Modernising Model Lifts and the Implications

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Abstract. Those undertaking the modernisation of a lift system should be competent and have sufficient understanding that the lift is either installed to a standard at the time it was first placed into service or by way of a conformity assessment directed through an Approved or Notified Body, where the lift is declared as a "model lift". These model lifts are typically mass manufactured and are limited to the exact requirements that deviate them from the standard, such as the rated speed, the rated load, and the travel or mass of an empty car.

Understanding the importance of these restrictions can often be daunting, and gathering the required information can be difficult at times. Completing a risk assessment can be a good way to capture these details. Components related to the equipment can often need verification. It is important to understand the detrimental effect on the overall modernisation scheme and the consequences after the lift has been placed back in service.

This paper looks at the implications of modernising lifts that have been subjected to a conformity assessment and are accompanied by CE marking.

This paper also looks at the commissioning methods when modernising lifts and where the lift parameters have been changed. This should allow concise testing requirements before placing the lift back into service.

1 INTRODUCTION

Modernisation of lifts is typically considered the next stage of a lift's life cycle. Since the introduction of the Lifts Regulations [1], many manufacturers have designed lifts to follow a Type of Examination scheme, typically known as a Model Lift and serially produced. Lifts subject to Type Examination have specific design parameters and undergo a conformity assessment by a Notified Body, which examines the technical aspects of the complete lift system and verifies that it meets the Essential Health & Safety Requirements of the Lifts Regulations. Typically these include solutions which may deviate from designated or harmonised standards such as BS EN 81-1 [2], BS EN 81-2 [3] or BS EN 81-20 [4] when the lift was first installed and placed on the market.

The CE mark on lift complete lift systems, and associated safety components indicates that the manufacturer affirms the goods' conformity with the Lifts Regulations, Essential Health and Safety Requirements (EHSRs). The CE marking is required for components sold in the GB market. Assessment(s) by a Notified Body or manufacturer according to a certified production quality system may be required. Where relevant, the CE mark is followed by the registration number of the notified body involved in the conformity assessment.

Since, for most of the time the Lifts Regulations have been in place, lifts in the UK have been CE marked (and approved by Notified Bodies), since the UK left the European Union, lifts might have been UKCA marked and Approved Bodies used for conformity assessment.

To be considered a modernisation of an existing lift and not a new lift, at least one significant component e.g. counterweight needs to be retained in addition to the car guide rails and brackets

which must be retained in their original positions. If only the guide rails are retained then the lift is a new lift and the Lifts Regulations apply.

The modernisation of model lifts can be far more complex than envisaged as it may be challenging to obtain the necessary documents, and in these cases, changing elements of the lift solely relies on full compliance to the applicable standard, as the modernisation process will unlikely satisfy the original Type Examination certificate issued, for the lift and ultimately may lower the level of safety of the lift system. Where the lift company undertaking the modernisation scheme does not keep within the Type Examination certificate, they will likely be responsible for the design changes and the associated risks being evaluated, calculated and appropriately addressed during the design.

The Lifts Regulations detail that lifts display a CE mark. This mark should be retained after the modernisation has been completed, as the lift can only be declared new once; however, it does not detail where it should be displayed and can often be shown in its original place mounted on the COP. This remains a requirement regardless of whether components are left with modernisation that have undergone a conformity assessment, such as counterweights with safety gears vs counterweights without safety gears.

2 CHALLENGES

One of the biggest challenges lift contractors encounter when undertaking modernisation works is obtaining the relevant information, which will likely include the calculations and inclusions listed on the Type Examination certificate and agreed with the responsible Notified Body.

Where this information is unavailable, when undertaking changes to an existing lift, one should first consider retaining the existing safety components and ensuring that the lift is not less safe after the changes have been made.

BS EN 81-80:2019 [5] assumes a lift is installed to the standards of the day and recommends that an audit be carried out before implementing changes to any lift installation by using Annex A to assess the existing level of safety and determine what changes, if any, are necessary to bring it up to today's state of the art. It does not foresee solutions that deviate from harmonised or designated standards which are part of a Type Examination.

