S E P T E M B E R 2 0 0 2

European Certification Board•
Security Systems

GUIDELINE

Requirements on strongrooms in cast in-situ
and/or pre-fabricated construction

ECB•S R03

C o n t e n t

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1 Scope

This Guideline establishes requirements and technical test criteria for strongrooms consisting of walls (side walls, base, ceiling) and a door. The walls may be built as cast in-situ construction or pre-fabricated construction (as a room-in-room system).

Depending on their resistance, strongrooms are classified in nine resistance grades (V to XIII). A room of a specific resistance grade shall be equipped with a strongroom door of the same or a higher resistance grade.

Optionally, strongrooms may be provided with additional safety features like protection against diamond core drill tools (CD protection) and explosives (EX protection).

Annex C2 contains requirements on the construction of the day-lock unit. Annex C3 gives recommendations for the construction of a control corridor.

NOTE: Strongroom doors (as the limits of the room) are type-tested and certified separately independent of the walls. This enables to build different combinations depending on the individual safety requirement.

If products according to EN 1143-1 contain electrical or electronical functional groups, VdS 2110 and VdS 2203 will additionally be applicable.

2 Definitions

In addition to EN 1143-1, the following definitions are applicable within the context of this Guideline:

2.1 Armouring element: Prefabricated element in strongroom walls of cast in-situ construction.

2.2 Security element: Prefabricated element of strongroom walls in pre-fabricated construction.

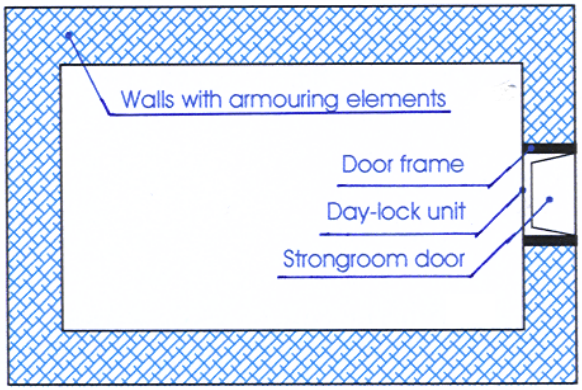
2.3 Control corridor: Corridor around a strongroom used for control purposes.

2.4 Manufacturer: According to this Guideline, the manufacturer is the manufacturer of the armouring element (licensee/ certificate holder).

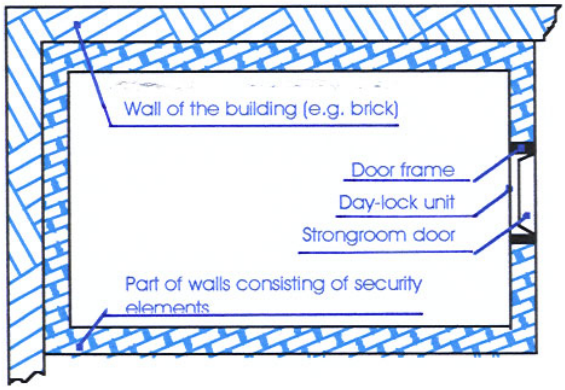
2.5 Day-lock unit (day gate): Additional barrier behind a strongroom door (e. g. grille day gate).

2.6 Strongroom in cast in-situ construction: Room with walls in cast in-situ construction which is built by joining prefabricated armouring elements with concrete (pouring in concrete into the formwork) on site. It is completed with a strongroom door including a prefabricated frame (see Figure 1).

2.7 Strongroom in pre-fabricated construction: Room with walls in pre-fabricated construction which consists of prefabricated security elements and is joined on site as a specific construction (room-in-room system). It is completed with a strongroom door including a prefabricated frame (see Figure 2).

