

## **DIFFERENT APPROACHES DURING ELEVATOR CONTROLS**

### **1. INTRODUCTION**

I was involved in a team that strived and struggled for putting the elevator controls into application and ensuring them to become widespread. I am very glad that I worked with my team-mates who initiated these studies and further continued them despite various difficulties. Present situation of the controls makes us very contented of course. It is vitally pleasing situation that the controls has become prevalent nationwide and that the authorized institutions undertake the application and inspection of the terms specified in the regulation. We should make every effort for the sustainability of this application. This should be considered and supported as both a public service that the security of the elevators will be ensured and increased, and an important duty to enable the development of sector through eliminating wrongful applications. The suggestions I will make are suggestive in order for the inspections to continue smoothly and should not be perceived as a criticism to the inspections and the structure of inspector institutions.

In each application, swinging happens before the everything fall in place. Methods that go beyond their aims and extreme behaviors may be seen. Sometimes the precautions to prevent these also go to the extremes. It should be considered important in terms of the continuity of the program to be ready for these kinds of problems, to solve them as soon as possible and non-conformities should be discussed in detail immediately. Our goal is to ensure security of the product. Established rules in the application should deliver a solution to this. Solution proposals should pay regard to the parties which are the user and the producer on an equal basis and endeavor to protect them. Protecting the sector that can manufacture the product should be taken into consideration as much as providing a secure product.

### **2. PRIMARY REASONS IN DIFFERENT APPROACHES**

### **3. EXAMINATION OF THE LEGAL STATUS**

### **4. NEW APPROACH AND GLOBAL APPROACH (2, 3, 4 are special positions for Turkey)**

### **5. ACTIONS DUE TO THE UNCONFORMITY OF LEGAL STATUS**

**5.A)** What is essential for an inspection must be ensuring the ESR that stands for “Essential Safety Requirements”. As defined in APPENDIX 1, these are compulsory requirements for a product. Conformity to standard is one of the most known ways of showing that ANNEX 1 terms are ensured but it is not the essential or only way. Some products may ensure the ANNEX 1 terms instead of standard terms in a different way. Usage of 6.5 mm (0.25 inch) diameter elevator suspension cables is the primary reason that we encounter the most. It causes problem in many inspection saying that “According to the standard, cables below minimum 8 mm (0.31 inch) cable cannot be used.” It is not also sufficient to show the certificate of the product. The certificate stating that the product can be used in elevator is primary and this certificate should be provided by a Notified Body authorized in the subject of elevator. A product featuring this kind of certificate cannot be inhibited by an inspector through restraining its right to move freely. Same case was frequently seen with an international motor brand having a pulley diameter of 200 mm (7.87 inch) or 240 mm (9.44 inch). Products were almost dismantled since they did not meet the 40 times of cable diameter. Similar cases are encountered when new inspectors start to work at each period and it is not also that easy to persuade the inspectors.

**5.B)** If a product bears CE symbol or has a Certificate obtained from a Notified Body, this product has the right to move freely and cannot be restrained. “I don’t like this.” and “This product is not appropriate for me.” or suchlike evaluations cannot give cause for dismantling the product. Except from an obvious mounting or capacity error, there should be no intervention or restraining to the product. If there is any doubt about the product, the authorized institution can be consulted. That authorized institution is the Provincial Directorates of Industry and Commerce in the region. You can report about your doubt but blocking the certificated product brings forth the right to compensation. The inspector is not the authorized institution, but just an official who is requested to perform status evaluation. Right to intervene the case belongs to the authorized institutions. It has been frequently seen that the protection of a certificated security product (regulator) is not seen sufficient and a new product design is requested recently in various products.

