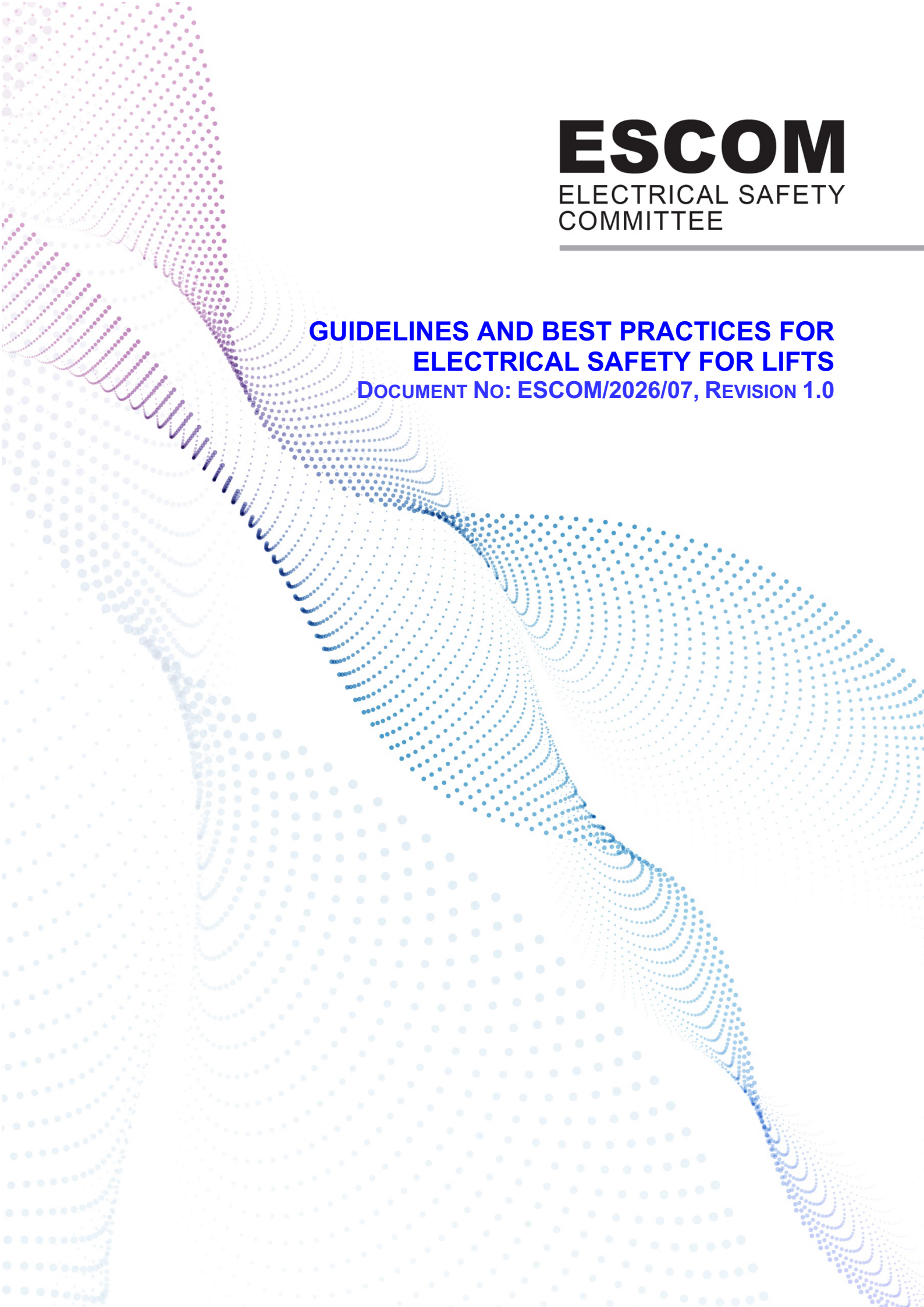




ESCOM

ELECTRICAL SAFETY
COMMITTEE

GUIDELINES AND BEST PRACTICES FOR ELECTRICAL SAFETY FOR LIFTS

DOCUMENT No: ESCOM/2026/07, REVISION 1.0

What is ESCOM?

The Safety, Health and Environment National Authority (SHENA) and Autoriti Elektrik Negara Brunei Darussalam (AENBD) established the Electrical Safety Committee or “ESCOM” in January 2023; with the objectives of promoting regulatory compliance and raising electrical safety standards within Brunei Darussalam.

Who are the ESCOM members?

The Electrical Safety Committee (ESCOM) comprises representatives and industry experts drawn from relevant government institutions and private organisations, collectively bringing extensive technical experience in electrical engineering, safety management, and industry practice.

ESCOM is **chaired by a representative from the Safety, Health and Environment National Authority (SHENA)**, with a **Deputy Chairperson appointed in accordance with the Committee’s Terms of Reference**. Subject matter experts from regulatory bodies, utilities, and industry may be invited to participate in specific working groups or provide technical input where required.

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AUTHORS			
Ir. Dk Roselawati Pg Hj Halus	ESCOM Core Member	Institute of Engineering Technology Brunei Network	
Aizat Hamidun	Member	Hibiscus Petroleum Berhad	
Zephyrin Aurelia Loh	Member	Hengyi Industries Sdn. Bhd.	
Manggau Galawing	Member	Ex-TG Zones Consultant and Services	
REVIEWERS			
Noramizah binti Haji Marali	ESCOM Core Member	SHENA	
Ong Pei Ying	ESCOM Secretary	SHENA	
CONTRIBUTORS			
Other members of the Electrical Safety Committee (ESCOM) who provided inputs, technical comments and support during the development of this document.			

ISSUE DATE		24 th June 2026	
ESCOM CHAIRPERSON			
NAME	Ir. Haji Noryasmin bin Haji Mohd Noor	SIGNATURE	

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1 INTRODUCTION

1.1 Background

Electrical safety shall be regarded as a fundamental requirement in the design, installation, operation, inspection, and maintenance of fixed passenger lifts installed within buildings with a rated capacity not exceeding 1000 kg (13 persons). Such lifts depend on integrated electrical systems, including motors, control circuits, wiring, door interlocks, and emergency devices, to ensure safe, reliable and efficient operation and passenger protection.

Failure of these electrical systems, or failure to maintain them in a safe and serviceable condition, may result in operational malfunctions, service interruptions, electric shock, fire hazards, or injury to passengers and maintenance personnel. Accordingly, robust inspection, testing, maintenance regimes, and strict compliance with applicable safety standards are imperative to ensure the continued safe operation of the lift.

In Brunei Darussalam, several incidents over recent years have highlighted the critical importance for enhanced electrical safety practices related to lifts operations and such incidents are as follows:

- a worker sustained fatal injuries following a fall attributed to a lift failure in a commercial building.
- a delivery worker fell from the first floor of a supermarket in the Brunei-Muara District when a cargo lift's chain failed during unloading operations.

These incidents reflect the complex interplay of electrical, mechanical, and operational risks present in the use of lifts. Failures in electrical control systems, insufficient preventive maintenance, and a lack of situational awareness can result in serious injuries or fatalities.

1.2 Introduction

This document outlines the guidelines and best practices for ensuring electrical safety in lifts. As essential components in modern buildings, lifts involve complex electrical systems that pose potential safety hazards if not properly installed, maintained, or operated.

1.3 Purpose

The purpose of this document is to serve as guidance and reference on the basic requirements for the design, construction, installation, inspection and safe use of work practices for lifts. **This is only recommended as the final option if there is no safer, practical or conventional means of access to.**

1.4 Scope

This document applies to the standard that specifies the safe use of lifts. This guideline covers the following: fixed passenger lifts installed inside buildings with a rated capacity under 1000 kg (13 persons), used in residential, commercial, or institutional buildings. This IGN does not cover the following: mobile lifts, goods/freight lifts, and lifts exceeding 1000 kg (13 persons).