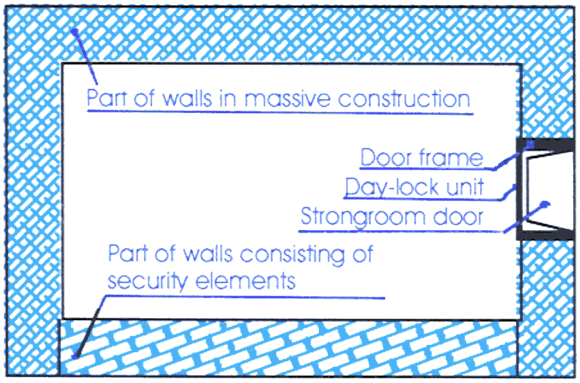


- Figure 1 -



– Figure 2 –

2.8 Strongroom in combined design: Room with walls consisting of a combination of cast in-situ construction and pre-fabricated construction. It is completed with a strongroom door including a prefabricated frame (see Figure 3).



- Figure 3 -

3 Normative references

This Guideline incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Guideline only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- EN 1143-1: Safes, strongroom doors and strongrooms, January 1997
- EN 1143-1 A2: Additional test with the diamond core drilling device on strongroom doors and strongrooms, January 2002
- DIN 1045: Beton und Stahlbeton; Bemessung und Ausführung (Concrete, reinforced and prestressed concrete structures; Design and specification/properties)
- DIN 1048: Prüfverfahren für Beton (Testing concrete)
- DIN 1084-1: Überwachung (Güteüberwachung) im Beton- und Stahlbetonbau; Beton B II auf Baustellen (Control – quality control – in concrete, reinforced and prestressed concrete production; B II concrete on building sites)
- DIN 1164-1: Zement-Zusammensetzung, Anforderungen (Cement composition, requirements)
- DIN 4226-1: Zuschlag für Beton; Zuschlag mit dichtem Gefüge; Begriffe, Bezeichnung und Anforderungen (Aggregate for concrete; Aggregate with dense structure; Definitions, terms and requirements)
- DIN 52 115-3: Prüfung von Gesteinskörnungen; Schlagversuch; Schlagversuch an Split und Kies; Kornklasse 8/12.5 mm (Testing of stone grains; Impact test; Impact test on grit and gravel; grain class 8/12.5 mm)
- ISO 9001 (EN ISO 9001): Qualitätsmanagementsysteme; Modell zur Qualitätssicherung/ QM-Darlegung in Design, Entwicklung, Produktion, Montage und Wartung (Quality systems – Model for quality assurance in design, development, production, installation and servicing)
- ISO 9002 (EN ISO 9002): Qualitätsmanagementsysteme; Modell zur Qualitätssicherung/ QM-Darlegung in Produktion, Montage und Wartung (Quality systems; Model for quality assurance in production, installation and servicing)
- ISO 9001:2000 (EN ISO 9001): Qualitätsmanagement-Systeme – Anforderungen (Quality systems – Requirements)
- VdS 2110: Richtlinien für Einbruchmeldeanlagen; Schutz gegen Umweltein-

flüsse; Anforderungen und Prüfmethoden (Guidelines for intruder alarm systems; Protection against environmental influences; Requirements and testing methods)

- VdS 2203: Richtlinien für Gefahrenmeldeanlagen; Softwaregesteuerte Anlageteile; Ergänzende Anforderungen und Prüfmethoden (Guidelines for danger alarm systems; Software-controlled components; Additional requirements and testing methods)
- VdS 2534: Richtlinien für mechanische Sicherungseinrichtungen; Einbruchhemmende Fassadenelemente (Guideline for mechanical security equipment; Burglary-impeding facing elements)
- TL MIN-StB 94: Technische Lieferbedingungen für Mineralstoffe im Straßenbau (Technical terms of delivery for mineral aggregates in road construction)
- Richtlinien “Nachbehandlung von Beton“ des Deutschen Ausschuss für Stahlbetonbau (Guidelines "Aftertreatment of concrete" of Deutscher Ausschuss für Stahlbeton, the German committee of reinforced concrete)

4 Classification

Strongroom walls for strongrooms are classified in resistance grades in accordance with their resistance against burglary (also see EN 1143-1:1996 Table 2).