**5.C)** The elevator sector is a very old industrial branch which has been commonly used in public service for around 150 years, manufacturing a product of which terms are determined by the international institutions. Tens of very experienced personnel and engineer reflect upon this subject and work for the product security. However, it is also taken into consideration in these studies that the product is in a producible level, its costs are suitable for international competition and national industries do not collapse. Thus, the product has an international definition and cannot be manufactured special to your region. You cannot also demand products or updates exclusive to you. You are an inspector but assigned for photo shooting. You are not expected to subdue and adjust the sector or contrivance. An examination organization is expected to perform control and provide information whether it is appropriate for mounting or not. Final control application should not be complicated with the first periodical control. Standard product is also a complete system ensuring the security and applying this will be sufficient. It is unnecessary to make fittings to the product or it is not our job to do so at least.

**5.D)** Control ethics is especially an important subject to lay emphasis on. There is a commercial law that has existed from of old. It might be established on right or wrong basis but it is not the duty of the inspector to interfere or adjust this. There is an applicable law system in the country and the trade is defined by the codes. There is no sense in show up for adjusting the system while there are courts, judges, and prosecutors for this. Many colleagues who are new in the sector surmise that the sector is also new and consider the date they start working as the milestone, feel the burden of all sector on their own shoulders and set off on a quest for solution. One should not exceed the authorities given in the regulations, should not intervene in the case and should not give recommendations to others. Everyone has their mind and law does the necessary. Jumping at a case thinking everything started with them, defending the first thing that comes into their minds as a solution may give damage to all parties.

In the end, the sector arose from the needs of the society and as long as this need maintains its continuity, it will subsist as well. The primary actors will be the competent body (ministry), elevator producers and users. It requires to continue without unbalancing this. Different approaches bring forward the complicate the current industry and this is undesirable for everyone. This is at least not demanded by the ones who are in their right mind. Others will have to adapt themselves to this anyway.

## 6. DIFFERENT TECHNICAL APPROACHES

I am still in connection with many companies which are both I give consultancy to and I worked with before as well as the ones I keep in touch with. They get in contact with me when they encounter problems and we try to do our best to find a solution together if there is anything that we can do. Usually the complaints we receive are caused by the requests of the inspectors more than the mistake of elevator company. We have to make explanations and some of them except these explanations while others insist on the mistake. Then we have to carry out the request when we couldn't find no way out. I will try to address some common problems we face though there are various problems in several areas such as final limit switches, safety gaps, gaps between the car and wall, buffer mountings, cabling and earthing.

### 6.A) Does it ensure to take precaution against upward speeding and undesirable movement if machine brake is used in jack shaft in elevator?

Free fall of the car as a result of rope breakage or breakage of drive group members' joint is especially one of the most risky cases in elevator. In this case, stopping the car can only be possible through a mechanic brake connected to the car. Thus, mechanisms against the downward free fall should certainly be connected to the car frame. However, apart from downward free falling, rope breakage is out of question since the car moves upwards during the upward speeding (EN 81-20 M 5.6.6) and undesirable movements (EN 81-20 5.6.7). Moreover, it is accepted that the drive group system is also active. Thus, it is specified that these mechanisms can be placed out of the car in EN 81-20 +A3 for both the Article 5.6.6 upward over-speeding in the Article 5.6.6.4 and for the Article 5.6.7 unwilld movement in the Article 5.6.7.4. Especially in the common c) subclause, this application is explained as: *"it should have effect on the driving pulley (for example directly on the driving pulley or on the same shaft just next to the pulley)"*. This means that geared machines with machine brake system on the main pulley shaft (systems with hub brake) and synchronized motored systems with brake system on the main shaft can ensure the protecting conditions against the upward over-speeding and un-willed car movement through using machine brakes. In order for machine brake to be used as such security device, the following conditions should be ensured:

- i) Machine brake is separately certificated in the Articles 9.10 and 9.11 of TS EN 81-1 +A3,
- ii) Detecting that the desired speed is exceeded through a speed monitoring device (this can be the bi-directional regulator of the elevator itself),
- iii) Engaging the machine brake when the speed limit is exceeded through a security switch (parachute switch can be used through the bi-directional operation of car brake mechanism),
- iv) Keeping the claws of machine brake under control (this can be ensured through connecting the brake claw switches to the panel and examining them in each operation).

