



ACCREDITATION SCHEME FOR INSPECTION BODIES

TECHNICAL NOTE: LEI 01

SPECIFIC REQUIREMENTS FOR THE ACCREDITATION OF INSPECTION BODIES FOR LIFT & ESCALATOR INSPECTION

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1 INTRODUCTION

- 1.1 The objective of the Lift and Escalator Certification Firm (Firm) is to uphold the safety and reliability of lift and escalator systems by:
- a) ensuring that its inspectors are highly competent and well-trained
 - b) leverage on technology as an enabler to enhance inspection processes and improve overall efficiency
 - c) facilitating the transfer of knowledge within the organization and ensuring continuous improvement of industry standards and practices.
- 1.2 The purpose of technical note is to prescribe the requirements for the accreditation of Firm with the view to undertake all of the following works relating to lifts and escalators:
- a) Inspection works relating to:
 - i) Examination, inspection and testing (EIT) for Permit to Operate (PTO) renewal application,
 - ii) Examination, inspection, testing and commissioning (EITC) after installation and major modification
 - b) Review of Lift and Escalator plans to ensure compliance to prevailing codes, standards and legal requirements
 - c) Conduct of incident investigation relating to Lift and Escalator
- 1.3 This technical note should be read in conjunction with documents listed in the Reference Section and government regulations where applicable.
- 1.4 Supplementary information for specific areas of inspection may be published as other Technical Notes.

2 EXAMINATION, INSPECTION, TESTING AND COMMISSIONING

- 2.1 The purpose of EIT/EITC is to determine the condition of lifts and escalators for conformance with standards or other normative documents and/or general requirements.
- 2.2 The lift covered in this technical note includes:
- a) Passenger lift
 - b) Goods lift (not including dumbwaiter or material hoists)
 - c) Vertical platform lift
 - d) Stair lift / Chair lift
 - e) Any other lift approved by Building Construction Authority

2.3 The escalator covered in this technical note includes:

- a) Escalator;
- b) Moving walks (or Passenger conveyor)

3 TOOLS AND EQUIPMENT

3.1 Tools and equipment which affect results that are critical to the conclusion of the examination shall be appropriate for the particular inspection to be performed.

3.2 List of minimum tools and equipment listed in Annex shall be maintained by the firm for their prescribed scope of works.

3.3 The firm shall ensure that all tools and equipment listed in Table 1, including those not under their charge, used during the course of work are calibrated and traceable to the International System of Units (the SI unit). Calibration shall be performed by recognized Singapore Accreditation Council (SAC) accredited laboratories or the National Metrology Institute who is a member of the BIPM MRA where possible. The firm shall ensure that the acceptance of calibration reports be based on the measurement traceability as specified in SAC-SINGLAS 006: Traceability of Measurement.

3.4 For test weight verification against the reference weights, the weighing scale and reference weight shall be calibrated by SAC accredited laboratories or the National Metrology Institute who is a member of the BIPM MRA where possible. In the case where the test weights are maintained by the lift and escalator servicing contractors, the firm shall assess and be satisfied that the calibration is traceable to a national or international standards of measurement. The firm shall also request and keep a record of the verification records of the test weights against the reference weights as well as the calibration records of the reference weights and weighing scale.

4 ANALYTICAL TESTING

4.1 Where analytical testing is required to support the evaluation, the firm shall ensure that the testing is performed by an SAC accredited laboratory or the National Metrology Institute who is a member of the BIPM MRA where possible. The firm shall ensure that it receives endorsed test reports from SAC accredited laboratories where available. Examples of analytical testing are chemical, metallurgical analysis or non-destructive test (NDT).

4.2 Analytical testing is a laboratory activity and therefore does not come within the scope of ISO/IEC 17020.

5 EIT/EITC METHOD, PROCEDURE AND REPORTS

- 5.1 The firm shall develop a set of standard operation procedure (SOP) which the EIT/EITC works shall follow. The SOP shall minimally cover the procedures on:
- a) preparation for the EIT/EITC;
 - b) carrying out of EIT/EITC for the lifts and escalators on site;
 - c) acceptance criteria for the inspection, testing and examination conducted;
 - d) recording and interpretation/analysis of the results;
 - e) documenting the inspection records and carry out data analytics of the inspection findings and results;
 - f) issuance of inspection reports.
- 5.2 The firm shall record the EIT/EITC outcomes and support it with objective evidence. Such evidence can include photos/videos of the condition or testing outcomes of the critical components.
- 5.3 The firm shall keep a copy of required Codes and Standards listed in Table 3 in Annex. Inspectors shall have the means to access these Codes and Standards as and when necessary, including during on-site inspection.
- 5.4 Prior to the carrying out EIT/EITC, inspectors shall review the logbook of the equipment or other documents as necessary for records of maintenance, repair or replacement of major parts, breakdown and incident if any. The review shall cover the records since last EIT/EITC.
- 5.5 EIT/EITC shall minimally cover the items determined by the prevailing codes, standards, or legislations.
- 5.6 The firm shall develop specific SOPs for different types and models of lifts and escalators that the firm is inspecting. The SOP shall take into account the different sub-systems/components that is being used for the configuration. For example, different SOPs shall be developed for the EIT/EITC of lifts that use polyurethane buffer, and for those using hydraulic buffer.
- 5.7 Following the EIT/EITC, the signatory shall review the results and recommend appropriate follow up actions where applicable to the owner.
- 5.8 Inspection reports, detailing the coverage and findings of each EIT/EITC shall be issued to the owner and/or owner representative. A final report shall be submitted after all findings are rectified.
- 5.9 The signatory shall not endorse on the final report until all recommended rectification work have been completed to his satisfaction.

6 INSPECTION PERSONNEL

6.1 INSPECTORS

- 6.1.1 The firm shall assess and deploy competent and adequate number of inspector(s) for the inspection works.
- 6.1.2 Inspectors shall be competent and are a registered Lift and Escalator Inspector (LEI) or a Specialist Professional Engineer (Lift and Escalator) with a valid practicing certificate. In addition, the inspectors must have sufficient relevant experience in their scope of inspection, for example in lift control, safety components, type testing and maintenance outcome requirements.
- 6.1.3 If the inspector(s) does not possess all the competencies required for the proper and thorough inspection of the lift and escalator, the firm shall deploy additional personnel with the relevant knowledge and expertise to assist in the inspection.
- 6.1.4 Inspectors must be familiar with the relevant standards or codes used in the inspection and testing activities.
- 6.1.5 The firm shall ensure that their inspectors are medically fit for their scope of inspection. It is the responsibility of the firm to ensure that any medical condition shall not affect the inspector carrying out the inspection works effectively and safely.
- 6.1.6 The firm shall maintain records of inspectors' qualifications, training and experience.
- 6.1.7 Inspectors shall carry out the inspection in accordance with the SOP described in 5.1.

6.2 SIGNATORIES

- 6.2.1 Signatories shall be registered Specialist Professional Engineer (Lift and Escalator) with a valid practicing certificate.
- 6.2.2 Signatory shall have good knowledge of the relevant standards or codes used in the EIT/EITC activities.
- 6.2.3 All inspection reports are to be endorsed by a signatory. The signatory shall only endorse inspection reports where he/she has reviewed that the inspection, any rectification works and records are carried out in accordance with the SOP described in section 5.1, and the results are to his satisfaction.

7 PREPARATION AND SIGNING OF FIXED INSTALLATION PLANS FOR APPLICATION OF APPROVAL

- 7.1 The firm shall review and verify that the Lift and Escalator Plans to be submitted to Building and Construction Authority for the purpose of application of approval shall be in compliance to prevailing relevant codes, standards and legislative requirements. The scope of the work shall cover the following areas:
- a) Lift and escalator design;
 - b) Building design related to lifts and escalators (e.g. access route to machinery spaces and refuge spaces within the lift shaft)
 - c) Lift safety components type testing;
 - d) Lift model type testing;
- 7.2 The firm shall assess and deploy suitable and adequate number of persons for the verification work. The person(s) must have sufficient relevant experience, competence and knowledge in the scope of work.
- 7.3 The firm shall ensure that the plans are reviewed in reference to prevailing codes, standards and/or legislation relevant to the design and the proposed components.
- 7.4 The firm shall issue a report detailing the scope of the review and the observations made with regard to compliance with prevailing codes, standards and/or legislation. The report shall be endorsed by the signatory.

8 INCIDENT INVESTIGATION

- 8.1 Owners of lift and escalator may appoint the firm to carry out investigation into an incident. The scope of incident investigation can include:
- a) Conduct analysis to identify the root cause of the incident;
 - b) Recommends improvement and rectification works to prevent recurrence of similar incident;
 - c) Issuance of investigation report.
- 8.2 The firm appointed for incident investigation shall be independent from the firm appointed for the most recent EIT or EITC works for the lifts and escalators (with reference to clause 1.1a).
- 8.3 The firm shall assess and deploy suitable and adequate number of persons for the investigation. The investigation shall be led by the SPE (L&E) from the firm who has the relevant experience, competence and knowledge in the scope of work.

8.4 The firm shall establish a SOP for the investigation works. The SOP shall include the procedures on responding to the incident, proper collection and storage of evidence and the tests and analysis.

8.5 The firm shall issue a report detailing the scope of the investigation, the findings and the recommendations to prevent the recurrence of such incident, if applicable. The report shall be endorsed by the signatory.

9 FIRM LEVEL REQUIREMENT

9.1 The firm shall have at least one SPE (L&E) appointed as the chief engineer with minimum 5 years of relevant experience practicing as a SPE (L&E). The chief engineer should be a full-time employee of the firm. In the event where the chief engineer is absent, there should be at least one SPE (L&E) who is suitably competent to cover the role of the chief engineer.

9.2 The firm shall appoint sufficient number of signatories. The signatories should be full time employees of the firm and shall not act as signatory for other lift and escalator certification firm.

9.3 The firm must ensure that there are adequate number of persons with relevant knowledge and experiences in the following core areas relating to lifts and escalators:

Key competencies

Mechanical:

- Mechanics,
- Hydraulics,
- Statics and fatigue/strength calculation,
- Material science and welding technology,

Electrical:

- Motor and drive technology,
- Electrical/electronic controls (including programmable logic control),
- Electrical engineering and Electromagnetic compatibility (EMC)

General:

- Type Testing of Lifts and safety components

9.4 In addition, the firm should also have adequate number of persons with relevant knowledge and experiences in the following areas relating to lifts and escalators:

- Acoustics
- Functional safety
- Vibration technology
- Lightning protection

- Cyber security
 - Fire safety
 - Occupational safety
- 9.5 A single person may not necessarily have the competencies in all areas. The firm shall have the key competencies through its employed persons.
- 9.6 For key competencies, the competent persons shall possess relevant qualifications and/or certifications, and a minimum 3 years' relevant experience.
- 9.7 For core competencies, the firm can engage external party for support when required.
- 9.8 The firm shall ensure that such key competencies must be available to support the work activities at all times.
- 9.9 The firm shall put in place adequate system to ensure that all persons carried out work activities are sufficiently trained and competent in carry out the work, and adhered to the established procedures in doing so.

10 DOCUMENTATION MANAGEMENT

- 10.1 The firm shall have documentation management system (digitalisation of record keeping) for keeping the:
- a) EIT/EITC records with relevant evidences including photos and videos;
 - b) Verification of lift and escalator plans with supporting documents;
 - c) Alternative solution record with project details including the risk assessment and approval;
 - d) Incident investigation records with relevant evidences;
 - e) Calibration records of the tools;
 - f) Internal audit findings
- 10.2 The reports on EIT for application of PTO (mentioned under 10.1 a) shall be kept for a minimum period of 5 years from the date of inspection/ testing / approval.
- 10.3 All other records mentioned in 10.1 shall be kept until the lift or escalator is demolished.
- 10.4 The firm shall ensure redundancy in records keeping.

11 TRAINING OF PERSONNEL

11.1 Competency Development Framework

- 11.1.1 The firm shall have competency development framework for each inspector. The framework shall include the assessment of the inspectors' current competency level, and the development pathway for the inspector to progress, and to acquire the requisite knowledge and practical experience.
- 11.1.2 The framework shall provide guidance on the scope / type of works that an inspector is allowed to be carried out based on their assessed level of competency.
- 11.1.3 Training log of each inspector shall be kept for at least 12 months after the inspector leaves the firm.

