PRESENTATION
BY
SEE KOK LENG
PART (I)
1. Introduction to Lift Maintenance
2. Risk Management Approach
3. Types of Hazards in Lift Maintenance
5. Hazards in Escalator Maintenance
6. Responsibilities of Various Stakeholders
7. Training for Personnel Involved in Maintenance Work


PART (II)
BCA’s Regulatory Changes to the Lift & Escalator Industry

[Source: BCA]

PART (III)
BCA Encourages Lift Owners to Modernise Lifts
Background information:

• ~61,000 lifts in Singapore currently

• BMSMA requires lifts to be maintained at least once a month

• >2000 lift maintenance workers
WORK SAFETY AND HEALTH FOR LIFT MAINTENANCE

Impact

High

Low

High Likelihood

Low Likelihood

High impact and likely to occur

Low impact and likely to occur

High impact but unlikely to occur

Low impact and unlikely to occur
# Work Safety and Health for Lift Maintenance

## Risk Assessment Form

<table>
<thead>
<tr>
<th>Company:</th>
<th>Conducted by: (Names, designations) (Date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process/Location:</td>
<td>Lift motor room at site</td>
</tr>
<tr>
<td>Approved by: (Name, designation) (Date)</td>
<td>Last Review Date:</td>
</tr>
</tbody>
</table>

## 1. Hazard Identification

<table>
<thead>
<tr>
<th>No.</th>
<th>Work Activity</th>
<th>Hazard</th>
<th>Possible Accident/ill Health &amp; Persons-at-Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Access to rooftop using cat ladder</td>
<td>Slip and fall from cat ladder</td>
<td>Fatal or fracture</td>
</tr>
</tbody>
</table>

## 2. Risk Evaluation

<table>
<thead>
<tr>
<th>2a.</th>
<th>2b.</th>
<th>2c.</th>
<th>2d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Risk Control (if any)</td>
<td>Severity</td>
<td>Likelihood</td>
<td>Risk Level</td>
</tr>
<tr>
<td>1) Provide adequate lighting. 2) Provide cat ladder with ringed hoops. 3) Wear safety harness (if necessary) and safety shoes.</td>
<td>Ma</td>
<td>R</td>
<td>M</td>
</tr>
</tbody>
</table>

## 3. Risk Control

<table>
<thead>
<tr>
<th>3a.</th>
<th>3b.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Risk Control</td>
<td>Action Officer, Designation (Follow-up date)</td>
</tr>
<tr>
<td>Service Engineer/Supervisor.</td>
<td></td>
</tr>
</tbody>
</table>

*Assumption:
All conventional practices and procedures will be followed and need not be listed specifically. These include:
- all required training, certification, permits, and so on;
- all normal supervision, maintenance and inspection routines; and
- all safe work procedures (SWPs) and PTW.
Training and Communication
Types of Hazards in Lift Maintenance

- Mechanical Hazards
- Electrical Hazards
- Fall From Heights
- Struck by Falling Objects
- General Hazard Considerations
Mechanical Hazards

Figure 4: Being trapped between an ascending lift car and the soffit of the lift shaft.

Figure 5: Being trapped between an ascending lift car and the door.
Mechanical Hazards

**Figure 6:** Being trapped between a descending lift car and counterweight inside the hoist way.

**Figure 7:** Being trapped between a descending lift car and the bottom of the lift pit.
Mechanical Hazards

Figure 9: Fingers may get pinched when ropes come in contact with pulleys and sheavers.

Figure 10: Fingers may get pinched at the moving parts that are left uncovered.
Mechanical Hazards

Figure 8: An example of eliminating the sharp corners of machine beams.
1. Sharp corners (cutting hazards)
2. Round corners are used to eliminate the cutting hazards
Electrical Hazards

Figure 11: Electrical panels without covers can expose workers to electrical hazards.

Figure 12: Damaged electrical cords.

Figure 13: Exposed wires.