If these conditions are ensured, elevator can enable these conditions in a more safe and comfortable way without the need for an additional certification proving that the Articles 5.6.6 and 5.6.7 are safed as well as for a brake mechanism for upward movement in the car. New EN 81-20 standard explains this subjects as follows:

#### ***"EN 81-20, 5.6.6 Ascending car overspeed protection means***

***5.6.6.2 .....In the case of using the machine brake, self-monitoring could include verification of correct lifting or dropping of the mechanism or verification of the braking force. If a failure is detected, the next normal start of the lift shall be prevented."***

As seen in the abovementioned article, it can be accepted that these systems are available in elevators through controlling that the machine brake claw switches are connected and operating without the necessity of performing additional tests if certificate is obtained and the required conditions are ensured. There is no need for requesting additionally a bi-directional car brake system and making effort for applying the test procedure in any case. However, levelling when the door is open should not be mistaken for this condition.

### **6.B) Should the safety gear mechanism switches be locked?**

Regulator switch and mechanic brake (parachute mechanism) switches work differently. Regulator contact becomes involved in before the mechanic braking and tries to stop the elevator electronically softer without an abrupt mechanic stop. On the other hand, safety gear switch engages in when mechanic braking happens or after that and prevent the elevator to run again. Though both of them are used in the same safety chain by force of habit, this is actually a misapplication. This did not cause problem in the past while the speed is around 1 m/s but as the speed increases, switches (regulator switch and final limit switches) that will suspend the elevator electrically in a controlled and soft way should change as circuit chain before the mechanic suspension devices. (suspension with safety gear brake, suspension through hitting the buffers). Thus, switches and invertors that will ensure the electrical suspension should be placed in the emergency suspension circuit. I will not elaborate on this subject as it is not related here but safety gear switch is a switch that has to engage in with mechanic brake and disengage when the mechanic brake retrieval is carried out. The standard explained the mechanic brake retrieval as follows:

#### ***“EN 81-20, 5.6.2.1.4 Release***

***5.6.2.1.4.1 The release and automatic reset of a safety gear on the car, counterweight or balancing weight shall only be possible by raising the car, counterweight or balancing weight.”***

It is desired that the elevator is ready to run automatically when taking the car upwards to perform retrieval after the braking. In this case, safety switch should turn back to its original state. Moreover, the condition saying that there should be no need to intervention to the car for the upward retrievals, through the addenda to the standard later on. (Article 9.10.7) Since this is what essentially demanded, safety gear switch should not be a locked switch. However, some companies can use locked switch in their own systems. They may not want to let the elevator operate again after the retrieval, make the safety gear switch locked in addition to the regulator switch and they may want to let the elevator operate again upon controlling the whole system. So, objecting to this is not true. If locked switch is used, switches should definitely be mounted on the car or in a way to be accessible and serviceable over the car and this situation should be specified in the retrieval guidelines particularly. However, inspector should not request locked mechanic brake switches unless there is no special case.

Preferring locked safety gear switch under car in high-rise elevators with a high rated load will lead to very risky consequences. It creates insecurity rather than a desired safety condition and this should be avoided. Attention must be paid to ensure the required safety in these kinds of applications. The subject here which should be paid special attention to is that the emergency electrical retrieval system -which will be used in braking cases- turns back to the operating mode in a way to perform retrieval after braking.

