TESTING OF DETECTORS OF OPENING IN INTRUSION AND HOLD-UP ALARM SYSTEMS

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Abstract. The problem of detecting of opening of a window or doors affects a large proportion of intrusion and hold-up alarm systems (I&HAS). In a time of increasing property crime, it is highly important for detector of opening to be able to detect opening windows, doors or other penetrations within the guarded area reliably and free of error. In the case of installation of detectors of opening it is naturally important not only to ensure correct installation, to gauge the external influences impacting upon the detector and ensure proper maintenance, but also to guarantee their capability of detection under more arduous conditions (attempts to sabotage etc.) These tests are important both, from an informative perspective and due to the possibilities of development of potential counter-measures which could lead to their improvement and an enhancement of their level of security. Tests were performed of the maximum zoom out among individual types of magnetic contacts. These tests showed that the manufacturing process is not perfect and the same magnetic contacts can have big differences.

Keywords: security risks, sabotage, intrusion and hold-up alarm systems, magnetic contact.

Introduction

Intrusion and hold-up alarm systems serve primarily for protecting buildings against unlawful conduct of third parties, and can be used as monitoring and control systems. They are therefore primarily a tool for ensuring a state of security. They operate in the material realm (physical protection of property, life and health) and in the emotional realm (providing a feeling of peace, safety and a certain security). As a result it is important for them not to malfunction and be sufficiently resistant to attack. The critical point of intrusion and hold-up alarm systems is predominantly elements of the building envelope protection [1; 2].

These elements are highly susceptible to poor installation, and as a result it is very important to pay attention to this problem. One of the most widely used types of detector is the MG detector (magnetic contact), which ranks amongst passive detectors. On average, of all the types of the building envelope detectors used a larger number of false alarms occur on these detectors. This higher error rate is primarily caused by incorrect installation.

Materials and methods

Several security risks may arise during the installation of intrusion and hold-up alarm systems which impair the security of the entire building. The risks which occur due to poor installation or various sabotage techniques are always a serious danger for the guarded premises [3; 4]. They may jeopardise the guarded property or even the lives of the people who the intrusion and hold-up alarm systems are intended to protect. Above all, however, they have an influence on determining the security risks of buildings.

Upon installation of MG detectors it is necessary to take into account a number of fundamental prerequisites. The first prerequisite is for the detector that it must be installed on the opposite side than are hinges of windows or doors [5; 6]. The second prerequisite is for the cabling not to be visibly installed [3; 5]. In addition the relevant norms must be adhered to upon implementation of the cable distribution mechanisms. If the cable distribution mechanisms are installed in such a manner that enables access to them, it is possible to sabotage these systems and thus attack the entire installation of the intrusion and hold-up alarm systems [2; 6].

The detectors MET-200, MET-44, TAP-15, 3G-SM-70MET, TAP-25-T, SM50T, FM-102, SD70, MET-55T, MET-300T, 3G-SM-85MET, and 3G-RM-20 were used for the measurement – see Fig. 1. These are frequently used detectors which are installed in both, small buildings and large firms. All the tested MG detectors are loop detectors with a simple type of sending of alarm information, which are cheap in comparison with other types of MG detectors (using a different type of data transmission).

Fig. 1. **Magnetic contacts:** 1 – MET-200; 2 – MET-44; 3 – TAP-15; 4 – 3G-SM-70MET; 5 – TAP-25-T; 6 – SM50T; 7 – FM-102; 8 – SD70; 9 – MET-55T; 10 – MET-300T; 11 – 3G-SM-85MET; 12 – 3G-RM-20

This measurement was carried out on five samples of each magnetic contact and was repeated ten times. The measurement of deferring distances was carried out according to the requirements of ČSN EN 50131-2-6. Tests were conducted in all magnetic contacts as well. The magnetic contact was always fixed to the plastic construction. Then, the magnetic portion stalled with speed 1 $mm \cdot min^{-1}$. After the alarm the maximum distance at which the alarm occurred was subtracted. According to the standards, a difference between the working distance (distance specified by the manufacturer) and separation distance (real distance separation) of about 10 % is normally tolerated.

The measured separation distances are indicated in the tables according to the size of the measured difference. This difference determines how much greater the real maximum distance of the magnetic contact is from the maximum distance specified by the manufacturer. For clarity of the results, the following tables show only the differences between the separation distance and the installation distance specified by the manufacturer, both in millimetres, and in percentage.

The first tests carried out were on separation tests on magnetic contacts in the first security category – see Table 1. Magnetic Contact:

- MET-200 the manufacturer states a working distance of 45 mm;
- MET-44 the manufacturer states a working distance of 75 mm;
- TAP-15 the manufacturer states a working distance of 24;
- SD70 the manufacturer states a working distance of 25 mm;
- FM-102 the manufacturer states a working distance of 24 mm.

Table 1

The separation distance difference for magnetic contacts in the 1st security category

Sample No.	MET-200		MET-44		TAP-15		SD70		FM-102	
	(mm)	(%)	(mm)	(%)	(mm)	(%)	(mm)	(%)	(mm)	(%)
Sample 1	16	34	-2	-2	0	0	23	94	5	20
Sample 2	7	16	15	20	1	3	24	96	4	18
Sample 3	16	36	10	13	0	0	20	78	8	34
Sample 4	-1	-1	3	3	0	0	18	73	9	39
Sample 5	12	26	13	17	1	3	22	88	8	33
ø	10	22	7.7	10	0.28	1	21.5	86	6.82	28

Tests were subsequently carried out on the separation on magnetic contacts in the second security category – see Table 2. Magnetic Contact:

- MET-55T the manufacturer states a working distance of 75 mm;
- MET-300T the manufacturer states a working distance of 45 mm;
- TAP-25-T the manufacturer states a working distance of 20 mm;
- SM50T the manufacturer states a working distance of 30 mm.

