



Disclaimer

The Electrical and Mechanical Services Department of the Government of the Hong Kong Special Administrative Region, China (“the EMSD”) publishes this booklet for the purpose of collecting, sharing and outlining the general, good and best practices for operation and maintenance service of lift and escalator installation (“the Booklet”) based on the best knowledge exchange with trade practitioners.

This Booklet serves as good reference at the time of publication, and shall be reviewed and updated with trade practitioners on need basis, in particular on exchanging and updating new practical innovative and technology initiatives applied in operation and maintenance activities.

Users of relevant trade stakeholders such as building owners, building occupants, facility management professionals, maintenance agents and relevant trade operators are free to consider and adopt the subject practices when satisfying their own operational needs and reference. The legal provisions referred to in this Booklet shall be construed in accordance with the relevant ordinances of the Government of the Hong Kong Special Administrative Region. Users should not only rely on the information given in this Booklet and could consult independent and relevant professional personnel whenever there are doubts about the application of the relevant ordinance or guidelines stated on the Booklet on individual circumstances.

Whilst every effort has been made to ensure and upkeep the accuracy of the Booklet at the time of publication, the EMSD shall not be responsible for any liability howsoever caused to any person by the use of or reliance on this Booklet.

Acknowledgements



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Working Group on Compilation of Booklet



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- **Building Services Operation and Maintenance Executives Society**
- **City University of Hong Kong (Division of Building Science and Technology)**
- **Hong Kong Housing Society**
- **Housing Department, the Government of the Hong Kong Special Administrative Region, China**
- **Mott MacDonald Hong Kong Limited**
- **The Association of Consulting Engineers of Hong Kong**
- **The Chartered Institution of Building Services Engineers (Hong Kong Region)**
- **The Hong Kong Association of Property Management Companies Limited**
- **The Hong Kong Federation of Electrical and Mechanical Contractors Limited**
- **The Hong Kong Institution of Engineers (Building Services Division)**
- **The Hong Kong Institute of Facility Management**
- **The Hong Kong Polytechnic University (Department of Building Environment and Energy Engineering and Department of Mechanical Engineering)**
- **The International Association of Elevator Engineers (Hong Kong-China Branch)**
- **The Lift and Escalator Contractors Association**
- **The Real Estate Developers Association of Hong Kong**
- **The Registered Elevator and Escalator Contractors Associated Limited**

Benchmarking Organisations



- **Henderson Land Development Company Limited**
- **Housing Department, the Government of the Hong Kong Special Administrative Region, China**
- **Hong Kong Jockey Club**
- **Hong Kong Science and Technology Parks Corporation**
- **Hong Kong University of Science and Technology**
- **Jardine Schindler Group**
- **Mass Transit Railway Corporation Limited**
- **New World Development Company Limited**
- **Savills (Hong Kong) Limited**
- **Sun Hung Kai Properties Limited**
- **Swire Properties Limited**

Preface

The EMSD endeavours to collaborate with the trade practitioners for adopting best practices and innovative technologies to improve the management of E&M assets, thereby enhancing the resilience and intelligence in buildings.

This Booklet recommends a basic framework for 15 key attributes important to users such as facility management professionals and relevant stakeholders involved in the design, construction, operation, maintenance, alteration, addition and replacement of lift and escalators in buildings. Under each key attribute, it outlines the general, good and best practices for operation and maintenance service of lift and escalator installation based on the best knowledge exchange with trade stakeholders, regardless of size, complexity or location.

With the dedicated collaboration and commitment with our trade practitioners, it is intended to develop the guiding practices that are professional, reliable, up-to-date and widely applicable for the asset management of most of the relevant electrical and mechanical assets in Hong Kong.



TERMS, DEFINITIONS AND ABBREVIATIONS

L&E Contractor	The Nominated Sub-contractor or the Specialist Sub-contractor employed by the Building Contractor or the contractor directly employed by the Employer as appropriate for the execution of the Installations in accordance with the Contract.
Installations	The work or services for the Lift and Escalator Installations forming parts of the Works to be installed, constructed, completed, maintained and/or supplied.
Particular Specification	The specifications drawn up specifically for the Installations of a particular project.
ANSI	American National Standards Institute
ArchSD	Architectural Services Department, the Government of the Hong Kong Special Administrative Region, China
ASTM	American Society for Testing and Materials
BS	British Standards, including British Standard Specifications and British Standard Codes of Practice, published by the British Standards Institution
BS EN	European Standard adopted as British Standard
EMSD	Electrical and Mechanical Services Department, the Government of the Hong Kong Special Administrative Region, China
ISO	International Organisation for Standardization
Responsible Person	A person who owns or has management or control of the lift or escalator.
RC	Registered Lift Contractor or Registered Escalator Contractor
RE	Registered Lift or Escalator Engineer

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Introduction



1.1 About This Best Practice Booklet

This Booklet is intended to outline the guiding principles on general, good and best practices to be considered during the design, construction, operation, maintenance, alteration, addition and replacement for the lift and escalator installations in buildings to upraise the efficiency of asset management. It is designed for those users who are currently engaged in asset management of these installations in existing buildings or those who plan for new design and fitting-out works with these installations in new buildings. This Booklet should be read in conjunction with applicable ordinances and regulations in Hong Kong.



1.2 Target Audience

Target audiences of this Booklet are primarily for trade stakeholders including building owners, building occupants, facility management professionals, maintenance agent or relevant trade operators.

While in daily operations, the safety, system reliability, operational efficiency and sustainability of the assets rely on the daily operation and maintenance practices. In this regard, some information and recommendations to the interest of the trade stakeholders are outline in this Booklet as reference.



1.3 How to Use This Best Practice Booklet

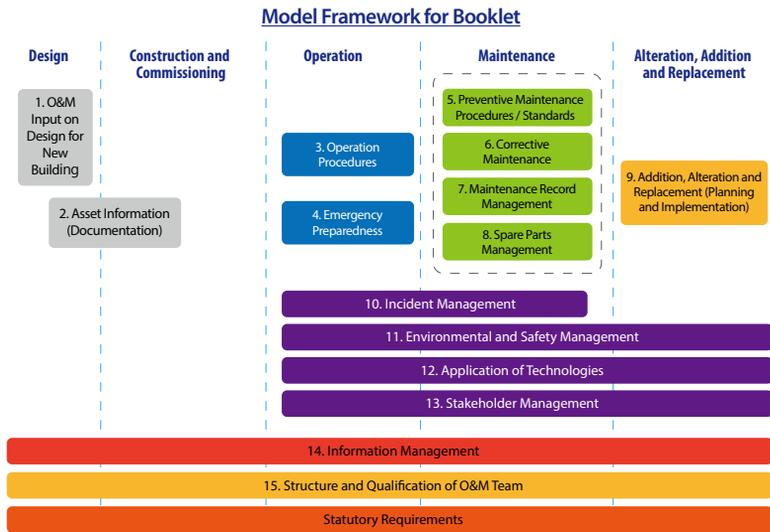
This Booklet mainly covers 15 key attributes in the following stages in new and existing buildings:

- **Design, Construction and Commissioning,**
- **Operation and Maintenance and**
- **Alteration, Addition and Replacement.**

The 15 key attributes are the key main considerations for achieving good or best performance in asset management of the lift and escalator Installations in buildings. Three levels of guiding principles, namely general, good and best practices, with associated examples of trade practices have been defined in each key attribute as reference. An additional chapter on “Innovative and Technology Initiatives” has also been included about the trend of technologies likely to be adopted to upraise the operation and maintenance service.

Level	Category	Description
Level 1	General Practice	Involving general operating practices in fulfilling statutory requirements and aligning common practice in the trade industry
Level 2	Good Practice	Involving good operating practices with higher standard on enhancing either asset safety, system reliability, operational efficiency or sustainability
Level 3	Best Practice	Involving best operating practices with highest standard on asset management with use of innovative technologies or relevant life-cycle considerations

The figure provides an illustrative map for the 15 key attributes in different sections of the booklet.



A summary of the contents in this booklet is as follows:

Section 1: Introduction to this Best Practice Booklet

Describes the important drivers for a building to perform efficiently and safely. This section explains what this Booklet is about, identifies key stakeholders and directs the reader to specific sections.

Section 2: Operation and Maintenance Best Practice Attributes

Describes the 15 key attributes for implementing good performance O&M of Lift & Escalator Installations in buildings. It defines three levels of practices namely, general, good and best practices for each.

The 15 key attributes are:

- (i) O&M Input on Design for New Building – It is important for Design Engineers to consider accessibility and maintainability right from the planning and design of a facility, through its life cycle.
- (ii) Asset Information (Documentation) – Good documentation is essential for facilitating good O&M. This section describes the key documents that are required for the efficient O&M of Lift & Escalator Installations.
- (iii) Operation Procedures - All activities associated with the routine, day to day use, support, and maintenance of a building or physical asset; inclusive of normal/ routine maintenance. O&M procedures at the system level do not replace manufacturers' documentation for specific pieces of equipment, but rather supplement those publications and guide their use.
- (iv) Emergency Preparedness – Being prepared for emergencies is important, and emergency management allow stakeholders to anticipate the types of potential hazards that could occur, and to think of ways to reduce the impact.
- (v) Preventive Maintenance Procedures / Standards - Preventive Maintenance consists of a series of time-based maintenance requirements that provide a basis for planning, scheduling, and executing scheduled (planned versus corrective) maintenance. It is of a planned nature (versus the unplanned nature of Corrective Maintenance (CM)).
- (vi) Corrective Maintenance – This is an essential maintenance task performed to correct failures, breakdowns, malfunctions, anomalies or damages detected during inspections, or through monitoring, alarming, or reporting, or any other source. The actions taken will aim to restore plant and equipment back into regular and required operation mode.
- (vii) Maintenance Record Management – This is a key part requiring efficient storage and management. Proper maintenance records minimise the number of expensive repairs, increase safeness in operation and enhance the visibility of equipment health.
- (viii) Spare Parts Management – Managing spare parts in an optimal way is an inherent and substantial part of O&M aimed at ensuring that spare parts are available in a timely manner for corrective maintenance in order to minimise the downtime of a system or equipment.
- (ix) Addition, Alteration and Replacement (Planning and Implementation) - This includes the analysis, procurement, management on additional, alteration as well as disposal and replacement of assets to meet the organisation's long term aims and objectives.
- (x) Incident Management – This is the essential process to restore normal service operation as quickly as possible and limit the potential disruption caused by an incident.

- (xi) Environmental and Safety Management - The Building Owner has the ultimate legal and moral responsibility to ensure the health and safety of people in and around the building and for the protection of the environment around it.
- (xii) Application of Technologies - Integration and adaptation of new technologies with innovative methods to optimise system performance as well as operational effectiveness.
- (xiii) Stakeholder Management – This is a critical component to the successful delivery of any service. It allows the correlation of stakeholders with potential known triggers, such as disruptions to their normal patterns and update on work progress, etc. It also estimates the impact that these reactions may have on your project or strategies and identifies whether targeted communication, mitigation or an alternative solution is required.
- (xiv) Information Management – This concerns a cycle of organisational activity: involving the acquisition of information from one or more sources, and the custodianship and distribution of that information to those who need it.
- (xv) Structure and Qualification of O&M Team - It is of critical importance that all O&M teams have a proper structure and their personnel have the relevant qualifications to perform the works in a safe, responsible and accountable manner.

Section 3: Innovative & Technology Initiatives

Describes the latest technology development in the use of innovative and technology initiatives adopted for O&M services for lift and escalator installations.

Section 4: Industrial Standards and Requirements

Describes the summary of relevant statutory requirements involved in the O&M services for lift and escalator installations.

Section 5: Useful Forms – Samples

Describes the commonly used forms / checklists adopted in O&M services for lift and escalator installations.



1.4 Stakeholder Responsibilities

Trade stakeholders should be aware of their roles, responsibilities and commitments to drive for implementation of the good and best practices, whenever applicable, for the betterment of their routine asset management.