### 6.C) Does it necessary to use double residual-current relay?

Although this is actually a very simple subject, making it this much complicated causes so many mistakes. The subject is associated with a formula we learned at high school.  $I=V/R$ . Current (I) is found by dividing voltage (V) into resistor (R). There are two values needed to be known. The first one is that it is fatal if a current above 80 mA passes through a human (less than one-tenth of 1 Ampere). The second one is that the resistance of a human body changes between 1500-3000  $\Omega$ . If a person having 2200  $\Omega$  with daily stress touches a phase conductor with 220 V line voltage, he/she receives a current of  $I=V/R$ ,  $I= (220 \text{ V})/(2200 \Omega) = 100 \text{ mA}$  (I take the human resistance high but the average resistance should be far lesser than this normally). If this current passes through you, it causes death but in order for this to happen, the energy source and the ground you step on (ground line) must be in connection (for the current to complete the circuit). Since the electrical supply is grounded in TT and TN systems, this connection is also available while in IT systems and isolated systems not (because the electrical supply does not have ground connection). If there is a 300 mA residual-current device in your circuit, 100 mA that will pass through you during the shocking does not open the circuit as it is a low value for the device to open the circuit but it may cause you to die. Thus, the only relays protecting the individuals in TT and TN systems where there is a shocking risk are 30 mA residual-current relays (our distribution system is mostly TT in Turkey and TN in a small region). So 300 mA RCDs are not used for personal protection. If you are installing the system with 30 mA rescue threshold RCD, there is no need for using 300 mA RC additionally. You can also use 30 mA RCD without any trouble if you use residual-current relays with PFI (Proof Frequency Inverters) code in especially the systems with inverter. These are sold in various companies with codes such as U, SI, SU, and PFI-U. They are also known as time delay RCDs (S Type RCDs) in the market. The reason of the delay is that they wait for condensers to lapse for 0.1 mins when they are first started up and then they operates without delay. In this case, only one 30 mA residual-current relay is sufficient but current capacity of RCD relay should be bigger than the whole value of current that may pass through the system. It will be enough for current value over 30 mA RCD to be higher than the current value of column line main circuit breaker or the value of total breaker currents. Floating systems should be used in IT systems and places like hospitals and they should be checked with RCM.

### 6.D) Is it compulsory to use residual-current relay in safety circuits?

There is a security rule of the standard that should be applicable for the safety circuits. If the circuit is completed through a ground or casing circuit, safety circuit will be temporarily deactivated as short-circuit. Especially the short-circuit occurring on the cables over the metal door on the doors or completing the circuit over the ground cause short-circuit in safety devices and deactivate them. Thus, the standard requires that if a short-circuit on casing or ground leak occur, these should be noticed and measure should be taken. The relevant article is as follows:

***“ EN 81-20, 5.11.1.4 An earth fault in a circuit in which there is an electric safety device or in a circuit controlling the brake according to 5.9.2.2.2.3 or in a circuit controlling the down valve according to 5.9.3.4.3 shall:***

- a) either cause the immediate stopping of the machine; or*
- b) prevent restarting of the machine after the first normal stop if first earth fault alone is not dangerous.*

*Return to service shall only be possible by manual resetting.”*

As seen from the article, the issue here is not a personal protection. The safety circuit's own safety is in question. In conclusion, the safety measure taken should stop the driving machine or prevent it from moving again. Several measures can be taken for this. If the issue is a safety line fed from an isolated transformer, a breaker with a simple low-voltage sensitive wire will work since the residual-current relay will not work anyway. There will be no risk for people to be shocked since it is fed from an isolated transformer. Or if the safety circuit is fed from an energy source lower than 50 V ac, a breaker with low value will be sufficient again and it does not pose a risk for people as well. Thus, both the safety circuit and people will be protected. *(TS HD 60364-4-41 December 2008 Article 413 Protective Measure: Electrical separation, 414 Protective Measure: Very low voltage provided by SELV and PELV).*

However, if the safety circuit is fed from a grounded transformer and has a voltage higher than 50 V ac, then both safety circuit and personal protection will be required. In this case, 30 mA RCD will carry out both operations *(TS HD 60364-4-41 December 2008 Article 411 Protective Measure; feeding source to be automatically out of circuit)*. Residual current used in the circuits at first does not perceive the residual currents after passing through the transformer and receives this as overload. Thus, a separate mono-phase 30 mA residual current is required. But if there is no transformer in between and the safety circuit is fed directly from the breakers, the initial residual current device will also control this. Inspector colleagues should decide according to the board setting instead of a direct rule. However, it is said in the new standard that the safety circuits chain should be protected with 30 mA RCD. This should be inquired from ELA. If isolation transformation system is used, RCD will not work anyway.

