



Ticket Machines

Requirements, Classification and Test Methods

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VdS-Guidelines for Physical Security

Ticket Machines

Requirements, Classification and Test Methods

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1 Introduction

Ticket machines are used for automatic issue of tickets paid for, for using public transportation.

The machines are mainly used in public areas. Ticket Machines consists at least of the input and assembly unit for means of payment, the ticket printer, operating devices as well as the control unit. After payment a corresponding ticket is provided.

Experience has shown that ticket machines represent a potential target for criminals who aim to remove stored money or blanc tickets.

Note: These guidelines take into account only the area of ticket machines, containing the banknote scanner and the blanc tickets as well as those receiving banknotes and coins, regarding violent attacks. Manipulative attacks on system related openings (fishing, trapping) and the control electronics are not considered.

Note: These guidelines do not include the area of ticket machines where payment via debit card and PIN code entry or e-ticketing is given, i.e. there is no consideration of this area regarding phishing.

1.1 Scope

The guidelines at hand contain minimum requirements for ticket machines to secure all value areas including blanc tickets against unauthorised access.

2 Validity

These guidelines are valid starting from 2012, December 1st.

Note: This is a translation of the German guidelines. In case of doubt, the German version shall be binding.

3 Normative references

These guidelines contain dated and undated references to other publications. The normative references are cited at the appropriate places in the clauses, the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to these guidelines only when announced by a change of these guidelines. For undated references the latest edition of the publication referred will be applied.

- **VdS 2156-1en**: Guidelines for Physical Security Devices, Locking Cylinders with Individual Locking Function
- **VdS 2227en**: Guidelines for Intruder Alarm Systems, General Requirements and Test Methods
- **VdS 2344en**: Procedure for the Testing, Approval, Certification and Conformity Assessment of Products and Systems for Fire Protection and Security Technologies
- **VdS 2396en**: Guidelines for Physical Security Devices, High Security Locks for Secure Storage Units

4 Terms

For the purposes of these guidelines, the general terms as summarised in the guidelines VdS 2227 as well as the following terms are valid.

Banknote scanner: Machine component which identifies the valid means of notes and rejects those the features of which have been identified as not valid.

Cash box – coins: Receptacle for the permanent storage of coins and token coins until collection.

Cash box door – coins: The door enables access to the cash box – coins of the ticket machine.

Note: The cash box door – coins may be identical to the service door.

Cash box door – notes: The door enables access to the cash box – notes of the ticket machine.

Note: The cash box door – notes may be identical to the service door.

Cash box – notes: Receptacle for the permanent storage of notes until collection.

Connecting unit – coins: The connecting unit links the coin slot by the coin scanner and the temporary container with the cash box – coins.

Connecting unit – notes: The connecting unit links the notes slot by the note scanner and the temporary container with the cash box – notes.

Control unit: All functions of the ticket machine are controlled via the control unit.

Coin scanner: Machine component which identifies the valid means of coins and rejects those the features of which have been identified as not valid.

Operation unit: The operation unit enables to perform system functions.

Operator: The person who is responsible for the operation of the ticket machine.

Return and release container: Container able to return the amount of physical payment after cancellation of a payment process as well as change needed and to receive the printed ticket.

Service door: The service door renders access to further technical function units of ticket machines.

Note: A ticket machine may dispose of further doors.

Temporary container – coins: A unit for collecting the money – coins at large, until the payment process is being confirmed or cancelled.

Temporary container – notes: A unit for collecting the money – notes at large, until the payment process is being confirmed or cancelled.

Ticket machine: Machine for prepayment, which according to the amount defined, issues a ticket to the user.

5 Classification

VdS-approved ticket machines are classified according to their resistance to burglary in one of four classes.

- FA 1
- FA 2
- FA 3
- FA 4

The requirements in terms of duration of a possible conquest and the effectiveness of the tools used increase from class to class – from FA 1 to FA 4.

The potential duration of the unauthorised opening of an individual ticket machine with the objective of extracting money depends to the construction of the machine significantly as well as to the choice of burglary tools and the professionalism and experience of the attacker, and the duration of use of the different tools (intensity of attack).

The assignment of classes, test times and test tools are shown in table 6-1.