It is essential that all involved stakeholders shall work collaboratively as a team. While those involved for improving the current practices, they shall commit to facilitate and provide sharing on the necessary training, practical experience, knowhow and awareness of modern technology and the skills of optimising performance in their organisations.

1.4.1 Building Owner

The Building Owner has the ultimate responsibility for operating and maintaining the base / central building services installations in adherence with all applicable legal requirements.

The Building Owner should motivate and empower all Stakeholders to deliver efficiencies through O&M practices. The policies and strategies set by the Building Owner should drive the process for setting up the implementation of maintenance contracts and efficiency measures.

1.4.2 Building Occupants (Tenant)

Tenants hold the responsibility to ensure that the operation of the equipment is efficient, human behavioural patterns do not affect the efficiency of Lift & Escalator Installations, and that work carried out during tenancy fit-outs does not affect the performance of building services installations.

Tenants should adhere to the lease conditions when available, including Green Leases and Tenancy Fit-Out Guidelines, that express mutual expectations between Building Owners and Tenants with regards to operation, maintenance and performance requirements of buildings. They should observe the statutory requirements and use the lift and escalator properly. When use of the lift or escalator is prohibited, anyone who uses the lift or escalator regardless of warning is in breach of the law.

1.4.3 Facilities Manager

The Facilities Manager (FM) is responsible for the Building's O&M. The FM should implement the maintenance and environmental policies and strategies set by the Building Owner in accordance with the allocated resources. The FM should take on the role of the champion who leads the process for implementing changes that deliver better practices for the O&M of the building.

It is important for the FM to develop a maintenance regime that is geared towards delivering good outcomes in partnership with Maintenance Service Providers, who would benefit from the enhanced system efficiency. Forming good relationships and ensuring effective channels of communication including good documentation, is an important aspect to the process.

2

Key Model Framework



2.1 O&M Input on Design for New Building

Design for Maintainability emphasises the importance of timely integration of design and construction knowledge with O&M experiences into the project design in order to optimise building life.

Maintainability should be considered, and incorporated into the building system design, ensuring the ease, accuracy, safety, and economy of maintenance tasks within that system. Maintainability refers to the effectiveness and efficiency of maintenance activities. New working practices encouraged, such as Building Information Modelling for Asset Management (BIM-AM), require the involvement of asset owners and FMs to understand the information they require on handover. FMs should be involved during design stage and ensure the information handed over by the contractor fits their specific needs.

Level 1

GENERAL PRACTICE

2.1.1

• Regular Design Coordination Meetings

For new building projects involving different design ideas on lifts and escalators, it is always necessary to solicit input from the lift and escalator O&M team. The O&M team can provide ideas and spatial requirements on not only daily operational issues, but also periodic maintenance, access, repair and upgrading considerations. Different lift design ideas can be considered from traditional, machine-room-less, regenerative, hydraulic and other properties. The O&M team can state their technical requirements for optimisation purposes in terms of reducing maintenance cost and getting the best access for repair. Therefore, for any new building projects, regular design coordination meetings between the design team and the O&M team to share views on maintenance is absolutely necessary.

- **Tender Documents**

Further to the design of the lift and escalator system with reference to O&M issues, tender documents containing O&M matters should be forwarded to the O&M team for comments. Cost and quality of maintenance of lifts and escalators after contract completion are critical issues of concern for awarding the tender as these have important resource implications for the subsequent follow up works to be carried out on the part of the O&M team.



Level 2

GOOD
PRACTICE

2.1.2

- **O&M Team to Provide Maintenance Requirements**

The O&M team should provide lift and escalator maintenance requirements to design team. This will enable the design team to cover all necessary lift and escalator maintenance requirements in the tender document and the future maintenance contracts.

- **O&M Team to Attend Coordination Meetings**

The O&M team should attend coordination meetings following the commencement of lift and escalator construction works. This will enable the O&M team to provide comments on all O&M provisions.



Level 3

BEST
PRACTICE

2.1.3

- **Design to Take into Consideration of Life Cycle Requirement and Redundancies**

The design team shall consider the following factors in the aspects of the life cycle of the asset from commissioning, O&M, refurbishment to decommissioning or total replacement:

- (a) Factors on facilities redundancies, changeovers or bypass to maximise system resilience at contingency and minimise impact to users during maintenance activities;
- (b) Factors on design guidelines for accessibility and maintainability aspects with regular review and update;
- (c) Factors on Guidance Notes on Construction Design and Management (CDM) guidance to improve health and safety aspects on building construction and maintenance.



2.2 Asset Information (Documentation)

Asset Information should be compiled, covering all major items of Lift & Escalator Installations in a format that is useful to the FM and Maintenance Service Provider. The information should be placed in readily accessible locations, and updated regularly with:

- Any repairs, upgrades, refurbishments, maintenance or decommissioning work.
- Updates to assessment information (relating to performance or risk).
- Changes in the wider environment (including regulations, responsibilities or ownership).

★☆☆★
Level 1

GENERAL
PRACTICE

2.2.1

• Proper Documentation as per Statutory Requirements

The Responsible Person for a lift or an escalator shall be responsible for, and maintain all documentation including, but not limited to, the following:

- (a) Use Permit – display at all times in a conspicuous position inside the lift car. For escalators, the valid use permit should be displayed in a conspicuous position adjacent to the landing, or if there is more than one landing, the main landing of the escalator.
- (b) As-built drawings – record in the general building plans as approved by the Buildings Department.
- (c) Maintenance record – maintain the log-book as specified in the regulations for at least the past 3 years.



- **Planning / Schedule of Examination and Testing**

The Responsible Person for a lift or an escalator shall engage a Registered Lift or Escalator Contractor to carry out periodic maintenance including lubrication, cleaning, check, adjustment and repair of components due to wear and tear for the lift or escalator at intervals not exceeding 1 month, arrange for a Registered Lift or Escalator Engineer to carry out periodic examination of the lift at intervals not exceeding 12 months or escalator at intervals not exceeding 6 months respectively and arrange a Registered Lift or Escalator Engineer to carry out periodic examination of the lift or escalator with load at intervals not exceeding 5 years, so as to ensure that the lift or escalator and all its associated equipment or machinery are kept in a proper state of repair and in safe working order.

The schedule should be well-planned in advance, to avoid unnecessary disruptions to the use of the lifts or escalator, and to avoid causing contraventions to Cap. 618.

- **Handover Report**

Regarding the issue of changing Registered Lift or Escalator Contractor, the Responsible Person shall allow sufficient time in advance with the existing and incoming Registered Lift or Escalator Contractors to carry out joint inspection before handover date.

Any defects / outstanding work items shall be demarcated by using “Lift and Escalator Unsatisfactory/Uncompleted Maintenance Works and Common Anomalies Report”. By regulations, this first report shall be submitted to the Responsible Person and EMSD before the date of maintenance works handover.

After defects are rectified, the second report shall also be submitted.



**GOOD
PRACTICE**

2.2.2

- **Possession of O&M Documents**

Lift or escalator information refers to the layout plan, as-built drawings, typical approval certificates for safety components, O&M manuals, and periodic examination certificates. These documents provide the basic specification of lift and escalator system. The Responsible Person is recommended to keep a set of the equipment information in the Building Management Office.

- **Maintenance History**

The Registered Lift or Escalator Contractor and the Responsible Person are recommended to keep a record of maintenance history of the lift or escalator, including but not limited to, the following:

- (a) Routine maintenance – details of maintenance scopes and regular activities covered under such maintenance.
- (b) Special activities – activities other than the routine maintenance such as periodic examination, special maintenance check, site/safety audit and third-party audit.
- (c) Responsible Person’s activities – activities related to the lift and escalator, such as repairing lighting and ventilation system in machine room, repairing works for spalling in lift shaft, cleaning in lift pit, obstruction guards near escalator vicinity etc.
- (d) Call-back analysis – report of data collected from all the service calls.
- (e) Corrective maintenance – details of replaced components covered under such maintenance.
- (f) Modernisation – details of systems which have been modernised.



**BEST
PRACTICE**

2.2.3

- **Possession of All Design Documentation**

All design documentation (e.g. design criteria, design calculations, design drawings, etc.) and asset information (e.g. make, model, year of installation), testing and commissioning report, operation and maintenance manuals, examination reports and certificates, spare part lists, tools lists, etc., provides a full picture of the lift or escalator. The Responsible Person is expected to maintain a comprehensive record of all design documentation for future review.

- **Statistics of Same Type**

The Registered Lift or Escalator Contractor is recommended to develop a database of the same type/model of lifts or escalator installed in Hong Kong. The relevant data and information should be made available to the Responsible Person and EMSD for record and information. This database should record information, including but not limited to, the following:

- (a) Manufacturer
- (b) Model number
- (c) Year of manufacture
- (d) Control system model
- (e) Rated load / Step width
- (f) Rated speed
- (g) Travelling distance / Rise
- (h) Location
- (i) Country of origin
- (j) Quantity of same model installed

- **Life Information History**

The Responsible Person is recommended to keep a written or electronic record of the Life Information History of lift or escalator to show the installation and replacement records of the main components and safety devices. Such record should include, but not be limited to, the following:

- (a) Manufacturer
- (b) Model number
- (c) Model approval record
- (d) Year of manufacture
- (e) Year of installation / replacement
- (f) Components that was previous used
- (g) Country of origin



2.3 Operation Procedures

Operational efficiency refers to the life-cycle, cost-effective mix of preventive, predictive, and reliability-centred maintenance technologies, coupled with equipment calibration, tracking, and computerised maintenance management capabilities all targeting reliability, safety, occupant comfort, and system efficiency.

Level 1

GENERAL PRACTICE

2.3.1

• Basic Operation Procedures

The Responsible Person shall understand and execute the responsibilities of the responsible persons for lifts or escalators as defined under the Lifts and Escalators Ordinance (Cap. 618), the Lifts and Escalators (General) Regulation, and other matters relating to lift or escalator maintenance works. The aim is to ensure the lift, escalator and all its associated equipment are kept in a proper state of repair and in safe working order. The Responsible Person shall engage a Registered Lift or Escalator Contractor to carry out the lift or escalator works, including installation work, major alteration and demolition work, and routine maintenance and periodic examinations.

• Safety and Operation Induction Training

The Registered Lift or Escalator Contractor shall conduct the safety induction training through Safety Supervisors based on the Factories and Industrial Undertakings Ordinance (Cap. 59) and the Lifts and Escalators Ordinance (Cap. 618) for the O&M team's engineers and technicians.

In addition, the frontline staff employed by the Responsible Person shall be aware of and familiarised with the operation manual as well as the Code of Practice for Lift Works and Escalator Works (the Works Code), which sets out the minimum industry standard in satisfying the requirements under Cap. 618.

☆☆☆
Level 2

GOOD
PRACTICE

2.3.2

- **Daily Operation Procedures**

The daily operation procedures are recommended to be prepared and reviewed by Registered Lift or Escalator Contractor or Building Management Office. The O&M team is expected to execute the daily operation procedures including, but not limited to, the following:

- (a) Inspection before resuming the Lifts/Escalators
- (b) Procedure for shutting down the Lifts/Escalators
- (c) Inspection and procedures for the non-operating Lifts/Escalators

- **Lift or Escalator Shut Down during Low Demand**

When the traffic demand on the vertical transportation system is low or subject to building operation requirements, such as non-office hours of a commercial building or closing time of a shopping mall, it is recommended that the lifts or escalators can be shut down during low traffic demand (except the fireman lifts and barrier free accessible lifts). It is very common that the lifts or escalators in each lift or escalator bank can be shut down in turn.



★★★★
Level 3

BEST
PRACTICE

2.3.3

- **Immediate Lift Car Assignment**

Whenever there is a lift bank, it is best to equip with the group control system for immediate lift car assignment. When the call button is registered, the assigned lift car within the group will be identified with a pre-arrival flashing hall lantern and a chime, so that the involved passenger will be waiting near the corresponding landing door when the lift arrives and the related psychological waiting time will be reduced.