#### **6.E) Does it necessary to use residual current device if 120 Voltage dc is used on a panel?**

We should look at the articles of relevant standard to make a detailed explanation on this issue.

**"TS HD 60364-4-41/December 2008 Low-voltage electrical facilities – Section 4 - 41: Protection for security – Protection against electric shock"** standard stipulates the condition that in case a direct or indirect contact to the electricity, protection is required if it poses a danger. Electric source cannot be created without ensuring the protection. Several protection methods are defined for this. The same standard determines **four main protection methods** on this subject.

If we are to summarize them:

1. Switching off the circuit automatically when there is a contact in the systems we use normally (RCD condition for usage),
2. Preventing the contact through special installation system by using double or reinforced isolation,
3. Isolating the system through using isolation transformer,
4. Using very low voltage.

It is deemed sufficient for protection to use any one of these systems in terms of the standard. Low-voltage definition which is the fourth section can be found in the article 414.1.1. In this article the upper value of SELV and PELV voltage is defined as 50 V a.c or 120 V d.c. If the system voltage is limited under these values, it is accepted that the system is safe.

In this situation, it is necessary to explain two points to evaluate the subject.

1. Every system that exceed **“the restriction of the voltage up to 50 V a.a. or 120 V d.a. value in the 1st voltage band”** should be protected in accordance with the first term and protection should be ensured with 30 mA RCD not to cause death in the conditions of indirect contact. However, this is not applicable for IT systems. 30 mA RCD should be used as compulsory condition in TT and TN systems we use. As specified in the standard, **there is no need for 30 mA RCD protection for indirect contact in systems below the value of 50 volt alternating current and 120 V direct-current.**
2. According to Article 5.11.1.4 mentioned in EN 81-20 standard, it is not compulsory to use residual-current relay in protection circuit as it was stated above. As can be seen from the Article clearly, ensuring that the machine stops is an adequate condition and this can be performed through a simple braker.

Besides, residual current device is not in the least compulsory in a **120 V d.a.** circuit. However, it can be used if the machine stops by this means but as can be seen clearly from the Article, residual-current relay is not compulsory when there is no shocking risk even if 220 volt is used in these circuits. A system that will stop the engine is sufficient.

### **CONCLUSION**

It is very pleasing that the elevator controls become widespread. It is equally important to ensure the continuity of this application. However, creating the required conditions and addressing the detected negations as soon as possible is required for the continuity. If new approach directives and the situation of the institutions, authorizations, inadequacies in educational level, and application variations tend to increase instead of decrease, this may cause various problems. In the end, our purpose is to create a sustainable, constructive and propelling inspection mechanism. We are keen on reasoning instead of reading and researching, and give education instead of taking it. Thus, we usually have an opinion on the issues instead of having knowledge about them. This should be not be seen as an acceptable application within the society anymore. People can know as far as they learn but the rest turns into a state of walking away from the truths and boondoggling.

I certainly try to understand commercial concerns of the examination institutions struggling to do business and having difficulty in finding inspector but you should not forget that the people across you face with at least the same commercial concerns as you do. While you trying to do business, the other people also trying to do the same and execute their entities. No one can defend the wrong so, both parties have to behave properly being aware of their own responsibilities. None of the parties should be treated unfairly and they should be protected. Authorization, exercising of power, ways to be followed when power is exceeded, inspection capability and sensitivity should be taken into consideration as problems to be discussed in detail in the long view. Sector components that has come to this point by overcoming many problems will also evaluate these problems swiftly and create reassuring solutions that will carry us onward. Our faith in this should remain and continue without any failure.

Respectfully yours,

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