Figure 14: Electrically charged when worker comes into contact with non-finger-safe termination blocks.

Figure 15: Overloaded circuits and plugs.

Figure 16: Flooded lift pit.
Fall From Height

**Figure 17:** Falling off open sides at the roof or edges of buildings.

**Figure 18:** Falling off the edge of the stairs.
Fall From Height

Figure 19: Falling off the top of the lift car to the bottom of the lift pit.

Figure 20: Falling through the opening landing door into the hoist way.

Figure 21: Falling off improperly constructed platform.
Struck by Falling Objects

**Figure 22:** Hand tools falling from lift car top to hoist way.

**Figure 23:** Equipment falling through the landing door to hoist way.
General Hazard Considerations

- Slippery/Uneven Floors
- Poor Lighting Condition
- Coordination between maintenance personnel working on the same lift
- Absence of communication devices
- Entrapment
- Mineral oil handling
- Fatigue
- Stress during rescue operation
- …..
Good Practices for Lift Maintenance Work
Access to Lift Machine Room, Pulley Spaces and Hoist Way

The lift owner is required to ensure a safe access to lift machine room, hoist way and lift landings as per SS550 Code of Practice: Installation, operation and maintenance of electric passenger and goods lifts.

The access/egress consists of access route to passageway and the passageway itself.

Some examples of a safe access to passageway are:
- Staircase or “ship’s ladder”;
- Cat ladders with ringed hoops from 2 metres upward. This would offer some form of fall protection if the cat ladder are located close to the building’s edge;
- The vertical cat ladder in a single plane;
Access to Lift Machine Room, Pulley Spaces and Hoist Way
Working Safely in the Machinery Room or Machinery Space

Some of the characteristics of a well-maintained lift machine room and hoist ways are:

• Protection against weather;
• Lockable machine room or maintenance door;
• Illumination levels of 200 lux at machine rooms from permanent lighting fixtures;
• Properly maintained lighting and switch socket outlets.
• Relevant safety signs are displayed within the machinery room.
• Adequate ventilation to keep the lift machinery and associated equipment at a temperature not exceeding 38°C when measured at a distance of 1 metre from such equipment.
Working Safely in the Machinery Room or Machinery Space

Figure 26: Examples of local ventilation system.
Good Practices for Working with Moving Parts in Machine Room or Machinery Space

Figure 27: An example of pulley guards with a viewing window for rope inspection.
Good Practices for Controlling Electrical Hazards

Figure 32: Examples of clear marking on lift isolators and distribution boards.
Good Practices for Controlling Electrical Hazards

Figure 33: Examples of using lockout and tagout to isolate the source of electrical energy in the machine room.
Good Practices for Controlling Electrical Hazards

Figure 30: Examples of finger-safe terminal block.

Figure 31: Examples of clear marking and labelling on electrical wires and terminations.
Working Safely on Lift Car Top
Working Safely Within the Hoist Way

- competent maintenance person
- used as a working platform
- safe work procedures in place
- FOLLOW safe work procedures
WORK SAFETY AND HEALTH FOR LIFT MAINTENANCE

Working Safely at Lift Landings

Figure 34: An example of using lift barrier to warn the public of falling hazards.

Figure 35: An example of door stopper to prevent door from getting accidentally shut.
Working Safely in Lift Pit

- competent maintenance person
- lift is operating *only* at inspection speed
- isolate and lock off the main power supply if necessary
- watch out for descending cage and counterweight
- no concurrent work to be performed above the pit
Working Under High Stress Condition

Stress management

Rushing For Time

Better late than never
Do not take hazardous short-cut
Hazards in Escalator Maintenance

Place adequate barricade with prominent signage at both entrance of the escalator
Hazards in Escalator Maintenance

When working on the escalator, the key must always be removed from the escalator key switch.