In derogation of EN 1143-1:1996 (Table 2), Table 1 of this Guideline contains requirements on strongroom walls in cast in-situ construction.

5 Requirements

5.1 Strongroom walls in cast in-situ construction

A summary of the requirements on the design and wall thickness of different resistance grades where armouring elements (see 2.1) are used is given in Table 1.

Table 1 - Minimum requirements for the classification of strongroom walls in cast in-situ construction

Resistance grade	Resistance grade in RU for complete access	Wall thickness	Number of standard armouring elements "S"	Number of special armouring elements "X" [1)]	Additional requirements for "CD" protection[1)] (optional) Resistance value in RU	Additional requirements for "EX" protection (optional) Resistance value in RU for post-detonation attacks
V	270	≥ 400 mm	1	-	--[1)]	14
VI	400	≥ 400 mm	1	-	--[1)]	20
VII	600	≥ 400 mm	1	-	--[1)]	30
VIII	825	≥ 400 mm	-	1	--[1)]	41
IX	1,050	≥ 400 mm	-	1 (CD)	3,500	53
X	1,350	≥ 500 mm	-	1 (CD)	4,500	68
XI	2,000	≥ 600 mm	-	1 (CD)	6,000	100
XII	3,000	≥ 750 mm	1	1 (CD)	7,500	150
XIII	4,500	≥ 1,000 mm	-	2 (CD)	9,000	225

[1)] CD requirements for strongroom walls of resistance grades V to VIII according to EN 1143-1 are being prepared analogous to the resistance grades IX to XIII (see also EN 1143-1 A2:2002).

5.2 Armouring elements

5.2.1 General

For the erection of a strongroom in cast in-situ construction, compact, prefabricated armouring elements (see 2.1) with a size of at least 1.5 m^2 (excluding single distance and corner elements for adjustments to the room geometry) should be used. The dimensions of the armouring elements shall be adapted to the requirements on site. Where necessary, their weight shall be dimensioned for transportation and installation by persons. The armouring elements shall be designed such that they are sufficiently stable both for transportation and for storage (in stacks). Where necessary, walking on the armouring on the base and the ceiling while the strongroom is being built shall be considered separately. Designs with permanent formwork are permitted.

5.2.2 Design (Recommendation)

With due consideration to all requirements, the design of strongrooms in cast in-situ construction may be as follows:

All technical elements which are important as far as security is concerned shall be permanently connected with the armouring element and must neither deform nor move when the concrete is poured. Provisions shall be made for appropriate clearances for the compaction of the concrete. Due to the concrete cover which must be provided by the client as well

as the installation of a contraction armouring, the armouring elements must not exceed the following thicknesses:

Standard armouring element “N“ ≤ 100 mm
Special armouring element “X“ ≤ 250 mm

Standard armouring elements “N“ may be built at one level with sufficient expansion and the appropriate supports. With isolated armouring elements, e.g. helical flat steel or special polyp-type steel rails, the distance from axis to axis should not exceed 125 mm. Normally a special drill protection, deep anchoring and spacers are not necessary.

Special armouring elements “X“ shall consist of two or three levels with sufficient expansion and the appropriate supports. Here as well, the distance should not be more than 125 mm. Every level should be arranged with a sufficient mismatch to the following level. The levels should be firmly and positively connected with each other through deep anchors of sufficient thickness (100/150 mm grid). Special drill protection should be available for one level, with the "CD protection" type for two levels.