Table 2

The separation distance difference for magnetic contacts in the 2nd security category

Sample No.	MET-55T		MET-300T		TAP-25-T		SM50T	
	(mm)	(%)	(mm)	(%)	(mm)	(%)	(mm)	(%)
Sample 1	26	34	26	57	5	26	2	5
Sample 2	33	44	21	46	4	22	1	3
Sample 3	18	23	26	58	4	22	7	22
Sample 4	24	32	20	43	3	14	4	12
Sample 5	17	23	18	39	3	14	3	9
ø	23.3	31	21.9	49	3.88	19	3.02	10

Tests were also carried out for polarized magnetic contacts in the third security category – see Table 3. Magnetic Contact:

- 3G-SM-85MET the manufacturer states a working distance of 30 mm;
- 3G-SM-70MET the manufacturer states a working distance of 25 mm;
- 3G-RM-20 the manufacturer states a working distance of 30 mm.

Table 3

The separation distance difference for magnetic contacts in the 3rd security category

Sample No.	3G-SM-85MET		3G-SM-70MET		3G-RM-20	
	(mm)	(%)	(mm)	(%)	(mm)	(%)
Sample 1	10	32	23	93	3	9
Sample 2	41	136	15	59	-4	-13
Sample 3	41	136	10	41	5	17
Sample 4	48	161	25	100	-9	-31
Sample 5	14	46	11	46	16	52
ø	30.66	102	16.9	68	2.14	7

Results and discussion

If we take into account that the difference between the working distance and separation distances of about 10 % is normally tolerated, then only four of the twelve magnetic contacts listed herein correspond to that number. Figure 2 shows the percentage difference of the measured separation distances compared to the working distances reported by the manufacturer.

The resulting average percentage difference in these twelve measured magnetic contacts is 36 %. This measurement refers to the risk of magnetic contacts as a whole.

Until all the systems are tested, it is possible only to ask how many detectors and systems are at all secure. A further question is whether any system exists which could provide reliable protection for a reasonable price.

The present state of development of security systems is at a point of stagnation [2; 6]. Although manufacturers are constantly attempting to develop systems, the majority copy old errors in the technical design into new products of a higher class, even despite the endeavors of customers to ensure that manufacture is modified. Without innovative approaches and user feedback, this array will carry into a blind alley.

To improve safety, it is necessary either to develop a new technology or use the bus detectors. Encryption of bus possibility of sabotage greatly complicates and increases the security of the system.

Improving safety on magnetic contacts is principally the improvement of manufacturing processes and controls.

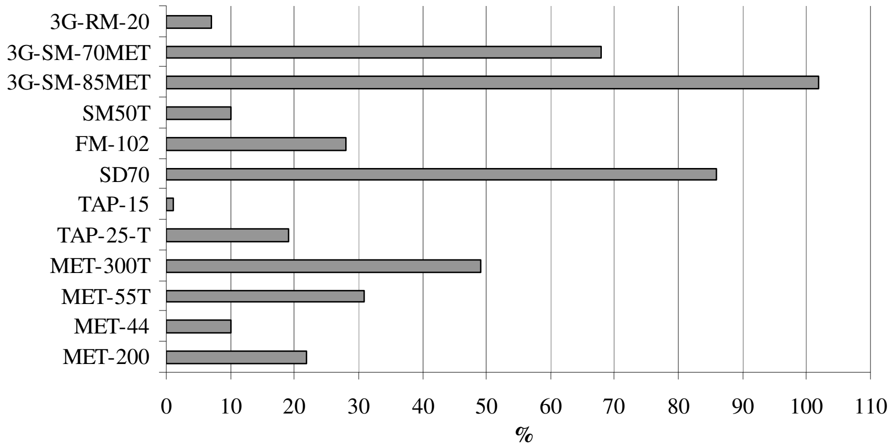

Fig. 2. **The separation percentage distance difference for magnetic contacts**

Conclusions

The technical design of security systems is unique for the majority of manufacturers. In the case of every manufacturer it is possible to find some poor technical designs which require modification. This deficiency can be resolved by technical development of the given product and adaptation to the customer requirements.

The practical tests conducted on MG detectors brought an insight into their functionality and usability in practice. If a saboteur is instructed about the operation of these detectors, then they can be overcome. At the same time the saboteur can also bypass the individual loops, and if skilled, can also bypass loops with an EOL (End of Line) resistor.

It can be concluded from the measured values that MG detectors are a relatively weak link in targeted attacks (sabotage), and it is important to always combine them with spatial protection. Very high-risk magnetic contacts are SD70, MET-300T, 3G-SM-70MET and 3G-SM-85MET. Although these MG detectors received the worst score from the measurements, most of others did not meet the required criteria either.

The only protection which would be usable against current sabotage techniques is the development of new technologies. It is very important not to cast doubt on this development and to apply constant endeavour to advance towards new technologies and greater security.

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