Must operate under inspection mode when removing the steps.
RESPONSIBILITIES OF VARIOUS STAKEHOLDERs

• Lift Owner’s Responsibilities
• Lift Contractor’s Responsibilities
• Lift Manufacturer’s Responsibilities
• Lift Maintenance Worker’s Responsibilities
Training for Personnel Involved

Personnel to be trained
Planning an effective training programme
Carry out the planned training programme
Evaluate effectiveness of training
Refresher or supplementary Training
PART (II)

BCA’S REGULATORY CHANGES TO THE LIFT & ESCALATOR INDUSTRY

[Source : BCA]
Regulatory Regime for Lifts

**Design**
- Lift designs need to comply with relevant standards/codes

**Installation**
- Certification of lifts by *Professional Engineers* (PEs) required for TOP/CSC* application

**Operation & Maintenance**
- Owner to engage registered lift contractor to maintain lift every month in compliance with the 20 maintenance outcomes
- Registered lift contractors to conduct *annual examination, inspection & testing* in the presence of an *independent AE before applying for permit to operate (PTO)*
- Display of PTO in lift (wef 1 Sep 2017)
- Put in place *adequate barriers* when lift is not operational

**Alteration & Replacement**
- Owner to notify the Commissioner in writing before any major alteration or replacement
- Notification of incidents
- Owner to keep maintenance records for min. 5 years

*TOP: Temporary Occupation Permit
CSC: Certificate of Statutory Completion

* New

Building Control Act

Building Maintenance & Strata Management (Lift, Escalator and Building Maintenance) Regulations 2016
Lift contractors must maintain lifts in accordance with the 20 maintenance requirements with outcomes.

### 20 Monthly Maintenance Requirements for Lifts

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door open control</td>
<td>Direct current machine</td>
</tr>
<tr>
<td>Door protective devices</td>
<td>Governor</td>
</tr>
<tr>
<td>Lift car and landing doors (gaps)</td>
<td>13. Main ropes and compensation ropes</td>
</tr>
<tr>
<td>Lift car emergency alarm</td>
<td>Compensation rope and sheave tie-down and tensioning</td>
</tr>
<tr>
<td>Lift car intercom</td>
<td>Buffer</td>
</tr>
<tr>
<td>Emergency power supply for lighting &amp; ventilation</td>
<td>Controller and electrical system</td>
</tr>
<tr>
<td>Movement of lift car</td>
<td>Guide shoes or rollers of lift car and counterweight</td>
</tr>
<tr>
<td>Housekeeping</td>
<td>Safety gears</td>
</tr>
<tr>
<td>Lift machine and drive</td>
<td>All lift parts (for corrosion and wear)</td>
</tr>
<tr>
<td>10. Brakes of lift machine and drive</td>
<td>20. Stopping or level accuracy</td>
</tr>
</tbody>
</table>

Additional maintenance items which are not included in SS 550:

**With effect on 25 July 2016**
1) Monthly Maintenance of Lifts

- BCA will carry out audit checks on lifts to ensure that lift contractors achieve the maintenance outcomes

- Possible enforcement actions:
  - Issue of Notice to Maintain
  - Issue of Notice to Suspend
  - Upon prosecution / conviction, max fine of $5,000
Permit to Operate (PTO) System

- Current lift certificate is valid until it expires

- Upon expiry of current lift certificate, lift owners have to apply for PTO after the examination, inspection and testing of the lift has been carried out

- BCA may carry out an inspection or direct a re-test or request for additional documentation before PTO will be issued

- PTO must be renewed annually

- The display of PTO within the lift cabin will be made
  - mandatory from 1 Sep 2017
• **Lift owner and the lift contractor must inform BCA** of the occurrence of a lift incident involving the following circumstances as soon as practicable
• Takes effect on 25 July 2016

(i) Death or injury associated with a lift, or any associated equipment or machinery

