MECH3005 – Building Services
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Lift and Escalators: Components and Control

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Lift Components

- Major lift components:
  - Prime mover (electric machine or hydraulic pump)
  - Lift car (car frame, the car itself)
  - Counterweight (if used)
  - Guide rails
  - Entrances/Doors
  - Safety gear & overspeed governor
  - Buffers (energy accumulation, energy dissipation)
  - Roping systems (compensating ropes, traction systems)
  - Car & landing fixtures (buttons, indicators & switches)
Can you identify all the components?

Components of an electric traction passenger lift

[Source: CIBSE Guide D]
Can you identify all the components?

Components of an hydraulic lift

[Source: CIBSE Guide D]
Lift Components

- Electric traction lift
  - Motor (AC or DC; gear or gearless)
  - Roping
  - Emergency brake
  - Lift doors
- Constructional dimensions
- Machine room position
- Controller cabinet
- Pit
- Shaft
Typical gearless machine

[Source: CIBSE Guide D]
Typical geared machine

[Source: CIBSE Guide D]
Position of guide rails

[Source: CIBSE Guide D]
Typical counterweight

[Source: CIBSE Guide D]
Typical car frame and lift car construction

[Source: CIBSE Guide D]
Typical door operator

[Source: CIBSE Guide D]
Centrifugal governor

[Source: CIBSE Guide D]
Instantaneous safety gear: serrated cam

Progressive safety gear

Instantaneous safety gear: roller type

[Source: CIBSE Guide D]
Typical lift machine room

[Source: http://www.elevator-world.com]
Machine-room-less lift system
Roping systems

[Source: CIBSE Guide D]
Lift Drives & Features

- Electric traction lift: motor drives
  - Gear
    - Single-speed or two-speed AC motor
    - Variable voltage AC motor
    - VVVF (variable voltage, variable frequency) AC motor
    - Variable voltage DC motor
  - Gearless
    - Variable voltage DC motor
    - VVVF (variable voltage, variable frequency) AC motor
  - Linear induction drive
Lift Drives & Features

- Hydraulic lift
  - Maximum travel of 21 m; speed up to 0.75 m/s
  - Advantages:
    - Capacity for very heavy loads
    - Accuracy in floor leveling
    - Smooth ride characteristics
    - Low-level plant room
    - No structural loads from winding gear
    - Pump room can be located up to 10 m from the shaft
Lift Drives & Features

- **Firefighting or fireman’s lift**
  - Specific provisions include
    - Break-glass key switch (at G/F to control the lift)
    - Min. duty load, say 630 kg (for firefighting equipment)
    - Min. internal dimensions (m), 1.1(W) x 1.4(D) x 2.0(H)
    - An emergency hatch in the car roof
    - Manufactured from non-combustible material
    - A two-way intercom
    - 1 hour fire-resisting doors of 0.8 m (W) x 2 m (H)
    - A max. of 60 sec to run full building height
    - Dual power supplies (normal + emergency)

Can you explain why we need each of them?
“Lift operator”
Lift Traffic Control

- Lift (group) control arrangements
  - Operator
  - Single automatic
  - Down or up collective
  - Directional (up & down) collective
  - Group collective
  - Programmed control
  - AI (artificial intelligence) assisted control
Fig 14 Lift car called to a floor. 'In use' lights switched on

Single automatic control

'In use' lights illuminated

Car occupied and moving either up or down

Fig 15 Lift car in control of occupant and cannot be called by other passengers

Single automatic control

Fig 16 Lift car vacated. ‘In use’ lights switched off. Lift can now be called by other passengers.

Down collective control

Fig 17 Passengers enter the car and press buttons to travel upwards

Fig 18 While travelling upwards all the landing calls are by-passed

Down collective control

Fig 19 When the car moves down all landing calls are collected floor by floor

Fig 20 Passengers leave the car.

Lift Traffic Control

- Group of lifts
  - A number of lifts placed physically together, using a common signalling system and under the command of a group lift control system
- Group traffic control algorithms
  - From simple 2 lift control to very sophisticated
  - Landing call allocation: assign a lift to service a particular landing call
Lift Traffic Control

• Purpose:
  • To allocate the landing calls in an optimum way to individual lifts in the group
    • Minimise passenger waiting time
    • Minimise system response time
    • Minimise passenger journey time
    • Reduce ‘bunching’ (lifts move around together, instead of being evenly separated, e.g. by sudden heavy traffic)
    • Minimise the variation in passenger waiting time