VdS VERLAG

Security Guidelines for

Museums and Showrooms

These Security Guidelines for Museums and Showrooms are not binding. In individual cases, insurers may accept other security precautions in line with their terms and conditions which may not comply with these Security Guidelines for Museums and Showrooms.

Note: This is a translation of the German guidelines; if there are any discrepancies, the German version shall be binding.

We wish to thank the Police, in particular the „Kommission Polizeiliche Kriminalprävention der Länder und des Bundes" (German Police Committee for Crime Prevention) for the good and constructive cooperation in developing these guidelines.

Editor: Gesamtverband der Deutschen Versicherungswirtschaft e. V. (GDV)

Publisher: VdS Schadenverhütung GmbH

Amsterdamer Str. 174
D-50735 Köln
Phone: +49 221 77 66 0, Fax: +49 221 77 66 341

Security Guidelines for

Museums and Showrooms

Table of Content

1 Introduction

Museums and showrooms are places of aesthetic visualisation of cultural creativity that serve as trustees of our cultural heritage. As sites that collect, preserve, exhibit and explain art and culture, they often house unique objects, many extremely valuable, either on a permanent or temporary basis whose loss or damage is irreplaceable.

Museums and showrooms therefore have a special responsibility: they need to protect the objets d'art and collectors' items entrusted to them from a large number of risks in the best possible manner.

In order to meet this special responsibility, a museum's management needs to implement a systematic protection scheme that clearly defines and documents the necessary structural protection measures as well as the organisational security measures. Such a protection scheme would typically include a specific risk assessment from which it derives protection concepts against identified risks.

These Security Guidelines can be used as reference during the planning stage of a building to help both the architect as well as the museum executive responsible for security.

Organisational measures in the context of the protection concept such as access restrictions, bag searches and adequate supervision top off the protection concept to be developed against burglary and theft, and prevent any pick pocketing or acts of vandalism during opening hours. However, visitors' legitimate interest in inconspicuous and discreet checks must always be taken into consideration.

Electronic and optical systems should complement physical security measures to monitor the areas structurally protected, and to generate an alarm in case of a crime (burglary or lock-in). The further outside electronic security measures are deployed (e.g. as perimeter protection with alarm loops in the outer glazing), the faster an alarm is triggered, causing immediate intervention by security guards if connected to the police or security services (cf. Figure 1 1). In addition to mere perimeter security measures, traps should also be monitored to detect locked-in burglars as early as possible.

These Security Guidelines provide practical recommendations to protect museums and showrooms against the risks of

- burglary
- theft by visitors or employees
- robbery
- vandalism
- fire, smoke and radiant heat
- damage by natural hazards and water.

Experience shows that approved burglar resistant elements installed in the course of the construction of a building provide the most effective protection. Often, physical retrofit products do not provide the same level of protection, though they clearly enhance security. In this context, planners, users and security officers need to focus their attention on the weakest elements of the security chain and, if required, upgrade them.

The general recommendation is to protect and monitor an object at risk with both physical and electronic security measures. Manned security and surveillance and the overall organisation of different protection measures are important components of an optimum protection concept.

The most important prerequisite for the different security measures is to complement one another in a useful way and constitute a harmonised security chain that makes it possible to insure the museum.

The Security Guidelines take up these principles and provide recommendations on how to install such a security chain. Hence, users should always review individual security measures and determine whether they weaken or strengthen the security chain.

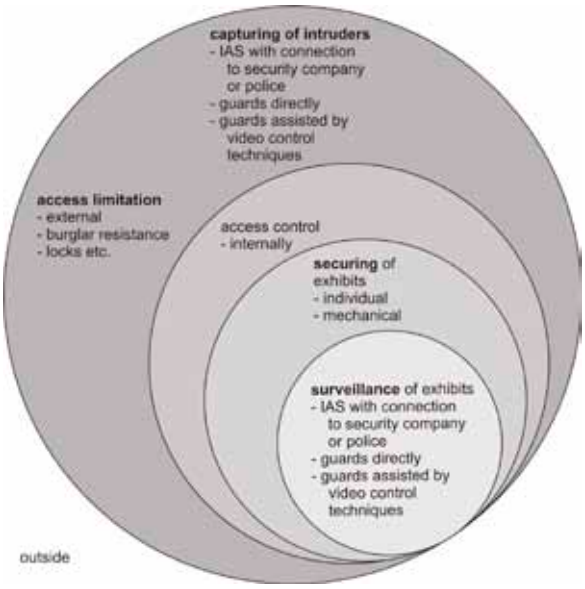

Figure 1-1 Multi-layered security

The top priority of a risk assessment for a museum or cultural institution is personal safety. This applies in particular to risks such as fire, robbery and threats to visitors by terrorist attacks which are a risk to be increasingly taken into account, particularly in case of exhibitions that have political or religious themes.

Protection of the building is secondary to personal safety which, in case of a fire, might have adverse effects on the building if priority is given to open escape routes. However, the best possible coordination of personal safety and asset protection measures involving the police and fire brigade ensures a high level of protection for artefacts and collectors' items.

Hence, the optimum protection concept against burglary/theft takes into account the structural measures that provide optimum protection as early as the design or planning stage to refurbish a museum or its depots and restoration workshops (cf. Figure 1 2).

Physical security measures such as burglar-resistant windows and doors play an essential part. Good physical security measures feature great burglar resistance – the higher the resistance, the harder it becomes for the burglar to overcome these security measures (in terms of time, tools, expertise) – and increases the risk for the perpetrator to be discovered and caught.

When coordinating physical and electronic security measures, the most important aspect is adequate burglar resistance of the physical security measures. As the perpetrator would need more time to overcome the security measures, it becomes more likely for security guards who have been alerted to intervene in time. It also helps to prevent successful blitz break-ins that European museums are increasingly affected by.

The objective of these Security Guidelines is therefore to make operators and supporters of museums, safety officers, planners and the police aware of the various options of security technology with a view to burglary/theft, fire protection and protection from natural hazards and water damage in museums and showrooms. They provide non-binding recommendations to parties involved for developing an effective protection concept (structural/organisational/ electronic) against the risks outlined here.

These Guidelines do not cover measures for protection against any other risks which include e.g. light, climate, insect infestation or improper

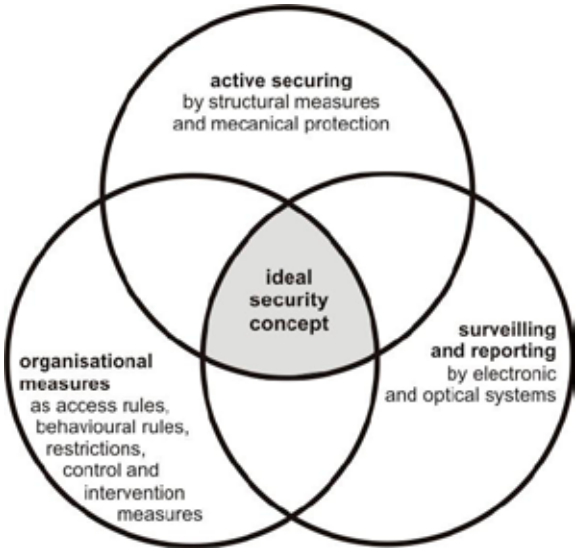

Figure 1-2 Active protection

handling of objects by museum staff or the development of contingency plans (cf. *Sammlungsgut in Sicherheit, Beleuchtung und Lichtschutz, Klimatisierung, Schadstoffprävention, Schädlingsbekämpfung, Sicherungstechnik, Brandschutz, Gefahrenmanagement* by Günter S. Hilbert with contributions by Barbara Fischer, Klaus Fitzner, Hans-Jürgen Harras, Paul Schmits, Achim Unger, Wibke Unge, 2002, 3rd fully revised and extended edition).

Regarding the development of contingency plans, cf. the German Guidelines *Erstellung von Evakuierungs- und Rettungsplänen für Kunst und Kulturgut*, VdS 3434 (Creating of plans for evacuation and saving of arts and cultural goods).

These Security Guidelines explicitly take into consideration that every building has different structural and organisational properties, e.g. requirements for the conservation of historical buildings or the composition of staff.

The scope of protection therefore always needs to be tailored to the individual organisation, the respective value of the artefacts and collectors' items as well as their type and size.

A classification of the museums in terms of the required scope of protection can only be made to a limited extent and is not subject of these Security Guidelines.

In general, every building has different occupancies and premises at risk. Therefore, it is useful to establish protection zones depending on the relevant occupancy. Protection zones

can be enclosed buildings, parts of buildings or rooms that are enclosed and that house the objects to be monitored. Protection zones may be independent or dependent of one another (cf. chapter 3.2.4).

Protection zones independent of one another may be useful, among other things, to prevent mutual damage in case of different occupancies (e.g. conversion of an exhibition area, operating a restoration workshop independent of opening hours, third party occupancy managing a café). This makes it possible to protect certain parts while others are being used.

The Guidelines also address:

- Taking objets d'art out of depots
- Tracing ownership
- Transport
- Outdoor exhibitions
- Short exhibitions (e.g. in savings banks, financial institutions, authorities, administrations and large trading corporations)

Note: Information on how to protect other buildings at risk, e.g. churches that house cultural heritage – both within the context of exhibitions and outside – but are not museums as such are addressed in the VdS Security Guidelines for Shops and Businesses, VdS 2333.

1.1 Status

The status of these Security Guidelines is October 1st, 2008.

1.2 Implementation of Protection Measures

When implementing protection measures, different intentions, skills and motivations of perpetrators and their expected approaches need to be taken into consideration.

Listed buildings need to comply with special requirements. Physical security measures as well as intruder alarm systems (IAS) might require impacts on the structure, e.g. by doors, windows, walls, ceilings and floors. It might, e.g. be necessary to install an optical warning device to protect and/or preserve assets, which might contrast with conservation principles for historical buildings and/or aesthetic considerations. This is why officials from conservation authorities for historical buildings should be involved as early as possible to find a solution that ensures effective burglar protection while also taking into consideration principles of architecture, art and conservation. Often, innovative security solutions can be developed through cooperation with officials of conservation authorities that take into account the respective local conditions. Depending on the scope of the measures, conservation permits might be required.

In case certified and approved burglar-resistant elements are installed (e.g. burglar-resistant doors, retrofit products installed by experts on windows etc.), all parties involved can be certain that these products proved during intensive tests are well suited as protection against burglaries. For instance, a VdS-certified burglar-resistant door needs to withstand an attack with tools typically used for a break-in for a defined minimum time. In general, the resistance level of a protection– resistance that a protection poses to an attacker – needs to be adequate. The higher the resistance level, the longer a perpetrator needs to enter a building or steal an object – and the greater the chances for intervention forces, e.g. the police of preventing the crime, catching the perpetrator in the act or prompting him to abort his project altogether.

In general, products for burglar and theft protection are divided into different classes. Investigations by the police show that many attempts at a burglary fail because of sophisticated security technology. The perpetrator needs to try harder the more sophisticated the protection; he loses time to overcome the protection which may prevent him from completing the theft.

Important note: When planning, installing and operating the protection measures, the relevant legal provisions and requirements for escape and evacuation routes must be complied with. More detailed provisions are contained in the respective regional building codes. Moreover, requirements for fire protection and protection from damage caused by water need to be taken into account.

2 Risks

Although the level of threat differs from one museum to the next, there are nevertheless comparable basic risks that almost all museums are exposed to. The level of exposure of museums and showrooms is determined by a number of factors such as location, size, type of exhibits (in particular material values of collections, cultural heritage and damage for which there is no material compensation) and political/religious relevance etc.

In order to assess the risks, an individual protection concept has to be developed.

The protection concept generally represents an analysis of possible attack and loss scenarios (taking into account potential damage) aimed at achieving a defined protection level. In this context, it is important to distinguish protection against malicious attacks (security) and protection from human or technical error (safety).

All protection concepts have a structural approach in common:

- Defining the object to be protected and protection goals
- Assessing the likelihood of a loss and potential scope of damage
- Analysing the threats/damage scenarios
- Developing measures to reduce the likelihood /scope of a loss
- Planning measures and providing means to prevent and mitigate the loss if the risk materialises
- Analysing acceptability of one's own risk
- Even a sophisticated protection concept is not able to completely eliminate the remaining risk

Risk management was not invented as late as the KonTraG [1] Act on controls and transparency in companies or the Sarbanes-Oxley Act [2]. Companies, organisations and individuals have had to cope with all sorts of risks since time immemorial.

Negative repercussions of risk management which has been reinvented after the credit crunch and numerous scandals include excessive red tape, a flood of literature on the subject matter and a corporate culture of tight controls and monitoring, which contrasts with a management style focused on team work.

The people working in these organisations pose the biggest risk, as they do not want to or are unable to sense changes in their environment (market risks, environmental risks and technological risks) in time. The wider the room for manoeuvre the greater is the risk. Since the sections of staff responsible for risk management in today's companies are at the disposal of the aforementioned protagonists, they have little influence on critical decisions.

One of the main problems in practical and operational risk management is a realistic assessment of risks, which is often based on subjective assumptions, and the definition of useful early warning indicators to monitor risk potential identified.

The risk assessment includes the determination of probability of occurrence and the possible extent of damage. It is based on a structured approach that classifies the risk and provides insight into the factors that have a positive or negative influence on the risk. The greater the probability and extent of damage, the more the project is at risk and needs to be radically rescheduled. Different methods can be used for the risk assessment.