(ii) Failure of drive system

(iii) Breakage of suspension rope

(iv) Failure of brake, overload device, safety component or safety equipment

(v) Failure of interlocking device for any lift door
## Lift Owner
- Ensure lift is maintained monthly according to prevailing standards/as prescribed and annually inspected
- Notify BCA before major alteration or replacement works
- **Apply for permit to operate**
- Notify BCA of the occurrence of lift incidents
- Keep maintenance records for min. 5 years

## Lift Contractor
- Maintain lifts according to prevailing standards/as prescribed and the **20 maintenance outcomes**
- The annual examination, inspection and testing of lifts is carried out by a lift contractor, in the presence of an Authorised Examiner
- Submit an investigation report, when instructed to do so by the COB

## Authorised Examiner (AE)
- Lift owners must engage an AE to conduct an annual examination, inspection and testing of all passenger lifts
- When a lift incident occurs, BCA may require the lift owner to appoint an AE to investigate, recommend rectification works and submit the findings to BCA
- **AE certifying maintenance must be independent from lift contractor and owner**
TIGHTER REGULATORY REGIME FOR ESCALATORS

1. Monthly maintenance
2. Annual inspection and testing
3. Permit to operate (PTO) system
4. Notification of incident
Regulatory Regime for Escalators

**Design**
- Escalator designs to comply with SS CP 15: 2004*

**Installation**
- Certification of escalator by Professional Engineers (PEs) required for TOP/CSC** application

**Operation & Maintenance**
- Building owners to engage registered escalator contractor to maintain escalator monthly and to meet the 10 maintenance outcomes
- Examination, inspection & testing to be carried out in the presence of an AE for application for permit to operate (PTO) annually

**Alteration & Replacement**
- Owner to notify the Commissioner in writing before any major alteration or replacement
- Display of PTO (wef 1 Mar 2018)
- Notification of incidents
- Owner to keep maintenance records for min. 5 years
- Put in place adequate barriers when escalator is not operational

**Building Control Act**

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* SS CP15:2004: Singapore standard – Code of practice for installation, operation and maintenance of escalators and passenger conveyors

**TOP: Temporary Occupation Permit**

**CSC: Certificate of Statutory Completion**
### Existing regulatory regime

- Building owners maintain escalators in accordance to the recommendations in the SS CP 15

### Tightened regulatory regime

- Escalator owner must engage a registered escalator contractor to maintain the escalator in accordance with SS CP 15 and *to meet the 10 maintenance outcomes*
- *3 months grace period* for owners to engage registered escalator contractor to *carry out monthly maintenance*
- *Escalator owner must keep all maintenance records* for min 5 years
1) Monthly Maintenance of Escalators

Escalator contractors must maintain the escalator in accordance with the 10 maintenance requirements (with outcome every month)

10 Monthly Maintenance Requirements for Escalators

1. Signage and indicator
2. Anti-climbing, anti-sliding, access restriction and deflecting devices
3. Emergency stop switch
4. Handrail system (overspeed & emergency stop)
5. Housekeeping
6. Driving machine, brakes, sprocket
7. Safety switch and sensor
8. Excessive speed and unintentional reversal protection
9. Operational clearance
10. All escalator parts (for corrosion and wear)

Additional maintenance items which are not included in SS CP 15

With effect from 1 Nov 2016
Existing regulatory regime

- Building owners inspect escalators every year in accordance to the recommendations in the SS CP 15

Tightened regulatory regime

- Annual examination, inspection & testing to be carried out by an escalator contractor in the presence of an AE in accordance with SS CP 15 and submission of certificate by AE to BCA

- AE must be independent from escalator contractor and owner

- Application for permit to operate (PTO)

- Display of PTO (wef 1 Mar 2018)
• Escalator owners have to apply for PTO after the **examination, inspection and testing of the escalator has been carried out**

• BCA may carry out an inspection or direct a re-test or request for additional documentation before PTO will be issued

• PTO must be renewed annually
• Deadline for obtaining PTO is based on the CSC date of the building

