Mechanical Barrier Systems for Alarm Applications used in Access Systems

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Abstract: The aim of this paper is to evaluate the problems of Mechanical Barrier Systems, which can be used as accessories to the access systems. In the first part, there are listed the basic elements of the security systems, which describe the basic properties of the prevention against the potential intruder. One of the chapters describes all conditions for the proper function of individual parts in the system. The most necessary requirements and standards for proper use of access systems with mechanical systems are also described in detail. The last chapter is devoted to the description of mechanical barrier elements in combination with access systems.

Keywords: Alarm System, Access System, Security, Mechanical Barrier Systems.

1. Introduction

The Mechanical Barrier Systems are used for the additional physical security of the protected building of the area against the unauthorized entrance of the person. It is used mainly in the perimeter sector like fencing and also in the casing sector like the doors and the windows. The main purpose of this system is to slow down the progress of the potential intruder who wants to break through the secured area. This time must be greater than the arrival of the security forces that can arrest the intruder before entering the protected area. The Mechanical Barrier Systems can be classified as technical security which replaces the less efficient physical security. The physical security is very inefficient and expensive. The author [1] mentioned that a person monitors the place more than 20 minutes, his attention drops by 30%; and for periods over an hour, this drop can reach 70%. That's why the technical components are more suitable and also more cost-effective.

The Mechanical Barrier Systems are the essential part of the technical security where components can be found in the form of the metal and the non-metal devices for security improvement. Only the buildings which have the Mechanical Barrier System can be protected by the insurance company against the potential robbery. There is a classification of the mechanical parts called security class and it directly differentiates between individual security levels according to the standardization. This classification is done by the independent and the certified laboratory. The classification is done by the number from one to four which also helps with the selection of the right component to the needed location.

The main prerequisite for the inclusion of the product in the security classification system is its testing by the certified laboratory and subsequent certification of the product resistance (Resistance Class) against violent intrusion. At the same time, the manufacturer must demonstrate that can supply the product to the market in consistent design and quality. The reliability of the product and the manufacturer for inclusion in the security class project must be certified by accredited certification. [2]

2. Access Systems

The access system is an electronic system that ensures the protection of objects against the intrusion of unauthorized persons. Another function of the system may also be the monitoring of the movement of people authorized in the given object. An access system is often installed as an accessory to electronic security systems or Closed-Circuit Tele-Vision (CCTV) equipment. [3] Each access system must first be evaluated for the security level of the object or area. These standards are used primarily as a reference for the needs of product certification. The definitions and requirements for environmental and equipment classes can be divided by location, mechanical, atmospheric and electrical equipment testing, design, installation, operation, and documentation requirements.

Every product in the marketplace needs to meet certain requirements for proper functionality and reliability. Access systems use the standards that are included in alarm and access systems. The standards deal with security applications for each access point in the system. The access control system may consist of any number of access points. Different levels of confidentiality in identifying users requesting access point access have led to the definition of recognition classes. The requirements for automated access control systems and components inside and outside buildings are defined.

3. Mechanical Barrier Systems for the Access Systems

Many mechanical blocking devices physically block or release input elements to an object secured by an access control system. These are different types of electromagnetic or electromotor locks, cylinders, turnstiles, culverts, etc. Self-locking locks are used, meaning that each time the door is closed, the lock bolt automatically pops out. Functional features and reliability are critical in selecting a suitable locking device where part of the access system is weakest. The connection of the drive with the electronics enables the user to fulfill all the requirements that the application expects from the security.

3.1. Self-locking Electromechanical Locks

The self-locking electromechanical lock can be installed in the door with high-security resistance. From the outside of the door, the lock can be unlocked with a key via a cylinder or a handle and an electric pulse. The lock handle can be controlled by the output contacts from the card reader, keyboard, button, etc. This type of lock is designed for entrance, fire and passage doors.