- **Continuous Traffic Monitoring**

The continuous traffic monitoring system is a real-time data analyser, which generates real-time information for the lift's self-learning programme that serves to improve the traffic efficiency of the lifts.

The analyser system uses video or load sensors analytics for people counting, and an object detector for area occupation checking. The system provides fast calculation and offers intelligent automatic bypass functions of lift travel. Video or load sensor analytics can be particularly useful for people counting and dispatching an appropriate number of lifts to required floors. For example, several lifts will be dispatched to a particular floor where crowds of people gathered in the lift lobby or in the lift car are detected after a banquet function.

For assigning the most efficient lift to transport people, the Destination Control System is an intelligent system using advanced traffic algorithms.

In addition, the system will record the traffic data history continuously for further analysis. This is an advanced real-time control system for specific lift traffic improvement.

- **Temporary Zoning during Peak Hours**

In office buildings, it is common to have heavy upward traffic congestion from the main floor lobby in the morning or after lunch hours. The temporary zoning mode can be applied to divide the lifts to service high and low zones instead of all floors during the peak periods. It is recommended that professional studies and surveys are undertaken to arrive at an optimal solution for the demarcation of high/low zones.

- **Idling Mode**

In low lift traffic situations, idling mode is recommended. In idling mode, the control system will command one lift to be non-operational in the group control command until a specified level of traffic demand is reached. This practice saves energy and offers a new control strategy.

Under "Idling Mode", a lift shall:

- (i) not respond to passenger calls
- (ii) reduce the car interior lighting to 50% or less of the total lighting power consumption automatically after idling for 10 minutes
- (iii) turn off the ventilation automatically after idling for 2 minutes
- (iv) turn off the air-conditioning automatically after idling for 10 minutes.

- **Service on Demand Operation**

- (i) Under “Standby Mode”, an escalator shall operate in a ‘crawling’ speed or stop until a user is passing by the escalator.

- **Remote Operation Monitoring System**

A remote operation monitoring system is an internet data control system for new lifts and escalators that has been designed for networking. It can provide other functions for remote monitoring and transmits lift or escalator data to a 24-hour service centre.

If any operational faults occur, the 24-hour remote centre will be alerted and appropriate actions will be triggered.





2.4 Emergency Preparedness

Building Emergency Preparedness is an effort to connect the emergency planning and response with the building users. The goal is to train personnel in basic emergency response actions, who know the building and occupants and can act as a resource and liaison to the stakeholders and building users.

An emergency action plan should identify all the potential hazards associated with the Lift and Escalator Installations, with a personnel responsibility matrix for allocating appropriate resources. The written plan should become an action document, updated according to an appropriate timeframe to ensure accurate information, such as updated contact information is provided.

Level 1

2.4.1

• Emergency Devices

If failure occurs in any emergency device of the lift (i.e. alarm, intercom system, emergency lighting, ventilation fan of the lift car), the Registered Lift Contractor shall be notified within 4 hours. If the device cannot be reinstated within 24 hours, EMSD shall be notified via a specified form.

• Emergency Contact List

The emergency contact list shall be displayed in a conspicuous place with the lift car or vicinity of escalator in case of any emergency situation, and may include:

- Power company for electrical failure
- Registered Lift or Escalator Contractor's 24-hours service centre
- EMSD's emergency contact

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- **Emergency Handling**

For all emergency situations including failure and trapped passengers, the Registered Lift Contractor shall arrive at the venue of incident within 1 hour (or within 30 minutes if trapped passenger is reported) upon being notified. The Registered Lift Contractor shall reset the system and rescue the trapped passenger.

For any serious incident including the death or injury of a person, the Responsible Person shall immediately notify the Registered Lift or Escalator Contractor to respond and report the incident to EMSD.



**GOOD
PRACTICE**

2.4.2

- **Emergency Procedures and Risk Assessment**

An emergency procedure identifies the responsibilities, actions and resources necessary to deal with an emergency. The procedure should require a consultation period with those who could be involved or affected by the emergency, and contain a program set out for testing, training and periodic review.

Before preparing a procedure, it is necessary to carry out a risk assessment, which should cover all scenarios of possible failures. The risk assessment should estimate the likelihood of an emergency event occurring, and how serious or damaging the consequences would be. The risk assessment should be carried out by appropriate safety professionals.

- **Regular Training on Emergency Procedures to Frontline Staff**

The frontline staff employed by the Responsible Person are expected to be conversant and they should receive regular training on emergency procedures. It is recommended that such a training should be conducted by Safety Supervisors every 3 months.

2.4.3

- **Regular Review and Drills**

When an emergency procedure and a risk assessment are in place, regular review and drills are recommended. A Registered Safety Officer (RSO) should regularly review the documents and conduct drills every 12 months.

Frontline staff are trained by the RSO on the emergency operations plan, rescue and procedure. Fire, incident and disaster drills shall be conducted yearly to ensure the fire alarm system is operational and evaluate staff response, knowledge and competence upon alarm activation.





2.5 Preventive Maintenance Procedures / Standards

The goal of Preventive Maintenance is to prevent equipment failure caused by fatigue, neglect, or normal wear, through replacing worn components before actual failure. Planned Maintenance and Condition Based Maintenance activities include partial or complete overhauls at specified periods, and include oil changes, lubrication, minor adjustments, and so on. Typical procedures recommend that personnel record equipment deterioration upon any inspection to facilitate the replace or repair worn parts before any system failure.

The Preventive Maintenance Program must include the methodology and record for all actions that are necessary to maintain the optimal functioning of the Lift & Escalator Installations. The required maintenance procedures will be unique to each property and the systems within these facilities.

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Level 1

GENERAL
PRACTICE

2.5.1

- **Statutory Requirements**

The Registered Lift or Escalator Contractor shall provide the monthly comprehensive maintenance services (including lubrication, inspection, cleaning, and adjusting of all items as necessary; repair, overhaul, replacement of defective parts; removal of protective guarding; and checking of all associated lift and escalator equipment). The Registered Lift or Escalator Contractor shall also maintain an efficient and prompt response to breakdowns, emergency call-outs or complaints to do with installation/equipment failure and/or unsatisfactory services.

Periodic maintenance of lifts or escalators including lubrication, inspection, cleaning and adjustment shall be conducted at intervals not exceeding 1 month.

Periodic examination of lifts shall include:

- (a) Thorough examination without any load in the lift car, at intervals not exceeding 12 months.
- (b) Thorough examination with full rated load in the lift car, at intervals not exceeding 5 years.

Periodic examination of escalators shall include:

- (a) Thorough examination without any load, at intervals not exceeding 6 months.
- (b) Thorough examination of the brake by load test or torque test, at intervals not exceeding 5 years.

- **Induction Training for O&M Team**

The Registered Lift or Escalator Contractor shall arrange induction training for its maintenance team on issues of safety, statutory requirements, repair techniques, performance targets, and work manner.

The goals of induction training are to build up a positive safety-conscious culture, learn new lift technology in design and O&M, increase knowledge of the company's safety systems and procedures, and understand the project specific requirements/information.





GOOD
PRACTICE

2.5.2

- **More Frequent Maintenance for Lift or Escalator and Maintaining Other Building Works and Building Services Installations**

More frequent maintenance such as weekly or bi-weekly maintenance of lifts or escalators is considered as good practice as it exceeds the statutory requirements.

In addition to the maintenance of the lift or escalator equipment, the Registered Lift or Escalator Contractor shall also report to the Responsible Person any defects of building work and building services installations. The building work includes the building fabric, cladding, concrete spalling, safety notices and signs, floor intersection guards and safeguards, building obstacles, etc. The building services installations include lighting, power socket, ventilation fan, air-conditioner in machine rooms, etc. This will provide an opportunity to maintain the lift well and lift or escalator system when no other maintenance contractors can enter the lift well or around escalator vicinity.

- **Handover Dispute**

During the course of the change in Registered Lift or Escalator Contractors, there could be potential to be concerns and disputes between the current and incoming contractors. To resolve this, the Responsible Person may commission a third-party independent lift or escalator audit to produce an audit examination report that serves to address the issues under dispute and to settle responsibilities of both contractors. The third-party independent lift or escalator audit shall be carried out by an independent Registered Lift or Escalator Engineer. or escalator audit shall be carried out by an independent Registered Lift or Escalator Engineer.





BEST PRACTICE

2.5.3

• Predictive Maintenance by Technical Approach

It is recommended that the Responsible Person employ high-quality and experienced lift professionals who would be put in charge of examining operation data, breakdown data, fault history and equipment condition, etc., as well as evaluating the predictive maintenance programme.

The evaluation will include:

- Early replacement of parts before fault occurs
- Regular intervals of independent audits
- Advice on spare part availability
- Advice on replacement, modernisation or major alteration
- Comment on maintenance quality

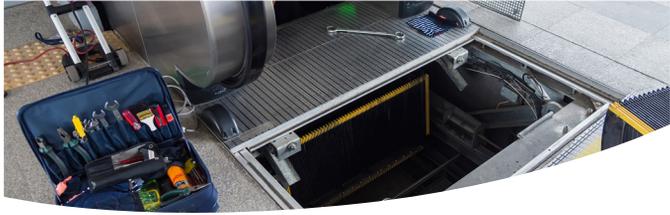
• Self-Diagnostic Program

If the lift is designed to be equipped with a self-diagnostic program, the self-diagnostic program should be set to run once a week at selected hours or as specified by the Responsible Person. During the running of program, lifts will travel inside the lift well continuously and data will be generated for further analysis to ensure the safe working condition of the lifts. It is recommended that the contractor use this data to prepare a detailed report on regular basis.

• Third Party Independent Lift or Escalator Audit

It is advisable to employ a third-party professional to conduct an independent lift or escalator audit on all lifts or escalators at least once a year. After the inspection, the third party shall provide an audit report that includes, but is not limited to, the following information:

- Log book analysis
- Findings with photo records
- Visual check on all major equipment
- Functionally test for all safety components
- Short term and long term recommendations
- Lift or escalator replacement / modernisation recommendations
- Maintenance review
- Breakdown trend analysis



- **Independent Periodic Examination of Lifts or Escalators**

Under the current system of lift or escalator inspection, a Registered Lift or Escalator Engineer who is an employee a particular Registered Lift/ Escalator Contractor, is charged with the job duties and responsibilities of inspecting and signing off on the lifts or escalators of his employing company.

The Responsible Person is encouraged to promote professional, independent and quality works. In order to enhance the transparency and independence of the inspection works, employment of an independent Registered Engineer to carry out periodic examinations is considered appropriate.

- **Application of QR Code by Mobile Phone**

The Registered Lift or Escalator Contactor's maintenance team is recommended to access lift or escalator information using mobile phone applications with QR code scanning and access passwords. The information should be specific to each lift or escalator, and may include design documentation, asset information, history of spare parts, and available stock of the parts.

- **Remote Monitoring System on Faults**

A lift remote operation monitoring system is an internet data control system for new lifts that has been designed for networking lifts. It shall provide other functions for remote monitoring, faults received, and data transmission to a 24-hour service centre.

A sophisticated self-checking programme can function on the basis of big data in maintenance statistics comparing the operation status of critical components. If a component is reaching the end of its service life cycle, the programme will prompt for early parts replacement. This is an advanced technology for predictive maintenance.

- **Lift or escalator Replacement Plan**

As some lifts or escalators operate for over 20 years, equipment breakdown becomes more frequent, and spare parts are likely to be unavailable or obsolete. The Responsible Person is recommended to consider full replacement or major modernisation of these lifts. A Lift or an Escalator Replacement Plan should be in place for implementation procedures.

- **Safety Devices Replacement Plan**

Safety devices in lifts or escalators are considered as the most critical components. It is recommended that replacement of safety devices should be based on their condition, and as according to EMSD's circular letters or guidelines. A Safety Devices Replacement Plan should be in place following evaluation by the registered lift or escalator contractors or professionals.

- **Timely Reporting of Maintenance Status via Mobile Application**

It is recommended that a mobile application is used to provide instant notification to the selected Responsible Person group for any fault log, contractor arrival time, resuming time, etc. This will enhance the management of lift or escalator service in a high technical manner.