Note: An equalisation of classes for façade elements (e.g. RC 1 to 6 according to DIN EN 1627) with classes FA 1 to FA 4 given to ticket machines is not possible. This is the case because the products "ticket machine" or (e.g.) "window" are aiming on elementary different protection targets. Basing on differences in the construction caused by the different protection targets attackers are able to use (partly) variable tool sets to carry out product specific attack alternatives.

6 Requirements

6.1 Documentation

The product documentation is to be handed in to VdS Schadenverhütung prior to the test and shall meet the criteria named as follows.

6.1.1 General requirements on the documentation

The documentation contains the following information:

- Date of issue and name of the manufacturer or name and function of the applicant who is ordering the test.
 - If dispatched in paper: indication of the required data on each page of the document.
 - If data is transferred in digital form, the data medium shall be authorised by the applicant; the correlation of printouts to the data medium is made VdS in-house (e.g. by embedding a watermark on each page naming the data medium exactly).
- Distinct statements regarding type of the products as well as the model number.

Depending on the information contained by the document the test laboratory may define its format.

6.1.2 Required documents

The documentation contains the following information:

- installation manual for the product handed in for testing
- operator manual for the product handed in for testing including the functions to be executed by using the operating unit
- instruction manual for the product handed in for testing including the functions to be executed by using the operating unit
- indication on products or components already tested and approved (e.g. profile cylinders or the locking mechanism of profile cylinders)
- detailed sketch of the cash box
- detailed sketch of the cash till, if given
- detailed description of the connecting unit and the temporary container
- documentation of circuits

6.1.3 Requirements for drawings

The technical documentation (drawings and other documents) shall contain the following information:

- cross and vertical sections
- number, location and characteristics of locks, bolt work, etc.
- number, clearances and configuration of the door latch, their dimensions (e.g. cross sections), bolt-mechanism and bolt types (e.g. movable or fix)
- location and design of areas with special protection measures
- purpose, arrangement and size of each opening including a detailed illustration of specially protected areas
- specifications of the materials used

6.1.4 Information on hazardous substances

Details of any materials and devices that produce in case of an attack gases, smoke, soot, etc. which can generate hazardous substances during the test are explained.

6.2 Marking

Ticket Machines shall be marked with

- details regarding the manufacturer or a trademark and
- the type designation and
- the classification (resistance class).

The marking shall be strongly made and (if necessary after opening certain doors) be visible.

In addition, the products shall be provided with the VdS label according to VdS 2344.

6.3 Resistance characteristics

Table 6-1 summarises the resistance times and the tool sets used for tests in respect of the individual class of the ticket machine.

Note: The test of requirements for anchoring of the ticket machine at its location is not part of the present guidelines.

class of ticket machine	resistance time ¹⁾	tool set ²⁾
FA 1 ³⁾	3 min	basic tool set, A, B
FA 2	3 min	basic tool set, A, B, C
FA 3	5 min	basic tool set, A, B, C
FA 4	5 min	basic tool set, A, B, C, D
<p>¹⁾ Time during which a tool is in contact to the test specimen (cf. chapter 7.3.2).</p> <p>²⁾ The tool sets are described in annex A.</p> <p>³⁾ An attack aiming on the locking solution of the cash box door is not permitted within class FA 1.</p>		

Tabelle 6-1 Requirements, overview

6.3.1 Access to the value area

The closure or the closure techniques of the access door for the stored money and the unprinted blanks shall at least meet the requirements for locking cylinders of class B in accordance with the *Guidelines for Cylinders with Individual Locking Function*, VdS 2156 or locks of class 1 according to the *Guidelines for High-Security Locks*, VdS 2396.

If for every single area of stored money and unprinted blanks a unique container with a respective door is given the closure or the closure techniques of each of these doors shall at least meet the requirements of locking cylinders of class B in accordance with the *Guidelines for Cylinders with Individual Locking Function*, VdS 2156 or locks of class 1 according to the *Guidelines for High-Security Locks*, VdS 2396.

Note: If so, no requirements regarding the locking of a service door are given.

For the proof of class FA 1 an attack aiming on the locking solution of the cash box door is not permitted.