Benefits of a comprehensive risk management: potential problems and exposures can be identified at an early stage.

Pitfalls of risk management: despite good research, risks can only be estimated. Such estimates always imply a certain degree of uncertainty.

The risks should be assessed taking into consideration the different sectors of a museum (cf. Figure 2 1).

---

1) Gesetz zur Kontrolle und Transparenz im Unternehmensbereich (Act on Supervision and Transparency in Companies), in short KonTraG is a comprehensive law that was approved on 5 March 1998 and entered into force on 1 May 1998. The objective of the KonTraG is to improve instruments to manage and supervise organisations and/or German companies. This Act changed a number of provisions from trade and corporate law. KonTraG predominantly specifies and elaborates provisions from the German commercial code (HGB) and the Stock Corporation Law (AktG).

2) The Sarbanes-Oxley Act of 2002 is a US law that contains binding provisions on corporate reporting resulting from the enormous financial scandals of big US corporations. It has been named after its authors.

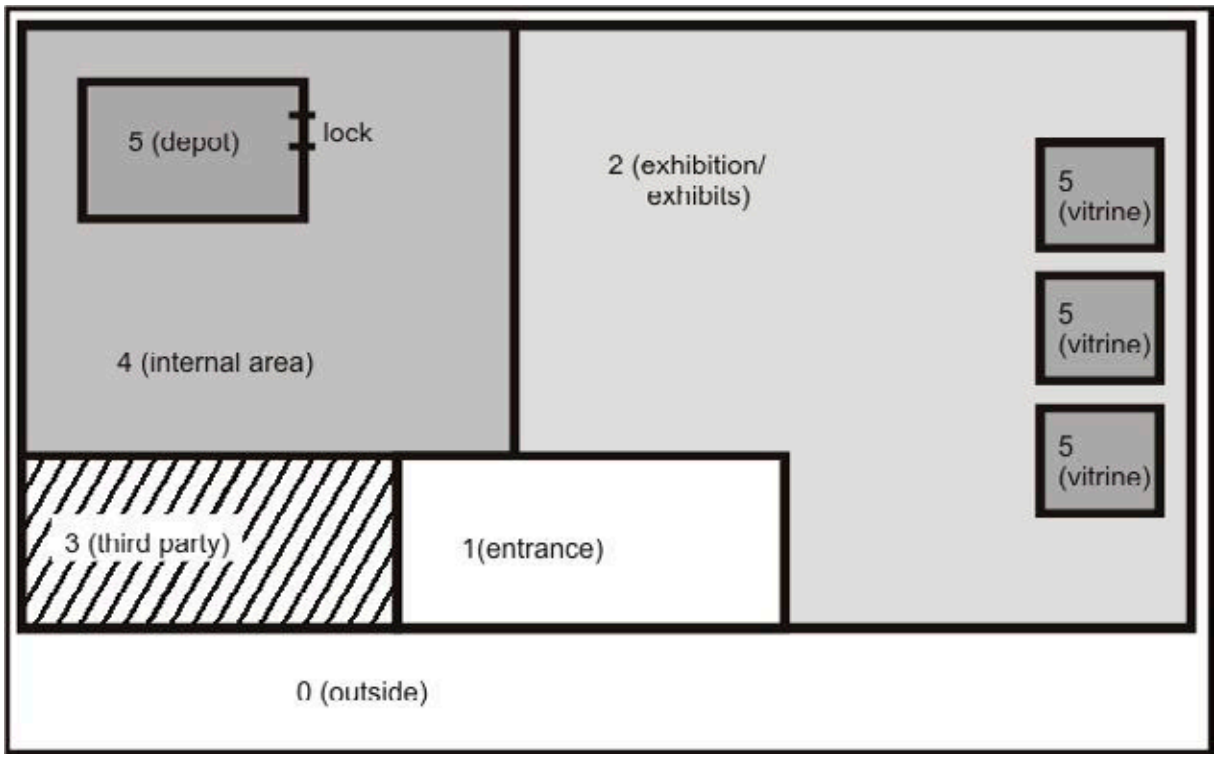

Figure 2-1 Sectors, schematic illustration

There is a difference between buildings which are exclusively used as museums and those which are part of other organisations or whose premises can also be used entirely or partially by other organisations. While “pure“ exhibition centres can be locked after opening hours, buildings with shared occupancies always provide the possibility of entering beyond opening hours. In any case, the museum’s rooms need to be partitioned from other – occupied – rooms. Any partition needs to accommodate physical security measures, electronic surveillance and organisational protection measures. Such a shared occupancy may result from e.g. an integrated restaurant that is operated during and beyond opening hours.

Sector	**Main risk**				
		structural mechanical	**Intruder / Hold up alarm system**	**Fire detection and alarm system**	**Video surveillance system**
0	Vandalism				
1	Intrusion, Vandalism				
2	Threat, intrusion, fire, vandalism, hold-up				
3	Intrusion, fire, vandalism				
4	Intrusion, fire, hold-up				
5	Intrusion, fire, hold-up				

Table 2-1 Example of a protection matrix

In general, such risks may be posed by different groups of users such as employees, service providers or third parties without a traceable connection to the museum (e.g. visitors).

All risks described below may result in immediate damage, for instance, stealing and destroying an exhibit. Moreover, almost every immediate damage is expected to lead to indirect repercussions. For instance, if the best exhibit of an exhibition is stolen, the museum has to expect a decline in visitors or, worse, public interest drying up. If artefacts and collectors' items are (perhaps repeatedly) stolen from a museum, this will have adverse effects on private and institutional collectors' willingness to provide items on loan. If equipment that has been stolen or destroyed by e.g. fire smoke, this may paralyse or obstruct the museum's operation for some time or bring it to a complete standstill. Other risks to the operation of a museum include natural hazards (storm, heavy rain etc.).

2.1 Burglary

Burglary crimes include intrusion and theft and crimes such as

- Theft of objects d'art and collectors' items (or other desirable objects) during the opening hours of a museum
- Blitz theft
- Replacement of exhibits by replica
- Theft during shipment

All these crimes may also be committed by third parties who have no connection with the museum; at the same time, however,

- theft by museum employees
- theft by contractors' employees

also need to be taken into account when formulating the protection concept.

Intrusion and theft as a particularly severe kind of theft is one of the most obvious risks to which objets d'art and cultural heritage are exposed. The FBI estimates that global losses amount to several billion US$. Security experts reckon with burglaries that may be aimed at exhibition halls as well as depots, utility rooms, external storage rooms or restoration workshops. Moreover, stolen objects of art and collections may be used to press money (so-called art napping).

The primary target of an intrusion is to steal objects of art or collections on display. Burglaries may also be aimed at other valuables such as e.g. admissions or change deposited in ticket booths or safety containers or IT and office equipment.

Another risk, both to the structure of a museum or its exhibits and other fitments, may result from a successful entry of a perpetrator into the premises as well as a search, which may lead to **non-targeted destruction** in particular.

Theft by and/or following **sneaking-in** and/or **locking-in** are special types of intrusion and are dealt with like burglaries. In these cases, the perpetrator hides in the museum or utility rooms which give him fairly easy access to the artefacts and collectors' items, making it possible for him to complete the crime after opening hours.

Crime preparations through e.g. manipulation or sabotage of security equipment aimed at a subsequent attack also need to be taken into account for the protection concept. This implies attempted burglary by a perpetrator who opens or manipulates windows or doors during opening hours to use them later either for access or to escape.

The design of escape and evacuation routes can have a **considerable** impact on the risk of burglary.

2.2 Robbery Hold-up

Robbery hold-ups are one of the most relevant risks for museums. In a hold-up, the perpetrator threatens to exert or exercises physical violence to achieve his actual goals. Threatening to use force helps the perpetrator to exert pressure to seize e.g. exhibits or cash (admissions etc.).

Robbery crimes include e.g. the following acts by perpetrators:

- Robbery hold-ups during opening hours aimed at museum employees or visitors
- Intercepting museum employees when entering or leaving museum premises before or after opening hours
- Sneaking into premises during opening hours of the museum with the aim of a subsequent hold-up
- Breaking-in after opening hours with the aim of a subsequent robbery hold-up.

The risk of robbery hold-ups is particularly significant as it is not only directed at assets but also and in particular against persons.

2.3 Vandalism

Vandalism in the broadest sense refers to deliberate, illegal damage or destruction of a third party's property; it is common in different forms. Vandalism directed at exhibits implies e.g. knocking over, breaking or spraying exhibits with the aim of partially or completely destroying them.

Vandalism is an offence to which there can be different underlying motivations:

- Malice
- Enjoying destruction
- Mental disorientation, emotional disorders
- Aggravation, bitterness, frustration
- Aversions against certain exhibition concepts and/or exhibits
- Destroying evidence, covering-up other crimes.

2.4 Fire and Fire Smoke

Fires (fire as well as smoke and heat) may have disastrous effects on people and exhibits, buildings and fitments.

The following factors pose the risk of fire development and spread:

- Arson
- Negligence (e.g. by wrong location for heaters)
- Defect (or obsolete) electrical systems and equipment
- Activities prone to catch fire (welding, soldering, hot-gluing, abrasive cutting etc.)
- Radiant heat by lights
- Handling flammable substances (among others, auto ignition)
- Open flames (e.g. candles during advent in the foyer at the ticket booth or in administration offices).

2.5 Natural Hazards

Natural hazards include:

- Heavy rain and accumulation of wastewater, e.g. due to technical problems in the sewerage system or the building's supply system
- Floods and storm surges
- Storm
- Hail
- Heavy snow
- Vibrations due to earth quakes, erosion, landslide.

2.6 Improper Handling of Artefacts and Collectors' Items

Risks as a result of improper handling of artefacts and collectors' items may be caused by museum employees in their daily routines, external service providers (e.g. cleaners, craftsmen) or visitors. Possible risks include:

Caused by museum staff:
e.g.

- Improper handling
- Improper storage
- Inadequate fastening (in an exhibition)
- Wrong environmental conditions in the exhibition not suitable for the exhibits (e.g. light, humidity, heat).

Caused by service providers:
e.g.

- Work carried out improperly (e.g. using wrong cleaning agents)
- Deviation from agreed procedures.

Caused by visitors:
e.g.

- Touching exhibits (touching, knocking over)
- Perspiration (sweat, humidity, carbon dioxide).

2.7 Other Hazards

In addition to the risks outlined above, the following hazards also need to be taken into account:

- Water pipes
- Sudden fluctuations in temperature and/or atmospheric humidity
- Humidity escaping from parts of the building (e.g. new concrete parts).

3 Protection Measures

Only well coordinated overall prevention is able to achieve an adequate level of protection which makes the risk of loss, damage, destruction of valuables or obstruction to business calculable. When implementing the protection concept, administration, exhibition and depot sectors, security control room and perhaps workshops need to be distinguished.

Optimum protection of a museum can be achieved by taking into account different protection levels.

The entire outside area of the building needs to be included in the risk analysis. This also applies to the entire public area which is not necessarily the museum's responsibility and includes access roads, car parks etc.

The outer shell of the building, the so-called perimeter needs to provide physical protection but also requires electronic surveillance. It makes sense to detect or report an intrusion when or immediately after the first physical barrier has been overcome. This should be followed by a second – stronger – physical barrier. In order to ensure effective intervention in the case of a burglary, the intruder alarm system (IAS) should be connected to a security company (SC) or the police. The combination of physical and electronic security measures achieves a high level of protection that also ensures an early activation of alarms.

Inside, an access control system (ACS) is able to monitor access to various sectors of the museum. ACS are suitable for those parts of the building to which only museum staff or a limited number of employees should have access.

Protecting selected exhibits poses a particular challenge. It is necessary to find customised solutions for particularly valuable objects. As to which protection measures shall be implemented needs to be agreed on a case-by-case basis.

Exhibits that require special protection (which may include originals as well as pieces that are exhibited as replica), in particular those that are not separately insured against theft, should be monitored around the clock by video surveillance systems– regardless of IAS surveillance.

It is necessary to ascertain whether there is an immediate risk for museum staff in addition to the risks which exhibits are exposed to. For instance, hold-up detector should be installed in the foyer near the ticket booths which makes it possible for employees working in the ticket booth to call help in case of danger. Using portable hold-up detectors (cf. *VdS Guidelines for Hold-up Trigger Devices for Intruder Alarm Systems*), VdS 2271) should always be coordinated with the police due to technical and organisational complexity, also in case they are connected to an alarm receiving and service centre (ARSC).

Despite extensive technical safeguards, additional surveillance of assets by security personnel will be required during opening hours. Installation of video surveillance systems makes sense, although this does not contribute to reducing the number of security guards required.

The protection concept must always be agreed with the insurer, the police and the planner of the exhibition at an early stage, which makes it possible to take into account expert knowledge and loss experience in time. As the case may be, it helps to avoid necessary and costly security upgrades.

The protection and surveillance measures suitable for museums and showrooms are summarised and explained below. Physical security measures should constitute the protection basis; they should be supplemented by electronic, organisational and personal surveillance measures.

3.1 Physical Security Measures

Physical security measures can be installed to protect the building on the one hand, and the collection's items on the other. Physical security measures must not be neglected, even when buildings or objects are protected by electronic surveillance. Physical security measures and electronic security technology complement one another. Replacing physical security measures with intruder alarm technology is not acceptable judging by the experience of burglary insurers and the police.