<table>
<thead>
<tr>
<th>PTO in 5 Phases</th>
<th>Deadline for obtaining PTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC obtained for buildings before 1 May 1989</td>
<td>31 Jan 2017</td>
</tr>
<tr>
<td>CSC obtained for buildings between 1 May 1989 and 31 December 2000 (inclusive)</td>
<td>30 Apr 2017</td>
</tr>
<tr>
<td>CSC obtained for buildings between 1 January 2001 and 31 December 2010 (inclusive)</td>
<td>31 Oct 2017</td>
</tr>
<tr>
<td>CSC obtained for buildings on or after 1 January 2011</td>
<td>31 Jan 2018</td>
</tr>
<tr>
<td>Escalator that is in any structure, or used in connection with any structure</td>
<td>31 Jan 2018</td>
</tr>
</tbody>
</table>

• The display of PTO for escalators will be made mandatory from 1 Mar 2018
• **Escalator owner and the escalator contractor must inform BCA** of the occurrence of an escalator incident involving the following circumstances as soon as practicable.

• Takes effect on 25 July 2016

(i) Death or injury involving an escalator, or any associated equipment or machinery

(ii) Failure of main drive system other than the failure of the main power system

(iii) Failure of brake, overload device, safety component or safety equipment
<table>
<thead>
<tr>
<th>Escalator Owner</th>
<th>Escalator Contractor</th>
<th>Authorised Examiner (AE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ensure escalator is maintained monthly according to SS CP 15 and annually inspected</td>
<td>• Maintain escalators according to SS CP 15 and the 10 maintenance outcomes</td>
<td>• Escalator owners must engage an AE to conduct an annual examination, test and inspection of all escalators</td>
</tr>
<tr>
<td>• Apply for permit to operate annually</td>
<td>• The annual examination, inspection and testing of escalators is carried out by an escalator contractor, in the presence of an Authorised Examiner</td>
<td>• When an escalator incident occurs, BCA may require the escalator owner to appoint an AE to investigate, recommend rectification works and submit the findings to BCA</td>
</tr>
<tr>
<td>• Notify BCA before major alteration or replacement works</td>
<td>• Submit an investigation report, when instructed to do so by the COB</td>
<td>• AE certifying maintenance must be independent from escalator contractor and owner</td>
</tr>
<tr>
<td>• Notify BCA of the occurrence of escalator incidents</td>
<td>• Notify BCA of the occurrence of escalator incidents</td>
<td></td>
</tr>
<tr>
<td>• Keep maintenance records for min. 5 years</td>
<td>• Put in place adequate barriers when escalator is not operational</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### New Requirements for Lift Safety

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Effective From</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conduct monthly maintenance in accordance with SS 550:2009 and meet 20 maintenance outcomes</td>
<td>25 July 2016</td>
</tr>
<tr>
<td>• Notify BCA of lift incident</td>
<td></td>
</tr>
<tr>
<td>• Keep maintenance records for min. 5 years</td>
<td></td>
</tr>
<tr>
<td>• Install adequate barriers when lift is not in operation</td>
<td></td>
</tr>
<tr>
<td>• Appoint independent AE</td>
<td></td>
</tr>
<tr>
<td>• Obtain annual permit to operate (PTO)</td>
<td>25 July 2016 (or upon expiry of existing lift certificate)</td>
</tr>
<tr>
<td>• Display permit to operate in lift</td>
<td>1 Sep 2017</td>
</tr>
<tr>
<td>New Requirements for Escalator Safety</td>
<td>With effect from</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>• Conduct monthly maintenance in accordance with SS CP 15 and meet 10 maintenance outcomes</td>
<td>1 Nov 2016</td>
</tr>
<tr>
<td>• Notify BCA of escalator incident</td>
<td></td>
</tr>
<tr>
<td>• Keep maintenance records for min. 5 years</td>
<td></td>
</tr>
<tr>
<td>• Install adequate barriers when escalator is not in operation</td>
<td></td>
</tr>
<tr>
<td>• Appoint independent AE</td>
<td></td>
</tr>
<tr>
<td>Display permit to operate on escalator</td>
<td>1 Mar 2018</td>
</tr>
</tbody>
</table>
### New Requirements for Escalator Safety

