Annex A
(normative)

Cylinders suitable for use in locking systems

A.3.1
Locking system

Combination of different coded cylinders and keys that are functionally related to each other

A.3.1.1
Master key system (MK-system)

locking system which has 2 levels of coded keys operating different cylinders whereby the master key can operate all cylinders

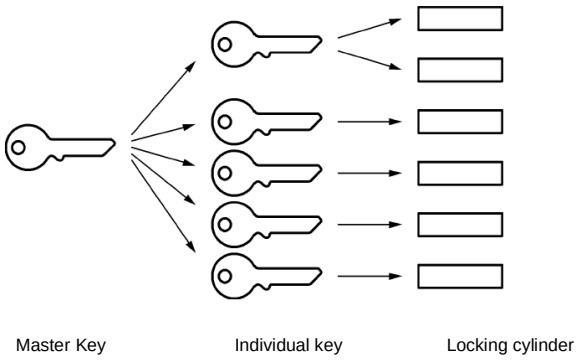

Figure A.1 — example for a master key system

The combination of master key system with a central locking system 3.xx.3 is possible

A.3.1.2
Grand master key system (GMK-system)

locking system which has 3 or more levels of coded keys operating different cylinders.

The combination of grand master key system with a central locking system is possible

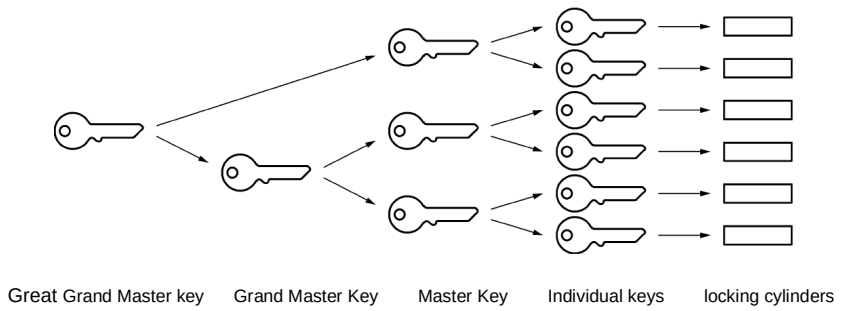

Figure A.2 — example for a Grand master key system

The combination of grand master key system with a central locking system 3.xx.3 is possible

A.3.1.3
Central locking system

locking system which has only one level of coded keys operating different cylinders whereby all keys operate central cylinders.

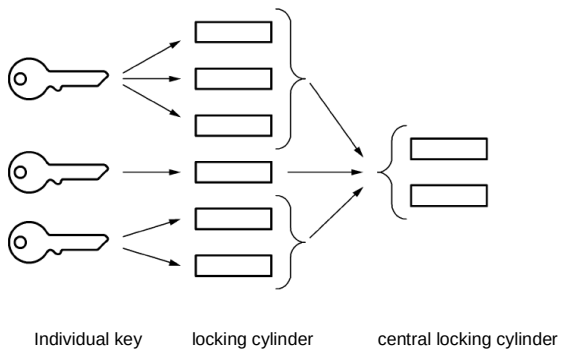

Figure A.3 — example for a central locking system

A.3.4 Central locking cylinder

locking system is a coded cylinder where a number of different keys operates this cylinder.

A.3.5
Lock chart

describing the interaction with all keys and cylinders in the locking system.

A.3.6

Legitimation ID
security protocol that is issued by the manufacturer of a locking system that indicates to the manufacturer a reference to allow the holder to obtain additional keys, cylinders, lock chart, or locking system data e.g.

- Security card
- Security letter (document)
- Certificate of Eligibility
- Document of ownership
- Certificate of legitimation
- Electronic Legitimation

A.4 Requirements for cylinders in a locking system

A.4.1 Minimum number of movable detainers and passive locking elements

A movable detainer shall have minimum 3 permutable characteristics (position, layer, height or other technical distinction). The minimum number of movable detainers shall be as indicated in Table A.1. The number of movable detainers shall be verified in accordance with A.6.1. In addition to realize a locking system profiles, profile pins or other passive elements are permitted for permutation.