2 DEFINITIONS

Key definitions for this IGN are listed below:

TERM	DEFINITION
Competent Person	A person with the sufficient knowledge, experience, training, skill and ability to perform the specific work required and who has passed any courses that is required for that work. This includes having such practical and theoretical knowledge and experience of the equipment which is to be thoroughly examined that will enable him / her to detect defects or weaknesses. The purpose of their examination is to discover and assess the safety of the equipment. The person must be able to certify with confidence whether it is free from patent defects and suitable in every way for the duty for which the equipment is required. An example of this person could be a Lifting Equipment Engineer.
Factors of Safety	This refers to a factor that is applied to the MBL to determine the SWL. The factor of safety for lifting gears which is intended to be used to suspend the workbasket shall be at least 10: 1 and equipped with a double safety load line.
Headroom	Unhindered floor-to-roof space within a work platform.
Lift	Includes any lifting appliance or lifting machine used for carrying persons, whether together with goods or otherwise.
Lifting Equipment	Generic terms used in this guideline which covers hoist and lift, lifting gear, lifting appliance and lifting machine. For the purpose of this guideline these are equipment used for lifting and lowering loads, including attachments used for anchoring, fixing or supporting a load. Lifting equipment covers a wide range of items which include: • Overhead cranes and their supporting runways; • Motor vehicle lifts; • Mobile cranes and cranes fitted to vehicles (Hiab Truck); • A building cleaning cradle and its suspension equipment; • Goods and passenger lifts; • Tele-handlers and forklifts; • Lifting appliances include a pulley block, gin wheel and chain block or set of chain blocks; • Lifting gears include any chain, rope, chain sling, webbing sling, rope sling, hook, shackle, swivel or eyebolt and cage, basket or work platform used for carrying persons while it is suspended from the load line of a crane, container, skid, spreader bar etc.; and • Lifting machine includes any crane etc.
Lifting Gear	(a) any chain, rope, chain sling, webbing sling, rope sling, ring, hook, shackle, swivel or eyebolt; and (b) any cage or work platform used for carrying persons while it is suspended from the load line of a crane (as defined under the WSHA, Cap 277).
Minimum Breaking (Or Failure) Load (MBL)	This is the theoretical load below which a sample of the item will not break or fail, when new.
Professional Engineer	A person registered as a professional engineer and who has in force a practicing certificate issued under the Board of Architects, Professional Engineers and Quantity Surveyors (BAPEQs).

Quality Assurance / Quality Control (QA / QC)	Documents and their system are conducted and prepared by a company to check and monitor the quality of their work during the project stage.
Responsible Person	The employer of the person to the principal under whose direction the person works.
Safe Working Load (SWL)	The maximum load as assessed by a competent person that an item of lifting equipment may raise, lower or suspend under the service conditions. The safe working load is marked on the equipment by the manufacturer.

3 ACRONYMS AND ABBREVIATIONS

ABBREVIATIONS	TERM	DEFINITION
AE	Authorised examiner	A person approved by the Authority under Section 33 of the WSHA, Cap 277 for the purpose of carrying out any prescribed examination or test of hoist and lift, lifting gear, lifting appliance or lifting machine (as defined under the WSHA, Cap 277).
WSH Officer	Workplace, Safety and Health Officer	Workplace, Safety and Health Officer appointed under Section 28 of the WSHA, Cap 277.
WSH Co-ordinator	Workplace, Safety and Health Co-ordinator	Workplace, Safety and Health Co-ordinator appointed under Section 29 of the WSHA, Cap 277.
WSHA, Cap 277	Workplace Safety and Health Act, Chapter 277	Primary Law on Workplace Safety and Health in Malaysia, introduced in 2009 which sets the legal framework related to the safety, health and welfare of persons at all workplaces.
LOTO	Lockout/Tagout	A safety procedure used to ensure that machinery or equipment is completely shut off, isolated from its energy sources, and cannot be started again before maintenance or repair work is completed.
OEM	Original Equipment Manufacturer	Refers to a company that designs and manufactures equipment or components that are sold either under its own brand or used in another company's final product.
RCD	Residual Current Devices	A safety device designed to automatically disconnect an electrical circuit when it detects an imbalance between line and neutral currents, indicating a leakage of current to earth.
PLC	Programmable Logic Controller	An industrial digital computer used to automatically control machinery and processes based on programmed instructions.
IR	Insulation Resistance	Measurement of a material's ability to resist electrical current leakage between conductive parts, usually measured in ohms (Ω).
VFD	Variable Frequency Drive	An electronic device used to control the speed and torque of an electric motor by varying the frequency and voltage of the power supplied to it.
Certificate of Conformity	CoC	An official document issued by a manufacturer or authorized body declaring that a product, equipment, or system complies with specified standards, regulations, or technical requirements.
PL	Performance Level	A measure defined in ISO 13849-1 indicating the capability of a safety-related control system to perform its safety function under foreseeable conditions. Levels range from PL a (lowest) to PL e (highest), with higher levels indicating greater safety reliability.

SIL	Safety Integrity Level	A measure defined in IEC 61508 / IEC 61511 quantifying the reliability of a safety instrumented function in reducing risk. Levels range from SIL 1 (lowest) to SIL 4 (highest), with higher SIL levels representing a lower probability of dangerous failure.
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4 APPLICABLE STANDARDS AND OTHER INDUSTRY GUIDANCE

4.1 Regulatory & Standards overview

Table 4-1 Regulatory & Standards Overview

STANDARD/GUIDELINE	SCOPE
ISO 13849-1 / IEC 62061	Safety of control systems (machinery) - Control-system architecture, safety requirements specification and validation ISO 13849-1: performance levels (PL) method for safety-related parts of control system (protective controls) IEC 62061: functional safety for safety-related electrical/electronic/programmable control systems in machinery
EN 61800-5-2	Safety requirement for adjustable-speed drives (safe stop, safe torque off, safe limited speed etc.)
ISO 14118	Safety of machinery — Prevention of unexpected start-up
ISO 14119 / IEC 60204-1	Interlocks and machinery electrical safety Part 1: general requirements. Primary reference for electrical control panels, wiring, earthing, isolation, protective devices, control circuits etc
ISO 12100	Risk assessment and risk reduction: general machine safety process for identifying electrical hazards and selecting protective measures
NFPA 70 / NEC	Electrical system safety and grounding
Manufacturer Recommendations	Always follow OEM guidelines for intervals and methods
NFPA 70E	Electrical safety in the workplace
EN 81-20 /EN 81-50	Safety rule for design and testing of passenger and goods lifts (covers many electrical safety aspects, interlocks, emergency systems and control equipment

EN 13015	Maintenance rules during servicing, including electrical indicators, stop devices, emergency lighting and signage
BS7671	Design, installation, inspection, and testing of electrical systems up to 1000 V AC or 1500 V DC
IEC60227-6	PVC insulated lift and flexible cables with rated voltages up to 450/750 V, including conductor types, insulation, sheath, and mechanical construction. Covers flat and circular cables used in lift applications and other moving connections.
IEC60245-5	Rubber-insulated lift cables with rated voltages up to 450/750 V, covering conductor types, insulation, sheath, and mechanical construction. Intended for use in lifts (elevators) and other flexible connections.