11.2 General Requirement

- 11.2.1 All inspectors shall undergo 20 hours of training per annum which is relevant to the lift and escalator. The training shall be in line with their competency development plan, and can include the following areas:
 - a) Upskilling of technical competencies with new or advanced knowledge or specialised areas;
 - b) Update on the latest technology development in lifts, escalator and their subsystems;
 - c) Maintain knowledge of current operating procedures necessary to discharge duties;
 - d) Update on the local as well as international code and regulatory requirements;
 - e) Sharing of inspection and incidents findings and data analytics.
- 11.2.2 The training can be any of the following:
 - a) Relevant post-graduate or diploma courses on engineering, examining, inspection and testing;
 - b) Lectures, short courses, conferences, workshops and seminars which are relevant for inspectors on technical, management, professional development, legal or regulatory matters;
 - c) courses conducted by in-house SPE or short attachment to lift firms
 - d) Other structured trainings recognized by Professional Engineers Board (PEB).
- 11.2.3 The firm shall carry out regular review of the training programmes to ensure that it is effective in raising the competency, skills and knowledge of the inspectors.

ANNEX

Table 1 - List of tools/equipment the firm is required to maintain

S/N	Type of Tool/Equipment	Purpose of Tool/Equipment
1	Vernier Caliper	Measures the length, width and thickness of objects
2	Measurement Tape	Measures the length, width and thickness of objects
3	Door Force Gauge	Measures the force required to open or close a door
4	Gap/Filler Gauge	Measures the gap between two components
5	Rope Tension Measuring Gauge	Measures the tension or force applied to a rope or cable
6	Multimeter	Measures various electrical properties such as voltage, current, and resistance
7	Insulation Tester	Measures the electrical insulation resistance of various components, cables, and electrical systems
8	Light Lux Meter	Measures the level of illuminance or the amount of light falling on a surface
9	Sound Level Meter	Measures the intensity or volume of sound in the surrounding environment
10	Accelerometer	Measures and detects acceleration forces in various directions
11	Tachometer	Measures the rotational speed of an object, typically in revolutions per minute
12	Current Clamp Meter	Measures electrical current without the need to physically disconnect the conductor being tested
13	Electronic Devices with relevant software for reading and annotating engineering drawing, including Autocad drawings, BIM files	Effectively review, mark up, and collaborate on technical drawings and models

Table 2 - List of optional tools

S/N	Type of Tool/Equipment	Purpose of Tool/Equipment
1	Magnetic inductive scan tools for wire ropes	Non-destructively assess the condition and integrity of wire ropes used in various applications
2	Laser distance measurement tool	Accurately and efficiently measure distances using laser technology

Table 3 – Reference codes

1. CP2 – Code of practice for installation, operation and maintenance of electric passenger and goods lift
2. CP15 – Code of practice for the installation, operation and maintenance of escalators
3. SS550 – Code of practice for installation, operation and maintenance of electric passenger and goods lifts
4. SS626 – Code of practice for design, installation and maintenance of escalators and moving walks
5. EN 81-20, Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods Part 20: Passenger and goods passenger lifts
6. EN 81-21, Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Part 21: New passenger and goods passenger lifts in existing building
7. EN 81-50, Safety rules for the construction and installation of lifts — Examinations and tests Part 50: Design rules, calculations, examinations and tests of lift components
8. EN 81-40, Safety rules for the construction and installation of lifts — Special lifts for the transport of persons and goods Part 40: Stairlifts and inclined lifting platforms intended for persons with impaired mobility
9. EN 81-41, Safety rules for the construction and installation of lifts — Special lifts for the transport of persons and goods Part 41: Vertical lifting platforms intended for use by persons with impaired mobility
10. ASME A18.1 Safety Standards for Platform Lifts and Stairway Chairlifts
11. SCDF – Code of Practice for Fire Precautions in Building
12. BCA – Code on Accessibility in the Built Environment
13. EN 115 – Safety of escalators and moving walks Part 1: Construction and installation

14. EN 115 – Safety of escalators and moving walks Part 2: Rules for the improvement of safety of existing escalators and moving walks

15. Building Control Act

16. Building Control Regulation

17. Building Maintenance and Strata Management Act

18. Building Maintenance Strata Management (Lift, Escalator and Building Maintenance) Regulations

19. BCA – Approved Document – Acceptable Solutions

20. Directive 2006/42/EC - Machinery Directive

21. Directive 2014/33/EU - Lift Directive

Note: All versions of the codes and standards are included.