2.6 Corrective Maintenance

The goal of every maintenance team is to be fast and effective, especially when it comes to unexpected breakdowns of critical plant and equipment, aiming to achieve:

- i) Reduced duration of both planned and unplanned downtimes;
- ii) Reduced cost of running a reactive maintenance strategy;
- iii) Reduced overall cost of maintenance operations.

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Level 1

GENERAL
PRACTICE

2.6.1

• Induction Training for O&M Team

The Registered Lift or Escalator Contractor shall provide its maintenance team with induction training covering issues of safety, statutory requirements, repair techniques, performance targets and work manner.

The goals of induction training are to promote a positive safety-consciousness culture, new lift technology in design and O&M, knowledge of the company and its procedures, and understanding of project specific requirements/information.

Specific training shall be tailored for particular buildings that have repeated faults in order to learn and adopt the right approach for troubleshooting and repair, and hence reduce the chance of having the same fault happen again.

• Reporting of Not Completing the Rectification Works within a Specific Period of Time

Development and use of a reporting system shall ensure technical transparency of repair situations, should the repair work duration extend to more than 8 hours. The report shall include causes of breakdown and the reasons for delay in service resumption; for example, spare part availability, diagnostics, labour, etc. The report shall be sent to the Responsible Person.

2.6.2

- **Monthly Fault Call and Emergency Repair Report for Performance Evaluation**

Every month, a report should be prepared from a database, which is set up for recording the history of all fault logs. The report should cover all kinds of faults due to mechanical, electrical and electronic failures, and vandalism, and include data pertaining to timing of fault reported, fault call made, repair team arrival, downtime, resumption of services, etc. For mechanical, electrical and electronic failures, detailed descriptions of causes, findings and repair methods shall be provided. This fault report should be detailed enough for analysis to prevent “repeated faults”, and trend analysis of breakdown.

- **Proper Documentation of Corrective Maintenance Record**

For every fault, the cause should be identified and analysed. Detailed information of the Corrective Maintenance record should include the following items:

- Time of fault reported
- Time of fault call to contractor
- Time of contractor arrival
- Time of resuming service
- Breakdown period
- Cause of fault, described in enough detail for analysis
- Repair items
- Spare parts used
- Lift machine room defects
- Building work defects
- Lift pit defects, etc.





**BEST
PRACTICE**

2.6.3

- **Timely Reporting of Fault Calls Maintenance Status via Mobile Application**

It is recommended that a mobile application is used to provide instant notification to the selected Responsible Person group for any fault reported, contractor arrival time, service resumption, etc. This will enhance the management of lift service in a high technical manner.

- **Sufficient Critical On-site Spare Parts**

In certain high-demand buildings and estates with a considerable number of similar buildings, it is necessary for the Owner to require the contractor to maintain sufficient stock of frequently used components, materials, and spare parts, on-site for immediate replacement in repair work. The actual on-site spare part inventory list should be monitored with cross-referencing to fault reports and spare parts used.

- **Trouble-shooting Guide**

The Registered Lift or Escalator Contractor should be requested to establish a set of troubleshooting guidelines. The goals of the guidelines are to provide fast guidance, clear advice and instructions to the maintenance team in order to identify the fault components or programmes. Use of a flowchart to illustrate the troubleshooting procedures is highly recommended.

- **Online Step-by-Step Maintenance Instruction Guide**

The Registered Lift or Escalator Contractor should establish an online maintenance troubleshooting software or maintenance guide to assist the maintenance team in the diagnosis process. Such software shall provide a series of troubleshooting questions for several common types of breakdowns and step-by-step repair/replacement instructions to solve the problem. The software shall be supported by technical experts.



2.7 Maintenance Record Management

Good management of maintenance records is essential for ensuring that a piece of equipment is performing in line with the manufacturer's warranty, and can help to determine its preventive maintenance schedule. It also assists service technicians in diagnosing repeat problems with a plant or equipment. Clear records can also provide assistance in legal proceedings, if ever necessary.

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Level 1

2.7.1

- **Proper Documentation of Preventive Maintenance Plan and Record at least 3 years**

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PRACTICE**

According to the Lifts and Escalators (General) Regulation (Cap. 618A) Part 2 Division 1 Section 2, the Responsible Person for a lift or escalator shall keep the record of the log-book for at least 3 years. The log-book shall be in the specified form (LE50L for lift and LE50 for escalator), and contain specified information and particulars such as description of the installation and installation contractors, specifications of lift or escalator, maintenance contractor and maintenance duration for lifts or escalators, details of lift or escalator work, maintenance schedule, etc. Such a record shall be provided for an enforcement officer's inspection within 3 days of the date of receipt of the request.





**GOOD
PRACTICE**

2.7.2

- **Computerised Maintenance Management Information System**

The Registered Lift or Escalator Contractor should be requested to establish a Computerised Maintenance Management Information System in order to input, analyse and review the database of the Maintenance Records, Fault History and Preventive Maintenance Plan. The maintenance management information system shall collect data from multiple online systems, analyse the information, and report data to aid in management decision making. By using such system, the Registered Lift or Escalator Contractor shall improve the decision-making process by using up-to-date and accurate data. Moreover, it can maximise efficiency with an overview of the operation, performance feedback, and comparison of results to planned performance by identifying strengths and weaknesses.



**BEST
PRACTICE**

2.7.3

- **Regular Review on Maintenance Records and Fault History**

The Responsible Persons, senior management of the building management office, and maintenance contractor, are recommended to review maintenance records and fault history periodically, for example, quarterly. The maintenance records and fault history should reflect the equipment condition, maintenance quality and passenger behaviour. Based on these items of information, the maintenance strategy and management arrangement, such as maintenance schedule, duration of each maintenance and maintenance items, should be reviewed to improve the lift or escalator performance and troubleshooting time.

- **Digitise the Log-book**

It is recommended that information and particulars of log-books should be recorded in an electronic format. To access the lift works record, authorised personnel of the building management and the registered contractor can scan a QR code at the venue or through an encrypted channel with authorisation. The electronic log-book should be conveniently uploaded to the cloud storage platform, and available for download to a computer, tablet, smartphone, or any other kind of reading device, instantaneously.

- **Big Data Analysis**

The Registered Lift or Escalator Contractor is recommended to make use of the latest technology of “Big Data Analytics” to analyse maintenance records. This advanced technology software should be developed by the lift or escalator manufacturers or software companies. The maintenance data of lifts or escalator and critical components should be recorded and transferred to the system for further analysis and comparison against benchmarks. The data from the same model or series of lift or escalator will be gathered, compared and listed systematically for maintenance planning and management. Big maintenance data analysis could provide useful statistics results, such as the total number of operating equipment, average number of equipment breakdowns per month, accumulated number of equipment breakdowns in current month, most frequent fault log records, etc.

- **Use Of Artificial Intelligence**

Artificial Intelligence (AI) can be used to provide decision-making tools and predictive reminders for Lift & Escalator Installations. A self-learning algorithm of AI uses the big data analysis results to predict future patterns and generate reminders for maintenance activities.

The following areas can take advantage of AI for maintenance data analysis of the following:

- Life span of particular lifts or critical components
- Condition of particular lifts or critical components
- Prediction of spare parts requirement
- On-time spare parts procurement and delivery arrangement
- Streamline maintenance schedule and maintenance items of each visit





2.8 Spare Parts Management

Spare parts management refers to a systematic and structured way to store and extract spare parts efficiently for any maintenance activity. A good system should minimise downtime during service disruption and simplify equipment maintenance.

Level 1

GENERAL PRACTICE

2.8.1

- **Maintain Sufficient Spare Parts at Warehouse**

The Registered Lift or Escalator Contractor shall maintain sufficient spare parts at the warehouse for the replacement of defective components. The warehouse(s) shall have adequate space to store the spare parts and necessary tools for emergency repair works. The stock size of the spare parts shall be proportional to the number and model of equipment undergoing maintenance works.

- **Provide Local Warehouse Location and Information**

The Registered Lift or Escalator Contractor shall provide the local warehouse locations and information. The Responsible Person shall visit the warehouse to confirm sufficient spare parts, and request information about methods of purchasing spare parts, time required for delivery, etc. With such a visit, stock-taking, the quantity, delivery and availability of spare parts can be ensured.



2.8.2

- **Maintain Sufficient Spare Parts**

A common reason for extended equipment downtime is that the spare parts cannot be delivered to the site on time. In order to minimise the delivery time of spare parts from warehouse to the site, the Registered Lift or Escalator Contractor is recommended to maintain sufficient stock of general spare parts, especially for long lead items, on site, for maintenance and emergency use. In addition, the Responsible Person is required to provide adequate storage area for keeping sufficient spare parts on-site.

- **Provide an On-Site Spare Parts List**

The Registered Lift or Escalator Contractor is recommended to establish an on-site spare parts list in accordance with the breakdown record and analysis. Based on breakdown frequency and impact level to users, the demand for spare parts can be classified into different priority rankings. The on-site spare parts list should include spare parts with the highest demand ranking. The on-site spare parts list should be reviewed periodically by the Responsible Person and Registered Lift or Escalator Contractor according to the up-to-date breakdown analysis.

- **Provide Supplier List Of The Spare Parts**

A supplier list of spare parts should be established by the Registered Lift or Escalator Contractor in order to secure its supply chain of spare parts. If the original supplier cannot provide the required lift or escalator spare parts, the Registered Lift or Escalator Contractor should identify alternative suppliers in the market. The Registered Lift or Escalator Contractor should keep a good communication channel with the suppliers on the supplier list. The content of the supplier list should include, but not be limited to, the following:

- Name of supplier
- Address of supplier
- Contact number of supplier
- Catalogue/type of supplier
- Production capacity
- Supplier's ranking



**BEST
PRACTICE**

2.8.3

- **Derive the Type and Quantity of On-site Spare Parts Required from Fault History, Maintenance Record, Equipment Age and Criticality, etc.**

The requirement of spare parts can be identified by not only general design factors, such as equipment age and criticality, but also individual condition factors, i.e. fault history and maintenance record. While the lift or escalator components are deteriorating to their end of service life cycle and increasing faults occurring, sufficient spare parts should be stored on-site for scheduled replacement or emergency use. Hence, type and quantity of on-site spare parts should be derived based on the general design factors and further finetuned according to the individual condition factors.

- **Identify Obsolescent Equipment**

There are several reasons for original suppliers to stop producing specific spare parts, such as eliminating harmful raw materials in production process and changing to new components from supplier's new product lines. In the lift and escalator industry, the manufacturing cycle of particular models and parts is around 25-30 years. Hence, the Registered Lift or Escalator Contractor should make all efforts to identify any obsolescent equipment. When the equipment production is stopped and no alternative is provided in the market, the spare part can be identified as obsolescent equipment.

- **Predict Spare Parts Requirement Using AI For Advance And On-Time Spare Parts Procurement**

Rather than using the traditional method of maintaining sufficient spare parts in the on-site storage, it is recommended to predict the spare parts requirements using AI technology. One of the AI applications in lift and escalator industry is using big data analytics software to predict the service life cycle of particular parts. With the real-time condition of parts and prediction of the service lifecycle, the spare parts requirement and on-time spare parts procurement can be achieved smartly and accurately by AI.



2.9 Addition, Alteration and Replacement (Planning and Implementation)

This includes the analysis, procurement, and management on additions, alterations as well as disposal and replacement of lift & escalator Installations to meet the organisational long-term objectives.

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Level 1

2.9.1

GENERAL
PRACTICE

- **Replacement as Corrective Maintenance**

Under the corrective maintenance philosophy, the Responsible Person makes decisions to adopt additions, alterations and replacement and hence takes the most proactive approach to enhance lift safety and management. The alterations and additions (A&A) involve addition, change and replacement of various lift or escalator equipment components. These A&A works shall be carried out by Registered Lift or Escalator Contractors.