Verify according to A.6.1.

A.4.2 Calculation capacity

The locking system shall be capable to calculate different variations of theoretical structures shown in A.4.2.1 and A.4.2.2.

Verify according to A.6.2

A.4.2.1 level structured schematic diagram

The locking system shall be capable to calculate a theoretical locking system in the level structured shown in figure A.4 subject to the requirements in table A.1

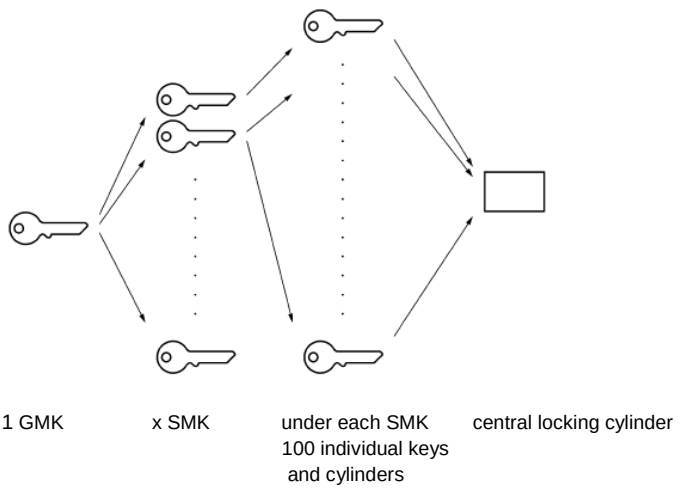

Figure A.4 - Requirements for the theoretical capacity of a locking system

Verify according to A.6.2.1

A.4.2.2 amount of different systems under single structured schematic diagram

Based on the theoretical level structured schematic diagram A.4.2.1 Figure A.4 a number of equal independent locking system shown in table A.1 shall be capable without interlocking in each other level structured schematic diagram.

Verify according to A.6.2.2

A.4.2.3 multiple structured schematic diagram

The locking system shall be capable to calculate a theoretical locking system in the multiple-structure shown in figure A.4 subject to the requirements in table A.5 up to the SMK level shown in table A.1. The structure shows a worst case scenario within a locking system with gradually overlapping SMKs.

	cylinder 1	cylinder 2	cylinder 3	cylinder 4	cylinder 5	cylinder 6	cylinder 7	cylinder 8	cylinder 9	cylinder 10	….	cylinder n
GMK	x	x	x	x	x	x	x	x	x	x		x
SMK 1	x											
SMK 2	x	x										
SMK 3	x	x	x									
SMK 4	x	x	x	x								
SMK 5	x	x	x	x	x							
SMK 6	x	x	x	x	x	x						
SMK 7	x	x	x	x	x	x	x					
SMK 8	x	x	x	x	x	x	x	x				
SMK 9	x	x	x	x	x	x	x	x	x			
SMK 10	x	x	x	x	x	x	x	x	x	x		
….												
SMK n	x	x	x	x	x	x	x	x	x	x		x

Figure A.5 - Requirements for the theoretical capacity of a multiple structured locking system

Verify according to A.6.2.3

A.4.3 technical differentiation

For cylinders in locking systems reserved key profile series or other technical differentiations must be used by the manufacturer, for a proper differentiation to the individual locking cylinders.

Verify according to A.6.3

A.4.4 Operation of security mechanism (inter-passing)

for the key related security grades 1 and 2, it shall not be possible before the durability test to operate the cylinder with the next closest key to its own key using a torque of ($1{,}5\,^{+0{,}2}_{0}$) Nm.

For the key related security grades 3, 4, 5 and 6, it shall not be possible before and after the durability test to operate the cylinders with the next closest key to its own key using a torque of ($1{,}5\,^{+0{,}2}_{0}$) Nm.

Test in accordance with A.6.4.

The next closed key refers to a key with the next unauthorised shear line according to the technical specification by the manufacturer.

Example:

54**1**31 key next level not locking

54**3**31 key code for SMK1

54**5**31 key code for Individual key

54**7**31 key code for SMK2

54**9**31 key next level not locking

Test in accordance with A.6.4.