Physical security measures are the basic prerequisite for a viable protection concept as they definitely prevent potential perpetrators from easily getting into the building and/or a protected area and getting hold of items from the museum's collection. Moreover, they are suitable to make simple theft more difficult.

Note: More detailed information on physical security measures,, in particular on situations in which complete burglar-resistant elements cannot be installed, are contained in the VdS Security

Guidelines for Shops and Businesses*, VdS 2333. A comparison of different approval classes is contained in Annex E to these Guidelines* (remark: in the German edition of VdS 3511 only).

An experienced security commissioner should be entrusted with the concept and maintenance of – both physical and electronic – security technology; he will also provide direct advice to the museum's management.

3.1.1 Walls

If walls are not sufficiently stable, a perpetrator can easily break through them. Attention must be paid to exhibition areas which are designed as individual protection zones; they need to have solid walls (as well as a solid ceiling and floor). It is possible that a perpetrator will try to enter through the ceiling (from the roof outside or through false ceilings inside) or through rooms on the lower floors.

There is a difference between walls of light construction without any special resistance to opening, walls of solid construction, e.g. bricks of 120 mm or more thickness or concrete and exceptionally solid construction, e.g. concrete walls of 200 mm or more thickness. Walls of light construction are generally not suitable as outer walls (or as partition for rooms that house valuable artefacts and collectors' items).

Plaster, insulation, isolation, lining and casing do not enhance resistance.

3.1.2 Doors

Tested and approved burglar-resistant doors featuring at least VdS class N should be installed.

The main characteristics of a tested and approved burglar-resistant door include:

- Stable design of door leaf
- High-quality hinges, possibly reinforced by lateral protection (in particular required for hinges on the outside)
- Sophisticated locking system (in general multipoint locks)
- Burglar-resistant door plate
- Lock cylinder, protected against unlocking techniques (opening the cylinder with similar keys, picking), drilling and pulling
- Potential infill (e.g. glazing) are as solid as the entire door element
- Competent assembly of the entire element (anchoring in the brickwork) in line with OEM specifications.

In case no burglar-resistant doors are installed, e.g. additional locks and hinges/lateral enforcements should be fitted to increase the protection level.

When upgrading a door or building a new one, it is vital to see to it that the old design and the new security elements are adjusted to each other/ tuned.

The security upgrades must not obstruct escape and evacuation routes or render them ineffective. This must be taken into consideration during the planning stage.

Note: Doors in escape routes must generally open easily from inside and with a single push in full width at any time.

Double Doors/Security Gates

In most cases, doors in historical buildings need to be preserved and must not be changed. In these cases, a double door (burglar-resistant door behind the original door which cannot be protected at reasonable expense or for reasons/ requirements of conservation of historical buildings) might be a possible solution provided the building's structure allows for its installation. This kind of protection is also suitable for other types of doors such as e.g. air locks to the depot, gates to underground car parks or escape staircases etc.

If someone tries to break in, an alarm triggered by the outer door would provide the optimum protection level. The inner door should serve as a burglar-resistant physical barrier. All solutions with intruder alarm systems need to see to it that *"Zwangsläufigkeit"* (cf. also chapter 3.2.6) is complied with.

3.1.3 Windows/Facade

Windows without burglar-resistant features can easily be overcome with simple tools in a matter of seconds.

This is why tested and approved burglar-resistant windows of at least class N should be installed.

Fixed glazing (fixed windows) have a benefit: physical protection and electronic surveillance are easier to realise than in openable windows.

Moreover, a fixed window does not pose the risk of being accidentally left open. Windows with fixed glazing should be as stable as openable elements.

Windows which can be opened can also be secured later by screwing down the leaf to the frame.

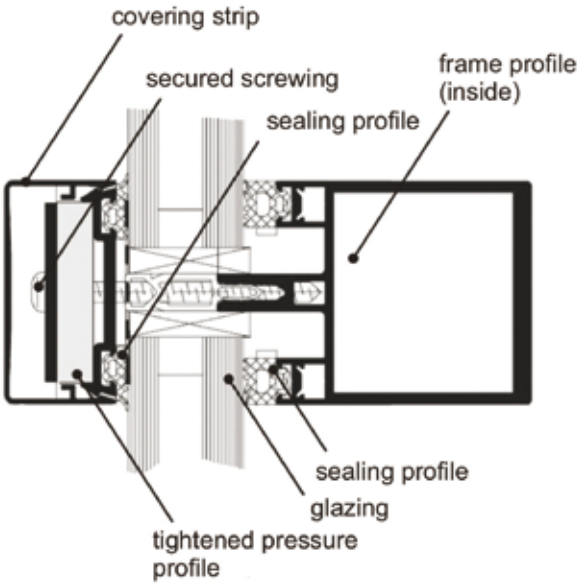

Figure 3-1 Post-bar curtain wall

Post-bar curtain walls are usually glazed on the outside (cf. Figure 3 1). The unprotected bolt connections of the cover strip (or putty) and the insufficient tightness of the connections are generally the weak spots.

In terms of protection, dome lights should be treated like windows. This also applies to glazed areas of the roof, e.g. in shed roofs. When planning the security measures, special attention must be paid to smoke and heat exhaust ventilation systems (SHEVs) or other ventilation openings. To some extent, these openings must comply with specified technical requirements while at the same time, be incorporated into the surveillance measures of the intruder alarm system.

The main features of a tested and approved burglar-resistant window include:

- Stable construction of leaf and frame of the window
- Resistant glazing
- Sophisticated fastening of glazing to leaf
- Wraparound burglar-resistant ironwork in combination with a lockable handle
- Competent assembly of the entire element (anchoring in brickwork) in line with OEM specifications.

If burglar-resistant windows cannot be installed, the protection level of the windows needs to be enhanced by additional locks, for instance, or ironwork replacement or, if possible, security glazing.

In general, historical windows cannot be secured. If such windows cannot be replaced for design or conservation reasons, the following safeguards might provide a solution:

- Iron bars
- Counter sash windows (second window/front window)
- Inserting solid glazing (penetration or break-resistant).

Counter Sash Windows

Counter sash windows have a long tradition. In most cases, a single historical window can be supplemented by a second one. This is generally compliant with conservation requirements since the historical structure remains unchanged (cf. figures below). Figure 3 3 shows the original window and the added enforced lock mechanics.

From the point of security, climate control and conservation, counter sash windows feature positive properties.

The outer window can be preserved to a large extent and/or restored from a conservation point of view. If need be, only contacts need to be integrated into the outer window to monitor opening and closing. The outer window also needs to be sufficiently solid in order to install an intruder alarm system that is almost 100 percent false-alarm-proof. It is necessary to decide on a case-by-case basis to what extent the window pane needs to be replaced by alarm glass (glass with integrated surveillance features) or whether another protection against penetration is required.

The inner window is designed in line with protection standards and features enhanced burglar-resistance. If possible, the inner window should be a tested burglar-resistant element.

If someone tries to break in, an alarm triggered by the outer window would provide the optimum protection level. The inner window should serve as a burglar-resistant physical barrier.

Figure 3-2 Countersash window, closed

Figure 3-3 Countersash window, open

In individual cases, burglar-resistant blinds (installed inside) or shutters/lattice grates also provide a solution. A mechanically stable lining inside e.g. from plywood or steel plate could also be a solution.

3.1.4 Other Openings

Other openings that make entering possible (openings e.g. required for ventilation and air conditioning systems) also need to be secured by e.g. bars. Openings that are not used should be closed permanently by e.g. bricking up. The design drawings should be used to check whether previous openings have only been covered up with a thin plaster board for aesthetic reasons. Such covers hardly provide any physical resistance.

The maximum clear diameter of wall openings and spacing of bars should not exceed 12 cm and/or reduced to that size. In general, openings with the following dimensions can be penetrated:

- Rectangle of 400 x 250 mm
- Ellipse of 400 x 300 mm
- Circle of 350 mm diameter

In the case of openings needed for air circulation, it is necessary to bear in mind that bars reduce the free cross section and may effect air circulation. This must also be taken into account for pressure relief openings of gas extinguishing systems and of smoke and heat exhaust ventilation systems (cf. chapter 3.6.3.2).

3.1.5 Bars

Fixed bars may already feature burglar-resistant properties. In addition, tested and approved burglar-resistant bars may be installed.

Bars without VdS approval need to comply with the following requirements:

- Square bars have a minimum cross section of 16 x 16 mm
- Round bars have a minimum cross section of 18 mm
- The bars are firmly anchored in the brickwork
- The size of openings between bars must not exceed 10 x 20 cm.

Contact points between bars should be fixed permanently, e.g. welded together. In addition, the design requirements for burglar-resistant doors need to be taken into account when installing trellised gates. The following aspects also need to be considered:

- Sockets of locks should be supported in the profile of the frame.
- The locking bars should be protected against attacks by a continuous rabbet in the frame.
- Penetration of and/or manipulation through the bars also need to be assumed. This could affect e.g. the fastening of the door's ironwork or even the door frame.

3.1.6 Roller Shutter

Conventional roller shutters do not have any burglar-resistant qualities. The installation of VdS-approved roller shutters might be a solution

for areas which can only be physically protected outside opening hours.

Installing blinds on the inside of doors or windows might also be an option.

3.1.7 Physical Protection

If the type of exhibit allows for it, physical security measures should not be dispensed with, even when electronic surveillance is also used for the exhibit's protection. At least, quick removal of objects should be discouraged in areas with public access. Figures, sculptures, paintings and other exposed exhibits should be effectively anchored in their spots.

Since in many cases particularly physical security measures interfere in the substance of an artefact or a collectors' item, they should only be assembled in close consultation with competent conservators.

It is necessary to consider whether the risk of destroying an object that is physically protected when attempting to remove or removing it is greater than the risk of removing an object (intact) that is protected only by electronic surveillance.

Physical security measures and electronic surveillance should be harmonised in such a way that any forceful attack is electronically captured at an early stage and the physical component becomes operational afterwards.

3.1.7.1 Protecting Free Standing Items

Freestanding items should be secured at multiple points, if possible.

Security measures should not be detectable, if possible, and their fastening should be concealed. However, it is necessary to ensure that effective protection against dismantling of security measures is still provided. In case of screw connections, for instance, screws or lock mechanisms with a special mechanical code that can only be unscrewed with matching tools could be installed.

In individual cases, e.g. when an exhibit is in a wall recess, it might make sense to protect it with security glazing or bars.

In case many smaller objects need to be protected, it might be a solution to partition the room or at least part of the room with glazing or bars.

3.1.7.2 Protecting Paintings

Paintings should be secured in such a way that special tools have to be used to remove them. Hanging systems that protect paintings from quick removal and make it easier for museum operators to fasten the paintings have proven to be effective. Cf. example in Figure 3 4; a T-pin that is attached to the wall is inserted into a profile that can be mounted onto a picture frame. Adjustment options and a simple safety device for hanging are also integrated.

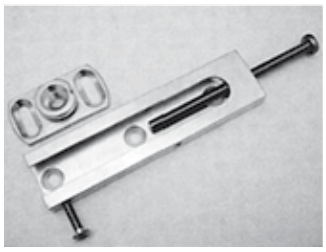

Figure 3-4 Hanging system

To protect valuable pictures and paintings from vandalism, they should be protected by special panes with antireflection coating.

3.1.7.3 Protection in Showcases

Showcases or vitrines are mainly used for safe presentation of exposed (small/valuable) exhibits.

Note: Aside from burglary protection, showcases may also provide protection against adverse environmental impacts (humidity, UV radiation, airborne pollutants, temperature fluctuations etc.).

The optimum solutions are tested burglar-resistant showcases. However, they are only provided by selected vendors, and it may not be possible to integrate them into every exhibition concept due to their design.

Experience shows that customised showcases need to meet the following requirements to grant minimum protection:

- Glass should be resistant to breaking
- Surfaces without glazing, e.g. cover, bottom, sides also need to have an anti-break design
- The width of the frame design into which the glazing or any other filling can be inserted should be approx. 20 mm
- Points of impact need to be secured against bending apart so that it is not possible to fish out small exhibits
- Unframed showcases should be avoided, if possible; in case they are nevertheless used, the glass panes should be glued together with

high-strength glue (simple silicon gluing is not suitable)
- Lockings (bolts and locks) need to feature the same burglar-resistant design which makes it difficult to reach for the exhibits
- Profile cylinder should be secured against unlocking or opening the cylinder with similar keys and feature protection against drilling and pulling
- Dead locks should feature the same protection properties as VdS-approved profile cylinders
- Protection against shifting and/or knocking over by screwing down to solid parts of the building
- Fixtures should only be accessible from inside. Alternatively, fixtures that are concealed or can only be dismantled with special tools can be installed
- In case of valuable exhibits, electronic surveillance of the showcase should be considered (opening, lock and reach-in, if required, detector inside).

In case visitors should be able to view particular exhibition rooms and/or areas which they cannot enter (e.g. living quarters with original furniture), glass partitions provide an option.

3.1.8 Safes/Depot

Valuable exhibits which are not shown or cannot be shown in an exhibition should be deposited in a special safety container or safe.

Safes and strongrooms are e.g. tested and approved in line with VdS 2450, and classified in terms of resistance grades. VdS-approved safety containers are labelled inside with the blue approval label shown in Figure 3 5.

Figure 3-5 Approval badge for safes

Safes, used in museums should be VdS-approved. Depending on the value of items to be deposited in the safe, suitable security features of the container need to be agreed with the insurer for every individual case. Security experts generally recommend to agree the requirements for deposit and storage of artefacts and collectors' items as early as possible with the insurer and the police for every individual case.