The results of the audit should indicate the safety measures identified. This will allow discussions with the building owner having identified elements of greatest concern and the priority for upgrading process.

Lifts which follow the Type Examination method and are classified as a model lift may include a range of deviations to the designated or harmonised standard to which the lift contractor undertaking the modernisation works may not have access, and the deviations may include, but not be limited to, lifts which,

- do not have a machine room (not included in earlier versions of BS EN 81-1/2),
- have a suspension method such as flat belts or ropes using materials such as aramid or coated in a polymer sheath.
- steel wire ropes with a reduced diameter or have reduced diameter traction sheaves.
- be limited on car or counterweight mass and have specific traction calculations.
- maintenance methods, which include access via the car.

Building owners who have completed modernisation schemes should understand their duties to the Building Safety Act and their responsibilities under the Fire Safety (England) Regulations, where lifts are used for firefighters or evacuation.

3 IMPLICATIONS THAT CAN OCCUR DURING A MODERNISATION

BS 5655-11:2005 [6] and BS 5655-12:2005 [7] provide recommendations and guidance for modernising traction and hydraulic lifts and may be used as a basis for modernising or modifying existing lifts. These British Standards act as a code of practice that can help guide the lift contractor undertaking the modernisation works and identify other consequences that should be considered.

BS 5655-11:2005 and BS 5655-12:2005 are undergoing complete revision due to their age and technological advancements. The core principles of BS 5655-11/12 are still relevant today but may provide guidance to address issues since their first publication.

3.1 Change of car or suspended mass

One of the most common occurrences of modernisation is a change of mass of an empty car or suspended mass, which increases or decreases a lift greater than 5 % of its original designed mass. A change in the suspended or driven mass can occur as the result of a larger or smaller car being installed, changes to the linings (car refurbishment), changes to the car doors/operators (manual to power doors, adding car doors, change of operator type), addition or changes of other equipment, and attachments carried on the car (car top balustrades, guarding, canopies, traps, etc.).

As many model lifts have fixed design parameters and changes in the mass of the empty car or suspended mass have similar effects to changing the rated load, there may be restrictions on what weight can be added or removed as defined in the Type Examination Certificate.

When the implications of adding mass to the empty car are considered, the operating range of components may be affected, some of which could be as follows:

- The rating of the safety components (the rated load of the safety gears and buffers may be exceeded).
- The suspension system (reduction of safety factors).
- The machine (maximum static load may be exceeded).
- The brake (maximum rating may be exceeded).
- The traction (maximum out-of-balance loads could be increased).
- The guide rails & brackets (buckling factor and forces on the pit floor and walls).

Reducing the suspended masses of the car and counterweight should also be respected; a reduction could compromise traction, where T1 or T2 applied traction ratios are inadvertently increased exceeding the critical traction ratios defined in the original traction calculation.

Any consequential changes to the lift systems must be checked and verified thoroughly, ensuring that the lift system operates within the constraints of the original manufacturers' Type Examination.

3.2 Change of suspension means

Although a change of suspension means, such as a re-rope, is conducted many times over the lifetime of a lift and, in most circumstances, considered a simple like-for-like replacement, it is essential that when replacing steel wire ropes, they match the original existing rope type.

The original rope selection will have been determined from the lift design parameters, including the masses in the system, length of travel, reeving ratio and direction changes, sheave configuration (V groove, round groove with undercut or round groove), speed, acceleration, jerk and the general environment.

Using this information, the original rope type would have been selected with the required tensile strength, construction, core material and lay. The same type and number of ropes should be replaced

to ensure the lift stays within its original design criteria, critical to the traction calculation and safety factor.