An electrical pulse in the electromagnetic coil locks the movable mechanism in the lock and the outer handle is fully functional for opening the door. The handle is movable but without the possibility of opening the door if the electrical pulse is not given from the access control system. A panic system can be placed and used on the inside of the door. By simply pressing the handle, the lock is unlocked and the door is opened without using the key and it can be used for emergency exits. The self-locking electromechanical lock is always locked by a two-point lock when the door is closed. After closing the door, the locking bolt is pushed against the anti-plate in the door frame into the door lock. The latch is automatically ejected and the lock latch is blocked and locked. [4]

3.2. Self-locking Electromotive Lock

The electromotive lock works in such a way that upon activation of the activation signal, the bolt is retracted inside the lock and subsequently unlocked. The lock is unlocked and the door can be opened just by pushing. When the door is closed, the safety latch together with the main latch is pushed against the anti-plate into the body of the lock and after the main latch jumps into the door frame, the bolt will be automatically ejected and the latch will be blocked. The lock is locked in two points and is protected against the slide out of the doorframe. In the event of a power failure, the lock remains locked. The lock can always be unlocked by a cylinder on both sides of the door or by pressing the handle on the inside of the door, the so-called anti-panic function. [5]

3.3. Digital Cylindrical Lock

The digital cylindrical lock is programmed according to the needs of the application and it is suitable for all Euro locks. It also contains memory for access recording, and it is suitable for network use without wiring. It has high security, flexibility, low operating costs. The digital cylinder is interchangeable with a standard mechanical cylinder that can be integrated into the network at any time. It is not controlled by a classical key, but by a programmable transponder via radio signal. Only one transponder is required for all cylinders in the security system. Access authorization is provided using a security plan. The data transfer is secured against copying by constantly changing crypto codes. For safety reasons, all electronics are located on the inside of the door. Lost transponders are simply overlay-mode for the system.

3.4. Input Units

When designing the external perimeter fences, it is assumed that the entrances and entrances to the protected object will be located. Particular attention should be paid to the protection of entrances as it forms the boundary between a freely accessible area and a protected area. The number of such inputs should be minimized for easy control. The most suitable solution for entering and entering the building are gates, barriers, turnstiles, safety culverts. A special requirement for the security of the building, such as prisons, nuclear power plants, etc., solve the entry of vehicles in the category of so-called two-stroke systems when the border is

overcome in two bars with controlled movement in the interspace. The construction solution creates an interspace separated by two gates, usually sliding, which are controlled separately by the control system. Turnstiles belong to special barriers of persons used for access zones of large areas, entrance halls of enterprises and institutions, objects of special importance.

The structure of the bars must be strong and stable. It must not sag in the structure, the individual bars must not be stretchable and must ensure a safe closure of the building space. It follows that heat-treated steel is best suited to their resistance. The mesh size of the bars and the cross-section of the grating shall prevent the grids from being crawled and easily overcome, such as cutting, scattering, etc. The mechanical motors, variations of the main shaft system and the cam systems, are replaced by drives and controls forming a transparent assembly leading to the state of the central control system. The central drives have a shorter startup time and the coordination of individual motor drives is ensured by the control unit. The big advantage is the cost savings associated with the purchase of mechanical drives. The modules that make up the drive are controlled by the Programmable Logic Controller (PLC) central unit involved in the central processing of the information, which is forwarded to further control the respective modules. The input and output signals can be processed and sent directly from each module unit.

4. Properties of the Mechanical Systems

This chapter describes the individual features of the restraint systems in general. Each element in the system must have its place in each subchapter. All mentioned information must be considered in the design of each new system.

4.1. Level of the Security

Each element or device of the system must be assigned to a degree of security to determine its performance. It must be in one of four levels, with the lowest level being one and the highest level four. The system security level must match the component with the lowest security level. Common rules for the application of mechanical barriers and alarm systems allow to optimize the security of property for specific risks or to assess the level of the specific security, or the establishment of security requirements for the building. The explanation of each level is the following:

- **Level 1:** Low risk: It is assumed that the intruder or burglar has little knowledge of the system and has a limited range of readily available tools available.
- **Level 2:** Low to Medium Risk: It is assumed that the intruder or burglar has limited knowledge of the system and the use of common tools and portable devices.
- **Level 3:** Medium to High Risk: It is assumed that the intruder or burglar is familiar with the system and has an extensive range of tools and portable electronic devices.
- **Level 4:** High Risk: Used when security has priority over all other aspects. It is assumed that the intruder or burglar is capable or able to prepare a detailed intrusion plan and have a complete range of equipment, including means to replace critical system components. [6]

The mechanical system of perimeter protection is the main feature of this group from the protected object. These mechanical systems are set up outside the protected object on the surrounding open area. It is basically fencing or enclosure of surrounding land including gates, gates, barriers, culverts, etc.