If the number and volume of the exhibits to be protected exceeds the possibilities of conventional safes, a depot room should be envisaged as a separate protection zone. Aside from tested and certi-fied strongrooms, depotrooms might also be an option, depending on the local conditions; their design should meet the following requirements:

- The construction of walls, ceiling and floor should be exceptionally solid
- Walls should not have any windows
- Doors must at least meet VdS grade B
- If ventilation openings are required, their clear width and/or height should not exceed 120 mm; if this is not possible, bars, if necessary with electronic surveillance, should be considered.
- Depot rooms must be subject to electronic surveillance (cf. chapter 3.2).

Aside from physical protection, safety containers also provide a slight – undefined – fire resistance time. So-called duplex safes provide enhanced and defined fire protection.

3.2 Electronic Surveillance

Intruder alarm systems (IAS) should be designed in such a way that intrusions/attempted intrusions are detected and notified as early as possible. In this context, physical security measures and surveillance by an IAS, taking into account the expected intervention time, need to be harmonised in such a way that upon an alarm, intervention forces are able to arrive at the scene even before the perpetrator has managed to overcome the security measures (cf. Figure 3 10). The interaction of electronic and physical security measures needs to be sufficiently fine-tuned to rule out the possibility of false alarms as much as possible.

In order to ensure the maximum level of functional reliability and monitoring effectiveness, intruder alarm systems installed should be VdS-approved. The intruder alarm systems that are suitable for museums feature different classes. In order to tailor the IAS to the risks at hand, classes are divided into e.g. B-SG 1, B-SG 2 or C-SG 3.

Intruder alarm systems of class B provide medium protection against attempted penetration in a set and unset state (e.g. against tamper). Intruder

alarm systems of class C provide enhanced protection against penetration in a set and unset state. Class C alarm systems also monitor safety-related functions.

Intruder alarm systems of class B-SG 2 are suitable for those areas of a museum that are less exposed, e.g. office and administration areas. To protect exhibition areas or individual exhibits, a class C IAS is generally suitable.

Depending on the type of exhibited and/or stored items, an IAS of VdS class B-SG 2 to C-SG 3 (or SG 4) might be suitable for exhibition areas and depots; for particularly valuable exhibits, a class C-SG 6 might be required.

VdS-approved IAS can be divided into several protection zones. The protection zones, in turn, may be attributed to different classes (e.g. depot meets class C-SG 3 and offices B-SG 2). All system components of a protection zone need at least to meet the requirements of the respective class. Shared system components (e.g. intruder control and indicating equipment, transmission unit) need to comply with the highest class available.

Intruder alarm systems are able to accommodate other security features provided appropriate detectors are installed. The installation of hold-up detectors will convert an IAS to an intruder and hold-up alarm system; hold-up alarms are purely for the sake of personal protection, and are permanently activated regardless of whether the IAS is in set state. Intruder alarm systems and hold-up alarm systems may be combined with one another or designed as stand-alone systems.

Moreover, internal alarms and emergency calls, for instance, may be generated that notify a security control room and/or additional security personnel and/or activate a video surveillance system.

Note: Additional information can be found in the Richtlinien für Planung und Einbau von Einbruchmeldeanlagen*, VdS 2311 (Guidelines for planning and installation of intruder alarm systems).*

Planning, installation and maintenance of a VdS-approved intruder and/or hold-up alarm system has to be carried out by a VdS-approved installer pursuant to Guidelines VdS 2311 and documented in the *Attest über die Installation einer VdS-anerkannten Einbruchmeldeanlage* VdS 2170 (Certificate for the installation of a VdS-approved intruder alarm system), (cf. Annex I; remark: in the German edition of VdS 3511 only). The system description attached to the certificate always has to be completed when the IAS complies with VdS Guidelines as well as the specifications of the police or the Guidelines *Richtlinien für Überfall- und Einbruchmeldeanlagen mit Anschluss an die Polizei* (Guidelines for hold-up and intruder alarm systems connected to the police).

Intruder alarm technology, installers and security companies are tested and approved by VdS Schadenverhütung. In the case of a connection to the police, the installer also has to be approved by the police in line with the *Bundeseinheitlichen Pflichtenkatalog der Kommission Polizeiliche Kriminalprävention der Länder und des Bundes (KPK)* (National standard specifications of the police commission for crime prevention of the Länder and the Federal Government), and the system has to be installed in line with VdS Guidelines.

The IAS should be set/unset by an ancillary control equipment with a material identification feature (e.g. mechanical or electronic key, chip card); in addition to that, class C systems require a mental identification feature (code, e.g. PIN, combination of letters, numbers or numerals) which are also able to generate a hold-up alarm. In addition, an ancillary control equipment with, for instance, a time control might be installed which only allows for IAS unsetting at specified and fixed times.

Aside from external setting, certain parts of the IAS can also be set from inside. This makes it possible, for instance, to monitor certain rooms or contacts during the day without activating an external warning device or remote signal in case of an alarm. This is a suitable option for all items monitored for removal and for doors in the course of escape and evacuation routes. Internal alarms may be forwarded to the in-house security control room or immediately notify museum or contractor security guards.

3.2.1 Surveillance Concepts

Shell protection is to protect a building's outer shell (windows, doors, outer walls as well as ceilings and floors) from penetration. Openable elements such as e.g. windows and doors are also monitored for opening and closing. Shell protection has the advantage of being able to detect attacks on the building at an early stage. The combination of shell protection with a well-aligned physical barrier in the shell is able to achieve a high level of protection, which provides for security and at the same time, gives intervention forces the opportunity to catch a perpetrator in the act of crime.

The purpose of focal-point surveillance is to detect a perpetrator (through e.g. motion detectors) who has already entered a building. In this case, there is no need for surveillance of every room. Focal-point surveillance can also combine electronic surveillance with physical security measures, so that a perpetrator who triggered an alarm is obstructed or held back by additional physical barriers; this increases the chance of catching the perpetrator in the act.

The disadvantage of focal point surveillance vs. perimeter protection is that the perpetrator can only be detected after entering the building. Focal-point surveillance may be installed to complement perimeter protection in order to detect perpetrators who e.g. sneaked in.

Trap protection is used to monitor only certain parts with an IAS which the perpetrator will most likely enter, e.g. a vestibule that the perpetrator crosses to enter other rooms (so-called traffic routes). Like focal-point surveillance, the handicap of trap protection vs. shell protection is that the perpetrator (sneak-in perpetrator) can only be detected once he is already inside the building.

Object surveillance refers to targeted monitoring of certain objects, e.g. sculptures, paintings, showcases or safety containers.

3.2.2 Special Detectors

The *Richtlinien für Planung und Einbau von Einbruchmeldeanlagen*, VdS 2311 (Guidelines for planning and installation of intruder alarm systems) describe surveillance measures for different types of risk. They do not necessarily explain highly specific solutions that may be required for electronic surveillance of objects of art and culture in detail. Some of these specific solutions will be described in the next paragraphs.

Electromechanical and/or electronic detector of a painting

These detectors monitor whether a painting is still in its place, using e.g. an electric contact that is kept closed by the weight of the framed painting (cf. schematic illustration in Figure 3 6). If the force by which the contact is activated changes too much (e.g. by taking the painting off), the contact opens and an alarm is triggered.

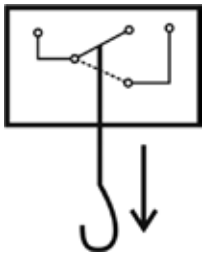

Figure 3-6 Detector of a painting, schematic illustration

Detector to monitor the canvas

Figure 3-7 Canvas surveillance

Special detectors can be used to monitor the canvas of paintings. If someone tries to remove the whole painting or its canvas, an alarm is triggered. A mechanical switch (cf. Figure 3 7) or optical system monitors the position of the canvas. For the optical system, the back of the canvas has to be illuminated with (low-energy localised) lights. Changes in light reflection are captured and used as detection criteria.

Detectors that operate capacitively

These detectors form an electric field around the object. Changes in this field which are created e.g. by a person getting closer to the object (through the field) are captured as detection criteria. The principle of capacitive surveillance can be applied to a multitude of artefacts, such as stand-alone objects, showcases (entirely or its contents only), paintings etc. Objects to be protected by capacitive surveillance might need to be prepared, e.g. by applying a conductive film onto the back or bottom of the exhibit.

Tear-off detector

Tear-off detectors can be used to protect objects that are fixed to their spot. If the object is removed, an alarm is generated. Tear-off

detectors can be installed e.g. by special screws (monitoring a pre-determined breaking point and, if given, generating an alarm).

Combination detector

Different types of detector can be combined in one product. For instance, different types of motion detectors or motion detectors with the option of video recording and alarm image storage can be combined with one another. The special logical connection of the functional principles makes it possible to discard the restrictions (e.g. no installation close to ventilation systems) listed in the VdS 2311 depending on the detection principle. It is necessary to make sure that only approved connections in line with the technical documentation of the system's owner are used.

3.2.3 Hold-up Detector

Hold-up detectors should be predominantly installed in high-risk areas (e.g. near the ticket office) or areas which make it easy to observe high-risk areas. Hold-up detectors should also be installed in rooms where it is possible for a perpetrator to lock in museum personnel. Hold-up detectors must not be easily identifiable to third parties. They need to be installed in such a way that the perpetrator does not notice activation of the detector or an activation signal attached to the detector. The detectors should be positioned in such a way that activation of an alarm by mistake is avoided. Installation of remote hold-up detectors (cf. Guidelines VdS 2217) should be considered taking into account the risk level.

If intruder alarm systems are equipped with hold-up detectors or if separate hold-up alarm systems are installed, a fundamental difference between the hold-up alarm system (HUAS) and the intruder alarm system has to be taken into account. In case of an acute danger, the HUAS is used to trigger a remote alarm manually. To trigger a hold-up alarm, a targeted manual operation (wilful activation of a hold-up detector) has to be performed.

Activation of a hold-up alarm is possible at any time, also in externally unset state, e.g. during normal business hours.

Note: Due to unpredictable responses by perpetrators, hold-up alarms should never be activated as an external alarm or internal alarm (no triggering of warning devices).

3.2.4 Protection Zones

Protection zones are separate rooms and sectors of the area monitored by the IAS. They may be defined individually within a building. Individual plans can be developed and protection zones designated for rooms that require a high protection level but are not constantly frequented (e.g. depot); their systems can be separately set/unset. The protection systems of these zones should generally be activated. They should only be unset when authorised personnel enters them.

Due to organisational demands, e.g. rooms being used by third parties, entering of contractors (e.g. cleaning staff), different working hours of museum employees, necessary maintenance work or multiple occupancies of rooms, it might be necessary to adapt the division of protection zones to individual circumstances. More specific information on the requirements and options of protecting a building by an IAS can be obtained from VdS 2311.

It is possible to install

- separated
- dependent and
- independent protection zones.

Separated protection zones are separated from the (actual) protection zone. Setting and unsetting procedures of both sectors is simultaneous.

Dependent protection zones are activated or deactivated consecutively in a specified sequence.

Independent protection zones do not influence one another. They can be individually activated or deactivated.

When planning the protection zones, it is necessary to take into account the direction of escape routes. Escape doors must not lead into a room monitored by an IAS.

3.2.5 Intruder Control and Indicating Equipment

Intruder control and indicating equipment – the "IAS' brain" – should be installed in the monitoring range of an intruder detector and a place which is not accessible to everyone. It needs to be installed in such a way that its parts are not detectable for unauthorised people and/or from outside the protection zone, so that quick access is not possible and third parties are unable to see

any signals. It might be useful to have a display of the IAS' status – regardless of the location of the intruder control and indicating equipment – e.g. in the security control room (it is necessary to ensure that the control room is accessible to authorised personnel only).

In case the intruder control and indicating equipment features hold-up detectors, it is necessary to ensure that the perpetrator does not notice the activation of a hold-up alarm (e.g. optimum signals that are not easy to spot, no acoustic signal).

In those cases where a fast attack on these components is possible, they require physical protection on top (e.g. a stable steel cabinet that can be locked).

If several protection zones are protected by an IAS, the intruder control and indicating equipment needs to be installed in the protection zone that is activated first and deactivated last. If required, a separate protection zone has to be installed for the intruder control and indicating equipment.

3.2.6 Zwangsläufigkeit

Compliance with Zwangsläufigkeit for intruder alarm systems approved by both the police and VdS is mandatory which provides the maximum level of reliability and comfort for the operator that the IAS is properly activated and deactivated.

Zwangsläufigkeit

- Prevents the operator from accidentally entering areas of the IAS that are activated through technical and structural barriers (the object cannot be accessed without prior unsetting as the last barrier is unlocked immediately upon deactivation).
- Ensures that all monitored doors and windows are properly closed and all detectors are non-operative prior to external unsetting (closing of windows and access gates is electronically monitored, the ancillary control equipment is not operational when windows and access gates are not closed).

3.2.7 Types of IAS Alarms

There are three different types of alarm activation which are often used in combination

- Internal alarm
- External alarm
- Remote alarm.

Internal alarm is activated inside the IAS' range. In general, an acoustic warning device is used for internal alarm activation, while optical warning devices are an option. Depending on the IAS concept, an internally activated IAS may trigger certain detectors (e.g. private doors, painting detector) that alarm the in-house security control room and/or external security personnel. In-house security guards can also be alarmed immediately by radio transmitters or receivers (often referred to as pagers).