A.4.5 Torque resistance of plug/cylinder relevant to key related security

It shall not be possible to rotate the plug and/or cylinder in the key related security grades 3 to 6, using the specified applied torque as indicated in Table A.1.

Test in accordance with A.6.5.

A.4.6 Direct coding on key

Direct key coding shall not be permitted on keys for the key related security grades 3 to 6 as specified in Table A.1. The function of the different keys shall be decoded, especially for GMK or SMK keys.

Note: direct code are number and/or depths of increments or an obvious assignment to the keys locking function (e.g. GMK = grand master key …)

Verify according to A.6.6

A.4.7 locking authorisation documentation

A lock chart or any kind of document describing the interaction with all keys, cylinders and function shall indicate

- System type designation;
- key number;
- cylinder number;
- locking authorisations

and can indicate further information like

- further key function
- information about locking cylinder type
- Special functions / equipment;
- Number of lock cylinders and the key

Verify according to A.6.7

Table A.1 Requirements for locking system security

Clause	Requirement	Test clause	Classes/Grades						Unit
			A	B	C	D	E	F	
A.4.1	Min. number of movable detainers	A.6.1	2	3	5	5	6	6	No
A.4.2.1	Min. number of calculation capacity (level structured)	A.6.2.1	-	-	1 MK 0 SMK[a] 3000 IK	1 GMK 20 SMK [a] 100 IK each	1 GMK 50 SMK [a] 100 IK each	1 GMK 100 SMK [a] 100 IK each	No.
A.4.2.2	Number of locking systems of different equal systems	A.6.2.2	-	-	tbd	tbd	tbd	tbd	No.
A.4.2.3	Min. number of calculation capacity of GMK/SMK with over-lapping SMK(n)	A.6.2.3	-	-	15	25	35	50	No.
A.4.3	Technical differentiation	A.6.3	-	-	Yes	Yes	Yes	Yes	-
A.4.4	Operation of security mechanism (Interpassing)	A.6.4	-	-	1,5 [b]	1,5 [b]	1,5 [b]	1,5 [b]	Nm
A.4.5	Torque resistance of plug/cylinder	A.6.5	-	-	15	15	15	15	Nm
A.4.6	Direct coding on key	A.6.6	-	-	No	No	No	No	-
A.4.7	locking authorisation documentation	A.6.7	-	-	Yes	Yes	Yes	Yes	-

[a] Number of grand master key (GMK), of Submaster keys (SMK) and number of different individual keys (IK)
[b] Tested before and after the durability test.

5 Test and Verification

5.1 General

In order to minimize the number of samples to be tested some samples may be used for several tests.

In the event of a test failure it shall not, at that point, be considered a failure to meet the standard. Two further cylinders, with the same design, shall be tested according to the failed test and both of them shall pass the test.

Where a product range is submitted for evaluation the test authority shall consider each individual test for each cylinder type. Where (by engineering judgement) it can be shown that a weaker or equivalent cylinder type is to be evaluated then no further testing needs to be carried out.

Check the cylinders and keys conform to A.4.1 to A.4.3 before commencing the performance tests.

For the performance test a test according to A.4.4 to A.4.7

If additional instructions for testing are required, the manufacturer shall supply such additional instructions. These additional instructions shall be documented in the test report.

A.6 Test methods – procedures

All physical test methods are given in 6.1 to 6.9.5

A.6.1 Minimum number of movable detainers and passive locking elements

The requirement shall be verified based on a written technical description showing the calculation algorithm and the technical distinction of active and passive locking elements.

A.6.2 Calculation capacity

The verification of A.4.2.1 and A.4.2.2 shall be verified on a sample lock chart calculation and a manufacturer's declaration.

A.6.2.1 level structured schematic diagram

The requirement shall be verified based on a lock chart and the appropriate calculation of key cuttings list and cylinder assembling list.

A.6.2.2 number of different systems under single structured schematic diagram

The requirement shall be verified on a manufacturer's declaration describing the distinction of the differentiation of the different numbers of level structured schematic locking systems.

A.6.2.3 multiple structured schematic diagram

The requirement shall be verified on a manufacturer's declaration describing the technical differentiation of the multiple structured locking systems.

A.6.3 technical differentiation

The requirement shall be verified on a manufacturer's declaration describing the technical differentiation of locking systems and single cylinders.

A.6.4 Operation of security mechanism (inter-passing)

Test in accordance with 6.8.5

A.6.5 Torque resistance of plug/cylinder relevant to key related security

The test shall be executed with a cylinder with at least 10 shear lines (10 different keys operating the cylinder).

Note: central locking cylinders will not be tested

Test in accordance with 6.8.6

A.6.6 Direct coding on key

The requirement shall be verified on a manufacturer's lock chart and calculation documentation.

A.6.7 locking authorisation documentation

The requirement shall be verified on a manufacturer's lock chart and calculation documentation

A.7 Classification

7.1 General

Classification shall be in accordance with the eight digit coding system as shown in Table A.1 and described in 7.2 to 7.9.

Table A.2

1	2	3	4	5	6	7	8
Category of use	Durability	Door mass	Fire restistance	Safety	Corrosion resistance and temperature	Key Related Security	Attack resistance

7.2 Category of use (1st digit)

Grade 1: for use by people with a high incentive to exercise care and with a small chance of misuse.

grade 1: medium frequency of use by people with a high incentive to exercise care and with a small chance of misuse, e.g. internal residential doors;
grade 2: medium frequency of use by people with some incentive to exercise care but where there is some chance of misuse, e.g. internal office doors;
grade 3: high frequency of use by public or others with little incentive to exercise care and with a high chance of misuse, e.g. public office doors;
grade 4: high frequency of use on doors which are subject to frequent violent usage, e.g. football stadiums, offshore installations (oil rigs), barracks, public toilets, etc.

Kommenterad [H.Maté1]: Extend the category to grade 1 to 4?

7.3 Durability (2nd digit)

Three grades of durability are identified as follows:

grade 4: 25 000 test cycles;

grade 5: 50 000 test cycles;

grade 6: 100 000 test cycles.

7.4 Door mass (3rd digit)

Only one grade of door mass is identified as follows:

grade 0: no door mass requirement.

7.5 Suitable for use on fire resistant / smoke control doors (4th digit)

Three grades of suitability for use on fire resistant / smoke controlled doors are identified:

grade 0: not approved for use on fire resistant / smoke control door assemblies;

grade A: suitable for use on smoke control door assemblies;

grade B: suitable for use on fire resistant and smoke control doors.

7.6 Safety (5th digit)

Only one grade of safety is identified:

7.7 Corrosion resistance and temperature (6th digit)

Four grades of corrosion resistance and temperature requirement are identified:

grade 0: no corrosion requirement; no temperature requirement;

grade A: high corrosion resistance; no temperature requirement;

grade B: no corrosion requirement; temperature requirement: from – 25 °C to + 65 °C;

grade C: high corrosion resistance; temperature requirement: from – 25 °C to + 65 °C.

7.8 Key related security (7th digit)

Six grades of key related security are identified in accordance with Table A.:

grade A: no requirement;
grade B: no requirement;
grade C: suited for basic locking systems with a non or a low number of SMK, the SMK are structured in the locking hierarchy; typically for master key systems;
grade D: suited for more complex systems with an average number of SMKs ;
grade E: suited for higher complexity of locking systems;
grade F: suited for grand complex locking systems with overlapping and high complexity of locking hierarchy.

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7.9 Attack resistance (8th digit)

Five grades of resistance against drilling and mechanical attack are identified in accordance with Table 3:

grade 0: no resistance against drilling; no resistance against mechanical attack;
grade A: 3 / 5 min resistance against drilling; resistance against mechanical attack except plug/cylinder extraction;
grade B: 5 / 10 min resistance against drilling; resistance against mechanical attack except plug/cylinder extraction;
grade C: 3 / 5 min resistance against drilling; resistance against mechanical attack;
grade D: 5 / 10 min resistance against drilling; resistance against mechanical attack.