- **Alterations and Additions as per User Requirements**

The A&A works shall be considered in accordance with the user's requirements on lift cars, lift shaft equipment, machinery space of escalator and equipment in the lift machine room. Major A&A works shall involve automatic devices, auxiliary rope-fastening devices, car-levelling devices, lift top operation device, lift-way or lift car door contacts, lift-way or lift car door interlocking devices, lift roller guide shoes, rope equalisers for lift, lift travel distance, speed, safety components, lift access switches, lift ropes, guide rails inside lift-way, controls, driving machine, braking system, non-reversal device of escalator, overspeed protection device of escalator, safety equipment of escalator, etc.

- **Computerised Testing and Commissioning Certificate and Record Of Tests**

The Responsible Person shall be required to employ the Registered Lift or Escalator Contractor to carry out all major alteration works, and arrange examination of the lift or escalator by Registered Lift or Escalator Engineer before the resumption of the normal operation of the lift or escalator. After the major alteration works, the Registered Lift or Escalator Contractor shall submit the testing and commissioning certificate and record of tests by uploading the information to EMSD's e-platform in order to obtain the required certificates.



**GOOD
PRACTICE**

2.9.2

- **Modernisation Planning**

As recommended by EMSD, to enhance lift or escalator reliability and safety, the Responsible Person is encouraged to consider the installation of lift or escalator modernisation components instead of total lift or escalator replacement. The installation of a double brake, an unintended car movement protection on brake, ascending car overspeed protection, advanced car door mechanical lock and door safety edge, intercom & CCTV, and automatic rescue devices, are usually recommended. For escalator modernisation including the installation of skirt panel safety devices, skirt panel deflector devices, emergency stop switches, landing floor plate safety devices, auxiliary brake, step sagging safety devices and missing step safety devices, change of control and/or motor for the service on demand features, are usually recommended.

To plan for lift or escalator modernisation, it is recommended for the Responsible Person employ an experienced Independent Lift or Escalator Consultant to evaluate the existing installation.

- **Replacement Planning**

If a Responsible Person is to consider a plan for total replacement of a lift or an escalator, the following major factors should be considered.

- Equipment age (typically exceeding 25 years operation)

- Fault frequency (frequently experiencing faults regardless of its maintenance frequency)
- Spare parts availability (equipment has become obsolete and spare parts will no longer be produced by the manufacturers)
- Law and safety requirements (do not comply with the latest law and safety requirements)

An alternative to determining the need for lift or escalator total replacement is to approach the Registered Lift or Escalator Contractor to provide professional recommendation, including studying the maintenance history, trend analysis of faults type and frequency, spare and defective part studies, computer modelling of lift or escalator replacement, etc.

- **Detail Replacement / Implementation Planning To Minimise Impact To User Operation**

To plan for the replacement of lifts or escalators, it is recommended that the Responsible Person employ an experienced independent lift or escalator expert to assess the work involving the following considerations for the sake of minimising impact to user operation and facilitating project implementation and management:

- Feasibility studies of replacement of the lifts with possibility to upgrade lift capacity and speed with the current lift shaft provisions on the structural and mechanical aspects.
- Feasibility studies of replacement of the escalators with possibility to allow the service on demand features with the current escalator wellway provisions on the structural and spatial aspects.
- Project planning involving tendering, administration, management and various contract issues.
- Planning for stage replacements in the case of multiple lifts or escalators.
- Quality control of workmanship.
- Supervision of contractors' work and consideration with other trade contractor.
- Progress monitoring.
- Testing and commissioning work.
- Handover.
- Defect liability, rectification and monitoring.
- Contract completion.



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PRACTICE**

2.9.3

- **Conduct Holistic Review on System Performance In The Planning And Design**

During the stage of examining the A&A works and replacement of lifts or escalators, it is a commendable practice to conduct an overall and holistic review on the lift or escalator system performance in the planning and design for equipment replacement. The factors to be considered shall include enhancing system reliability, operational safety, operational efficiency, energy saving and efficiency, detailed further below:

- New installation normally provide innovative and up-to-date technologies for best performance in operation reliability.
- New lifts normally operate safety and smoothly with less faults in the early years.
- Newly replaced installation with hi-tech machineries can normally provide good operation and smooth riding comfort. Some design provisions may allow faster speed and more capacity.
- New installation may include re-generation of electricity provisions to provide energy efficiencies.
- New installation often supports hi-tech energy efficient motors to provide energy efficiencies.

- **Seamless Implementation with Backup Arrangement**

During the implementation of lift or escalator replacement, it is necessary to consider backup arrangement of lift or escalator service in order not to seriously affect the operation service of the lift banks. For example, if one lift is taken out of operation for replacement works, the lift bank services during the morning/lunch peak hours can be supplemented by a nearby passenger lift in the back of house area. After peak hours, the back of house passenger lift will resume its normal function. For the case of escalator, sufficient notice and sign shall be given to passengers to use a nearby passenger lift if available.

As there is potential for other lift faults to arise during lift or escalator replacement, it is always necessary to plan ahead for backup arrangements for different scenarios with suitable personnel on standby for efficient operation arrangements.

- **Consideration of Life-Cycle Cost In Planning And Design**

In order to provide the best service for grade A office buildings, Responsible Persons should consider life-cycle cost analysis for lift or

escalator replacement work. Lift or escalator service for high grade buildings or venue for public service cannot be deteriorated due to spare parts, frequent faults, etc. To achieve a high-performance building standard, new design, innovative technology and high-performance lift or escalator systems may be considered even when the lift or escalator is less than 20 years old.

To justify efficient operations and energy efficiency, it is common to consider life-cycle costing. New lifts or escalators require significant initial costs, but provide lower operation costs due to efficient motors and advance controls, and lower maintenance costs during the first year of operation due to manufacturer warranty and elimination of frequent replacement of aged parts and components. Aged installation involve high operation costs and high maintenance costs due to traditional motors and control, frequent breakdowns, etc. To act as an aid in lift or escalator replacement decisions, conducting a 25-year life cycle cost analysis is recommended to produce a solid evidence-based report to consult.

- **Employ Independent Consultants for Project Management**

It is common for the Responsible Person to employ an Independent Consultant to take up the role of lift or escalator replacement project management. The Consultant should carry out the following scope, and assist the Responsible Person with implementation:

- Feasibility studies of replacement of the lifts with examination of upgrading lift capacity and speed.
- Feasibility studies of replacement of the escalators with examination of using the service on demand features.
- Morning / lunch peak survey and recommendations on improvement of lift traffic pattern.
- Conduct life-cycle cost analysis.
- Holistic review of A&A and replacement work.
- Backup arrangement during implementation.
- Project planning involving tendering, administration, management and various contract issues.
- Planning for stage replacements in the case of multiple lifts or escalators.
- Project management and funding application, if applicable.



2.10 Incident Management

Incident management refers to the "the combination of facilities, equipment, personnel, procedures and communications operating within a common organisational structure, designed to aid in the management of resources during incidents".

When a service is disrupted or fails to deliver the promised performance during service hours, it is essential to restore the service to normal operation as quickly as possible. In addition, any condition that has the potential to result in a breach or degradation of service ought to trigger a response that prevents the actual disruption from occurring. These are the objectives of incident management.

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Level 1

GENERAL
PRACTICE

2.10.1

- **Notify Relevant Parties as per Statutory Requirements**

It is a statutory requirement that the Responsible Person shall notify EMSD, in writing by using the specified form, and the Registered Lift or Escalator Contractor, of any reportable lift or escalator incidents, including the death or injury of a person, failure of the main drive, breakage of any suspension rope, failure of overspeed governor, safety gear, overload device, interlocking device of the lift door or brake, failure of escalator brake, step chain, drive chain, or safety equipment, within 24 hours of coming into knowledge of the incident.

If the lift or escalator involved in the incident cannot resume operations within the specified 4-hour period, the Registered Lift or Escalator Contractor shall notify all users by displaying a notice on the specified form describing the type of incident involved, and reason for suspension.

- **Conduct Internal Incident Investigation**

Upon receiving an incident notification from the Responsible Person, the Registered Lift or Escalator Contractor shall carry out an investigation and submit a detailed report to EMSD within 7 days.

Internal incident investigation shall be carried out by Registered Lift or Escalator Contractor. The process for reporting, tracking, and

investigating incidents involves the checking of staffing, performance, and documentation, and tracking of investigations on process safety incidents and the trending of incident investigation data to identify recurring incidents.



GOOD PRACTICE

2.10.2

- **Conduct Incident Investigation and Streamline Rescue Time**

For serious incidents involving serious injury and death, internal investigation by Registered Lift or Escalator Contractor may not be sufficient. It is recommended that a thorough investigation with sufficient details should be covered by an independent professional third party.

Breakdown of a lift or power failure of a building commonly leads to the trapping of lift passengers. With a thorough review of the incident investigation report, the Responsible Person shall be able set a time limit within which the Registered Lift Contractor must send personnel to rescue the trapped passengers. The definition of the rescue time limit in the maintenance contract should consider the Registered Lift Contractor's service centre location, number of emergency staff during and outside of office hours, emergency procedures in case of a typhoon, etc.

The Responsible Person should set up an incident management procedure for staff to learn and be trained to streamline rescue time and work.

- **Establish Emergency Manual**

During lift or escalator incidents, it is always a good practice to anticipate response from the team employed by the Responsible Person. Lift or escalator incidents can be categorised in cases of injury, death, trapping, water leakage and flooding, typhoon situations, etc. The development of an Emergency Procedures Manual should equip employees with specific procedures and guidelines for dealing with a variety of different incident situations that may occur. Training of staff shall be necessary to cope with the different types of incidents. This manual should provide guidelines for specific actions by employees and workers and should be reviewed from time to time.

- **Conduct Third Party Independent Lift or Escalator Audit**

For serious incidents involving serious injury and death, internal investigation by Registered Lift or Escalator Contractor may not be sufficient. It is recommended that a thorough investigation to a reasonably detailed extent should be carried out by a qualified independent third party. A third-party independent audit should include investigation of root cause to identify the most probable deficiency or failure reason, such as component functions, maintenance conditions, etc. The Responsible Person may consider the recommendations from the independent professionals for enhancing the maintenance of the lifts or escalators.

- **Conduct Necessary Alteration / Addition for System Reliability**

Serious incidents may arise from old lifts or escalators without the installation of the up-to-date safety devices recently recommended by EMSD to enhance system reliability and safety. The Responsible Person should seriously consider the installation of these devices to prevent the future occurrence of incidents. The installation shall be regarded as alteration and additional work.

- **Review on Operation And Maintenance Procedures**

Following serious incidents and subsequent investigation through independent third party audits, the lift or escalator professional will give recommendations on O&M.

For operations, lift modernisation including the installation of a double brake, unintended car movement protection device on brake system, ascending car overspeed protection, advanced car door mechanical lock and door safety edge, intercom & CCTV, and automatic rescue devices, are usually recommended. For escalator modernisation including the installation of skirt panel safety devices, skirt panel deflector devices, obstruction guards, emergency stop switches, landing floor plate safety devices, auxiliary brake, step sagging safety devices and missing step safety devices, are usually recommended. For maintenance, various recommendations on preventive and corrective issues should be implemented into the maintenance contract.





**BEST
PRACTICE**

2.10.3

- **Sharing of Critical Incidents with All O&M Personnel**

It is strongly recommended that incident information be shared among all O&M staff within the same organisation/trade. The sharing of incident experience is valuable as it will provide an information platform to all staff to learn and become aware of critical issues underlying various incidents. Each incident experience should upgrade and improve the contractor's maintenance quality.

- **Prevent Re-Occurrence of Incidents**

Incident review and sharing are important issues in providing good maintenance quality. Incident faults occurring in any particular model/type of lift or escalator should provide insight to the same type of lift or escalator installed in another venues. Precautionary actions should therefore be taken in order to eliminate similar problems in the other venues.





2.11 Environmental and Safety Management

Environmental and Safety Management ensures that operations are safe for all building users and visitors. Building Owners are obliged to implement all reasonable precautions to protect the environment, and maximise the building's life cycle efficiencies.