5 TECHNICAL REQUIREMENT

5.1 Design and installation requirements

When specifying technical requirements for a fixed passenger lift inside a building, with a rated capacity under 1000 kg (13 persons), considerations must include its intended use, passenger capacity, applicable safety standards, and integration with the building's structural and electrical systems. These factors ensure the lift operates safely, reliably, and efficiently while providing protection for passengers and maintenance personnel.

Lifts must meet the Lifts Directive 2014/33/EU (harmonized standards such as EN 81 family give presumption of conformity). Machinery must comply with the Machinery Regulation EU 2023/1230 and related harmonized standards.

These systems are often used in industrial, commercial applications for vertical movement.

5.1.1 Capacity & Dimensions

- Load capacity: Usually specified in kg or number of persons (e.g., 1000 kg or 13 persons)
- Car dimensions: Width, depth, and height to accommodate load size
- Shaft dimensions: Must support car and counterweight systems

5.1.2 Speed & Travel

- Lifting speed: Measured in m/s (e.g., 1 m/s for standard passenger lifts, 0.2–0.5 m/s for freight lifts)
- Total travel height: Floor-to-floor distance × number of floors

- Number of stops/floors: Define how many floors the lift will serve

5.1.3 Drive Mechanism

- Hydraulic drive: Ideal for low-rise buildings (2–4 storeys)
- Traction drive: More energy-efficient and suitable for mid to high-rise
- Machine-room-less (MRL) options: Save space

5.1.4 Control System

- Automatic control system: Microprocessor-based, PLC, or integrated building management
- Call system: Up/down buttons, destination dispatch (for high traffic)

5.1.5 Safety & Compliance

- Emergency brake, overload detection, door safety sensors
- Emergency communication system
- Compliance with standards such as:
 - EN 81 (Europe)
 - ISO 25745 for energy performance

5.1.6 Environmental & Power Requirements

- Power supply: Typically, 3-phase (e.g., 400 V, 50/60 Hz)
- Standby/emergency power provision (optional)

Basic Design schematics:

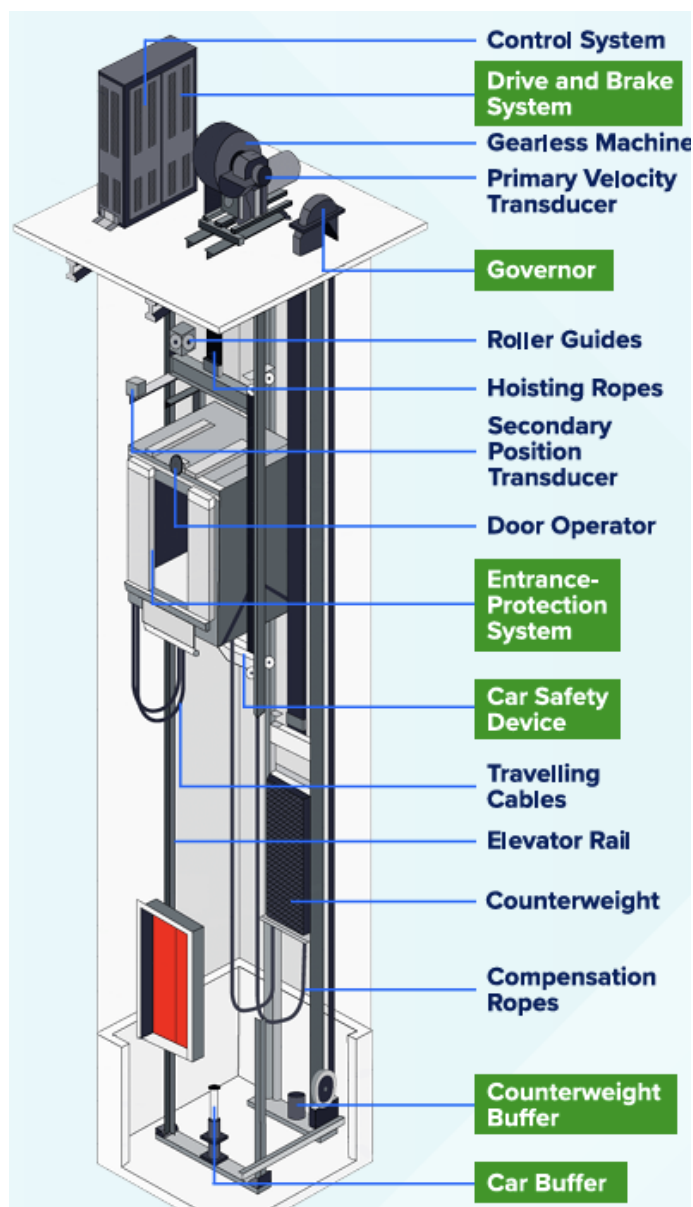
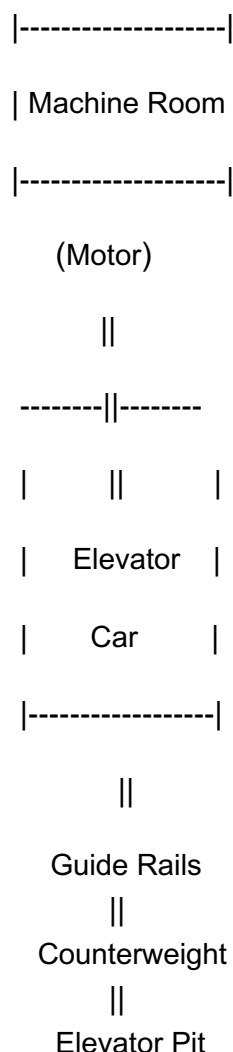


Figure 1 Lift (Elevator) Basic Design Schematics

5.2 Electrical Safety

Electrical safety is critical to ensure safe operation, protect equipment, and prevent injury or fire.

5.2.1 Power Supply and Isolation

- Dedicated electrical circuit: A lift must have its own circuit with clearly labeled breakers.
- Main isolator switch: Should be located outside the lift shaft/machine room for emergency disconnection.
- Emergency power supply: Optional but recommended — via uninterruptible power supply (UPS) or generator to allow safe evacuation during power failure.

5.2.2 Grounding & Bonding

- All metallic parts (car, doors, guide rails, motor housing, etc.) must be properly grounded to prevent electric shock.
- Ensure equipotential bonding of structural elements to avoid voltage differentials.

5.2.3 Protection Devices

- Circuit breakers (MCBs) or fuses: Protect against overloads and short circuits.
- Earth leakage circuit breakers (ELCBs) or residual current devices (RCDs): Provide shock protection.
- Overvoltage protection: Surge protection devices (SPD) should be installed where lightning or voltage spikes are likely.

5.2.4 Control Panel and Wiring

- Must be lockable, enclosed, and accessible only to qualified personnel.
- Wiring should meet relevant standards (e.g., flame-retardant, marked, neatly routed in trays or conduits).
- Emergency stop circuits must be fail-safe (normally closed loop).
- Use LSHF (Low Smoke Halogen-Free) or fire-rated cables. Wiring colors, marking, terminal blocks and drawings per IEC/EN 60204-1

5.2.5 Emergency Features

- Emergency stop switch:
 - Located inside the car and at machine/control room.
- Battery backup for:
 - i. Emergency lighting
 - ii. Alarm/buzzer
 - iii. Intercom or phone system
- Fall Protection: Required when working in elevator pits, on lift car tops.

5.2.6 Common Safety Tips:

- Routine inspections of electrical systems, cables, and enclosures.
- Regular IR thermographic scans to detect overheating or loose connections.
- Train operators and maintenance personnel on electrical hazards and emergency shutdowns.
- Use only qualified electricians for installation, modification, or repairs.

5.3 Inspection and maintenance requirements

Focusing on compliance, preventive maintenance, and fail-safe operation.