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain permit to operate (PTO) in 5 phases*:</td>
<td></td>
</tr>
<tr>
<td>• CSC obtained for buildings before 1 May 1989</td>
<td>31 Jan 2017</td>
</tr>
<tr>
<td>• CSC obtained for buildings between 1 May 1989 &amp; 31 Dec 2000 (inclusive)</td>
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<td>• CSC obtained for buildings on or after 1 Jan 2011</td>
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</tr>
<tr>
<td>• Escalator that is in any structure, or used in connection with any structure</td>
<td>31 Jan 2018</td>
</tr>
</tbody>
</table>
PART (III)

BCA ENCOURAGES LIFT OWNERS TO MODERNISE LIFTS
BCA encourages lift owners to modernise lifts

Singapore, 16 September 2016 – As part of its ongoing review of lift and escalator regulations in Singapore, BCA has been studying the existing lift stock and looking into possible recommendations to enhance the reliability and performance of lifts.
## Annex – List of proposed items for modernisation of existing lifts

<table>
<thead>
<tr>
<th>S/N</th>
<th>Modernisation Items</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ascending car over speed protection (ACOP)</td>
<td>A traction drive lift shall be provided with ascending car overspeed protection, which includes speed monitoring and speed reducing elements to detect uncontrolled movement of the ascending lift car, and shall cause the lift car to stop or at least reduce its speed to that for which the counterweight buffer is designed.</td>
<td>Lifts certified to CP2:2000 and earlier versions</td>
</tr>
<tr>
<td>2</td>
<td>Unintended car movement protection (UCMP)</td>
<td>A traction drive lift shall be provided with a means to detect and stop unintended lift car movement away from the landing with the landing door not in the locked position and the lift car door not in the closed position, as a result of failure in any single component of the lift machine or drive system upon which the safe movement of the car depends, except failure of the suspension ropes and the traction sheave of the machine.</td>
<td>Lifts certified to SS550:2009 (before adoption of first amendment in 2014) and earlier versions</td>
</tr>
<tr>
<td>3</td>
<td>Slacken governor rope electrical safety device</td>
<td>Electrical safety device to detect the slackening of the governor rope, and which will initiate a stop of the lift car movement.</td>
<td>Lifts certified to CP2:1979 and earlier versions</td>
</tr>
<tr>
<td>4</td>
<td>Car apron</td>
<td>A smooth vertical part extending downwards from the sill lift car entrance. It is meant to avoid the risk of people at the lift landing falling into the lift shaft if the lift landing doors are opened when the lift car is stopped above the levelling position.</td>
<td>Lifts certified to CP2:2000 and earlier versions</td>
</tr>
<tr>
<td>S/N</td>
<td>Modernisation Items</td>
<td>Description</td>
<td>Remarks</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Light curtains as a door protective device</td>
<td>Light curtains as a door protective device</td>
<td>For existing lifts which do not have these features</td>
</tr>
<tr>
<td>6</td>
<td>Electrical safety interlocking for multi-panel door</td>
<td>An interlocking switch for every lift door panel that ensures where the lift door panel is open, the lift will stop moving immediately and remain in position.</td>
<td>For existing lifts which do not have these features</td>
</tr>
<tr>
<td>7</td>
<td>The telephone, intercom system or other communication device installed in the lift shall enable notification or direct communication with personnel who can activate emergency response</td>
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<td>For existing lifts which do not have these features</td>
</tr>
<tr>
<td>8</td>
<td>Automatic rescue device (ARD) if there is no provision for standby generating power system</td>
<td>A battery-operated device which will bring the lift to the nearest landing and open both the lift landing and car doors in the event of power failure.</td>
<td>For existing lifts which do not have these features</td>
</tr>
</tbody>
</table>
Thank you