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Level 1

2.11.1

- **Fulfil Statutory Requirements on Environmental And Safety Management**

GENERAL
PRACTICE

Under the Factories and Industrial Undertakings (Safety Management) Regulation (Cap. 59), proprietors or contractors of certain industrial undertakings are required to develop, implement and maintain, in respect of their undertakings, an environmental and safety management system which contains a number of key process elements. Issues regarding lift and escalator safety refer to the proper O&M of lifts and escalators.

The relevant environmental legislations relating to lift and escalator installation are the Noise Control Ordinance (Cap. 400) and the Waste Disposal Ordinance (Cap. 354).

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Level 2

2.11.2

- **Establish Environmental Management System and Safety Management System**

GOOD
PRACTICE

Establishing an internationally recognised system that exceeds statutory requirements on lift system is regarded as a good practice.

The Environmental Management System (ISO 14001) and Safety Management System (OHSAS 18001 or ISO 45001) involve planning, developing, organising and implementing. Planning is the process of determining in advance what should be accomplished. Developing is the process of determining how the safety and health objectives should be realised. Organising is the process of prescribing formal relationships between people and resources in the organisation to accomplish objectives. Implementing is the process of carrying out or putting into practice the plans to achieve the desired objectives, with appropriate and adequate control to ensure proper performance in accordance with the plans.

• Adoption of Eco-Friendly And Sustainable Systems / Practices

Regarding the adoption of eco-friendly and energy saving lift & escalator systems and sustainability in design, various initiatives can be considered:

- Machine-room-less system
- Double decker lifts
- Computerised control system
- In-Cab sensor
- Destination dispatch software
- Regenerative drive system

Regarding noise pollution controls, the following issues relating to lift installation are to be considered:

- Location of machine room at plant room with thick walls with sound adsorption materials, and soundproof doors
- Selection of quiet driving machines
- Adoption of practices such as regular lubrication moving parts, replacement of worn-out components and inspection of equipment alignment
- Use of anti-vibration pad or vibration isolator to avoid structural vibration transmission
- Selection of silent type exhaust fans



Regarding waste disposal controls, the following issues relating to lift installation are to be considered:

A trip-ticket system is a recording system for orderly disposal of construction waste to disposal facilities by trucks. The implementation of such a system ensures a certain level of accountability. Moreover, it facilitates the recording of waste as it arrives at the landfill or public filling area and minimises the potential for cross-contamination with other wastes, which the vehicle operator may pick-up en route to the disposal facility.

- **Proper Documentation Of The Environmental And Safety Management System**

When an environmental and safety management system is developed, comprehensive and accurate documentation of the system shall be required. All policies, goals and objectives, duties and responsibilities of key environmental and safety personnel, policies and procedures that make up the program should be documented. Documentation is typically consolidated into an environmental and safety management system manual, or in other operations manuals or an electronic database system.

2.11.3

- **Third Party Audit On Execution Of The Environmental Management And Safety Plan**

Third party audit is conducted primarily for the purpose of assessing the execution of management system, ongoing behaviour, performance and risk that each third party relationship represents to a company. This will include both contractual and non-contractual parties. The audit should take place every year.

- **Identify Improvements On The Environmental Management And Safety Plan Regularly**

Environmental and safety review constitutes the “feedback loop” which enables the relevant industrial undertaking to reinforce, maintain and develop its ability to reduce risks to the fullest extent and to ensure the continued effectiveness of the environmental and safety management system. The review should be conducted by a review officer who can be an employee of the relevant industrial undertaking to be reviewed or an outsider who is not an employee of the relevant industrial undertaking. He shall be a person who is capable of competently carrying out a review. He will identify any areas of improvement. He should have a good understanding of the operation of lifts and escalators; and the legal requirements in Hong Kong relating to industrial safety and health, and should have received appropriate training on how to review the effectiveness of an environmental and safety management system with a view to improving it.

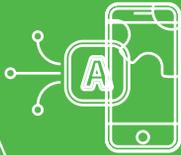


- **Monthly Report On Safety And Environmental Issues Of The Site Concerned**

A monthly report should be provided by the contractor to summarise the following items:

- (a) The environmental and safety performance across the contract works;
- (b) Environmental and safety risk across the maintenance works;
- (c) Any significant environmental and safety incidents for the month and any recent updates on past incidents;
- (d) The progress against the environmental and safety work program.





2.12 Application of Technologies

Technology and tools can be used to lower the cost of implementing and managing O&M best management practices.

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Level 1

GENERAL
PRACTICE

2.12.1

- **Adopt minimum market available technologies**

- Adopt minimum market available technologies as required by statutory requirements (e.g. Code of Practice on the Design and Construction of Lifts and Escalators);
- Check and ensure that relevant statutory requirements are fulfilled when adopting new technological solutions.



GOOD
PRACTICE

2.12.2

- **Latest Computerised Control Systems Including Self-Learning System**

The latest computerised control systems, such as a self-learning system, is a technology using algorithms that learns from existing traveling data to automatically improve the lift performance. During the learning period, the lift control system collects, stores and evaluates data. The traveling data will be used to study traffic patterns and optimise the lift dispatching pattern so as to minimise the time spent by passengers in the lift. This self-learning system, for instance, will assign an appropriate number of lifts to floors which have been identified with the highest population requiring transportation.

- **On-Site Adjustable Operation Program**

Operation patterns of lifts will vary depending on the type of building, which are interrelated to building activities and population distribution. An on-site adjustable operation program is important to address issues including non-service floors, dedicated lift services, bypass floors for speedy service, etc. in a short period of time. Lift technicians or even the property management team can adjust the operation program easily in the computerised control station at the building.

- **Implementation of Energy Regenerative unit**

For conventional lifts, the power generated by the traction machine is dissipated as heat in the building. Lifts equipped with regenerative units act as a power generator when travelling downwards with a heavy load or upwards with a light load. Moreover, lifts equipped with regenerative unit can capture and condition the regenerated power to be fed directly into the building electrical system for immediate consumption. Compared to conventional lifts, regenerative lifts are 20% to 30% more energy efficient.

In general, for all new lift installations with rated speed over 2.5 m/s, energy regenerative units are included as standard design.

- **Service on demand control**

A lift control system with demand control functions will distinguish peak hours and high demand, and adjust lift service efficiency accordingly. The latest lift group control system allows multiple lifts to work together systematically and optimally, aiming to provide maximum convenience to passengers. Lift control systems should be designed to detect and manage the operation patterns in different nature buildings.

There are three elements, speed of lift, numbers of lift and serviced floor, and can be adjusted as according to the exact population flow for every landing floor during the peak traffic hours. This also applies to high / low zone assignment.

An escalator control system with passenger detection system will distinguish the idling period during traffic demand and adjust the escalator service efficiency accordingly. The escalator will resume to its normal speed when passenger is approaching the escalator at the upper or lower landing subject to its entrance side. Further consideration in respect of safety, operation and riding quality should be considered when deploying automatic stop at low traffic demand period.



**BEST
PRACTICE**

2.12.3

- **Video or load analytics for lift control during peak usage periods**

Video or load analytics is a technology which is used to identify or verify numbers of passenger waiting on each landing floor from a video source, or if inside the lift car from a load sensor. In general, video or load analytics works through identifying humans, analysing the demand and providing solutions.

As there may be cases of lift passengers in wheelchairs, baby carriages, and other large objects that occupy space but do not cause an exceedance of the lift rated load, the advanced system evaluates the occupied lift car floor area for floor bypass services.

- **Remote monitoring system**

A remote monitoring system is an internet data control system for new lifts that have been designed for networking lifts. It shall provide other functions for remote monitoring, faults received, and data transmission to a 24-hour service centre.

A sophisticated self-checking program can function on the basis of big data in maintenance statistics by comparing the operation status of all critical components. If some components are deteriorating to their end of service life cycle, the program will prompt for early parts replacement instead of waiting for the actual fault to happen. This is an advance technology for predictive maintenance.

- **Application of IoT and big data analytics**

The latest technology of IoT and “Big Data Analytics” to analyse maintenance records is highly recommended as best practice. This advanced technology can be developed by the lift or escalator manufacturers together with software companies, and can obtain the necessary data by installing non-intrusive sensors on the lift or escalator equipment. The data can be transmitted to the client or lift companies through the mobile network or LAN network. The maintenance data of lifts or escalators and critical components will be recorded and transferred to the system for further analysis and comparison against benchmarks. The O&M data from the same model or series of installation will be gathered, compared and listed systematically for corrective and planned maintenance, and management. Big data analysis for maintenance data could provide useful statistics results, such as the total number of operating equipment, average number of equipment breakdowns per month, accumulated number of equipment breakdowns in current month, most frequent fault log records, trends of faults for certain components etc., and could lead to predictive maintenance in the future.





2.13 Stakeholder Management

Stakeholder management is a set of techniques that harnesses the positive influences and minimises the effect of the negative influences. It involves systematic identification, analysis, planning and implementation of actions designed to engage with stakeholders. Stakeholders are individuals or groups with an interest in the building or facility operation because they are involved in the work or affected by the outcomes. Most buildings or facilities and portfolios will have a variety of stakeholders with different, and sometimes competing, interests. These individuals and groups can have significant influence over the eventual success or failure of the work.

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Level 1

2.13.1

• Notification of Stakeholders on Service Interruption

- Notify stakeholders (e.g. property management company, incorporated owners, building occupants and tenants) on the works schedule of maintenance activities and installation works which involve service interruption;
- Implement an emergency plan to minimise service suspension.

GENERAL
PRACTICE



**GOOD
PRACTICE**

2.13.2

- **Notification of stakeholders on scheduling maintenance activities involving service interruption**

The Registered Lift or Escalator Contractor should prepare and submit the maintenance program for the approval of stakeholders. Upon the approval of the maintenance program, the Registered Lift or Escalator Contractor should provide the maintenance schedules for all the preventive maintenance tasks, to be based on both manufacturers' recommendations and other authoritative sources. Moreover, the Registered Lift or Escalator Contractor shall also advise and recommend the features in which replacement and/or repair are required before the product or component life-cycle has come to an end.

- **Coordination with stakeholders on service needs to improve system reliability and performance**

The Registered Lift or Escalator Contractor should provide inspection and servicing regularly, for which the frequency shall not be less than the statutory requirement. All maintenance works should be well planned, coordinated, and organised with sufficient staff and adequate tools in order to meet the satisfaction of stakeholders. The Registered Lift or Escalator Contractor should meet with stakeholders to report any inspection findings, unsatisfactory items and the worn components regularly. Discussions should be recorded.

2.13.3

- **Engagement of stakeholders on O&M activities scheduling for addition, alterations and replacement works**

Engagement of stakeholders is the process by which the Registered Lift or Escalator Contractor involves parties who may be affected by the decisions it makes or can influence the implementation of its decisions. An underlying principle of stakeholder engagement is that stakeholders are provided the chance to influence the decision-making process on the topic of O&M activities scheduling for addition, alterations and replacement works.

- **Keep stakeholders well informed on progress of all O&M activities, performance of building systems**

The Registered Lift or Escalator Contractor should report to the stakeholders on any defects, findings and performance of the building fabric, cladding or the lighting/power socket, ventilation/air-conditioning in the lift machine room, safety notices and signs, floor intersection guards, etc. If there are any necessary repairs, the work should be carried out either by others or by the Registered Lift or Escalator Contractor.

- **Conduct a third-party independent audit**

To evaluate the lift or escalator system reliability and performance, it is advisable to employ a third-party professional to conduct an independent audit covering all lifts or escalators at least once a year. After the inspection, the third party shall provide an independent audit report including, but not limited to, the following information:

- Findings with photo record
- Visual check on all major equipment
- Functionally tests on all safety components
- Short-term and long-term recommendations
- Replacement / modernisation recommendation
- Maintenance quality review
- Breakdown trend analysis



2.14 Information Management

During the life of the system, the O&M Phase is the longest and most expensive and the information system provides the most value to the organisation in this phase.