For the proof of classes FA 2 to FA 4 an attack aiming on the locking devices according to table 6-1 is permitted.

Note: If the installation of the locking solutions, e.g. locking cylinder of class B, does not fulfil the installation requirements of the chosen locking solution, for an attack on them tools named in the guidelines mentioned above may be used analogously.

7 Tests

7.1 Preparation of the tests

7.1.1 Test team

The test team includes:

- the head of the test team
he is responsible for planning, directing and controlling the test
- the time keeper
he is responsible for the time keeping and generating the test protocol
- the test specialists
these carry out the work required on the specimen directed by the head of the test team.

Note 1: If necessary, the use of more than one time keeper is permitted.

Note 2: The head of the test team may also act as test specialist himself and/or as time keeper.

7.1.2 Timing

Used is a clock that holds a measurement uncertainty of 0.05 min or less (at 10 min) and a graduation of at least 0.01 min. If required, multiple clocks are used.

7.1.3 Protocol

The main test regarding chapter 7.3 will be documented. The protocol informs inter alia on which tools were used for how long.

7.2 Preliminary tests

Before beginning the main test, the following series of steps are executed.

7.2.1 Test of the documentation

A visual inspection of the documentation is executed.

The following tests only start when all required documentation in accordance with chapter 6.1f are present and the requirements mentioned there are met.

7.2.2 Preliminary tests

Before carrying out the attack with tools and before writing the test plan, the test team may perform preliminary tests on the specimen in order to familiarise themselves with the design and possibly to identify existing vulnerabilities.

A documentation of the preliminary tests in the context of the report is not required.

Times to carry out preliminary tests are not allocated to the resistance time.

7.2.3 Test plan

Before beginning the main test (determination of resistance time) the head of the test team designs a test plan. The composition of the individual test plan is created in a way that by judgment of the test team leader and the test team the test (by using the tools meeting the intended class of the ticket machine) the shortest resistance time is expected.

A documentation of the test plan in the context of the report is not required.

Note: Depending on the design of the presented specimen, several tests (possibly at several specimen) may be required.

7.2.4 Selection of tools

The selection of tools for testing in practice is basing on the test plan. The selection only includes tools shown in table 6-1 and described in annex A, which are allowed for the examination within the desired ticket machine class.

Apply to tests within class FA 4 using the hydraulic tool (specification in annex B): The point at which the force of the hydraulic tool is set, shall not be changed during the test. A multiple application of the force at this point is allowed.

Note: The adapter necessary for the application of the power adapters are made tailored to the specimen if necessary. The time required for preparation of the adapter(s) is not part of the resistance time.

7.3 Main test

The aim of the main test is to determine whether requirements for product labeling and structural requirements of the sample affecting its resistance against unauthorised access, are fulfilled and whether during the resistance time named in table 6-1 by using the specified tool sets therein, an access on the value areas according to chapter 7.3.4 can be achieved.

The specimen is mounted to obtain reasonable stability against tilting analogous to the installation instructions of the manufacturer, assuming most unfavourable conditions.

7.3.1 Labelling

A visual inspection is done whether the labelling is existing as mentioned in chapter 6.2.

Furthermore, it is examined whether this labelling is appropriate sufficiently stable e.g. by trying tearing off the label, by wiping with a watered cloth or by simple scraping.

The result of the test is documented.

Note: If necessary, this test may also be done after the main test on a completed series product.

7.3.2 Time keeping

The time segments necessary for obtaining access to the value areas according to chapter 7.3.4 are recorded with the stop watches described in chapter 7.1.2 and documented. The time information to be documented start with the application of a tool to the sample and end with the withdrawal of the tool. If the test is divided in several time-sections these individually measured times are added to the overall resistance time.

The operating times of the individual tools are measured and documented in the test report. The results of each attack can be documented. The final result of the attack (after reaching the predetermined resistance time) is documented.

7.3.3 Locking of the access to the value areas

There is a view or document review and if necessary an examination following the guidelines named in chapter 6.3.1, if the requirements for the closure of the closure techniques of the access door respectively the single cash box doors are met in accordance with chapter 6.3.1.

In the classes FA 2 to FA 4, the inspection of the locking may be carried out depending on the decision of the test team leader by the use of tools in each class additionally.

The result of the test is documented.

7.3.4 Access to the value areas

Using the selected tools according to 7.2.4 it is checked whether

- the removal of the cash box or of the optionally present temporary box for payments *banknotes* is possible or whether a possibility can be provided to extract the contents (cash) of the cash box or the optionally present temporary box,
- the removal of the cash box or of the optionally present temporary box for payments *coins* is possible or whether a possibility can be provided to extract the contents (cash) of the cash box or the optionally present temporary box,
- the removal of unprinted blanks is possible.

The use of the existing specimen (systemic) openings in the examination, e.g. to gain access to cash or ticket blanks, is permitted without restriction.

The result of the test is documented.

Note 1: The time spent in accordance with chapter 7.3.3 is counted against the maximum allowable resistance as shown in table 6-1.

Note 2: The time required for a withdrawal of cash from the cash box or the temporary box or for the removal of unprinted ticket blanks is not added to the resistance time. However, if the test shows that the removal of a large part of the stored payment or of the unprinted ticket blanks takes more than five times of the time which is required for the ticket machine class according to table 6-1, the request is also considered met.

Note 3: Special means impeding or aggravating a withdrawal of cash from the cash box or the temporary box or the removal of unprinted ticket blanks may be attacked. The time spent is counted against the maximum allowed resistance time according to table 6-1.

Note 4: For attacks aiming on a single reservoir for remaining money which only lead to a removal of parts of payments coins, only 50 % of the maximum of the allowed resistance time according to table 6-1 is to consider.

Annex A Test tools (normative)

description	type specification
basic tool set	
screw driver	width 6 mm
long-nose pliers	length 200 mm max.
combination pliers	length 200 mm max.
pin punch	DIN 900
pin punch	FL 25 x 6, length 200 mm max.
pin punch	diameter 15 mm, length 200 mm max.
locksmith's hammer	200 g according to DIN 1041
socket head wrench	length 120 mm max., DIN 911
spanner	length 180 mm max.
tweezers	160 mm (none-magnetic)
rope	manila rope
steel wire	binding wire
hook	bent welding wire
torch	arbitrary
tape	duct tape, fabric tape
knife	blade 120 mm max.
industrial vacuum cleaner	rated input 2000 W, including arbitrary adapter
tool set A	
screw driver	width 10 mm
screw driver	width 14 mm
wooden wedge	l/w/h 200/80/40 mm max.
plastic wedge	l/w/h 200/80/40 mm max.
multi slip-joint gripping pliers	length 240 mm
pipe wrench	length 240 mm
tool set B	
nail puller	length 710 mm
hammer	500 g according to DIN 1041

tool set C	
club hammer	1.5 kg, shaft length 400 mm
axe	length 350 mm
chisel	arbitrary size
hack saw (for metal)	arbitrary dimensions and blades
metal shears	right, length 260 mm
pipe wrench	length 410 mm
bolt cutter	length 750 mm max.
pin punch	arbitrary size
screw driver	arbitrary size
steel weges	arbitrary size
electronic power supply	arbitrary
tool set D	
drilling machine	rated input 600 W max.
hammer drill	rated input 600 W max.
hydraulic tools	50 kN max. arbitrary adapters
high speed drills	arbitrary
carbide drills	arbitrary
solid carbide drills	arbitrary
hole saw	arbitrary
hole cutter	arbitrary

Annex B Specification of hydraulic tools (normative)

description	type specification
lever driven piston pump	
manufacturer	Yale Industrial Products GmbH
type	HPS - 1/0.7A
tank capacity	0.7 l
working pressure	700 bar max.
measuring equipment	
manufacturer	HBM (Höttinger Baldwin Messtechnik)
type	Digibar II – K-PE 300
attached pressure gauge	KI. 0,15 (changeable to test load)
uncertainty of measurement	± 0.15 % of terminal value
nominal effective range	0 ... 1000 bar
hydraulic cylinder	
universal cylinder	
manufacturer	Yale Industrial Products GmbH
type	YS
trunk piston cylinder	
manufacturer	Yale Industrial Products GmbH
type	YCS

Note: Equivalent tools are permitted.