Where the replacement or change of suspension means is not the same type, it may be considered a significant modification, which may have implications on the original Type Examination if:

The parameters of the suspension are altered by a replacement, which is not a like-for-like or not included in the original scope of approval (e.g., Type Examination – the friction factor of the replacement suspension means is not the same as the original design or not compatible with the sheave surface).

The traction sheave is also changed, which is considered an 'important modification' (by E.2 of BS EN 81-1, C.2 of BS 81-20 and 4.4 of BS 5655-11). It would require testing, e.g., to ensure that sufficient traction is available for worst-case loadings and that traction is lost when the counterweight is buffered, where appropriate.

3.3 Change of controller

Ensuring that a new controller meets all the EHSRs and incorporates, as a minimum, an equal level of safety as the original system can be tricky since all the safety features of the original design might not be apparent or understood from a site survey or the documentation available. Nevertheless, these features might need to be replicated in a new control system.

Examples are the use of additional monitoring functions in the controller required by a Type of Examination, such as

- the use of pulse or trip counters to monitor the working life of suspension means,
- the detection of uncontrolled car movement (UCM), or
- the failsafe functionality of inspection and rescue systems.

When a new control system is to be fitted, another vital consideration is whether the lift has functionality specified on how the lift behaves in the event of a fire. Generally, a new control system for a lift which is not for the use of firefighters or evacuation purposes should meet the relevant requirements as defined in BS EN 81-73: 2020 [8] so that fitting a recall device at a later date is practical. Where another operation is required, e.g., for an evacuation or firefighters lift, this should be assessed to see if it can be brought up to current standards.

The UCMP requirements in BS EN 81-20: 2020 and, as recommended in BS EN 81-80: 2019, have implications for lift control systems and safety components. Therefore, if these parts are being changed, consideration should be given to introducing UCMP for the lift.

When modernising lifts with existing UCMP and the Type Examination Certificate is available, the details should be considered when interfacing with new components. In the case of model lifts, the Type Examination certificate might not be available; therefore, a detailed risk assessment should be carried out to ensure a fully engineered and safe solution is incorporated for the modernisation scheme.

Since UCMP consists of three elements, it should be understood that each device or a combination of devices is considered a safety component in its own right. Where modernising a lift placed on the market without UCMP or modernising a lift with UCMP but placed on the market before 20 April 2016, the elements required to provide UCMP can be added without the entire UCMP necessarily needing to be CE or UKCA-marked.

3.4 Change of maintenance procedures

Some model lifts combine maintenance and inspection through the car ceiling without having access to the car roof. These types of lifts may have a restriction on the structural elements surrounding the car top and may be designed this way to access sections of the lift, such as the machine. Changes to specific design elements should consider the requirements of BS EN 81-1, BS EN 81-2, or BS EN 81-20 and the building design to ensure that the refuge areas and fall protection remain.

When a modernisation scheme includes upgrading these types of lifts and the refuge areas do not comply with the relevant standards, the lift must be approved by the UK government's Department of Business and Trade before being placed into service.

4 TESTING OF A MODERNISED LIFT

After the work has been completed, BS 5655-11:2005 and BS 5655-12:2005 recommend the tests that should be conducted.

These modifications, including rated speed, rated load, travel increase and car mass changes, are understood to be important modifications. Therefore, a full test of the complete lift installation should be carried out.

Where the modifications include other items, there might still be consequential changes. The tests must be conducted on these modifications to ensure that the main changes and any consequential changes result in a safe installation.

Test records can be made using either the BS 5655-10.1: 1995 [9], BS 5655-10.2: 1995 [10], PAS 32-1:1999 [11] or PAS 32-2:1999 [12] or a combination of the appropriate parts of these documents, but not a mixture of these document, depending on when the lift installation was first put into service.

When lifts have undergone a significant change, the Lifting Operations and Lifting Equipment Regulations 1998 [13] (LOLER) explains that every employer needs to ensure that lifting equipment exposed to conditions causing deterioration, which is liable to result in dangerous situations, is *Thoroughly Examined.*

Ensuring that a thorough examination is conducted at the correct intervals is often a topic that could be known better when modernisation works have been undertaken on a lift and is something that can be interpreted differently. The guidance surrounding when a thorough examination refers to being organised by the building owner, which could be understood as something that has been completed if the modernisation works are completed between the thorough examination periods.