5.3.1 Inspection requirements

Table 5-1 Inspection Requirements

INTERVAL	INSPECTION TASKS
Daily / Pre-shift	Visual checks of control panel, indicators, lighting, and alarms
Monthly	Door interlock check, safety brake test (manual activation if applicable), emergency stop
Quarterly	Overspeed governor test, car guide rails inspection, buffer condition check
Annually	Full load test, safety gear test, final limit switch function, battery backup and UPS test

Key Safety Inspection Points:

- Door interlocks and limit switches
- Emergency stop and alarm system
- Brake release function
- Over-speed governor rope and tension
- Shaft lighting and access ladders
- Controller panel cleanliness and labeling
- Grounding and bonding continuity

5.3.2 Maintenance requirements

Table 5-2 Maintenance Requirements

TASK	FREQUENCY	NOTES
Lubricate guide rails and bearings	Monthly	Use OEM-recommended lubricants
Test brake wear and alignment	Quarterly	Replace if lining is worn or spring force degraded
Check traction ropes and sheaves	Annually	Measure wear and elongation
Battery replacement (UPS/emergency)	Every 2–3 years	Check under load conditions
Software/firmware updates	As released	By certified technician

Record all tests, findings, and repairs in a Lift Maintenance Logbook (often legally required).

5.3.3 General safety measures during inspection & maintenance

- LOTO: Mandatory before accessing motors, electrical panels, or control circuits.

- Use of PPE: Gloves, safety shoes, arc-rated clothing, helmets for shaft.
- Fall Protection: Required when working in elevator pits, on lift car tops.
- Proper Access: Use of certified ladders, platforms, or catwalks with guardrails.
- Two-Person Rule: For confined spaces (lift pits, shafts) or live circuit testing.
- Calibration: Test devices and safety sensors must be calibrated according to OEM instructions.

5.3.4 Recordkeeping & Documentation

Table 5-3 Recordkeeping & Documentation

DOCUMENT	PURPOSE
Maintenance Logbook	Record all maintenance, repairs, replacements
Inspection Checklists	Daily/weekly/monthly forms signed by technician
Fault/Breakdown Log	Fault codes, causes, and corrective actions
Certification Logs	Calibration, load testing, brake test certification
Training Records	Ensure technicians are qualified for inspections

5.3.5 Inspection outcome

- Pass: No faults; system safe for continued use.
- Conditional Pass: Minor issues noted; scheduled repair without shutdown.
- Fail: Major fault; system must be locked out until repaired.

5.4 Correct sizing of electrical equipment

It is essential to ensure that electrical equipment is properly sized, rated, and classified, particularly if installed in hazardous environments.

The following outlines the technical requirements in these areas:

5.4.1 Motor Sizing

- Power rating (kW/hp): Based on load capacity, speed, number of starts per hour.
- Torque requirements: Sufficient starting and running torque.
- Service factor: Typically 1.15 or higher

5.4.2 Control Equipment

- Contactor & relay ratings: Must handle full-load current (FLC) and inrush currents.
- Breaker/fuse size: Typically 125 %–150 % of FLC.
- Soft starters / VFDs: Commonly used to control acceleration/deceleration.

5.4.3 Power Supply

- Must match equipment requirements: typically, 3-phase, 400/415 V.
- UPS may be required for emergency systems.

5.4.4 Other Considerations

- Emergency Power Supply: Backup battery or generator required for evacuation lifts.
- Thermal Management: Heat dissipation for drives and motors.
- Cable Selection: Flame-retardant, low smoke halogen-free (LSHF), especially in buildings.
- Earthing and Bonding: Essential for protecting passengers and maintenance personnel by preventing electric shock and ensuring fault currents are safely carried to earth

5.5 Correct installation of electrical equipment

5.5.1 General Safety Principles

- Compliance with Standards:
 - Electrical installations must comply with:
 - IEC 60204-1 – Safety of machinery electrical equipment
 - EN 81 – Lifts and escalators
 - ISO 13849-1 / IEC 62061 – Functional safety of control systems
 - Qualified Personnel:
Installation must be performed by licensed electricians or trained technicians under proper supervision.

5.5.2 Main Electrical Panel

- Panel layout, segregation of control & power circuits.
- Located in a dedicated machine room or controller cabinet.
- Must be easily accessible and properly ventilated.
- Lockable disconnect switch required near the main panel.

5.5.3 Wiring and Cabling

- Use LSHF (Low Smoke Halogen-Free) or fire-rated cables. Wiring colors, marking, terminal blocks and drawings per IEC/EN 60204-1
- Cables must be secured and protected against mechanical damage (conduit or trunking).
- Use flexible trailing cables in the hoist way to accommodate movement.

5.5.4 Motor and Drive Installation

- Motors must have thermal protection and grounding.
- Drives (VFDs) should be installed with proper clearance for cooling.
- Vibration isolation may be necessary.

5.5.5 Control and Safety Circuits

- Redundant or fail-safe design for critical circuits (e.g., door interlocks, emergency brakes).
- Positioning and design of emergency stops, safety-related stop categories, safe reset procedures and lock-out/tag-out arrangements. Emergency stop buttons must be provided at key locations.
- Over-speed governors, limit switches, and load sensors must be integrated.

5.5.6 Emergency Power

- Backup supply (battery or generator) required for emergency operation or rescue mode.
- Lighting and alarms must remain operational during power outages.

5.5.7 Earthing & Bonding

- All metal parts must be bonded.
- Ensure Overcurrent protection, RCD where required, protective earth (PE) continuity, bonding throughout the system. IEC 60204-1 guidance applies.

Table 5-4 Summary Installation Checklist

ITEM	REQUIREMENT	CHECK √
Power Disconnects	Lockable, accessible, emergency-rated	
Cable Type	Flame-retardant, LSHF, shielded, flexible where needed	
Overcurrent Protection	Breakers or fuses rated per motor/controller specs	
Earthing & Bonding	All metal components, with continuity checks	
IP/NEMA Rating	Based on environmental exposure (dust, water)	
Safety Interlocks & E-Stops	Mandatory on guards, platforms, and access points	
Control Panels	Labeled, IP65 or higher, separate low-voltage control	
Backup Power	Required for lift emergency systems	
Compliance	NEC, IEC, ISO or local electrical codes	

5.6 LOTO for electrical equipment

LOTO procedures are essential to prevent accidental energization during installation, maintenance, inspection, or repair activities.

5.6.1 General Requirements

5.6.1.1 Energy Isolation:

- Disconnect all sources of hazardous energy, including:
- Electrical (main power, control circuits)
- Mechanical (motors, tension, gravity)
- Stored energy (capacitors, springs, hydraulic)

5.6.1.2 Lockout Devices:

- Use mechanical locks on disconnect switches, breakers, or isolators.
- Devices must be durable, standardized, and resistant to environmental factors.

5.6.1.3 Tagout Devices:

- Attach clearly visible warning tags stating:
- “Do Not Operate”
- Name of person who applied it
- Date and time of application

5.6.1.4 Zero Energy Verification:

- Test the equipment to ensure no voltage or residual energy remains.
- Use a voltage tester or meter after lockout is applied.

5.6.1.5 LOTO for Lift (Elevator) Systems

5.6.1.5.1 Isolation Points

- Main disconnect switch in the machine/control room
- Car top control switch
- Battery backup isolator (if installed)

5.6.1.5.2 Specific Safety Steps

- Place elevator car at a floor, notify users.
- Engage emergency stop and control room disconnect.
- Lock and tag main electrical panel isolator.
- Verify no control power at controller terminals.
- Secure hoist way or pit access to prevent unauthorised entry.