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Level 1

GENERAL
PRACTICE

2.14.1

- **Proper record of certificates and documentations as per statutory requirements by relevant parties**

In accordance with Section 39 (1) of the Lifts and Escalators Ordinance (Cap. 618), the Responsible Person must ensure that the Use Permit is displayed at all times in a conspicuous position in accordance with the guidelines set out below:

1. The Use Permit should be posted such that the bottom of the Use Permit is at a height of at least 1m above floor level of the lift car;
2. The Use Permit should be posted such that the top of the Use Permit is at a height of not higher than 1.8m above floor level of the lift car;
3. The Use Permit should be posted adjacent to the landing of an escalator, such as on the balustrade or obstruction guards; and
4. The Use Permit should not be obstructed by any items, including leaflets, stickers or notices.

According to the Lifts and Escalators (General) Regulation (Cap. 618A), the Responsible Person for a lift/escalator shall keep the record of the log-book for at least 3 years. The log-book shall be in the specified form, (LE50L) for lift and (LE50) for escalator, and contain specified information and particulars such as description of the installation and installation contractors, specifications of lift/escalator, maintenance contractor and maintenance duration for lifts/escalators, details of work, maintenance schedule, etc. Such a record shall be produced for the enforcement officer's inspection within 3 days after the date of receipt of the request.

2.14.2

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Level 2

GOOD
PRACTICE

- **Sharing of maintenance information among different stakeholders**

Maintenance information, such as the O&M Manual, Preventive Maintenance Procedures, Corrective Maintenance Plan, Maintenance Record, Parts Inventory Record, etc., should be stored in a registered location/office. The stakeholders, i.e. the law enforcement officers, Responsible Person, management officers, maintenance contractor, etc., shall access such registered location/office upon demand.

- **Comparison of similar type of lift or escalator system**

The Registered Lift or Escalator Contractor is requested to establish a Computerised Maintenance Management Information System in order to collect and analyse data. The statistics will be generated based on the similar type of lift or escalator (speed, no. of stop, capacity, nature of buildings etc.). The stakeholders can identify and compare the performance of the particular lift system in the market.



2.14.3

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Level 3

BEST
PRACTICE

- **Common platform for storage and dissemination of O&M information with a view to enhancing the transparency**

The Registered Lift or Escalator Contractors should maintain O&M information with high transparency and promote proper maintenance. It is recommended to store and disseminate O&M information on the common electronic platform, such as Cloud storage. The stakeholders, i.e. the law enforcement officers, Responsible Person, management officers, maintenance workers, etc. should have easy access to the O&M information.



2.15 Structure and Qualification of O&M Team

Structure is the people, positions, procedures, processes, culture, technology and related elements that comprise the organisation. It defines how all the pieces, parts and processes work together. This structure must be totally integrated with the strategy defined for the organisation to achieve its mission and goals. Structure supports strategy. If an organisation changes its strategy, it must change its structure to support the new strategy. When it doesn't, the structure acts like a bungee cord and pulls the organisation back to its old strategy.

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Level 1

2.15.1

• In-house training

In accordance with Sections 1(b) of Part 2, Schedule 10 of the Lifts and Escalators Ordinance, the Registered Lift or Escalator Workers who apply for renewal of registration shall complete at least 30 hours of relevant training within the 5-year period immediately before the date of submission of the renewal application.

The Registered Lift or Escalator Contractor shall provide the in-house training and other training opportunities to the members of O&M team. These training sessions are required to maintain, improve and broaden knowledge and skills, and develop their personal skills in the profession. Appropriate balance shall be maintained among the following subject areas:

- (a) General occupational health, safety and environmental protection;
- (b) Safety for Lift and Escalator work;
- (c) Practical technology and appropriate codes of practice for lift and escalator's installation, demolition, maintenance, repair, commissioning, and examination;
- (d) New technology within the lift and escalator industry; and
- (e) General Professional Matters (such as business management, supervision skills, customer service skills and other related matters).

GENERAL
PRACTICE

- **Maintenance team / contractors available but on-call**

The Registered Lift or Escalator Contractor shall provide a Qualified Person who is a Registered Lift or Escalator Engineer or a Registered Lift or Escalator Worker to provide a monthly maintenance service to maintain efficient and prompt response to breakdowns, emergency call-outs or complaints for installation/equipment failure and/or unsatisfactory services.

According to the Code of Practice on Lift Works and Escalator Works Section 6.4, upon receipt of a passenger entrapment call, the Registered Lift Contractor shall dispatch two or more lift workers to the scene to release the trapped passengers. Only lift workers who are conversant with the characteristics of the lift in question shall be deployed to handle the release operation. At least one of these two lift workers shall be a Qualified Person.



**GOOD
PRACTICE**

2.15.2

- **Resident O&M team with supervisors and maintenance personnel with proper qualifications**

Employment of a resident O&M team is considered as a good practice as it exceeds the statutory requirements. The resident O&M team should consist of experienced supervisors and maintenance workers. At least one of the workers should be a Qualified Person. Moreover, the lift workers should attend and complete the Registered Lift or Escalator Contractor's or manufacturer's training in order to become conversant with the characteristics of the particular lift model.





**BEST
PRACTICE**

2.15.3

- **Engineers / maintenance managers to oversee and review**

The engineer / maintenance managers of the Registered Lift or Escalator Contractor are recommended to oversee and review the maintenance activities / practices and maintenance records periodically; for example, quarterly. The purpose of supervision and review actions is to ensure the procedures and performances of maintenance activities / practices align with the O&M Manual and the standard of the Registered Lift Contractor.

- **Centralised / Regional Command Centre(s) for O&M activities**

In order to provide the best service for continuous 24-hour O&M activities, the Registered Lift or Escalator Contractors should consider establishing a Centralised / Regional Command Centre. The emergency response technicians with necessary tools should be on standby in the Centralised / Regional Command Centre, so as to minimise the response time for the installation breakdown call or passenger entrapment call. The selected critical spare parts should be stored in the Centralised / Regional Command Centre based on the recommendations from the AI technology for maintenance data analysis.

- **Training maintenance team for use of BIM**

The Registered Lift or Escalator Contractor is recommended to use BIM to optimise the planning, implementation and management of a lift system. BIM is a process that covers planning, designing, building and managing the facilities of a building, including the lift system. The maintenance team should take advantage of BIM and the monitoring system, such as collecting and recording the parts information, tracking the condition of parts, identifying the life span of parts, and determining a part's replacement schedule.

3

Innovative & Technology Initiatives

The operation and maintenance of buildings have already been facing several critical challenges, including the aging workforce, aging assets and climate change. The new generation of smart technologies such as artificial intelligence, asset management Internet of Things, building management system, building information system or even specialised drone-enabled automation applications would have brought further challenges to us with safety and well-being of occupants and visitors inside buildings elevated to a completely new level. Building O&M practitioners shall endeavour to adopt innovations, technologies and best practices/guidelines to improve the management of E&M assets, thereby enhancing the resilience and intelligence of government buildings.

Below are five emerging technology trends that may have impact on facilities management industry.



3.1 Technology Trend 1: CAFM Software

In the current dynamic market, computer aided facility management (CAFM) software is highly important for facilities manager in the workplace. Tasked with many responsibilities, facilities manager require complete day-to-day functionality by integrating technology, processes, and people. With the help of CAFM software, facilities manager can better execute daily operational responsibilities from monitoring and managing customer service requests to preventive maintenance and operational facility services.



3.2 Technology Trend 2: Building Information Modelling (BIM)

Although not a new technology, Building Information Modelling-Asset Management (BIM-AM) is a tool used by contractors and architects to develop and scale virtual models of building projects. Giving building owners and operators a complete visual model of the facility prior to construction, it provides valuable insights into project delivery timelines and budgets.

When integrated with existing work order programs or facility maintenance software, BIM delivers on improved floor plans, asset information and financial estimates. As the technology continues to evolve, the importance of BIM in facilities management will continue to grow.



3.3 Technology Trend 3: Internet of Things (IoT)

The Internet of Things (IoT) refers to the network of internet accessible devices utilised by organisations. Relying on tools such as sensors, thermostats and actuators to evaluate data and reduce the amount of energy used for tasks, IoT systems effectively reduce energy bills and provide insightful data to improve efficiency within all facilities. With various sensors generating data, facilities management organisations are able to identify issues and potential problems faster and easier.



3.4 Technology Trend 4: Drones

Drones are unmanned aerial vehicles (UAVs) that have the ability to improve efficiency in facilities management. Some of these opportunities include safety in inspections, and the automation of delivery services. Still in its infancy, there is no disputing that sending a drone equipped with a high-resolution camera is a quicker and safer way to evaluate a building's exterior than sending a member of the team.



3.5 Technology Trend 5: Artificial Intelligence (AI)

Artificial intelligence (AI) is the broader concept of machines being able to carry out tasks in a smart manner. AI also refers to machines imitating and bettering human performance. More adaptive than traditional systems, AI holds an array of capabilities for enhanced performance in the facilities management industry. A part of AI, machine learning is a current application that provides machines access to data and allows them to draw insights on their own. With machine learning, facilities management organisations can better predict how much time an asset, such as a building, has before its performance degrades or fails. From online chatbots in customer service to finding patterns in historical data through the use of algorithms, AI will expand and benefit all departments within a facilities management organisation.



3.6 Technology Initiatives

Based on the above five technology trends, the technology initiatives in respect of the 15 key attributes are summarised below for reference

O&M Aspect	Feasible Initiatives	Reference
O&M Input on Design for New Building	<p>a) Simulate best practice O&M activities using BIM or other simulation software to understand operability and maintainability before construction.</p>	<ul style="list-style-type: none"> • BIM for Facility Managers issued by International Facility Management Association (IFMA) • BIM-AM Standards and Guidelines issued by EMSD • Housing Authority BIM Standards and Guidelines
Asset Information (Documentation)	<p>a) Adopt computerised asset information model such as BIM to maintain all asset information under an efficient asset management system;</p> <p>b) Inspect, digitise and upkeep latest record and logbook for Fire Services Installations and equipment on a regular basis;</p> <p>c) Implement mobile solutions for asset management record retrieval and updating of records, e.g. O&M manual, fault history, etc.;</p> <p>d) Adopt Radio Frequency Identification (RFID) or QR codes for asset management.</p>	<ul style="list-style-type: none"> • BIM for Facility Managers issued by (IFMA) • BIM-AM Standards and Guidelines issued by EMSD • Construction Industry Council BIM Standards

O&M Aspect	Feasible Initiatives	Reference
Operation Procedures	<ul style="list-style-type: none"> a) Adopt cloud-based technology to store information of Lift and Escalator Installations and equipment to be accessed by property management personnel when needed; b) Implement IoT-enabled self-diagnosis function for the healthiness of major Lift and Escalator equipment; c) Incorporate on-line condition monitoring and mobile technologies on Lift and Escalator systems to improve maintenance and reduce downtime. 	
Emergency Preparedness	Nil	
Preventive Maintenance Procedure / Standards	<ul style="list-style-type: none"> a) Conduct predictive maintenance based on data analysis on fault history and equipment condition. 	
Corrective Maintenance	Nil	

O&M Aspect**Feasible Initiatives****Reference**

Maintenance Record Management

a) Adopt computerised monitoring system to maintain detailed maintenance information with capability for prompt alert, review and further analysis. The system at least contains the following information for weekly updates by designated person(s):

- Maintenance contractor's organisation chart and contact list
- Monthly fault call and emergency repair reports
- Daily fault call progress report
- Details of corrective maintenance
- Equipment breakdown report
- Working programme for maintenance, annual inspections and tests, overhaul, drills, safety inspections and any other scheduled works
- Preventive maintenance schedule
- Details of preventive maintenance completed
- Spare part list
- Registers of tools, equipment, materials, spare parts and instruments as well as calibration certificates of instruments
- Record of plants and equipment details
- Overhaul reports
- Record of statutory submission
- Any other useful information (e.g. site photos)

O&M Input on Design for New Building

O&M Aspect	Feasible Initiatives	Reference
Spare Parts Management	a) Utilise an automatic inventory control system using AI to manage spare parts inventory by prediction of spare parts requirement using AI for advance and on-time spare parts procurement.	
Incident Management	<p>a) Consider advance management tools to help optimise system performance, e.g., BIM – asset registers, equipment life-cycle track, system configuration, critical device status, maintenance history, installation visualisation, etc.;</p> <p>b) Adopt IoT technologies to allow quicker and instant reporting and maintenance data collection for future improvement.</p>	
Addition, Alteration and Replacement (Planning and Implementation)	a) Adopt advance management tools such as integrated facility management tools to allow a quick search of all equipment information and records, to enhance effectiveness of overall planning.	
Environmental and Safety Management	a) Adopt recycled components or equipment for the maintenance / repair / replacement works;	
Application of Technologies	<p>a) Adopt application of AI, big data analysis, IoT etc.;</p> <p>b) Knowledge transfer from research to industry to Interface Science / Technology.</p>	
Stakeholder Management	a) Establish a smart system to automatically notify stakeholders on upcoming schedules and progress of all O&M activities, addition, alteration and replacement works.	

O&M Aspect	Feasible Initiatives	Reference
Information Management	<ul style="list-style-type: none"> a) Establish an integrated management system (iBMS); b) Create centralised database for automatic replacement planning for equipment; c) Establish an online real time server for storing maintenance related information through mobile devices; d) Provide online access of all information for maintenance party during preventive maintenance works. 	

Structure and Qualification of O&M Team

Nil

4

Industry Standards and Requirements



4.1 Guidance Notes and Codes of Practice

The readers may refer to the prevailing statutory requirements, websites of the Controlling Authorities and following documents for further information on the relevant specific requirements:-

- Lifts and Escalators Ordinance (Cap. 618);
- Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines (latest edition), Electrical & Mechanical Services Department, HKSAR, China;
- Best Management Practices on Operation and Maintenance of Lifts and Escalators (latest edition), Building Services Operation and Maintenance Executives Society;
- Code of Practice for Lift Works and Escalator Works (latest edition), Electrical & Mechanical Services Department, HKSAR, China;
- Code of Practice for the Electricity (Wiring) Regulations (latest edition), Electrical & Mechanical Services Department, HKSAR, China;
- Code of Practice on the Design and Construction of Lifts and Escalators, Electrical & Mechanical Services Department, HKSAR, China;
- Code of Practice for Energy Efficiency of Building Services Installation (latest edition), Electrical & Mechanical Services Department, HKSAR, China;
- Code of Practice for Building Works for Lifts and Escalators (latest edition), Buildings Department, HKSAR, China;
- Codes of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment (latest edition), Fire Services Department, HKSAR, China;
- Code of Practice for Fire Safety in Buildings (latest edition), Buildings Department, HKSAR, China;
- Construction Design and Management (Health & Safety Design Management) Guidance Notes (latest edition), Development Bureau, HKSAR, China;
- General Specification for Lift, Escalator and Passenger Conveyor Installation in Government Buildings (latest edition), Architectural Services Department, HKSAR, China;
- Guidebook for Responsible Persons for Lifts (latest edition), Electrical & Mechanical Services Department, HKSAR, China;
- Guidebook for Responsible Persons for Escalators (latest edition), Electrical & Mechanical Services Department, HKSAR, China;
- Guidelines on Safety of Lift Shaft Works: Volume 2 – During Lift Installation Stage until Issue of Occupation Permit and Handing Over to Developer (latest edition), the Construction Industry Council;

- Guidelines on Safety of Lift Shaft Works Volume 3 – Throughout the Occupation Stage of Building (latest edition), Construction Industry Council;
- Guide on Safety in Lift Repair and Maintenance (latest edition), Labour Department, HKSAR, China; and
- Testing and Commissioning Procedure for Lift, Escalator and Passenger Conveyor Installation in Government Buildings (latest edition), Architectural Services Department, HKSAR, China.



4.2 International Standards

The readers may refer to the prevailing international standards as accepted by the Controlling Authorities or the approval standards for existing buildings:-

- Australian Standard AS 1735 Lifts, Escalators, and Moving Walks, 2016
- ANSI/NETA ATS-2017 – ‘Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems’
- BS 7671: Requirements for Electrical Installations, IET Wiring Regulations, Eighteenth Edition, 2018
- BS 6423: 2014 Code of practice for maintenance of low-voltage switchgear and control gear
- BS 6626: 2010 Maintenance of electrical switchgear and controlgear for voltages above 1 kV and up to and including 36 kV – Code of Practice
- BS 7430: 2011+A1:2015 Code of practice for protective earthing of electrical installations
- BS EN 13015:2001+A1:2008 Maintenance for Lifts and Escalator – Rules for maintenance instructions
- CIBSE Guide D Transportation Systems in Buildings, 2020 Version
- CIBSE Guide M Maintenance Engineering & Management, 2014
- Construction (Design and Management) Regulations, United Kingdom;
- Health Technical Memorandum (HTM) 06-01 – ‘Electrical services supply and distribution’ (for hospitals) particularly Section 17 on maintenance and operational management
- Health Technical Memorandum (HTM 08-02) Design and maintenance of lifts in the health sector, 2016
- IEC 60300-3-11-2009 – ‘Dependability Management - Application Guide - Reliability Centred Maintenance’
- IEC 60364 Low-voltage Electrical Installations
- Lift and Escalator Industry Association Code of Practice LM01: Maintenance requirements for lifts, lifting platforms, escalators and moving walks, 2013
- The American Society of Mechanical Engineers ASME A17.1/CSA B44 - Safety Standards for Elevators and Escalators, 2019
- SAE standard JA1011 – ‘Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes’

5

Useful Forms / Check List – Samples



5.1 Check List for Periodic Maintenance of a Lift

For keeping the lift and its associated equipment or machinery in safe working order, at least the following applicable items are to be checked for proper condition, and attended to if necessary, in accordance with schedule recommended by the lift manufacturer :

Maintenance Items	Examples of checks
a) Lift machine gearbox and bearing	Check condition
b) Traction Machine, including motor shaft, bolts connection worm gear and flange of the traction sleeve	Check operation Check bearing for wear Check lubrication
c) Brake	Check braking system Check part for wear Check stopping accuracy
d) Overspeed Governor and tension pulley	Check moving parts for free movement and wear Check operation Check switch
e) Drum, sheaves, grooves of sheaves and pulley	Check condition and grooves for wear
f) Commutators and slip rings of motor generator set	Check condition
g) Controllers contact, interlock and dashpots	Check cabinet is clean, dry and free from dust
h) Floor selector generator set	Check operation

Maintenance Items

Examples of checks

- | | |
|---|---|
| i) counterweight guide shoes and lubricators and pulley | Check Guideshoes, rollers for wear
Check fixings
Check lubrication where necessary |
| j) lift well cleanliness and condition of lift well enclosure | Check cleanliness and condition of lift well enclosure |
| k) guides and fixings | Check for deterioration and wear |
| l) limit switches, direction switches and their operating devices | Check operation |
| m) car door and landing door | Check door closed contact or lock
Check doors for free running
Check door guiding
Check door gaps
Check wire rope or chain when used for integrity
Check passenger door protective device
Check lubrication |
| n) car guide shoe and lubricators, tensioning devices and door operating gear | Check operation |
| o) any irregularities in starting, stopping and general running of the lift | Check operation |
| p) car controls, car door switches, safety edges, emergency stop, alarm bell and intercom system; condition of car body fixing, car interior and floor covering; car lighting, car ventilation and levelling accuracy | Check operation |
| q) landing buttons, indicators, and fireman's lift switch | Check operation |
| r) door-lock operation including electrical and mechanical interlocks for car door and landing door | Check operation |
| s) suspension ropes, compensation ropes/ chains, their anchorages and rope retainer (rope guard) | Check for wear, elongation and tension
Check lubrication only where intended |

Maintenance Items	Examples of checks
t) slack rope switch, safety gear switch, broken tape or rope switch and overspeed governor switch	Check operation
u) counterweight clearances for rope stretch; rope equaliser; filler weight fixings; and safety gear for guide clearance and free movement	Check operation
v) buffer condition	Check oil level Check lubrication Check switch when fitted Check fixings
w) travelling cables and their anchorages	Check operation
x) safety notices and signs	Check condition

Note

In addition to the items listed in the maintenance schedule/instructions provided by the lift manufacturer, the RC responsible for maintaining the lift shall also carry out the following maintenance items for not less than twice a year if the concerned lift does not equipped with unintended car movement protection device, ascending car overspeed protection device or double braking system. The following maintenance items shall be completed in one single maintenance visit.

a) Disassembly maintenance of the braking mechanism for the lift machine brake.	The RC shall ensure that the relevant components of the brake (e.g. brake lining, solenoid plunger, brake spring, etc.) are in good and safe working order and ensure that all levers and moving parts of the brake must be kept clean with smooth operation and properly lubricated, and the relevant parts of the brake replaced in accordance with the manufacturer's instructions.
b) Measure the braking distance	Measure the braking distance by performing no-load brake test to ensure compliance with the lift manufacturer's requirements.

Maintenance Items

Examples of checks

c) Measure grooves of traction sheave in the lift traction machine and replace the traction sheave in accordance with the manufacturer's requirements.

Perform no-load traction test for the lift and measure the levelling accuracy to ensure the traction and levelling accuracy are in compliance with the lift manufacturer's requirements.

d) Check the mechanical locks and electrical contacts of all lift landing doors to ensure they are in safe working order.

Check operation



5.2 Check List for Periodic Maintenance for a Hydraulic Lift

In addition to the check list for the electric lift, at least the following applicable items which are pertinent to a hydraulic lift should be checked and attended to –

Maintenance Items

Examples of checks

a) ram and cylinder condition

Check for oil leakage

b) levelling switches

Check operation

c) pipework, joints, bolts and fixings; stop valve; oil reservoir; pump and motor

Check Condition

d) control valves, pilot and levelling valves; overrun and cut-off devices; overload relief valve

Check Condition

e) air release cock and anti-syphon valvey

Check condition

f) Oil tank

Check hydraulic fluid level, adjusted to within the margin set by the manufacturer, written record should be kept as to the quantity of hydraulic fluid added to the system.

Check tank and valve unit for leakage

Maintenance Items	Examples of checks
g) Gland packings and seals – where gland packing or seals are used for valves and cylinders	Examine and maintain in accordance with manufacturer's recommendations to prevent excessive loss of hydraulic oil.
h) Relief valve	Check to ensure that the seal is intact.



5.3 Check List for Periodic Maintenance of an Escalator

For keeping the escalator and its associated equipment or machinery in safe working order, at least the following applicable items are to be checked for proper condition, and attended to if necessary, in accordance with a schedule recommended by an escalator manufacturer :

Maintenance Items	Examples of checks
a) clearances between consecutive steps/pallets and between the steps/pallets and the skirt panels	Check clearances and operation
b) drums, pulleys and moving parts	Check operation
c) machine room cleanliness	Check condition
d) any irregularities in running the escalator/passenger conveyor	Check operation
e) safety devices, such as skirt panel switches, handrail inlet switches, emergency stop switches, broken drive/step chain devices, overspeed governor, speed monitoring device that for detection of overspeed or unintentional reversal of the direction of travel, step sagging devices, missing step devices, comb plate switches, etc.	Check condition
f) main drive system including drive chain and sprocket	Check condition Check for tension and wear Check bearing for wear Check lubrication
g) step/pallet rollers and step/pallet chain	Check for tension and wear Check lubrication

Maintenance Items	Examples of checks
h) handrail	Check for free running and condition Check tension Check synchronisation between step/pallet band and the handrail
i) operational brake and auxiliary brake (if equipped) including their braking efficiencies	Check braking system Check parts for wear
j) comb	Check condition Check meshing with step s. pallets or belt
k) lubricating pump and oil	Check operation
l) motor gear box	Check gear and associated parts Check lubrication
m) lighting system	Check operation
n) floor intersection guards and any safeguards against adjacent building obstacles from causing injury to users	Check condition
o) safety notices and signs	Check condition