External alarms make use of optical and/or acoustic warning devices (flash light, siren) to notify the anonymous public. The warning devices, in particular the sirens, also makes it obvious to the perpetrator that the intrusion has been detected. External warning devices may also be installed within the monitoring range in order to directly influence the perpetrator/s.

It is not certain, however, to what extent the anonymous public responds to the optical or acoustic signals and notifies e.g. the police.

- Property insurers and the police recommend not to use external alarms only.

In general, a **remote alarm** is transmitted via a phone or data transmission line (e.g. telephone or internet). Its purpose is to notify a central organisational unit (e.g. security company, police) of an intrusion. The risk of a tamper attack on the transmission path can be prevented by installing a VdS-approved IAS, using VdS-approved transmission paths and equipment.

- Class B and C IAS require activation of external alarm on top of remote alarm. The desired deterrent effect on perpetrators can be achieved by external acoustic warning devices in the protection zone.
- Activation of external warning devices may not be necessary if receipt of the alarm is acknowledged by the alarm receiving centre no later than 240 s after triggering. In case the system is directly connected to the police, installation of the external alarm has to be agreed with the police.

3.2.8 Intervention

Alarms generated by an intruder alarm system can only be effective if they lead to suitable intervention measures.

When intervention measures are agreed, it is necessary to specify whether keys are deposited with museum staff or an intervention centre. In case the IAS triggers an alarm, the key must be available on site at short notice. In order to ensure a swift and effective operation of the intervention team in the case of an alarm, intervention plans need to be formulated in advance.

To facilitate and structure such a plan, VdS Schadenverhütung developed the certificate for alarm and intervention services *Alarmdienst- und Interventionsattest, VdS 2529* (Certificate of alarm and intervention measures) (cf. Annex H; remark: in the German edition of VdS 3511 only). Once the operator of the IAS, the security company and, if necessary, the police have agreed suitable corrective actions prioritised in line with their importance to respond to different potential alarms, they are documented in the certificate for alarm and intervention services. In case of an alarm, the security company (SC) may swiftly carry out the agreed measures one by one, ensuring maximum success of the intervention. It is vital to regularly check all data on the intervention measures to see whether they are still up to date since telephone numbers and names of contacts etc. may change.

Cf. also chapter 3.4 Video technology.

3.3 Access Control

The installation of a VdS-approved access control system (ACS) is a viable option for rooms that are accessible to authorised personnel only. Information on how to plan and install ACS is contained in VdS Guidelines 2367. ACS may also be installed separately from intruder alarm systems, e.g. in areas that are not monitored, or during normal business when the IAS is unset. Access to rooms that require a higher security level should generally be managed by an ACS. These include the store, server and IT rooms, restoration workshops etc.

If there is a need for enhanced security, motor-operated locks and/or self-locking electromechanical locks should be installed rather than electrical door openers only.

The ACS needs to be set in such a way that access authorisation and keys issued (including keycards or mnemonic codes such as combinations of numbers or letters) are assigned to certain persons. This makes it possible to identify and record when someone enters or leaves a room, which key is beeing used and who is the “owner” of that key.

Biometric systems may be a feasible option for areas that are particularly exposed. However, before installation of such a system, it is necessary to ascertain whether the false acceptance rate (FAR) and/or the false reject rate (FRR) of the biometric system are acceptable for the respective application. Biometric systems can be combined with conventional transponder systems, which may prolong the processing time of an actuation.

Organisations that are extremely exposed may require additional measures such as security checks of individuals, isolating devices, checks for weapons (metal detectors) or other precautions.

Information on the design of ACS can be found in Annex G (remark: in the German edition of VdS 3511 only).

3.4 Video Technology

Using video technology events can be detected, reported and recorded. More sophisticated technologies make it possible to detect and identify perpetrators. When installing video technology provisions, employees’ rights etc. are not violated.

Pursuant to DIN 33450, a sign (cf. Figure 3 8) has to indicate to the public that video surveillance is in place. The organisation responsible for recording (e.g. name of the museum where the video recording is made) should be indicated underneath the sign.

3.4.1 Purpose of Video Technology

The purpose of video surveillance systems (VSS) is to extend the possibilities of optical surveillance; they enable security personnel to monitor not only its immediate environment but also rooms and objects that are far away. Moreover, if required, focal points may be designated for surveillance.

In case there is a discrepancy or a suspicious situation, immediate notification of the security guards on site, e.g. by radio communication, mobile phone or pager, has to be ensured to be able to take action immediately.

Figure 3-8 Indication of video surveillance

Note: It is virtually impossible to replace security personnel with video technology.

3.4.2 Applications

If cameras are positioned in such a way that all relevant areas are visible, security personnel is able to reduce the number of rounds depending on the risk situation, or use the cameras to pre-select the areas to be covered during the round.

Monitoring of escape routes

VSS are viable options for monitoring escape routes for the purpose of both personal protection (check whether escape route can be used safely in case of a fire) and asset protection (check whether a perpetrator tries to use escape routes to get away).

Deterrence

The deterring effect on potential perpetrators is similar to that of lighting systems (cf. chapter 5.1.). There is no evidence of the deterring effect, though it can be assumed – as it is not evident what effect a visual inspection and/or recording has for a perpetrator.

Preliminary alarm checks

In case of an alarm, the security personnel is able to do a quick and effective preliminary check. If the security guards are familiar with their environment, the exhibits and the respective surveillance range of the cameras, and if they are trained regularly, they are competent to do so.

To what extent preliminary alarm checks by a security company in case a remote alarm is triggered by the VSS needs to be determined on a case-by-case basis. It is in particular essential to determine who is responsible for deciding whether to intervene or not to intervene, and which criteria form the basis to decide whether to take action or not.

In general, a remote alarm should not be ignored simply on the grounds that the video image does not show any indications of an intrusion. Perhaps, an intervention can be carried out with minimum resources when the video images transmitted indicate that there is no immediate danger.

In case a burglary is detected by the video technology, the police can be notified immediately, which saves valuable time otherwise required for preliminary alarm checks (cf. Figure 3 9). The odds of catching a perpetrator in the act of crime, this way preventing loss of exhibits, are improving the less time is used for preliminary alarm checks (response to alarm activation) and the faster the actual intervention (attempts at catching the perpetrator) can be launched.

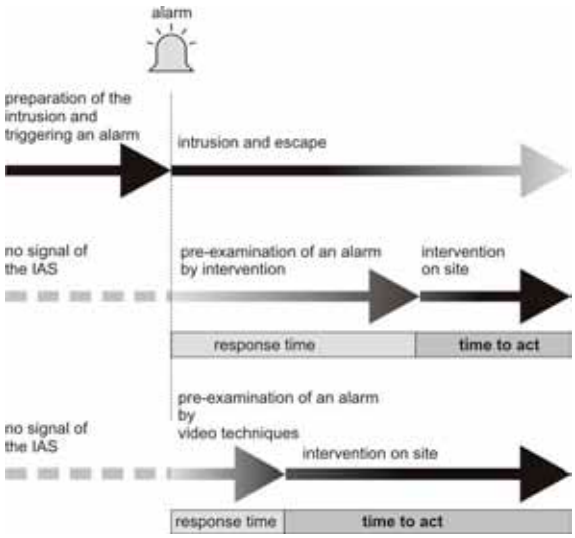

Figure 3-9 Preliminary alarm check

Evaluating progression of events

State-of-the-art video surveillance systems (VSS) save all images recorded for a certain period of time. Their magnetic core memory makes it possible to view events prior to, during and after the actual crime, and evaluate them; if need be, the findings can be used for investigation purposes or planning of counter action.

Information for manhunt and conservation of evidence

If the recording quality is adequate, video material can provide useful information for the police investigation after a theft or any other damage. Video technology designed and installed pursuant to VdS 2366 meets these strict requirements.

Video sensor technology

VSS may feature special video sensors that detect and signalise motions.

Surveillance of removal

Modern CCTV systems process changes of an image that happen without any detectable motion in the scene. These cameras detect removal of a painting even if the camera view is restricted to a certain angle.

Add-on to ACS

Video technology can be added to the access control system. With CCTV in the entrance area, it may be possible e.g. to grant access to certain persons who need not produce evidence of identification to the ACS. Moreover, even with an ACS, the VSS may have an additional control function if the immediate entrance area (either permanently or during a security round) is within a security guard's view. The security guard does not necessarily have to be posted at the door.

Outdoor application

In order to optimise outdoor application of VSS, movable objects up to a certain size may be faded out. Hence, small animals moving within the camera range are no longer sources of trouble. Other provisions for applications of video technology in public areas need to be complied with.

3.4.3 Camera Location

Complementing access control systems by video surveillance systems (mounting cameras at access doors) is a feasible option as much as surveillance of individual objects or areas that are particularly exposed.

At least all emergency exits leading from the building to public premises should be monitored by video cameras. Even though this may not be sufficient to prevent theft, the cameras are able to spot a thief who is trying to get away with his loot through the emergency exit, and interventions can be initiated immediately.

Note: Doors in escape routes must generally open easily from inside and with a single push in full width at any time.

3.4.4 Documentation

The video surveillance system installed has to be documented in a special certificate (cf. Annex J; remark: in the German edition of VdS 3511 only). The certificate for a video surveillance system VdS 3426 includes all important data on the system such as which system components have been used and where they have been installed relative to the object.

The installation certificate makes it possible to get a reliable overview of the VSS in order to develop further measures in the context of a protection plan, for instance.

In addition, the installation certificate provides certainty to installers and operators. It documents exactly what the installer agreed with and subsequently realised at the request of the operator. Special solutions or permitted deviations from requirements defined by planning guidelines are also explained and documented by the certificate. Failure to take certain action, e.g. no camera surveillance at exits must also be documented to be able to track decisions and agreements.

3.5 Protection Against Vandalism

Various physical security measures, in particular surveillance by security guards may be used as targeted protection against vandalism.

Technical precautions against vandalism make it more difficult for a perpetrator to access the object to be protected. They may include:

- Transparent panes in front of the object
- Storage/exhibition of items in showcases
- If possible, exhibition of exquisite copies.

Surveillance by security personnel is designed to influence visitors' behaviour in such a way that they cannot damage objects in any way. Upon entering the premises, security guards urge visitors to deposit large bags, backpacks, umbrellas etc. at the reception or cloakroom so that potentially damaging objects cannot enter exhibition areas.

As vandalism occurs rather during normal opening hours than following a burglary it is of paramount importance to raise the awareness of and properly train security personnel.

3.6 Fire Protection

The danger of fire in museums and other facilities that exhibit objects of art and cultural heritage poses a serious threat (fire, heat, smoke and fire gases, extinguishing water etc.) to these organisations. Though a fire insurance and loss of profits insurance may compensate for the material damage caused by a fire, the personal injuries and damage resulting form partial or total loss of irreplaceable artefacts, collectors' items and exhibits are much more serious.

The damage that such a negative incident can do to a museum's image must not be underestimated either. Preventive fire protection measures are able to mitigate the fire risk in museums and showrooms effectively. Smart investments in structural and technical features in combination with organisational measures ensure safe operation of museums and showrooms.

This does not only apply to new buildings; suitable measures are able to realise improvements in old buildings. Pursuant to the relevant legal standards of the Federal States (regional building codes, industrial health and safety laws), the operator is obliged to determine and implement the necessary precautions.

3.6.1 Holistic Fire Protection Concept

Effective fire protection can only be achieved by a fire protection concept tailored to the respective institution; it brings all individual protection measures in line. The *Leitfaden für die Verantwortlichen im Betrieb und Unternehmen, Brandschutz-Management*, VdS 2009 (Guidelines for individuals responsible for fire protection management in operations and companies) contain information on how to implement such a concept. A fire protection concept includes measures of preventive fire protection (with individual structural, system-related and operational/organisational elements) as well as fire defence that consist of rescue and fire-fighting operations. All these necessary components interact with each other. A fire protection concept is required to meet the principal fire protection goals, as specified by the sample building code. Pursuant to article 14 of the building code, structural systems need to be designed in such a way that they prevent development of a fire and spread of fire and smoke and make it possible to rescue people and effectively fight the fire in case of an emergency. Consequently, the fire protection concept specifies the general and user-specific measures.

Total or partial renunciation of individual measures, in particular in the case of old structural systems, generally results in claims for compensation. Operators of old buildings should therefore check regularly whether any upgrades are required.

Fire defence is not intended nor is it suitable to compensate for deficiencies in preventive fire protection. Measures envisaged in preventive fire protection plans must take into account the capacity and resources of the local fire brigade, e.g. alarm transmission paths, equipment, response time.

Structural fire protection forms the basis of fire protection, which includes determination of fire com-partment sizes, required fire resistance classes of supporting and non-supporting structures as well as specifications on the burning behaviour of building materials (Material classes in line with DIN 4102-1, in future DIN EN 13501, Part 1). System-related fire protection measures complement structural fire protection. They include e.g. configuration of smoke and heat deflection systems, automatic fire detec-tion and alarm systems, fire extinguishing systems, alarm transmission systems and other fire sup-pression measures such as risers, wall hydrants, portable fire extinguishers etc. Streamlined opera-tional-organisational measures are a vital prerequisite for smooth interaction of structural and technical fire protection measures in case of an emergency. However, they are never able to compensate for softer requirements that apply to structural and technical fire protection measures. Organisational measures include, e.g. developing and updating fire safety regulations (DIN 14096), alarm and contin-gency plans (see also *Leitfaden für die Erstellung von Evakuierungs- und Rettungsplänen für Kunst und Kulturgut, VdS 3434* (Guidelines for the development of evacuation and rescue plans for art and cultural heritage), or escape and rescue plans in line with industrial health and safety laws), regular fire protection drills for employees or the development of plans for the fire brigade (DIN 14095).