Instead, the building owner should organise a thorough examination after any serious modification and complete it before the lift is returned to service.

5 MODERNISATION PRODECURE

Any proposed modernisation should involve a documented assessment of the impact of the modifications to the Essential Health and Safety Requirements (EHSRs) of the Lifts Regulations, which were applicable at the time the original lift was placed on the market and should take the form of a risk assessment following the format of BS EN ISO 14798:2013 [14]. This should consider the guidance in BS EN 81-80:2019, BS 5655-11:2005 & BS 5655-12:2005 and the design and compliance solutions of the lift.

Where the original design had a Type Examination, the person undertaking the modernisation may deviate from the original design. Still, they are responsible for ensuring that the Essential Health and Safety Requirements (EHSRs) of the Lifts Regulations continue to be fulfilled and that the level of safety is maintained. If it is found that one or more EHSRs still need to be fully met, then the

modernisation must be adapted to ensure the EHSRs will be met. They would need to carry out a risk assessment, design calculations and tests to demonstrate the adequacy of their design.

The following procedure is recommended when undertaking changes to an existing CE-marked lift.

- If a lift is changed, a risk assessment of the proposed changes should be made to ensure safety is not reduced.
- The original CE marking of the lift car should be retained.
- A permanent notice stating the change date and company name should be fixed on or in the car.
- A file should be compiled and retained of the changes made.
- The replacement components and all other affected parts should be tested before the lift is returned to service.
- Records of tests before placing into service should be retained.
- Updated information should be provided to the owner where the change will affect the user or maintenance procedures described in the original owner's manual, including where changes have occurred in the original electrical wiring diagrams.
- A change record should be included in the original logbook previously issued to the owner when the lift was new.
- An independent inspection body should undertake a thorough examination before returning the lift to service.

6 CONCLUSION

The modernisation of an existing lift might include obviously significant modifications such as a change of rated load, rated speed or travel. Even where the modernisation involves apparently minor changes such as a car reline or a change of suspension type/specification, these are also considered important modifications. BS 5655-11/-12, although quite old, still provide good principles for what should be checked and tested. The modification of lifts designed according to type examination since the introduction of the Lifts Regulations presents new challenges since the person designing the modernisation scheme might not have the original design details and might not appreciate the tolerances on system parameters in the original design. A systematic approach to design based on the use of risk assessment is recommended and the use of current test sheets to check the conformity of new components and a check that consequential modifications have not resulted in a less safe installation.

REFERENCES

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[4] BS EN 81-20:2020, *Safety rules for the construction and installation of lifts – Lifts for the transport of persons and goods – Part 20: Passenger and goods passenger lifts*

[5] BS EN 81-80:2019, *Safety rules for the construction and installation of lifts — Existing lifts – Part 80: Rules for improving the safety of existing passenger and goods passenger lifts.*

[6] BS 5655-11:2005, *Lifts and service lifts – Part 11: Code of practice for modifying existing electric lifts.*

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BIOGRAPHICAL DETAILS

Michael Grover-White is the LEIA Technical Manager and sits on BSI's MHE/4 lifts, hoists and escalator committee where he is active on current work projects including a revision of BS 5655-11/-12. He represents BSI on the CEN TC10 working groups responsible for the main lift safety standards, standards for lift operation in the event of fire, and for lifts for accessibility. He is contributing work on CIBSE Guide D 2025 including as principal author of the chapter for the upgrading of safety, performance and equipment of existing lifts.

Michael is a Technician Member of the IET (TMIET), holds NVQs in Testing and Commissioning and Electrical Installations. Prior to his current role, he worked in a wide variety of technical roles and lift companies and sat on the LEIA technical committee since 2019.