this way, there is no need of preferential consideration of the fire accelerating or even the potential of explosion, during the fire-fighting and rescue operations. Thus, the emergency services can primarily concentrate on controlling the fire and rescuing 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 significantly minimised. Therefore the classification according to the EN-standards makes for a far more precise risk assessment.

These safety-related statutory specifications do not exist in all countries. Laboratory staff using single or double walled metal storage cabinets, are exposed to a higher risk, as built and test specifications for these types of cabinet do not fulfil the strict specifications of BS EN 14470 design.

The following illustration demonstrates the comparison between a safety storage cabinet (acc. to BS EN 14470) and a storage room for hazardous materials and flammable liquids designed in accordance with the European standards:



A fire-resistant safety storage cabinet according to BS EN 14470-1 becomes the "storage room within the laboratory"

This illustration clearly shows that the safety storage cabinet has the same comparable safety-related characteristics as 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 duration and on the other hand the laboratory is protected against the substances stored in the cabinet. The use of fire-resistant cabinets (Type 90) directly in the workplace drastically reduces the transport time for hazardous materials and gase, reducing associated risks almost to zero.

The 'insulated' construction of BS-EN 14470 safety storage cabinet, helps to restrict the damage locally. Safety storage cabinets built to other constructions standards often have no insulation, but instead rely on the sprinkler systems in the rooms they are installed in, to limit the rise in temperatures and spread of fire. In this case the fast control of the fire is contradicted not only by the typical water damage, but also by the potential spreading of hazardous materials by mixing with the fire fighting water. Furthermore, the sprinkler installation is a so called active safety systems, which only reacts in the event of fire. This means that one only knows whether the system is working correctly, in the event of fire.

The European safety storage cabinet excels by 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 permanent.

The equipment of laboratories world-wide with safety storage cabinets in accordance with European safety standards is desirable, not only with regard to personal safety. In case of fire, far less property damage can be expected. This emphasises the practical added value of the cabinets compared to less expensive cabinets which do not comply with the requirements of BS EN 14470.

BS EN 14470 consists of two parts. Part 1 refers to 'safety storage cabinets for flammable liquids' and part 2 refers to 'safety storage cabinets for pressurised gas cylinders'.

The standard was implemented in the course of European harmonisation, aiming to standardise the various safety-regulations in the different countries. The test and construction requirements, for the admission of safety storage cabinets for flammable liquids and cabinets for pressurised gas cylinders, are regulated in this standard and were adopted in all participating member states of the European Union.

The principal safety requirements according to BS EN 14470:

- Minimisation of the fire risk associated with the storage of flammable materials.
- Protection of the material stored in the cabinet for a known (tested and approved) period of time in the event of fire.
- Minimisation of the fumes escaping to the working environment.
- Retention of any possible leakage within the cabinet.
- Provision of enough time, in the event of fire, for personnel to leave and sufficient time for fire fighters to enter the building before the stored materials turn a small fire into an uncontrollable blaze.

The safest solution for the user is a safety storage cabinet Type 90 (G90 for safety cabinets for pressurised gas cylinders). Type 90 indicates that the safety storage cabinet shields the stored hazardous materials for 90 minutes in the event of fire. Within this time the temperature inside the cabinet must not rise by 180 Kelvin. In gas cylinder cabinets the temperature at the surface of the bottle valve bracket may not exceed 50 Kelvin.

Examples of commonly stored Industrial Solvents

Solvent	Flash Point (°C)	Autoignition (°C)	Boiling Point (°C)	Explosion Limits
Acetone	Minus 18	538	56	2.6 – 13%
Ethyl Acetate	Minus 4	426	77	2.2-11%
Ethanol	Plus 14	363	78	3.3-24.5%
MEK	Minus 3	515	80	1.8-10.1%
Hexane	Minus 23	284	69	1.2- 7.7%

The flash points are self evidently low. In a single skinned or double skinned cabinet the boiling points would be reached very quickly indeed within the first couple of minutes. A solvent can expand by a factor of tens of thousands when turning into a vapour and the autoignition temperature is reached soon afterwards. Heat enters the cabinet extremely quickly and solvent vapour escapes soon afterwards with potentially catastrophic results.

Several factors in BS EN 14470-1/2 cabinet construction minimise the amount of heat entering a cabinet and minimising the amount of solvent vapour released into the working environment. These are as follows:

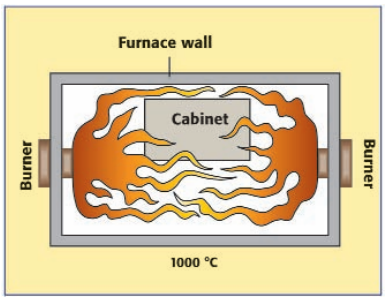
1) Main body construction is highly insulating gypsum encased in sheet metal.

2) Every possible air gap is surrounded by intumescent materials which swell up to 20 times their original volume in the event of a fire.

3) Thermal fuses are incorporated so that doors or drawers which are left open automatically shut in the event of a fire.

BS EN 14470-1 requires a furnace test by an independent material testing institute:

- The fire resistance must be investigated by tests on a design sample
- The fire resistant cabinet is exposed to flames in a suitable furnace
- The doors, walls and ceiling of the cabinet being tested must be exposed to the same heating conditions
- Cabinets must be tested as free-standing single cabinets
- The example being tested must be positioned with its rear wall at least 100 mm from the furnace wall
- The flame exposure is carried out in accordance with the standard temperature curve of BS EN 1363-1 (5.1.1)
- The temperature rise is measured inside the cabinet
- The cabinet must then be classed as type 15, 30, 60 or 90, according to the time that has elapsed before the temperature rose by 180 K.



Furnance test according to BS EN 14470-1

Apart from the safety aspects, cabinets according to BS EN 14470 can be equipped with many different interior equipment variations, in order to make work most effective and utilise maximum storage space.

When it comes to storing flammables in a cabinet it is not only important to shield the flammables from an external fire, but also to avoid fires or explosions inside. This can be achieved by technical ventilation. The Standard also gives clear advice:

BS EN 14470-1 (safety storage cabinets for flammable liquids)

- Cabinets shall be equipped with openings for inlet and exhaust air
- The openings must close automatically when exposed to a temperature of 70 +/- 10°C
- The entire air volume inside a ventilated cabinet shall be exchanged at a rate of at least 10 times per hour, at a maximum pressure drop of 150 pa
- Ventilation has to be effective directly above the bottom collecting sump

BS EN 14470-2 (safety storage cabinets for pressurised gas cylinders)

- Cabinets shall be equipped with openings for inlet and exhaust air
- The openings shall close automatically in the event of a fire
- The entire air volume inside a ventilated cabinet shall be exchanged at a rate of at least 10 times per hour for flammable or fire supporting gases; at least 120 times per hour for toxic gases; at a maximum pressure drop of 150 pa
- Air circulation system within the cabinet shall ensure adequate purging from minor leakage

Safety storage cabinets according to BS EN 14470-1 in a laboratory at Gießen University

More than 50 safety storage cabinets connected to a central ventilation system

Type 90 safety storage cabinets according to BS EN 14470-1 in a laboratory at Sussex University