Moreover, the measures specified in the alarm and contingency plans are designed to help minimise the actual scope of the damage in case of a fire and contain possible fire loss.

Organisation and management of fire protection is of paramount importance. A fire protection commissioner (cf. also chapter 3.6.4.1.) is usually entrusted with this responsibility. The organisation of the procedures to be followed in case of an alarm need to be regularly reviewed by drills conducted at least once a year.

Important note:

A fire prevention show by the local fire protection commission does not replace inspection of fire protection equipment and organisational measures, and ensuring their permanent readiness for operation, which is the responsibility of every fire protection organisation.

Information on alarm and fire protection plans are contained, among others, in VdS Guidelines Brandschutz im Betrieb, Leitfaden für den Brandschutz*, VdS 2000 (Guidelines on fire protection in companies, Fire Protection Manual).*

3.6.2 Structural Fire Protection Measures

All structural measures are subject to the building codes, special building regulations and the relevant technical building regulations introduced by the Federal States. The individual experts responsible for fire protection should be involved and consulted as early as possible in developing all building activities.

This ensures that principal fire protection requirements are considered. Consultants of the fire insurance provide valuable input as well. Fire protection should also be considered in structural measures not subject to building permits as well as refurbishment and construction measures.

3.6.2.1 Fire and Smoke Compartments

Museums and buildings with exhibitions must be divided into fire and smoke compartments relative to their size. The building codes and special building regulations of the respective Federal State need to be complied with.

Rooms with a particular concentration of assets (e.g. depots) should generally be divided into separate fire compartments – even if they do not comply with requirements of construction supervision. If necessary, larger depots should be divided into several fire compartments in order to avoid total loss of the depot. When the building is divided into fire compartments, it is necessary to make sure that they have a smoke-proof closure.

Note: There are burglar-resistant doors that provide protection against burglary and theft as well as protection against smoke and fire.

Information on the specification of fire compartments and the closure of openings can be found in the *Brand- und Komplextrennwände, Merkblatt für die Anordnung und Ausführung, VdS 2234* (Fire break and complex partition walls, leaflet for layout and implementation).

3.6.2.2 Evacuation Routes

The length of evacuation routes depends on the type and occupancy of the building. All components of the evacuation routes as well insulation materials, walls and ceiling covering must consist of inflammable material (material class DIN 4102-A or DIN EN 13501 Part 1, class A). Corridors that are generally accessible and connecting bridges in buildings of low height need to be isolated at least by fire-retardant components (F 30), doors and tunnels by fire-resistant components (F 90 AB). Other buildings are subject to stricter requirements (constructing walls along the line of the design of fire-break walls.

To achieve Zwangsläufigkeit of intruder alarm systems, the installation of electrical locking systems in doors of evacuation routes should be considered.

Building code and special building regulations of the respective Federal State need to be complied with.

3.6.2.3 Openings in Fire Break Walls

Openings for air conditioning systems, doors and closures of openings for cable must be closed by systems approved by construction supervision. Further information can be obtained from the leaflet *Brand- und Komplextrennwände*, VdS 2234 (Leaflet on fire break and complex partition walls).

Changes to approved fire-resistant closures are subject to separate regulations. Only changes specified in the DIBt leaflet *Änderung bei Feuerschutzabschlüssen* (Changes of fire closures) (cf. Annex K; remark: in the German edition of VdS 3511 only) are permissible. Otherwise, doors will lose their approval.

The provisions that apply to changes to fire-resistant closures must also be complied with when installing an intruder alarm system; this also applies to restructuring or extensions.

3.6.2.4 Special Rooms and Areas

Rooms or sectors (e.g. workshops) that pose a particular fire hazard (e.g. storage of flammable liquids) or with higher risk of damage to assets (e.g. depots) need to be isolated from other sectors by fire-resistant and smoke-proof partitions. Rooms and buildings are regarded as isolated by fire-resistant partitions in the sense of these Guidelines if they are protected by fire-proof ceilings and walls as well as fire-resistant doors and closures. Moreover, depots should not be established in attics if there is a significant hazard due to the structural fire load represented by wooden roof trusses often in combination with flammable insulation material and flammable roof cladding (e.g. trapezoidal corrugated sheets for flat roofs) and more difficult fire suppression attacks due to closed roof cladding.

3.6.2.5 Insulating Material

If possible, insulating material should be non-flammable and meet class DIN 4102-A or DIN EN 13501 Part 1, class A for building material.

3.6.2.6 Completion of the Interior/Furniture

Non-flammable materials should be used for completing interior decoration; if that is not possible, flame-retardant material that does not drip must be used. If possible the use of halogenated plastic should be minimised. Fire loads and potential ignition sources should be avoided.

3.6.2.7 Fire Protection for Special Systems

Electrical Junction Boxes

If possible, electrical junction boxes should be installed outside exhibition areas and depot rooms. Junction boxes in exhibition areas and depot rooms must be isolated by fire-resistant and smoke-proof partition walls. Residual current protective devices need to be installed in all distributors. Moreover, DIN VDE 0100-718 *Installations for gatherings of people (cf. Räume oder Orte mit unersetzbaren Gütern von hohem Wert (Rooms or places with irreplaceable goods of high value))* need to be considered and complied with. DIN VDE 0100-482 *Protection against fire where particular risks or danger exist (see Rooms or places with irreplaceable goods of high value)* serves as additional reference. Automatic voltage activation of depot areas after leaving the rooms also makes sense.

Electrical Systems

Electrical systems and equipment need to be installed and operated in line with approved technical regulations. They include DIN VDE standards, in particular series VDE 0100, VDE 0105 and VDE 0800.

Moreover, the relevant accident prevention regulations (currently in force: BGV A3 and/or GUV-V A3) also need to be considered when installing, modifying and maintaining electrical systems and equipment. Residual current protective devices (RCD, formerly FI safety switch) have to be installed in electrical systems. The rated differential current (I n) of the protective device must not exceed 300 mA, and 30 mA for additional personal protection.

Lights must be selected in line with DIN EN 60598-1 and installed pursuant to DIN VDE 0100-559. They must be installed in such a way that they do not cause any fire. Recommendations on how to select, install and operate lights are contained in the *Richtlinien zur Schadenverhütung, Leuchten, VdS 2005 (Guidelines for loss prevention, lights)*.

Ventilation Systems

The respective relevant model guideline on fire protection requirements for ventilation systems needs to be consulted. Ventilation pipes need to have a smooth interior surface and consist of non-flammable materials including their insulation material and cladding. In order to prevent fire spread to other fire compartments, blocks or floors of buildings, they must feature a fire-proof design (L 90 in line with DIN 4102-6) or protected by fire-resistant fire dampers (K 90 in line with DIN 4102-6) activated by smoke detectors approved by building permits.

The Richtlinien Lüftungsanlagen im Brandschutzkonzept – Merkblatt für Planung, Ausführung und Betrieb, VdS 2298 (Guidelines ventilation systems in fire protection concepts – leaflet on planning, installation and operation) serve as additional reference.

To prevent spread of smoke, additional measures might be required such as monitoring by smoke detectors or possibly deactivation of the

ventilation system by a fire detection and alarm system.

Elevator Systems

Elevator systems must be designed in line with the requirements resulting from building laws and the Ordinance on industrial safety (*Betriebssicherheitsverordnung*). Moreover, they should be equipped with a state-of-the-art fire control that initiates automatic evacuation rides in all elevator cars (rerouting elevator cars to access or alternative levels).

Rooms for Electronic Facilities

Rooms that house systems for information technology (IT systems) and surveillance equipment require a fire-resistant isolation from other areas. Loss prevention measures are described in the leaflet on loss prevention *Anlagen der Informationstechnologie*, VdS 2007 (Systems for information technology).

The measures outlined in the leaflet *Anlagen der Informationstechnologie*, VdS 2007 may also be applied accordingly and taking into account personal protection, to protect other equipment sensitive to smoke in particular.

3.6.3 Structural Fire Protection and Security Systems and Equipment

3.6.3.1 Fire Detection and Alarm Systems

Museums and showrooms should be equipped with a fire detection and alarm system (FDAS) with a suppression range that covers the whole building. The purpose of a fire detection and alarm system is to detect a fire early, localise it and notify the control room responsible. This function is performed by automatic detectors, among others, supplemented by non-automatic fire detectors (manual alarms). Full protection pursuant to DIN 14675 must be realised by means of automatic fire detectors.

Information on the installation and operation of fire detection and alarm systems is contained in the *Richtlinien für Brandmeldeanalgen, Planung und Einbau*, VdS 2095 (Guidelines for Automatic Fire Detection and Fire Alarm Systems; Planning and Installation), and the standard *Brandmeldeanlagen, Aufbau und Betrieb*, DIN 14675 (Fire detection and fire alarm systems – design and operation) and *Gefahrenmeldeanlagen für Brand, Einbruch und Überfall, Teil 2: Festlegungen für Brandmeldeanlagen*, DIN VDE 0833-2 (Hazard alarm system for fire, burlgary and hold-up, part 2, requirements for fire alarm systems).

3.6.3.2 Internal Alarm Systems

Following consultation of the fire brigade in charge or the fire protection authority, suitable alarm systems, preferably electro-acoustic emergency warning systems, must be installed.

Transmission of voice announcements suitable for the respective situation by such warning systems ensures that organisations designated for this purpose and individuals affected are informed and receive specific instructions on what to do.

3.6.3.3 Smoke Exhausting

The staircase must feature a smoke exhausting system and/or ingress of smoke must be prevented (smoke exhaust ventilation systems, smoke repression systems, air lock). Actuators of smoke exhaust ventilation systems must be designed and mounted in such a way that they can be operated safely.

Note: See Guidelines for Smoke Exhaust Ventilation Systems in Staircases, VdS 2221.

When designing a new museum, the installation of smoke and heat exhaust ventilation systems (SHEVs) should be taken into account during the planning. The general term SHEV subsumes natural smoke exhaust ventilation systems (NSHEVs) as much as motor-operated smoke exhaust systems (SEs). Their purpose is to prevent personal injuries and damage to works of art and collectors' items caused by aggressive and toxic smoke gases and heat exposure.

Note: Refer to Guidelines for Natural Smoke and Heat Exhaust Ventilation Systems (NSHEVs), VdS CEA 4020.

The installation and operation of a smoke and heat exhaust ventilation system must be synchronised with other technical systems (e.g. extinguishing system, air conditioning system) and the fire protection commissioner must be consulted. For instance, SHEVs must not open automatically in rooms protected by a gas extinguishing system; these and other requirements are specified in the relevant Guidelines for planning and installation of gas extinguishing systems (VdS 2380, VdS 2381, VdS 2093).

Smoke exhaust ventilation systems should have the following features:

- The smoke exhaust ventilation system must be planned and designed for every individual application.
- Smoke exhausting pipes and dampers that penetrate ceilings or walls of defined fire resistance classes need to be of the same fire resistance class.
- Only non-flammable materials (class A in line with DIN 4102-1) must be used for smoke exhausting pipes.
- The smoke exhaust ventilation system should be designed in such a way that smoke and hot gases can already be deflected during fire development.
- Openings to the outside must be planned in such a way that they are protected from any external impacts.
- Smoke exhaust ventilation systems should improve asset protection as well as rescue possibilities for people (e.g. facilitated access for rescue forces and evacuation through staircases that can be accessed safely).

It should also be possible to deflect smoke from exhibition areas and depots. The smoke exhaust ventilation systems should be dimensioned in such a way that the low-fuming layer is above the exhibition level of the artefacts. Required openings for gas streaming out should not be in the outer facade since aspects of burglary/theft/ vandalism protection also need to be considered.

3.6.3.4 Supply of Extinguishing Water

In coordination with the relevant authority, a sufficient and effective supply of extinguishing water must be ensured to achieve fast fire suppression. The nearest extinguishing water tap (hydrant) should not be more than 150 m away from the building or its entrance.

3.6.3.5 Fire Extinguishing Systems and Equipment

Suitable fire extinguishers and, if necessary, a sufficient number of wall hydrants must be installed in clearly visible spots of the corridors. Water and Foam extinguishers are generally recommended for administration areas, while water, foam, powder, grease fire and/or CO2 extinguishers may be suitable for other areas depending on the type of exhibits and occupancy. The wrong extinguishing agent may not only have a direct suppression effect but also damage the objects affected by the fire, which needs to be taken into account. The right choice of extinguishing agent should also be agreed between the fire brigade and restorers.

Note: Refer to Feuerlöscher, Regeln für die Ausrüstung von Arbeitsstätten, VdS 2001 (Fire extinguishers, Guidelines for workplace configuration).

3.6.3.6 Automatic Fire Extinguishing Systems

In general, automatic fire extinguishing systems, if possible, with residue-free, non-corrosive extinguishing agents without expanding effect are the only option suitable for museums. This is provided by many gaseous extinguishing agents. As people need to leave the premises before gaseous extinguishing agents can be applied (depending on the gas used), gas extinguishing sytems are generally not suitable for all areas with public access.