4.2. Technical Survey

Security survey can be defined as the process of analyzing factors affecting the design of alarm systems and determine the required security level. As part of the process of setting up alarm security and emergency systems, security assessment is part of the first stage of the system design. The technical survey of the building is part of the alarm system establishment, which is carried out only after the design of the system composition document. It also includes a tour of security areas to verify the selection, location, and position of individual system components, including verification of their environmental impact selection. The technical survey may be carried out in conjunction with a safety assessment for less extensive buildings. [7]

The technical survey is based on the evaluation of four basic areas of interest that the designer should consider in the subsequent design of the system when processing the project documentation. These are secured values, building, external and internal influences. These areas can be classified into two groups - risk analysis and other impacts.

4.3. Breakthrough Resistance

As mentioned before, the mechanical barrier systems have a fundamental irreplaceability especially because they are able to provide object protection with the mechanical resistance that the individual components have. The time the offender must spend to overcome the mechanical strength of the mechanical system is called breakthrough resistance. Each mechanical restraint system is surmountable, but the variability of the individual mechanical system is determined by the amount of energy delivered, the time and type of tools needed to overcome the system. This determines the level of security of the objects. The position of mechanical barrier systems in a comprehensive security system is given by their ability to create a qualified barrier against the intruder into objects of a protected interest.

The greater the risk of the protected interest, the greater the RC coefficient will be. If applied protection is to be effective, its value must be greater than 1. If it is equal to or less than 1, it cannot be considered as effective protection. Conversely, the larger the coefficient, the lower the risk of threat and the quality of the protected interest protection system will be. For creature fillings like door and window closures, grilles and gates, the minimum breakthrough time is specified in the safety class classification. This time must be increased by 2 - 3 times. This gives the real-time, in which the hole can be overcome. We also apply this time to individual components of doors and other closures. The breakthrough times of the lock or the use of classifications according to the lower safety class of both components are the so-called critical point principle.

4.4. Resistance Class

On the basis of new requirements for the security of buildings in terms of mechanical barrier systems, there was a need to introduce a new designation of security classes in this area, which are currently designated by the abbreviation RC (Resistance Class). The standards deal with breakthrough resistance - resistance to burglary of so-called security doors, windows, grilles, gates, shutters and other openings, including their components. The standard introduces 6 safety classes designated as RC 1 to RC 6 and defines basic requirements and criteria for their fulfillment for individual classes. The individual RC security classes are characterized in the table of this standard as follows:

- **RC 1** - (not applicable) Occasional offender attempts burglary using little simple tools and physical violence (kicking, hitting, lifting, pulling) The offender has no special knowledge of the resistance level of the MZS, has little time and is trying not to cause noise.
- **RC 2** - 3 min. The occasional offender attempts to break in using simple tools and physical violence. He has little knowledge of the resistance level of MZS, has little time and tries not to cause noise.
- **RC 3** - 5 min. The offender attempts to overcome the MZS using a 710 mm crowbar and another screwdriver, hand tools (small hammer, punches, mechanical hand drill, etc.). The offender has some knowledge of the closure system and is able to use this knowledge with this tool.
- **RC 4** - 10 min. The experienced offender also uses a locksmith's hammer, ax, chisels, chisels, portable drill, etc. This additional tool allows thieves to expand the number of attack methods, or their combination - drilling, chiseling, prying, etc. The thief does not solve the noise problem.
- **RC 5** - 15 min. Very experienced offender also uses one-handed power tools (eg angle grinder up to 125 mm blade diameter).
- **RC 6** - 20 min. The highly experienced offender also uses two-hand power tools (angle grinder up to 230 mm diameter, jigsaw) not to worry about noise.

The individual RC security classes are characterized by the type of tools that can be used to overcome the hole fill – mechanical system and then the time for which the breakthrough - overcoming - opening can be performed. The range of tools ranges from simple tools to very aggressive tools. The time that is set for each RC expresses the net operating - working time when the tool is in contact with the affected barrier. In a practical attack, the real-time would be about 2 to 3 times this value, depending on the offender's experience, knowledge, and skill.

Conclusion

The aim of this work was to describe the connection between the access system and the Mechanical Barrier Systems. These systems perform the function of a fixed object that can be controlled remotely. The mechanical elements must be firmly positioned, but there must be parts to allow access to the person. For example, a lattice is a static part that cannot be opened

and the typical example of a movable device is a classic turnstile. Both elements of the system must be designed and used according to the rules outlined in several standards. These standards, both for mechanical barrier systems and access systems, are outlined in several chapters of this work. For proper functionality and safety, each project employee should follow all of the standards mentioned. For each of the elements are given basic information and properties that can be encountered in real conditions.

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