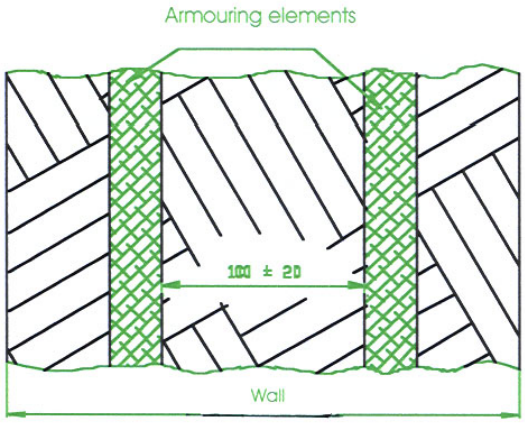
5.3 Position of the armouring elements in the walls

5.3.1 Resistance grades V - XI

The armouring elements should be installed centrally in the wall.

5.3.2 Resistance grades XII - XIII

The minimum clearance between the armouring elements shall be (100 ± 20) mm (also see Figure 4).



- Figure 4 -

5.4 Strongroom walls in pre-fabricated construction

Strongroom walls in pre-fabricated construction exclusively consist of prefabricated security elements (see 2.2.) which are joined to an independent construction on site. The security elements shall fulfil the requirements according to EN 1143-1:1996 (Table 2).

5.5 Strongroom walls in combined construction

Strongrooms may also be built with a combination of cast in-situ construction and prefabricated construction.

5.6 Additional requirements on protection against attacks with explosives ("EX protection")

Strongroom walls with "EX protection" must additionally satisfy the resistance values for post-detonation tool attacks as shown in Table 1. Cable ducts shall be designed such that they cannot be used to transport explosive materials (e.g. igniters or charges) into the interior.

The additional test with explosive materials shall be made in accordance with EN 1143-1: 1996 Clause 9.

5.7 Additional requirements on protection against attacks with diamond core drilling devices ("CD protection")

If the strongroom wall shall have CD protection, the wall as from resistance grade IX on shall be dimensioned for a resistance value in accordance with EN 1143-1 A2. The requirements of Table 1 must be fulfilled. The additional test with the diamond core drill device is made in accordance with EN 1143-1:1996 Clause 8.

5.8 Built-in fittings and wall holes

5.8.1 Conduits

Conduits passing through the wall (room ventilation, cable ducts, etc.) are permitted up to an internal diameter of 51 mm (2" resp.). These conduits shall either be cranked on both sides or be equipped with other obstacles e.g. by welding in a warped flat steel in such a way that a view into the room is not possible. The installation of suitable hollow sections of deviating geometry, e.g. rectangular tubes is possible, if the usable internal cross section does not exceed 20 cm^2 and the largest internal dimension does not exceed 70 mm.

If several conduits are used, they shall be installed with a minimum clearance of 200 mm (centre to centre) and they must only be aligned in one direction (horizontally or vertically) in relation to a distance of 500 mm.

Conduits should preferably be installed in the upper or lower third of the room (related to the internal height). They shall be placed in the appropriate clearances in the armouring elements.

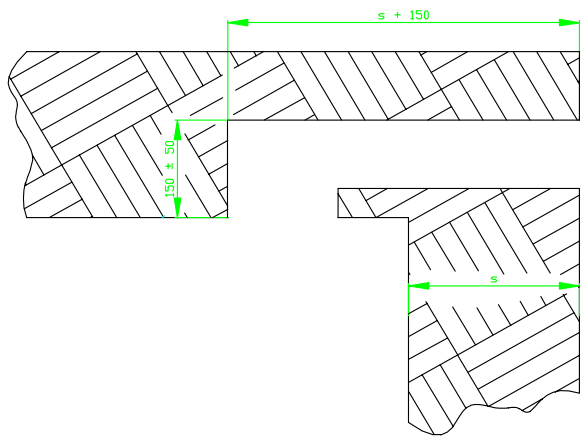
On conduits of types which do not satisfy the above-mentioned requirements, a type-test shall be made.