As water extinguishing systems (e.g. water mist extinguishing systems, pre-action sprinkler system with pipes not bearing water permanently activated by a fire detection and alarm system) can be activated selectively and deliver fast and localised suppression with water volumes adequate for the relevant risk, they may also contribute to reducing the scope of the damage.

In view of the protection goals, the type of extinguishing system to be installed can be determined as early as the planning stage in close consultation between a competent planning office or a VdS-approved installer, the relevant museum representatives and the insurer.

Note: It is possible to obtain VdS approval for other new extinguishing technologies pursuant to the Verfahren für die Anerkennung neuer Löschtechniken (Entwurf), VdS 2562 (Procedure for the approval for new extinguishing techniques). The only prerequisite is evidence on the effectiveness and reliability of the new extinguishing technology.

The following VdS Guidelines need to be considered in connection with fire extinguishing systems:

- VdS 2093 CO2 Fire Extinguishing Systems; Planning and Installation
- VdS 2304 Local Application Protection for Electric and Electronic Equipment; Guidelines for Planning and Installation

- VdS 2380 Fire Extinguishing Systems Using Non-liquefied Inert Gases; Guidelines for Planning and Installation
- VdS 2381 Fire Extinguishing Systems Using Halocarbon Gases; Guidelines for Planning and Installation
- VdS 2496 Guidelines for the Triggering of Fire Extinguishing Systems.

Permanent oxygen reduction in rooms not frequented by the public may reduce the risk of fire development as alternative to fire suppression. This option is particularly suitable for depots or showcase (small volumes). In case there are plans for a reduction system, it must be included in the holistic fire protection concept. Special emphasis must be placed on public health protection of visitors and employees.

Note: Information on fire suppression with inert gas or reduced oxygen concentration can be found in the Guidelines for Inerting and Oxygen Reduction Systems; Planning and Installation, VdS 3527.

3.6.4 Organisational Fire Protection Measures

Organisational fire protection measures must always be kept up to date and coordinated with the relevant fire protection organisation and, if required, the insurer. Aside from designating a fire safety commissioner and regular fire safety training of staff, organisational fire protection also includes the development and regular update of the following:

- Fire safety regulations
- Alarm plan
- Escape and rescue plan
- Contingency plan
- Fire protection plan and
- Fire brigade plan
- Planning and monitoring of required maintenance.

Moreover, other fundamental factors such as housekeeping, no smoking policy, flammable repair and maintenance jobs etc. also need to be taken into account. See also *Richtlinien Brandschutz im Betrieb,* VdS 2000 (Guidelines on fire protection at work).

3.6.4.1 Fire Protection Representative

In general, the museum's management is responsible for fire protection. It may transfer the responsibility for organisation and management of fire protection to a person (fire protection representative) whom it sees fit. The fire protection commissioner reports directly to the management and is responsible for fire protection within the duties entrusted to him (please refer to leaflet *Bestellung, Aufgaben, Qualifikation und Ausbildung von Brandschutzbeauftragten*, vfdb 12/09-01 (Appointment, responsibilities, qualification and training of fire protection representatives). The fire safety officer must have the personal and technical qualifications to carry out fire protection; to this end, he needs to be duly authorised.

The safety commissioner, who is also responsible for fire protection pursuant to the health and safety regulations, may also be designated as fire protection commissioner. The fire protection commissioner must be able to identify and judge risks, and he needs to see to it that they be removed and damage is minimised. He has the following responsibilities:

- Formulating fire safety regulations, alarm, contingency and fire protection plans
- Conducting fire safety training for staff and documenting it
- Organising and supervising fire safety inspections
- Instructing and supervising remedy of fire safety deficiencies
- Defining substitute measures in case fire protection systems and equipment fail or are shut down
- Consulting on matters of fire protection, e.g. for planning of new buildings or refurbishments
- Responsible for keeping constant contact with the fire brigade, authorities, insurers and joint drills and inspection rounds.

Keeping a fire protection track record that documents the most important activities is generally recommended. It should in particular define which inspections and tests need to be conducted and how/when they were conducted. Any deficiencies and how they were remedied should also be recorded. Inspections should be conducted by way of a checklist. Moreover, fires and their causes, even if immediately suppressed, should be documented in the track record to identify potential weaknesses.

3.6.4.2 Fire Safety Regulations

Due to their importance, fire safety regulations need to be put into force by the management and communicated to all employees. The fire safety regulations need to be constantly kept up

to date, taking in particular into account changes in procedures and structural systems. They must contain the most important measures of fire protection at work and specify how to behave during and after a fire. It should be formulated in accordance with the relevant fire protection organisation. A structure in line with DIN 14096 parts 1-3 is generally recommended:

- Reduce fire loads to a minimum
- Define how to behave in case of a fire and train employees
- Define regulations for assembly and installation jobs
- In principle, flammable jobs should not be permitted, only with a special permit and after taking appropriate precautions for fire protection
- Instruct contractors and supervise their work
- Constantly ensure and monitor good housekeeping
- Avoid ignition sources
- No smoking policy, if necessary, install separate smoking zone isolated by special fire safety measures.

Recommendations on how to formulate fire safety regulations for museums can be found in Annex F (remark: in the German edition of VdS 3511 only).

3.7 Water and Other Natural and Environmental Hazards

In addition to the risks of fire, burglary/theft, robbery and vandalism outlined before, works of art and collectors' items of special value also need to be protected against a range of other hazards since these allegedly minor and often underestimated hazards have a great potential for damage and destruction.

3.7.1 Damage Caused by Water

Damage caused by water may have manifold causes. Aside from damaged water pipes (water escaping from feeding and discharge pipes of the water supply), this category also includes damage caused by heavy rain, back pressure due to weather conditions or extinguishing water.

In general, museums and all their supply and discharge systems, exhibition and depot rooms need to be designed in such a way that they are protected against water getting inside. If possible, depot rooms should have pipes which are not permanently water-bearing.

Museums and showrooms should not be situated in

- Areas exposed to flooding and
- Areas with works of art that require special protection should not be accommodated
- Directly underneath flat roof areas with expansion joints and inlets
- Underneath water tanks.
- If these risks cannot be avoided, protective measures suitable for the respective situation must be taken. These may include:
- Storage of artefacts and collectors' items above ground level (elevated racks, shelve storage), the minimum height should be 12 cm (Euro palette)
- Avoiding plug-in connections (power supply and data cables) in false floors or directly in floors; in case plug-in connections cannot be avoided they should have IP 54 safety design.
- Water dams
- Anti-flooding flaps in the waste water and rain water pipes (special attention on regular maintenance and inspection)
- Water detectors connected to the alarm system
- Pump well with automatic lifting pump
- Collection tanks under potential weak spots connected to the building's drainage system (e.g. below the cooling aggregates of air-conditioning systems in the depot)
- Pipes (e.g. for waste water, steam, fresh water supply, heating) – even those in suspended ceilings – should be removed, if possible.

In case water-bearing pipes cannot be avoided for technical reasons, the following precautions must be taken:

- The material of the pipes must be anti-corrosive and suitable to withstand the specified pressure. Suitable methods must be applied to check welded joints for cracks.
- The pipes should be double-walled (either directly or by subsequent encasing). Humidity sensors should be installed in the outer shell; their signals are to be transmitted to a contingency organisation that is manned 24 hours, 7 days the week.
- The water pipes monitored by humidity sensors need to be isolated by electrical valves (that can be closed without power) installed outside the risk area.
- Check valves should be easily accessible and clearly labelled.

3.7.2 Damage Caused by Natural Hazards

In addition to the risk outlined in chapter 3.7, other conceivable natural hazards such as earthquakes, landslide, the weight of snow and avalanches need to be taken into consideration in particular during the planning phase. As these hazard depend to a large extent on the position (e.g. on a hill or slope) of the respective museum and/or showroom, customised concepts need to be developed for natural hazards.

An appropriate design of the building structure is able to prevent or at least significantly reduce any damage caused by natural hazards. This applies in particular to damage caused by erosion, strong wind or hail. Moreover, support structures and/or deflector barriers provide effective loss prevention against heavy snow and/or avalanches.

3.7.3 Damage Caused by Strike of Lightning and Overvoltage

Damage by indirect and particularly direct strike of lightning may be reduced significantly by suitable protection concepts, cf. VdS *Richtlinien Blitz- und Überspannungsschutz in elektrischen Anlagen*, VdS 2031 (Guidelines on protection of electrical systems against lightning and overvoltage). A competent specialist planner, e.g. a VdS-approved EMC expert is able to develop a comprehensive concept for overvoltage protection.

In case electromagnetic fields emitted e.g. by mobile phones or other radio transmitters can cause interference, suitable counter measures need to be specified (e.g. banning mobile phones).

3.8 Documentation

Documentation of all technical measures (air conditioning systems and their configuration, fire protection, security and access control systems etc.) constitutes the basis for a smooth operation as well as effective trouble-shooting. It must be updated continuously.

The following elements (this list does not claim to be complete or exclusive) should be part of the documentation:

- Structural plans
  - Site map (premises)
  - All architectural and detailed design plans
  - Ground plan/floor plan/occupancy plan
  - Plan of water-bearing systems in/above risk-relevant areas
  - Water retention concept
- Electrical drawings for
  - Energy supply
  - (VdS-approved) Lightning/ overvoltage protection
  - Potential equalizer
  - Flow diagrams
- Fire protection concept
  - Fire protection plan (alarm and fire brigade operations plan)
  - Fire safety regulations
- Security technology
  - Intruder alarm system (IAS)
  - Fire detection and alarm system (FDAS)
  - Access control system (ACS)
  - Video surveillance system (VSS)
- Contingency planning
  - Emergency telephone list
  - Supplier list
  - Plans to take exhibits out of storage.

All systems and installations available as well as all loss prevention measures conducted must be documented. Information has to be added to or changed in the documentation whenever extensions are made or refurbishments carried out.

Such documentation should already be compiled during the planning stage of a museum (or, if necessary, individual exhibitions).

3.9 Handling and Treatment of Artefacts and Collectors' Items

Artefacts and collectors' items should only be handled and treated by competent and specially qualified staff. In order to ensure proper and appropriate handling of every object, an internal quality management system should describe all relevant activities by way of procedures, specifications and standards for documenting all relevant tasks.

Damage by visitors or other third parties can only be avoided if people are kept away from the respective exhibit or by effective supervision.

Adequate protection of an exhibit against accidental damage by visitors can be achieved by providing "virtual" barriers for objects of minor value, e.g. by cordoning off an exhibit. It helps to prevent accidental contact.

3.10 Technical Installation

3.10.1 Electrical Installation

Electrical installations are to be installed and maintained in line with approved electrical engineering standards. The installation network of new systems needs to be designed as a TN-S system in line with DIN VDE 0100-300 throughout the building. The most important benefits of a TN-S system include:

- an isolated zero conductor throughout the entire building
- protection and potential equalizer to a large extent free of operating current
- predominantly avoiding adverse stray current in conducting parts of the building and piping.

In order to ensure these prerequisites on a continued basis, permanent monitoring of fault current should be installed that triggers an alarm when the limit is exceeded, notifying the relevant people.

In order to enhance a fail-safe operation, it is possible to install redundancies of important cables and power lines depending on the protection required.

To enhance technical safety, VdS-approved lights should be installed. DIN VDE 0100-559 and the requirements contained in the *Richtlinien Leuchten*, VdS 2005 (Lights), the *Richtlinien Niedervoltbeleuchtungsanlagen und -systeme*, VdS 2324 (Low-voltage lighting systems) and, the *Richtlinien Elektrische Leuchten mit begrenzter Oberflächentemperatur*, VdS 2499 (Electrical lights with limited surface temperature) are the relevant standards to be considered for installation of lighting systems.

Note: Conventional low-voltage halogen lights develop a high temperature at close range. This may result in discolouration of surfaces or more profound direct surface damage and even cause a fire.

Moreover, safe data transmission and safe internal and external communication must be ensured.

3.10.2 Air Conditioning/Ventilation Systems

The prerequisite for proper climate control of all rooms is compliance with limits for ambient temperature and humidity defined by the art experts of the respective museum.

A monitoring system that is isolated from the air conditioning and ventilation system should be installed; it monitors the air conditioning system to maintain specified limits for temperature and humidity; if these limits are exceeded, the monitoring system triggers a signal and/or shuts-down the air conditioning. The signals should be transmitted to a control room that is manned permanently.

4 Organisation

Aside from the physical security measures and electronic measures (e.g. intruder alarm system and video technology, access control), organisational measures constitute the third element of the security system.

Organisational measures include instructing personnel on potentially dangerous situations, administering keys and allocating access authorisation, drawing up an inventory of objects of art and cultural heritage available and developing evacuation and salvage plans for objects of art and culture (cf. VdS 3434). Moreover, clear procedures for operation of physical security measures and electronic surveillance measures need to be defined. The best security system is useless if it is not properly operated and/or activated.

Small exhibits that are difficult to be protected by physical security measures should be as far away from escape doors as possible.

4.1 Security Commissioner

In order to implement security policies, it makes sense to appoint a certified security commissioner as person responsible for security. He should report directly to the museum's management/ management board. The security commissioner assesses all risks associated with asset protection and develops appropriate counter measures. The risk and security analysis of the security commissioner makes it possible for the museum's management/management board to take all relevant decisions.