5.6.1.5.3 Extra Measures

- Use two-person rule for pit access.
- Install pit props or mechanical stops to support car weight.
- Disable emergency lighting where powered by a separate circuit.

5.7 Roles & Responsibilities

Table 5-5 Roles & Responsibilities

ROLE	RESPONSIBILITY
Authorized Person	Applies lock/tag, performs work
Affected Person	Notified of LOTO, does not operate equipment
Supervisor	Verifies proper LOTO procedure, ensures compliance
Safety Officer	Audits procedures, trains personnel

5.8 Documentation & Signage

Maintain written LOTO procedures for each machine or system.

Include:

- Equipment identification
- Energy sources and isolation points
- Lock/tag placement instructions
- Verification method
- Provide LOTO station with locks, tags, keys, and documentation near the work area.

5.9 Re-energization Procedure

1. Confirm all tools and people are clear from the system.
2. Remove lockout devices only by the person who applied them.
3. Notify affected personnel.
4. Restore power and test normal operation.

Table 5-6 LOTO Summary Table

REQUIREMENT	LIFT SYSTEMS
Lockable Disconnect	In machine room
Tag with Info	Operator, time, reason
Verify Zero Energy	Voltage test at terminals
Additional Isolation	Battery/UPS
Re-energize	Procedure Controlled and authorized

5.10 Fail safe mechanism

Fail-safe mechanisms are designed so that in the event of a failure (power loss, component fault, signal loss, etc.), the system defaults to a safe condition, preventing injury or equipment damage.

5.10.1 Brake System

- Fail-Safe Electromechanical Brake:
- Normally closed (engaged by spring pressure).
- Opens only when powered (via motor controller).
- In power loss or control failure, brake automatically engages.

5.10.2 Overspeed Governor

- Monitors car speed via centrifugal mechanism.
- Triggers mechanical safety gear (clamps rails) if car exceeds set speed.
- Independent of main control system (fail-safe by design).

5.10.3 Door Interlocks

- Prevents elevator from moving if doors are not fully closed and locked.
- If the interlock circuit is broken, the system defaults to non-operational (fail-safe open circuit).
- Uses redundancy in circuits for safety-critical doors.

5.10.4 Limit Switches & Final Limit Switch

- Detect elevator car position.
- Normal limit switches prevent overruns at top/bottom.
- Final limit switch is hard-wired, mechanical — stops power if car exceeds boundary (fail-safe trip).

5.10.5 Buffer Springs / Hydraulic Buffers

- At pit bottom, absorbs impact if the car or counterweight descends too far.
- Passive system, no power required (fail-safe via energy absorption).

5.10.6 Emergency Stop & Communication

- Emergency stop buttons in car and control panel — removes power from drive.
- Two-way communication (fail-safe: powered by battery/UPS).

5.10.7 Battery Backup for Controller

- Enables car to move to nearest floor during power failure.
- Battery checks are periodic; if battery fails, elevator stops — not continues blindly.

5.10.8 General fail-safe design principles

Table 5-7 General Fail-safe design principles

PRINCIPLE	DESCRIPTION
De-energize to trip	Systems trip to safe mode when power is lost (e.g. brakes, E-stop)
Redundancy	Critical sensors (e.g. overspeed, door locks) may be duplicated
Open-Circuit Safety	Control circuits are designed so that open/broken wire = trip
Mechanical Backup	Buffers, brakes, clamps engage without need for power
Battery/UPS	Ensures safety systems function during power outages
Self-Diagnosis	Modern systems monitor for faults and revert to safe state

Table 5-8 Fail-safe design summary table

SYSTEM COMPONENT	FAIL-SAFE MECHANISM
Lift Brake	Spring-applied, power-release
Lift Door Lock	Normally closed safety circuit
Overspeed	Mechanical trip + rail clamp
Belt Safety	Misalignment, speed sensors trigger stop
Control Power	Battery/UPS for control & rescue
Guard Interlocks	Power cut when guard removed

Fail-Safe Verification Checklist that you can use during the commissioning or routine inspection of lift (elevator). It's structured for practical, on-site use and ensures all critical safety features are functioning in a fail-safe manner.

6 TRAINING AND COMPETENCY REQUIREMENTS

6.1 Minimum training and competency for lift service technician

The maintenance and inspection of lifts are vital to the safety use of the lifts for the public.

It is the responsibility of the company to ensure their service technicians are competent to perform maintenance and inspection on lifts.

Below is the minimum competency expected by the service technician:

Safety:

- Good understanding of electrical safety and hazard
- Awareness of health, safety and environment at workplace
- Hazard and risk awareness
- Safety during work at height
- Understanding of lifts' safety features
- Completed relevant training programs

Maintenance, inspection, troubleshooting and repair:

- Mechanical wear & tear
- Corrosion inspection
- Wire rope inspection
- Electrical inspection
- Motor inspection
- Electrical system
- Risk awareness
- Control system
- Operation
- Basic mechanical and rotating equipment

(2) Lift and Escalator Course for Engineers |BCA Academy

7 CERTIFICATIONS

7.1 Under the **Workplace Safety and Health (General Provisions) Regulations**, any lift used at workplaces to carry people or goods **must be thoroughly examined and certified fit for use by an authorised examiner** every **six months**. Failing to use a certified lift or to maintain the required inspection schedule is considered an offence and may lead to enforcement action by SHENA.

7.2 Lift owners/employers/occupiers/persons in control must ensure:

- The lift is inspected by the contractor, endorsed for certification by a third party.
- Risk assessments are conducted, and necessary safety controls are in place before operations begin.

7.3 Certificate of Inspection

CERTIFICATE OF INSPECTION			CERTIFICATE OF INSPECTION		
No.	Date:	Page 1/2	No.	Date:	Page 2/2
THIS TO CERTIFY, that the undersigned surveyor to this society did at the request of "name of client" attended at "location" for the purpose of inspecting the equipment mentioned below and report as follows: Description: Serial no: Manufacturer: Car dimension: Model/Type no: No. of stops: Max no. of passengers: Max lift capacity (Safe working load): Speed: Lift type: Date of last inspection: Date of certificate issue: Specification: Technical referential: <u>INSPECTIONS AND TESTS</u> -Review of previous inspection certificate -Review of manufacturer's documentations & date plate issued by "lift company" -Review of lift maintenance report (dated) – "lift company" -Thorough visual inspection & functional test was carried out -Test of braking system (Governor test), warning & emergency safety devices (ARD & EBOPS test) <u>REMARKS</u> • Visual functional & load test to be carried out every five (5) years • Intercom not available, only emergency alarm bell (one way communication) is available • Car-top rear handrail not available • No ventilation fan available inside shaft <u>CONCLUSION</u> Based on inspections and tests of the equipment described above was found satisfactory at the time of inspection.			<u>NEXT INSPECTION</u> Visual/Functional test: Visual/Functional test/ Load test:		
			"Chop" Surveyor to "third party contractor"		
			"Chop" Reviewed by Surveyor to "third party contractor"		

8 RISK MANAGEMENT

Lift owners are reminded of their legal duties as per **Sections 17 and 19 of the WSH Act, Cap 277, Regulations 19 of the WSH (General Provisions) Regulations, and the WSH (Incident Reporting) Regulations.**

These legal responsibilities include:

- Periodic maintenance of lifts as per the manufacturer's recommendation by engaging a lift service contractor to ensure the lifts are in safe condition and precautions are undertaken.
- Ensure that the lifts are examined by an Authorised Examiner at statutory intervals.

- Clearly display the certificate of test and examination, as well as the maximum capacity/safe working load/maximum number of persons which the lift can safely carry.
- Establish and implement an emergency response plan, such as lift entrapment and loss of power
- To act promptly to remedy any defects that were found.
- Ensure that every rope/chain/wire, part of the structure and every article supporting the lift is of good construction and sound material and is of adequate strength suitable for the nature of its use.
- To report to SHENA of any reportable incidents including dangerous occurrences, as soon as reasonably practicable.