5.8.2 Ventilation elements (Ventilation)

Ventilation elements (e.g. bundle ventilation) may be used, they shall, however, be type-tested. A type-test may be dispensed with, if alternatively a so-called angle-type ventilation is installed in accordance with the following requirements:

- The internal cross section of the ventilation duct must not exceed 200 cm². One of the internal dimensions (height, width or diameter) shall be ≤ 100 mm.
- The ventilation duct shall be L-shaped (see Figure 5). The long side shall have a minimum wall thickness of s + 150 mm, the short side of (150 ± 50) mm. Existing stops and mounting devices shall be excluded.
- The internal space of the ventilation duct shall be equipped with an at least 2.5 mm thick welded interior armouring (strip) along at least 25% of the length of every side. In the area of the armoured sections of the duct, the available cross section must taper to ≤ 100 cm². The longitudinal axis of the cross section of a built-in duct shall run flush to one edge of the internal space.
- The armouring elements shall be placed as close to the ventilation element as possible and shall be rigidly and permanently joined with it (e.g. through welded joints). As an alternative, the same number of additional armourings with the same function may be inserted in intermediate layers in such a way that they overlap at least 150 mm upward and downward.

If the constructional conditions require a higher air flow rate, several right-angle ventilation elements may be used. The clearance between the ventilation elements shall then be ≥ 1,000 mm.



- Figure 5 -

5.8.3 Systems-related pre-existing openings

Strongroom walls shall not have any holes in the protective materials which are not absolutely necessary for locks, cables or anchoring purposes.

NOTE: In strongrooms, additional equipment in accordance with EN 1143-1:1996 Clause 3.6 (pre-existing openings needed in day and night strongrooms) up to a size of 200 cm² are only permitted in connection with an installed deposit system (drop-in hole, chute and cassette receiving unit), if they are included in the design drawings in accordance with 5.3 g and fulfil the requirements according to 7.4 and 7.5.3. The references to these clauses refer to EN 1143-1.

5.8.4 Holes for transportation and assembly

Holes for transportation and assembly (e.g. of prefabricated security elements for strongroom walls in pre-fabricated construction) shall be recorded in the Technical Documentation.

NOTE: These holes may be used in the type tests as points of attack.

5.8.5 Concealed electrical wiring, telecommunication wiring and similar installations in cast in-situ constructions

Per m^2 of the wall, floor and ceiling surface, not more than one concealed unit (e.g. concealed splitting box) may be installed. The minimum distance to the next installed unit shall be ≥ 600 mm. The installation depth may be 15 % of the wall thickness, but not more than 80 mm. The area must not exceed 45 cm^2. Every concealed wiring shall only be connected via one supply lead and one terminal lead each. The outer duct diameter shall not exceed 20 mm.

If the standard number, installation depth or cross section are exceeded, the wall shall to be reinforced by the dimension of the deepest indentation.

If provisions have been made for a concealed wiring of structure-borne sound alarms, the maximum mounting depth may be 80 mm and the maximum surface may be 250 cm^2. Upon completion of the room, the structure-born sound alarms shall be completely installed and connected with a VdS-recognised intruder alarm system.

The installation of concealed wiring at a later date is not permitted.

5.9 Production, processing and aftertreatment of concrete

5.9.1 General

Strongroom walls in cast in-situ construction are built by joining prefabricated armouring elements (see 2.1) with concrete (pouring in concrete into the formwork) on site. The following clauses define requirements on the production, processing and aftertreatment of the concrete needed for this.

5.9.2 Regulations

The regulations applicable to the production, processing and aftertreatment of concrete shall be complied with.

5.9.3 Cement

The cement used shall be in accordance with DIN 1164-1 and shall be suitable for the respective wall thickness.

5.9.4 Concrete aggregate

The concrete aggregate shall comply with DIN 4226-1, Clause 7.1.2 “Increased requirements “ (e).

In conformity with TL MIN-StB 94 Clause 4.5 proof of resistance against impact with an aggregate crushing value of 8/12 of 22 % by weight in accordance with DIN 52115-3 shall be established.

5.9.5 Grain composition of the concrete aggregate

The grain structure shall comply with DIN 1045 (maximum grain size 16 mm to 32 mm) and be in the range between the particle size distribution curves A and B.