4.2 Security Regulations

Due to their importance, security regulations need to be put into force by the museum's management/ management board and communicated to all employees. The security regulations need to be

constantly kept up to date, taking in particular into account changes in procedures and structural systems. They must contain the most important measures of asset protection and specify how to behave during and after a theft, a vandalism attack or any other attack on the museum's assets.

The following list provides some first guidance; however, it needs to be adapted to the respective risk:

- Identify the values available
- Estimate to what extent perpetrators may covet these values
- Identify specific risks (e.g. possibilities for an item to get damaged or stolen)
- Develop optimum protection measures
- Determine affordable security measures
- Define how to behave during and/or after a loss
- Coordinate measures to be implemented with museum's management/management board
- Museum's management/management board puts security regulations into force.

4.3 Security Control Room, Internal

The in-house security control room – also referred to as control room manned 24/7 – operated during opening hours of the museum and/or round the clock is qualified to coordinate protection measures and effective intervention measures. All information relevant to the museum's security must be pooled by this control room. In-house procedures are then applied to process this information one-by-one.

The necessary technical systems and equipment to this end must be provided. Ancillary control equipment and information displays of the intruder alarm system and monitors of the potential video surveillance system must be installed. Appropriate means of communication with the supervising staff must be provided.

When the security control room is built for the supervising staff working there, structural protection against possible threats from outside must be provided. See also *VdS Richtlinien für die Anerkennung von Wach- und Sicherheitsunternehmen, Notruf- und Serviceleitstellen*, VdS 2153 (Guidelines for approval of security companies, emergency and service control rooms).

4.4 Supervision

To monitor visitors' behaviour in exhibition halls, security guards should be deployed. They should be easily identifiable by uniforms or other characteristics to stand out from the visitors.

The security guards, museum staff or employees of service providers, need to be trained on a regular basis and briefed about the exhibition and its importance. They need to be familiar with their legal rights in relation to visitors. Depending on the type of exhibition, the number of security guards needs to be determined on a case-by-case basis. The area to be monitored must not be too large and/or muddled; and the value of exhibits and their removability must be taken into account.

Cleaning staff and other staff present, craftsmen etc. need to be supervised when they work beyond opening hours. An adequate number of security guards should also be present during any set-up or dismantling jobs.

Before the security system of an exhibition's protection zone is activated, the exhibits need to be checked to make sure that they are intact and all in their place locks of doors and showcases must be inspected to make sure they are locked and show no traces of manipulation. The rooms need to be screened to make sure that there is no one inside, while areas that are like blind corners (potential hiding spots) need to be double-checked. Removal of objects e.g. by restorers needs to be reported and/or indicated to the security personnel.

4.5 Cloakroom

Visitors should not be able to enter the exhibition with coats and other large items of clothing, bags, purses, backpacks etc. not only for reasons of burglary protection but also for reasons of conservation. For this purpose, enough cloakrooms and/or lockers must be provided. If the cloakroom and/or lockers is/are full, additional visitors should be denied access as long as there is no room to deposit coats/bags.

In case of special events with a large number of visitors, additional cloakrooms must be provided, e.g. by using neighbouring rooms for this purpose.

4.6 Keys and Key Authorisation

Whenever a key is issued, this must be recorded, which can be done manually in a keys' log or a so-called key management and/or transfer system. Access authorisation should be granted on the basis of every employee's responsibilities and managed by key allocation. It is vital to ensure that unauthorised individuals cannot get hold of keys at any time, not even for a short while (danger of copies being made). To this end, keys need to be locked away in a qualified key cabinet.

Only senior employees have the right to use a master key and/or a passkey; they are also responsible for its safe deposit.

In general, master keys should only be issued to security personnel in case of an emergency. Keys to safety-relevant areas must not be issued to cleaning staff.

4.7 Cash Deposits

Cash deposits which third parties – if so, threatening to use or applying force – could get hold of must be kept at a minimum. A safety container with adequate resistance grade must be provided to enable ticket booth staff to temporarily deposit and/or scoop off large amounts of cash during the day, reducing their exposure. So-called deposit containers (special safety containers in line with VdS 2528) are suitable for this purpose.

The area of the ticket booth should be designed in such a way that quick access to open tills is made as difficult as possible.

Hold-up detectors near the ticket booth staff and video surveillance should be installed in the entrance area, taking into account health and safety requirements.

4.8 Video Surveillance

Video surveillance systems can only be supplementary to security guards who monitor visitors. As a sole security measure, video surveillance is inadequate (cf. also chapter 3.4).

4.9 Contractor Service Providers

In case contractors are hired such as cleaners, transport and/or security personnel, special requirements need to be taken into account.

Consequently, security companies that provide security and supervising personnel should be certified in line with *VdS Richtlinien zur Anerkennung von Wach- und Sicherheitsunternehmen*, VdS 2153 (Guidelines for approval of security companies, emergency and service control rooms). Companies may offer other services such as keeping the gate certified in line DIN 77200 (requirements for secu-rity services).

The responsibilities entrusted on the security personnel need to be defined clearly and unmistakably, and should be checked for proper implementation.

The security company employed must have adequate third party liability insurance that covers potential loss. The insurance sum must be agreed with the insurer.

Only qualified (references) transport companies that are specialised in shipping artefacts should be hired for transport of exhibits within or outside the building.

4.10 Contingency and Evacuation Plans

Contingency and evacuation plans need to be tailored to the special features of the building as well as the works of art and cultural heritage. See also VdS Guidelines Leitfaden für die Erstellung von Evakuierungs- und Rettungsplänen für Kunst und Kulturgut, VdS 3434 (Developing evacuation and rescue plans for art and cultural heritage).

In order to implement loss prevention measures professionally, responses to possible loss scenarios must be prepared. It is necessary to consider what could happen and/or which areas might be affected (cf. chapter 5.5.).

The possible jeopardising of exhibits as well as possible immediate action should be contemplated. Priorities to save exhibits should be determined. Moreover, it is necessary to create the prerequisites for exhibits to be stored in internal or external depots or to be taken there.

Aids such as tarpaulins, blankets, palettes, packaging material and means of documentation

should be provided to be able to initiate immediately protection and rescue measures.

Note: In general, it is necessary to bear in mind that it might be necessary to quickly open and/ or dismantle partitions and physical security measures in an emergency, e.g. a fire. The appropriate keys and special tools need to be instantly available, which requires a suitable organisation.

4.11 Inventory, Identification

All artefacts and collectors' items need to be inventoried collecting the following data:

- Inventory number
- Colour pictures with total views and close-ups of special features such as inscriptions, markings or damage (with scale of colour and dimensions)
- Type of object (e.g. painting or sculpture)
- Description (e.g. shape and colour)
- Material and make
- Size and weight
- Inscriptions and markings such as signature, dedication, title
- Special characteristics such as damaged parts, repair or flaws
- If possible, title of the object
- Subject of artistic expression
- Date of creation, period
- Artist or maker
- Value of the object
- Conservation status
- Restoration measures carried out or planned.

All information and data need to be stored safely to be available after a possible loss of an object. Computer-aided inventory programmes might be a useful option. Any kind of data back-up should be made in a separate room (building) away from the original data.

The data compiled may help to identify stolen or recovered objects, or be useful evidence for police investigations on a theft.

If there are no individual characteristics or there is no unmistakable description, subsequent labelling may be useful for identification. The label should be clearly visible and attached permanently.

Moreover, labelling by way of special transponders (Radio Frequency Identification (RFID) transponder) that operate on the basis of radio is also an option. These systems make it possible to save information on miniature storage media directly on the object. RFID transponders are miniature transmitters with individual identification that do not require a power supply of their own. They can be localised and registered by way of scanners. A computer processes the data saved and/or retrieved.

Note: Any lasting change in the artefact or collectors' item has to be discussed with the art experts and restorers of the museum.

4.12 Recovery

Whenever artefacts and collectors' items are stolen or robbed, the primary objective is to recover them, which is to say that any possible support must be given to the investigating organisations.

4.12.1 Art Loss Register

The Art Loss Register (ALR) may help to obstruct sales of stolen artefacts and help resolve art theft. The ALR's data pool is matched with auction houses, galleries and art dealers, thus making an important contribution to resolving crimes involving objets d'art and insurance fraud.

There are representations of the Art Loss Registers all over the world. Further information can be obtained from **www.artloss.com**.

4.12.2 Art Hatch

It may be useful to give perpetrators the opportunity of immediately returning artefacts and collectors' items captured – without threatening to use repression. The aim is not to negotiate with perpetrators on returning the items (pressing money) but to prevent destruction of art. If a thief or robber finds the stolen items useless, he might dispose of them or destroy them beyond recovery. A so-called art hatch gives perpetrators the opportunity to return stolen artefacts and collectors' items without being detected or personal contact, and without having to fear prosecution. The works of art can be deposited in some kind of locker (e.g. close to a museum's foyer).

5 Other Recommendations

The following contains some general recommendations for designing, planning and organising a museum. Structural fire protection measures are outlined explicitly in chapter 3.6.2.

5.1 Exterior lighting

There is no definite evidence on the deterring effect of exterior lighting on potential burglars, but it can generally be assumed. Local illumination (lamps, floodlight) increases the risk for a perpetrator to be recognised and consequently caught. Moreover, exterior lighting may be effectively combined with video surveillance technology.

Lamps should be installed and/or designed in such a way that masking or destroying them (e.g. by throwing stones) becomes as difficult as possible. The lights can be switched on by a timer, motion detectors or a dusk switch. Additional lights should be activated by motion detectors in the most exposed areas, so that a potential perpetrator is able to see an immediate reaction to what he is doing.

Sophisticated lighting makes visual inspection of illuminated areas possible. Security guards being blinded by the lights or excessive shadows should be avoided.

5.2 Voltage Supply

Voltage supply should be restricted to an inner area, i.e. the premises protected by an IAS or security guards. If outside sockets cannot be avoided, they should generally be disconnected from the grid whenever they are not used – even if they have caps that can be locked. When outside sockets are available, perpetrator could easily apply electrical tools (e.g. drill, right angle grinder), which could drastically reduce the time required to overcome doors, windows, bars or walls.

5.3 Enclosure

A suitable enclosure constitutes an additional barrier. It might prevent people from getting to the building and make it difficult for trucks to get close to the facade. In addition, the driveway can be blocked by other suitable barriers or bollards, e.g. large natural rocks or plant buckets, even if the premises cannot or should not be enclosed.

5.4 Increased Exposure

Scaffolding outside a museum increases exposure and should be avoided in any case. If scaffolding cannot be avoided, windows that can be accessed from the scaffolding must be protected in the same way as ground floor windows.

Security guards could protect these particularly exposed parts as long as the building is increasingly exposed (i.e. until the scaffolding is removed) as an alternative to physical security measures. Electronic surveillance alone is not sufficient for standard windows because of their low resistance grades. Perpetrators would be able to use standard windows to get inside a building within a matter of seconds.

Note: Wire mesh etc. for plants could be used to climb up; the insurer should be informed about such structures. All windows that can be reached by means of some climbing aids should be protected in the same way as ground floor windows.

Exposure could also be increased by e.g.:

- Installing key depots outside
- Failure or limited function of security systems
- Limited personnel resources in safety-relevant areas
- Special exhibits.

The insurer must be informed about the increased exposure; if necessary, the insurer may demand enhanced protection measures while exposure is still high or develop such measures in coordination with the insured.

5.5 In case of emergency

Aside from preventive measures or action that can be taken in an emergency, an evacuation and rescue plan should also specify what to do in case of an emergency. In principle, a timely initiation of rescue measures has a major impact on the scope of damage. This implies:

- In order to avoid subsequent losses (immediately resulting from or fostered by the initial loss), the building affected is to be protected by surveillance and, if necessary, structural measures.
- The rescue and evacuation operations initiated, if possible, during the emergency shall be continued (e.g. moving objets d' art

to safe areas that are not affected or alternative depots). Documentation of the objects moved. Unless documentation of losses was not immediately undertaken during the emergency, it should be done in a timely manner.

- If possible, emergency conservation measures should be taken for objects damaged (e.g. freezing soaked books) that prevent further degradation and facilitate subsequent restoration. A plan for such emergency measures must be drawn up.
- Take measures that ensure business continuity, e.g. separate areas affected by the damage.
- Targeted public relations activities to avoid possible speculations that could have adverse effects on the museum's image.
- The insurer must be immediately informed and involved in all measures to minimise damage.

6 Appendicces

Note: By reason that the appendices are only available in German language they are not displayed. If interest in the appendices is given please refer to the German edition of VdS 3511.

Annex A	Normative References
Annex B	Definitions (normative)
Annex C	Abbreviations (normative)
Annex D	Further information (informative)
Annex E	Comparison of approval classes (informative)
Annex F	Notes for the establishment of a fire protection regulation for museums (informative)
Annex G	Access control – notes for the realisation (informative)
Annex H	Alarmdienst- und Interventionsattest, sample (informative)
Annex I	Certificate of conformity of intruder alarm systems, sample (informative)
Annex J	Certificate of conformity of video surveillance system, sample (informative)
Annex K	Changes of fire closures (informative)
Annex L	Examples of required security measures according to VdS 2311 (informative)
Annex M	List keywords (informative)

Publisher: Gesamtverband der Deutschen Versicherungswirtschaft e.V. (GDV)

Publishing House: VdS Schadenverhütung GmbH
Amsterdamer Str. 174 • D-50735 Köln
Phone: +49 221 77 66 - 0 • Fax: +49 221 77 66 - 341