8.1 Regular maintenance

8.1.1 Regular maintenance of lifts is essential to ensure their safe, reliable, and efficient operation. It involves the routine inspection and servicing of electrical systems, control panels, wiring, safety devices, and mechanical components. Preventive maintenance plays a vital role in identifying potential issues early, reducing the risk of unexpected breakdowns, and extending the service life of the equipment. The primary objectives of lift maintenance are to prolong the equipment's lifespan, improve its safety and reliability, minimize the inconvenience caused by equipment downtime, avoid costly repairs, and prevent violations of safety regulations that could lead to penalties.

8.1.2 Maintenance activities should strictly follow the manufacturer's recommendations and comply with all relevant local safety standards and regulations. Key maintenance tasks include: -

8.1.2.1 Inside the Car:

- Examine the interior of the elevator car for damage to the walls, ceiling, and handrails.
- Examine the position indicator lights and replace any burned out lights.
- Operate the elevator going up and down and check the leveling accuracy, acceleration, and deceleration. Make any adjustments deemed necessary.
- Check to make sure that the door moves smoothly and does not slam or bounce.
- Make sure the door restrictor operates properly and make any necessary repairs.

8.1.2.2 Outside the Car:

- Check the hall stations and lights and replace any burned out lights.
- Inspect the door panel and clearances.
- Test the Phase 1 firefighters' service.

8.1.2.3 Machine Room:

- Make sure the machine room does not contain any material unrelated to the elevator.
- Check components for leaks, unusual vibration, or wear.
- Inspect electrical components for evidence of overheating or failure.
- Lubricate components, if necessary.
- Check the oil level.
- Make any necessary adjustments or schedule follow-up service.
- Check the ambient temperature of the machine room must not higher than 38 degree Celsius.

8.1.2.4 Top of Car:

- Check that the stop switches and inspection station function properly.
- Remove any debris from the top of the car.
- Inspect any visible components, including rollers, guide rails, and leveling devices.
- Check the traveling cables for wear and inspect connections.
- Inspect the door operator and its components.
- Check the hoist way for evidence of rodents, fire safety, and vandalism.

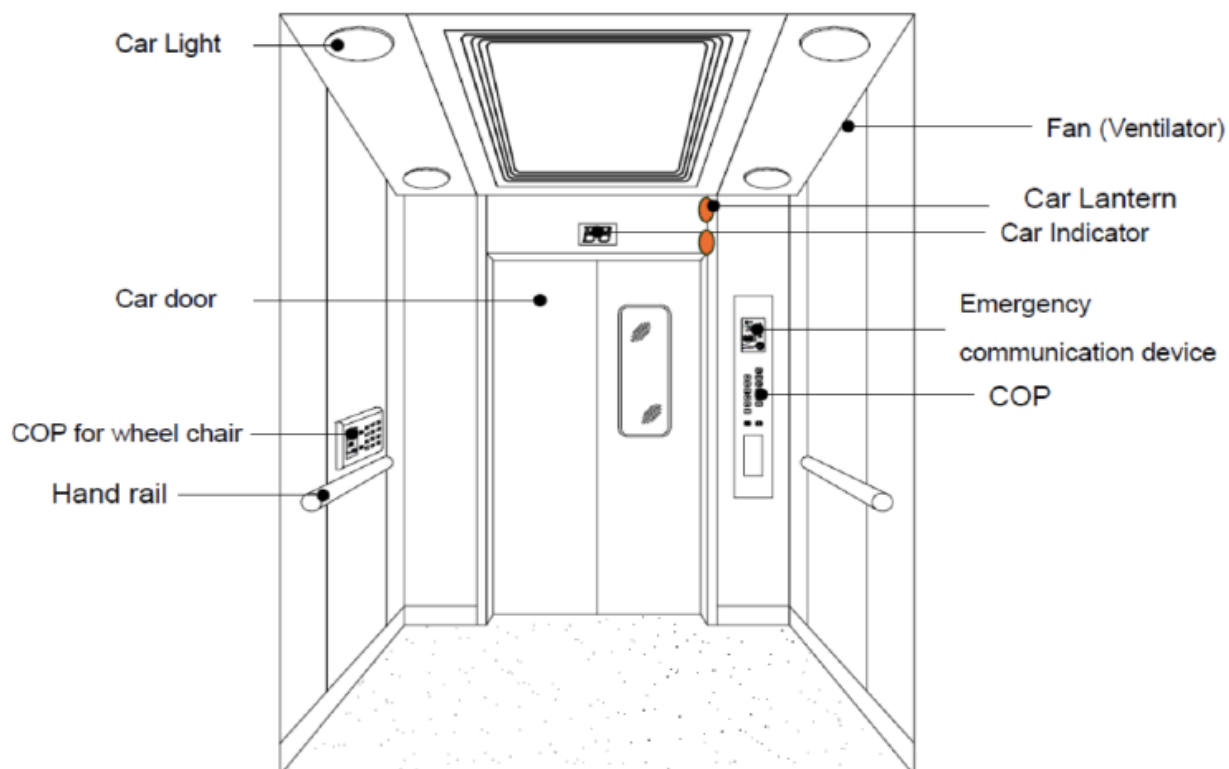
8.1.2.5 Pit:

- Make sure that the stop switch, lights, and GFI outlet function properly.
- Clean the pit and check for signs of leaks.
- Inspect the spring buffers for signs of corrosion, alignment, and secure attachment.
- Inspect all visible components, including rollers, guide rails, safeties, and switches.
- Check the travel cable for wear, pinches, and snags.
- Make sure the sump pump is clean and operating correctly.

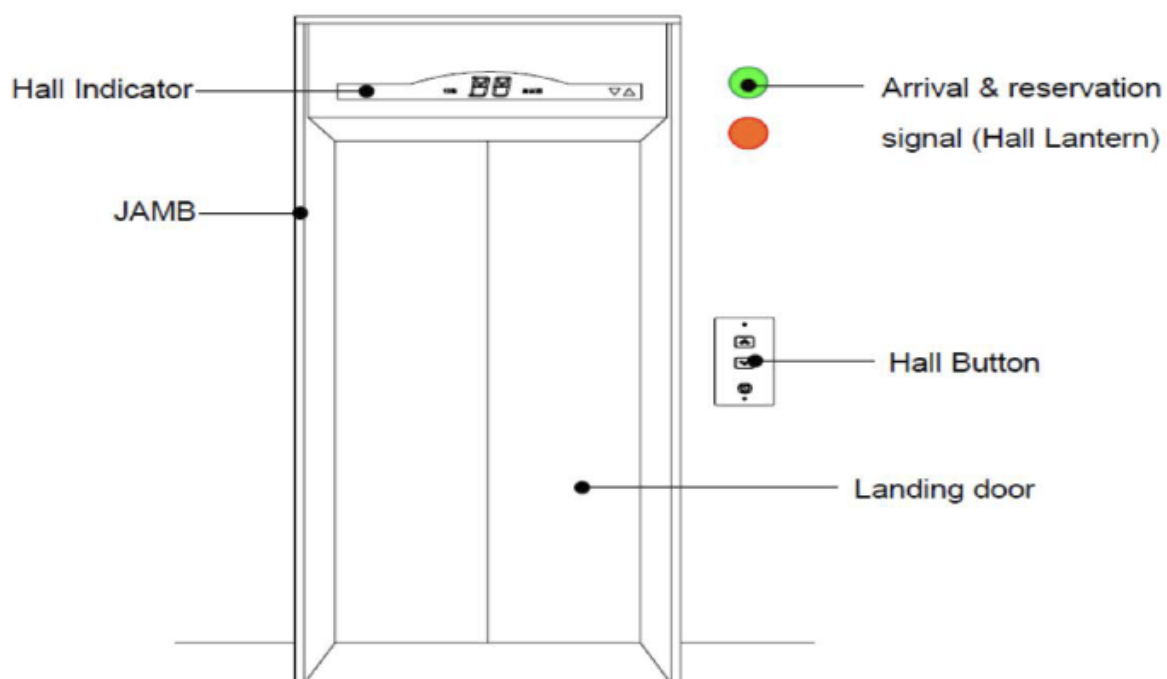
8.1.2.6 Others Services in related to lift shaft:

- Make sure that the ventilation (natural ventilation, air-condition or exhaust fan) operate properly. (The air ventilating devices must be installed at machine room, hoist way, and car to make good condition for lift operation (General Temperature 0 °C~ +40 °C)
- Make sure that motor room / head room is water tight.
- Don't leave items in the front of machine room entrance and around that interrupt room accessing.
- A machine room must be always locked, and limit room accessing except qualified person.
- A machine room and hall require enough and proper lighting for normal operation.

Car Inside



Elevator Hall



8.1.2.7 Records

Maintenance and Servicing work processes ensure that we have properly documented formal inspection procedures and records. Capturing all data output takes the form of a review. These are reviewed for accuracy and completeness and the review is signed off prior to them being issued to the customer.

After all the maintenance had been done / carried out successfully then the equipment/s will be put back to normal operation.

Example of Elevator Maintenance Record Form

NO.	MAINTENANCE DATE	MAINTENANCE PERSONNEL	MAINTENANCE SITUATION	REMARKS
1	DD/MM/YYYY	Name	Maintenance and servicing	Lift is normal
2				
3				
4				
5				
6				
7				
8				
9				
10				

8.2 Risk assessment

Do a formal risk assessment (ISO 12100) to identify required safety functions and required PL/SIL levels.

A risk assessment for the safe use of lifts is essential to identify potential hazards, evaluate the likelihood and severity of risks, and implement appropriate control measures to ensure the safety of all users and maintenance personnel.

Common hazards associated with lift operations include entrapment due to mechanical failure or power loss, injuries from sudden stops or misaligned landings, electrical shock during maintenance, unauthorized access to lift shafts or machinery rooms, and slips, trips, or falls in the lift car or surrounding areas.

There are also risks related to overloading the lift beyond its rated capacity, as well as the possibility of fire hazards in the control panel or lift shaft due to poor maintenance or electrical faults.

To mitigate these risks, all lifts must be routinely inspected and maintained according to manufacturer guidelines and local safety regulations. Emergency alarms, communication systems, and safety interlocks should be tested regularly to ensure functionality.

Appropriate signage must be displayed to warn of load limits, and lifts should not be used during fire emergencies unless certified for such use.

Maintenance personnel must follow LOTO procedures and wear appropriate personal protective equipment (PPE), including gloves, helmets, and electrical protection when servicing lift components.

Safety barriers and warning notices must be installed during any repair or servicing work to prevent unauthorized access.

Table 8-1 Risk Assessment

Item	WORKS ACTIVITY	HAZARD EFFECT	RISK CONTROL ACTION	EMERGENCY PREPAREDNESS PLAN
Car Cage (Top & Bottom). Lift Pit/Landing & Car Door	Replacement of Landing & Car Door	Fall/falling object -Physical inspection -Hands on tools	Provide appropriate PPE's related to work. -(Hard Hat, Eye glass, Harness & Hand gloves)	Maintenance Team Office Hour: 1234567 Mobile No: 1234567 BOMBA HOTLINE NO. 238-0402 AMBULANCE 991
			Ensure fall protection plan is in place when lift landing is opened -(Barricade, Signages, Hard hat)	
		Pitching -Physical inspection - Hands on tools	Provide appropriate PPE's related to work. -(Barricade, Signages, Hard hat, hand gloves)	
			Provide machinery space w/out posing any safety risk to worker. -(Cutting Machine, Electric drill, wrenches)	
Lift Motor/Distribution Board/Cable Trunking/Electrical Panel(E&I)/Button Fixtures (Car & Landing Button)	Replacement of Light diffuser/Switches/Button Fixtures	Falling break glass -Visual inspection - Physical inspection	Follow lock-out/tag-out procedure when isolating power source before execution of work. (Lock with key, Barricade, Signages, hand gloves, Ladder)	Maintenance Team Office Hour: 1234567 Mobile No: 1234567 BOMBA HOTLINE NO. 238-0402 AMBULANCE 991
		Expose on electric -Physical inspection	"Provide appropriate tools required before execution of work -(Instrument tools, tester, plier, screw etc.) fire extinguisher, etc.)	
	Replacement of electronic/Electrical Parts	Expose on electric -Visual inspection -Physical inspection	Follow lock-out/tag-out procedure when isolating power source before execution of work. (Lock with key, Tagging, Barricade fire extinguisher, Signages & hand gloves)	
	Inspection of control panel hall/car button	Expose on electric -Visual inspection	Provide appropriate PPE's related to work. -(Hand gloves & Eye glass) Provide appropriate tools required before execution of work (Instrument tools, tester, plier, screw etc.)	

Item	WORKS ACTIVITY	HAZARD EFFECT	RISK CONTROL ACTION	EMERGENCY PREPAREDNESS PLAN
	Replacement of traction motor/governor	Expose on electric -Physical inspection	Follow lock-out/tag-out procedure when isolating power source before execution of work. -(Lock with key, Tagging, Barricade Signages & hand gloves)	Maintenance Team Office Hour: 1234567 Mobile No: 1234567 BOMBA HOTLINE NO. 238-0402 AMBULANCE 991
			Provide appropriate Tools -(Wrenches, Chain Blocks, Cutting machine)	
	Inspection and replacement of control panel/hall & car button.	Expose on electric -Visual inspection - Physical inspection	Follow lock-out/tag-out procedure when isolating power source before execution of work. -(Lock with key, Tagging, Barricade Signages & hand gloves)	
Hoisting rope/Guide rail (Car & Counter weight)/Buffer & Oil Buffer (refilling & cleaning)	Replacement of oil or spring buffer for car & counterweight.	Pitching -Physical inspection	Provide appropriate PPE's related to work. -(Hard Hat, Goggles, Harness & Hand gloves)	Maintenance Team Office Hour: 1234567 Mobile No: 1234567 BOMBA HOTLINE NO. 238-0402 AMBULANCE 991
			Provide appropriate Tools -(Wrenches, Chain Blocks, Cutting machine)	
	Oil refilling/cleaning	Oil spill on the pit. -Floor pit slip	Provide appropriate PPE's related to work. -(Hand gloves, safety boots & face mask) Provide appropriate tools & cleaning materials. Oil reservoir, detergent soap, absorbent material (sand or soil)	
	Replacement of traction motor/Hoisting Ropes	Pitching/Falling -Physical inspection	Provide appropriate PPE's required. -(Hard Hat, Goggles, Harness & Hand gloves) Provide machinery space w/out using any safety risk to worker. -(Cutting Machine, Electric drill, wrenches, Chain blocks & electric hoist)	

Additionally, all lift users should be educated on safe operating practices, such as waiting for the lift to fully arrive before entering or exiting, not blocking doors, and avoiding unnecessary movement inside the lift.

A clear emergency response plan must be in place in case of entrapment or equipment failure.