5.9.6 Compression strength of concrete

The compression strength of the concrete established after 180 days shall be equivalent to a continued strength of 60 N/mm^2 (60 MPa).

5.9.7 Concrete composition

The water-cement ratio must definitely not exceed a value of 0.42.

The reference values for the fine aggregate content according to DIN 1045 Table 3 shall be observed.

The setting of the fresh concrete consistence shall be such that it is suitable for being processing for the respective element of the construction. The temperature of the fresh concrete shall be kept at the lowest-possible level.

Plasticizers, retarders and other concrete admixtures shall only be used, if a test certificate has been issued by Deutsches Institut für Bautechnik (DIBT) and their suitability has been established by means of an aptitude test.

Proof of a concrete aptitude test in accordance with DIN 1045 including all necessary specifications shall be made available.

5.9.8 Concrete aftertreatment

Clauses 4.2 to 4.4 and 5.2 of the “Aftertreatment of concrete“ guideline of Deutscher Ausschuss für Stahlbetonbau shall be observed.

5.9.9 Supervision

For room concrete B II, supervision in accordance with DIN 1084-1 shall be ensured.

5.10 Technical documentation

The manufacturer of strongroom walls shall have a technical documentation in accordance with EN 1143-1:1996 Clause 5.

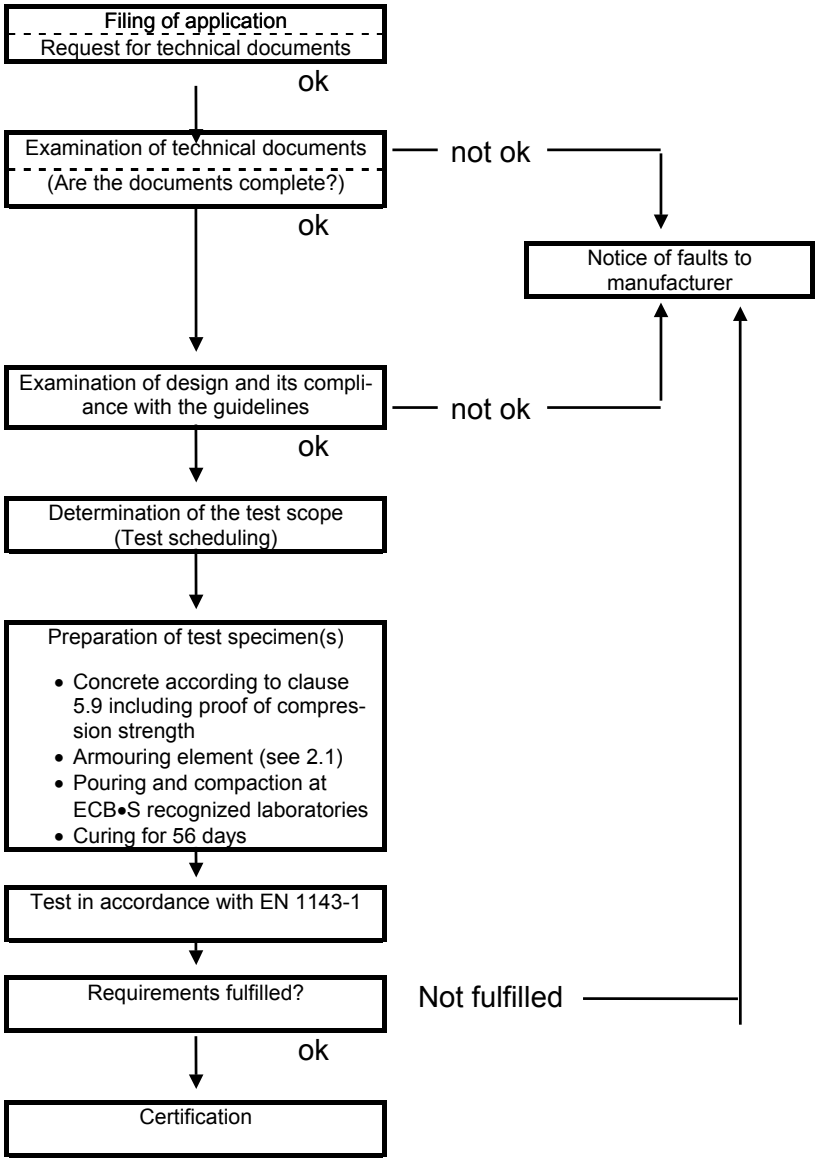
6 Tool attack test

6.1 Test procedure

The type tests on strongroom walls in cast in-situ construction are made in accordance with the test schedule shown in Figure 6.

6.2 Specimen room documentation

For every resistance grade, a specimen room documentation shall be presented.


Filing of application
Request for technical documents
ok
Examination of technical documents
(Are the documents complete?)
not ok
ok
Notice of faults to manufacturer
Examination of design and its compliance with the guidelines
not ok
ok
Determination of the test scope (Test scheduling)
Preparation of test specimen(s)
• Concrete according to clause 5.9 including proof of compression strength
• Armouring element (see 2.1)
• Pouring and compaction at ECB•S recognized laboratories
• Curing for 56 days
Test in accordance with EN 1143-1
Requirements fulfilled?
Not fulfilled
ok
Certification

- Figure 6 -

7 Design and construction

7.1 Documentation

All security relevant measures which need to be considered in design and construction shall be clearly and unmistakeably recorded in a documentation.

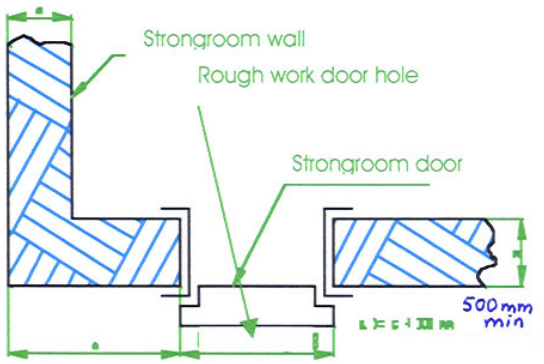
The documentation for the installation of the room door shall particularly deal with the following items:

- Rebate structure (reveal structure)
- Joint between the door sill and the strongroom floor
- Permitted maximum distance between the rough work hole for the strongroom door and the external dimension of the strongroom door (gap which needs to be filled).
- Specifications for filling possibilities (holes for filling)
- Specifications for packing and compacting the concrete in the space between the strongroom walls and strongroom door (for concrete, see Clause 5.9)
  - If there is no joint to the armouring elements, the filler (concrete) shall be in accordance with Clause 5; the installation of the door and the joint to the walls shall be described in detail in the Technical Documentation.
  - If there are joints to the armouring elements, proof of the compression strength is not required (for concrete, see Clause 5).

7.1.1 Installation of the door

The door and doors, respectively, shall be type-tested in accordance with EN 1143-1: 1996 and shall at least have the same resistance grade as the walls or a higher one.

With strongrooms in cast in-situ construction and/or pre-fabricated construction, the distance between the outer edge of the walls and the rough door opening shall not be less than 500 mm (see Figure 7).



- Figure 7 -

7.1.2 Expansion joints

Where expansion joints are needed due to the design and construction, the respective wall(s) shall be heightened to the left and right over a range of ≥ 500 mm to the 1.5 fold value of the standard resistance value (e.g. by strengthening the walls or by using additional security elements in pre-fabricated construction). The expansion joint must not run straight through the walls, and it shall not be more than 30 mm wide.

All armouring elements beside the expansion joint shall be X-modules in CD-construction. The distance from the armouring elements to the respective boundary surfaces of the expansion joint shall not exceed 50 mm.

7.1.3 Water barrier

Where water barriers are needed, the strongroom walls shall be reinforced to be 100 mm thicker at least 500 mm over and under the water barrier (where appropriate, under it only down to the bottom edge of the base or the bottom edge of the floor).

7.1.4 Load-bearing columns

Where for static reasons bearing columns or supports need to run through the strongroom, the resistance value of the walls shall be increased to the 1.5 fold value of the standard resistance value in an area of 500 mm around the hole (e.g. by reinforcing the walls or by using additional security elements).

7.1.5 Construction joints

All construction joints caused by the progress of the concrete work shall comply with DIN 1045.

8 Marking

The walls and the door shall be marked in accordance with EN 1143-1:1996, Clause 11.

Annex A
(Normative)

A.1 Construction of a strongroom

A.1.1 Responsibility

The licensee is allowed to build strongrooms of certain resistance grades in compliance with EN 1143-1 and the necessary Technical Documentation. Upon completion, the manufacturer shall mark the walls and the door with the ECB•S test certificate. By doing this, he will confirm that the strongroom complies with the requirements of EN 1143-1 and has been certified in accordance with EN 1143-1.

NOTE: Normally, the construction (concrete work) of the strongroom is not performed by the manufacturer (holder of the certificate), but a third party. The manufacturer shall provide this third party with all information needed for the execution of the construction in compliance with this Guideline. In addition, the manufacturer shall satisfy himself, e.g. by checking certificates, that the construction measures have been executed according to the specifications.

A.1.2 Modifications

Subsequent modifications of a strongroom certified by ECB•S which are not the subject of the documentation (e.g. additional holes in the walls) are not permitted.

NOTE: In this case, the strongroom will lose its ECB•S certification. The test label must be removed.

A.1.3 Documentation

The construction of ECB•S certified strongrooms shall be documented within the framework of the certified quality management system according to ISO 9001 (EN ISO 9001) and 9002, respectively, or ISO 9001:2000 (EN ISO 9001:2000).

A. 1.4 Building site supervision

The ECB•S reserves the right to make inspections on site after the construction of ECB•S-certified rooms. If a documentation is not satisfactory or clear enough, the ECB•S is entitled to request core drillings (e.g. in order to test the concrete) in coordination with the client and the construction firm.

A.2 Day-lock unit (day gate)

For organizational reasons it may be necessary that access to the strongroom is not possible for any person while the door is open.

If an access restriction is required (e.g. by the insurance company), a burglary-impeding door of class N according to VdS 2534, shall be used for this day-lock unit (day gate). If the door has infillings of glass or similar material, they shall at least be equivalent to resistance class EH02.

Annex B (Informative)

B.1 Control corridor

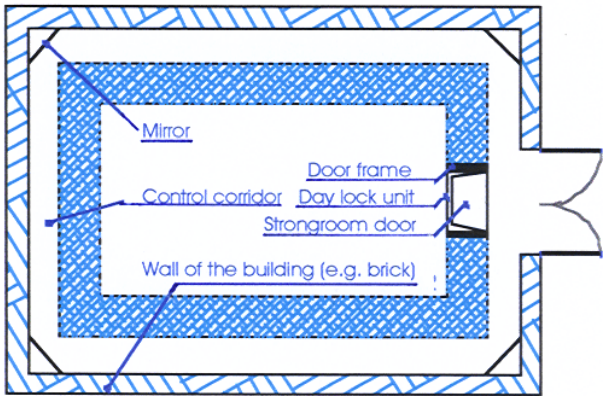
For control purposes and in order to impede burglary attempts, a room may be equipped with a corridor around (control corridor). The wall separating the control corridor from other areas should at least be fixed and solid.

This control corridor should be no more than 500 mm wide and should only have one access. The access should at least be a burglary-impeding door of class N according to VdS 2534.

Where there are particularly high risks, the control corridor should be extended to the ceiling and base.

It should be possible to observe the control corridor without any difficulty (e. g. by means of mirrors or – preferably – video display units).

NOTE: The control corridor should be controlled by means of a VdS-approved intruder alarm system.



- Figure 8 -