- Be careful when stepping in and out of the lift to avoid tripping hazards and to be cautious of any loose items from getting caught on the doors.
- Report any problems or malfunctions related to the lift to the building management.
- Do not use your hands, legs or objects to keep lift doors opened.
- Do not use the lift in case of emergencies such as fire or natural disaster. Use the stairs.
- Do not overload or overcrowd the lift. Take note the maximum capacity that is displayed in the lift.

For lift users who are trapped inside:

Table 8-2 For lift users who are trapped inside

DO'S	DON'TS
Stay calm	Panic
Press the emergency call button to report the situation	Force the doors open
Wait for help to arrive	Attempt to exit the lift car
If lift is dark, use your mobile phone as a light source	Make sudden and/or continuous movements
During evacuation, exit the lift car only when it is parked at the same level as the floor level	Do not exit the lift car when not parked at the same level as the floor level

For individuals who are aware that there are people trapped inside lift:

Table 8-3 For individuals who are aware that there are people trapped inside lift

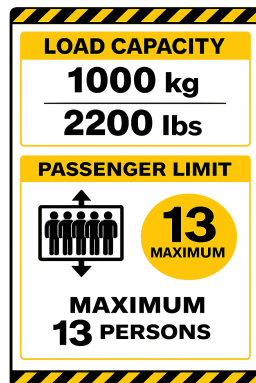
DO'S	DON'TS
Contact building management or lift service contractor for assistance	Attempt to rescue the people trapped inside by forcing the doors open.
If the above are not possible, contact the Fire and Rescue Department	
If possible, help the trapped people to remain calm.	

9 SIGNAGES

Clear and appropriate signage plays a vital role in ensuring electrical safety in and around conveyors. Such signs serve as clear visual reminders to alert personnel of potential electrical hazards, delineating restricted or controlled areas, identifying emergency procedures, and reinforcing necessary safety precautions. By prominently displaying safety signages, workplaces can help prevent accidents, support compliance with safety regulations, and fosters a culture off heightened awareness and responsibility.

Warning signs shall be prominently installed at nips points and other moving parts to highlight entrapment and electrical risks. Clear emergency stop signage, floor marking for safety zones are also among crucial signages important for application.

Table 9-1 Signages

TYPES OF SIGNAGES	SIGNAGES
Load Capacity and Passenger Limit Sign	 A rectangular sign with a yellow background and black text. It features a black border with yellow diagonal stripes at the top and bottom. The text reads: 'LOAD CAPACITY' in bold, followed by '1000 kg' and '2200 lbs' in large bold font. Below this, it says 'PASSENGER LIMIT' in bold, followed by an icon of three people and a yellow circle with '13' and 'MAXIMUM' inside. At the bottom, it says 'MAXIMUM 13 PERSONS' in bold.
Emergency Communication Instruction	Jika berlaku kerosakan sila hubungi Incase of lift breakdown please call During office hours: After office hours:  A rectangular sign with a red border and white background. It has the title 'IN CASE OF LIFT BREAKDOWN' in bold. Below the title, it says 'LAPURKAN KEROSAKAN LIF KEPADA:'. There are two sections: 'DURING OFFICE HOURS' with a red phone icon and 'AFTER OFFICE HOURS' with a red phone icon. Each section has a list of contact information: 'PLEASE CONTACT OFFICE', 'CONTACT NO', 'FAX', and 'PLEASE CONTACT HOTLINE NO'. Below these sections, there is a red fire icon and text about the fire brigade. At the bottom, there is a red fire icon and text about the fire brigade. At the very bottom, it says 'YOUR SAFETY IS OUR PRIORITY' and 'KESELAMATAN ANDA KEUTAMAKAN KAMI'.

	
Prohibition Signs	
	

SAFETY NOTICE

Please use the elevator button correctly, get in and out of the elevator car as soon as possible in an orderly manner.

Strictly prohibit bumping, kicking, prying elevator doors, components, buttons and other devices. It is strictly forbidden to horseplay in the elevator car.

It is strictly forbidden to enter the elevator car with overweight, extra-long, extra-tall and dangerous goods. The load to be carried should be evenly placed in the center of the elevator car. Do not scratch elevator doors, car walls, suspended ceilings, etc.

In case of fire, earthquake and other disasters, it is strictly forbidden to use elevator to escape. In case of elevator failure or power failure, please use the alarm button or walkie-talkie button in the elevator for help and dial the rescue telephone of the elevator maintenance unit (speak English or Malay).

Please keep the elevator environment clean, do not scribble or paste things, and please do not tear down this SAFETY NOTICE.

10 REFERENCES

- Guidance for lifting of persons in work platforms suspended from SHENA, 2025
- Lifting Operations at the workplace from SHENA, 2024
- Approval and Registration of third-party inspection agencies for lifting equipment from SHENA, 2021
- Safe use of lift at the workplace (SHENA poster)
- Method statement – maintenance (Airod Sdn. Bhd.)
- Stannah - Lift regulations standards - regulations for lift owners
- Stannah - Lift regulations standards - building regulations
- Stannah - Lift regulations standards -lift specification standards
- Stannah - Lift regulations standards - lift design standards
- Lockout -tagout procedures guide - RS

11 APPENDIX

FAIL-SAFE VERIFICATION CHECKLIST

ITEM	DESCRIPTION	PASS / FAIL	NOTES
1. Brake System	When power is removed, brake engages automatically	☐ / ☐	
2. Overspeed Governor	Simulate overspeed – verify mechanical trip engages safety gear	☐ / ☐	
3. Door Interlocks	Check if elevator will not move with door open or interlock disconnected	☐ / ☐	
4. Final Limit Switch	Manually test upper and lower final limit cut-off	☐ / ☐	
5. Emergency Stop (E-stop)	Test E-stop buttons inside car and machine room – system must halt	☐ / ☐	
6. Communication System	Test two-way emergency communication under power loss	☐ / ☐	
7. Backup Battery	Simulate power failure – verify elevator moves to nearest floor	☐ / ☐	
8. Control Circuit	Break any signal wire – system must enter safe state	☐ / ☐	
9. Grounding Check	Confirm continuity of protective earth (PE) to all components	☐ / ☐	
10. Pit Safety	Check pit props / buffers / lighting function under emergency	☐ / ☐	

VERIFICATION DETAILS

- Project/Area Name: _____
- Location: _____
- Performed By: _____
- Date: _____
- Supervisor Sign-off: _____

LIFT MAINTENANCE SERVICING RECORD

No. _____
Date:

Building Name:

SERVICING ITEMS	Lift No						SERVICING ITEMS	Lift No					
	1	2	3	4	5	6		1	2	3	4	5	6
ELAVATORS							Interphone/Battery						
Traction Machine							Door Shoes						
Motor Generator							Door Mechanism						
Carbon Brushes							Door Lubrication						
Brake And Levers							Panel Screws						
Gear Oil Level							Hall Button & Lantern						
Greasing							Supervisory Boards						
Relay Coil & Contacts													
Fuses													
Machine Room Condition							Step Chain Tension						
Ard / Ebops							Drive Chain Tension						
Rope Tension							Chain Lubrication						
Hanger Rail & Roller							Greasing						
Oiler							Traction Machine						
Guide Shoe/Roller							Brake						
Door Interlocks							Combs						
Limit & Safety Switches							Demarcation Comb						
Car Top & Pit Cleanliness							Lighting & Balustrade						
							Steps						
Alarm Bell/Battery							Safety Switches						
Car Lighting							Stop Button						
Car Buttons & Switches							Handrail & Equip						
Car Ventilation							Alarm Buzzer						
Position Indicators													

Remarks:

Parts Replaced:

Time In: Owner/Representative's Name & Signature:
Time Out: Serviceman's Name & Signature: