

Part 1 General	1
1.1 Scope	1
1.3 Definition	2
Part 2 Electric Elevators	17
2.1 Construction of Hoistways and Hoistway Enclosures	17
2.1.1 Hoistway Enclosures.....	17
2.1.2 Construction at Top and Bottom of the Hoistway.....	18
2.1.3 Floor Over Hoistways	18
2.1.4 Control of Smoke and Hot Gases	18
2.1.5 Windows and Skylights.....	18
2.1.6 Projections, Recesses and Setbacks in Hoistway Enclosures	19
2.2 Pits	19
2.2.1 General.....	19
2.2.2 Design and Construction of Pits.....	19
2.2.3 Guards Between Adjacent Pits.....	19
2.2.4 Pit Access	19
2.2.5 Illumination of Pits.....	20
2.2.6 Stop Switch in Pits.....	21
2.2.7 Minimum Pit Depths Required.....	21
2.2.8 Access to Underside of Car.....	21
2.3 Location and Guarding of Counterweights	21
2.3.1 Location of Counterweights.....	21
2.3.2 Counterweight Guards.....	21
2.3.3 Remote Counterweight Hoistways.....	21
2.3.4 Counterweight Runway Enclosures.....	22
2.4 Vertical Clearances and Runbys for Cars and Counterweights	22
2.4.1 Bottom Car Clearances.....	22
2.4.2 Minimum Bottom Runby for Counterweighted Elevators.....	22
2.4.3 Minimum Bottom Runby for Uncounterweighted Elevators.....	23
2.4.4 Maximum Bottom Runby.....	23
2.4.5 Counterweight Runby Data Plate.....	23
2.4.6 Top Car Clearances for Counterweighted Elevators	23
2.4.7 Top Car Clearances for Uncounterweighted Elevators.....	23
2.4.8 Vertical Clearances with Underslung Car Frames.....	24
2.4.9 Top Counterweight Clearances.....	24
2.4.10 Overhead Clearances Where Overhead Beams Are Not Over Car Crosshead.....	24
2.4.11 Equipment on Top of Car Not Permitted to Strike Overhead Structure.....	24
2.4.12 Refuge Space on Top of Car Enclosure	24
2.5 Horizontal Car and Counterweight Clearances	24
2.5.1 Clearances Between Cars, Counterweights, and Hoistway Enclosures.....	24
2.6 Protection of Space Below Hoistways	25
2.6.1 Where the Space is Underneath the Counterweight and/or Its Guides.....	25
2.6.2 Where the Space is Underneath the Car and/or Its Guides.....	25
2.7 Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms	25
2.7.1 Enclosure of Rooms and Spaces.....	25
2.7.2 Maintenance Path and Clearance.....	26
2.7.3 Access to Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms	26
2.7.4 Headroom in Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms..	27
2.7.5 Working Areas Inside the Hoistway and in the Pit	28
2.7.6 Location of Machinery Spaces, Machine Rooms, Control Spaces, Control Rooms and Equipment	30
2.7.7 Machine and Control Rooms Underneath the Hoistway.....	32
2.7.8 Remote Machine Rooms and Control Rooms.....	32
2.7.9 Lighting, Temperature, and Humidity in Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms	33
2.8 Equipment in Hoistways, Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms	33

2.8.1 Equipment Allowed	33
2.8.2 Electrical Equipment and Wiring.....	33
2.8.3 Pipes, Ducts, Tanks, and Sprinklers.....	33
2.8.4 Electrical Heaters.....	34
2.8.5 Air Conditioning.....	34
2.8.6 Miscellaneous Equipment	34
2.9 Machinery and Sheave Beams, Supports, and Foundations	34
2.9.1 Supports Required.....	34
2.9.2 Loads on Machinery and Sheave Beams, Floors, or Foundations and Their Supports.....	35
2.9.3 Securing of Machinery and Equipment to Beams, Foundations, Guide Rails Structural Walls, or Floors.....	35
2.9.4 Allowable Stresses for Machinery and Sheave Beams or Floors, Their Supports, and Any Support Members That Transmit Load to the Guide Rails or Structural Walls	36
2.9.5 Allowable Deflections of Machinery and Sheave Beams, Their Supports, and Any Support Members Loaded in Bending That Transmit Load to Guide Rails or Structural Walls	36
2.9.6 Allowable Stresses Due to Emergency Braking.....	36
2.10 Guarding of Equipment and Standard Railing	36
2.10.1 Guarding of Equipment.....	36
2.10.2 Standard Railing.....	37
2.11 Protection of Hoistway Openings	37
2.11.1 Entrances and Emergency Doors Required.....	37
2.11.2 Types of Entrances.....	38
2.11.3 Closing of Hoistway Doors.....	38
2.11.4 Location of Horizontally Sliding or Swinging Hoistway Doors.....	38
2.11.5 Projection of Entrances and Other Equipment Beyond the Landing Sills.....	38
2.11.6 Opening of Hoistway Doors.....	38
2.11.7 Glass in Hoistway Doors.....	39
2.11.8 Weights for Closing or Balancing Doors.....	39
2.11.9 Hoistway Door Locking Devices and Power Operation.....	39
2.11.10 Landing-Sill Guards, Landing-Sill Illumination, Hinged Landing Sills, and Tracks on Landings.....	40
2.11.11 Entrances, Horizontal Slide Type.....	40
2.11.12 Entrances, Vertical Slide Type.....	41
2.11.13 Entrances, Swinging Type.....	43
2.11.14 Fire Tests.....	43
2.11.15 Marking.....	44
2.11.16 Factory Inspections.....	44
2.11.17 Transoms and Fixed Side Panels.....	44
2.11.18 Installation Instructions.....	44
2.11.19 Gasketing of Hoistway Entrances.....	45
2.12 Hoistway Door Locking Devices and Electric Contacts, and Hoistway Access Switches ..	45
2.12.1 General.....	45
2.12.2 Interlocks.....	45
2.12.3 Hoistway Door Combination Mechanical Locks and Electric Contacts.....	46
2.12.4 Listing/Certification Door Locking Devices and Door or Gate Electric Contacts.....	47
2.12.5 Restricted Opening of Hoistway or Car Doors	47
2.12.6 Hoistway Door Unlocking Devices.....	47
2.12.7 Hoistway Access Switches.....	48
2.13 Power Operation of Hoistway Doors and Car Doors	49
2.13.1 Types of Doors and Gates Permitted.....	49
2.13.2 Power Opening.....	49
2.13.3 Power Closing.....	49
2.13.4 Closing Limitations for Power-Operated Horizontally Sliding Hoistway Doors and Horizontally Sliding Car Doors or Gates.....	53
2.13.5 Reopening Device for Power-Operated Car Doors or Gates.....	54
2.13.6 Sequence Operation for Power-Operated Hoistway Doors with Car Doors/Gates.....	54
2.14 Car Enclosures, Car Doors and Gates, and Car Illumination	54

2.14.1 Passenger and Freight Enclosures, General.....	54
2.14.2 Passenger-Car Enclosures.....	56
2.14.3 Freight-Car Enclosure.....	58
2.14.4 Passenger and Freight Car Doors and Gates, General Requirements.....	58
2.14.5 Passenger Car Doors.....	58.2
2.14.6 Freight Elevator Car Doors and Gates.....	58.3
2.14.7 Illumination of Cars and Lighting Fixtures.....	58.3
2.15 Car Frames and Platforms	59
2.15.1 Car Frames Required.....	59
2.15.2 Guiding Members.....	59
2.15.3 Design of Car Frames and Guiding Members.....	60
2.15.4 Underslung or Sub-Post Frames.....	60
2.15.5 Car Platforms.....	60
2.15.6 Materials for Car Frames and Platform Frames.....	60
2.15.7 Car Frame and Platform Connections.....	61
2.15.8 Protection of Platforms Against Fire.....	61
2.15.9 Platform Guards (Aprons).....	61
2.15.10 Maximum Allowable Stresses in Car Frame and Platform Members and Connections...	61
2.15.11 Maximum Allowable Deflections of Car Frame and Platform Members.....	61
2.15.12 Car Frames with Sheaves.....	61
2.15.13 Suspension-Rope Hitch Plates or Shapes.....	62
2.15.14 Calculation of Stresses in Car-Frame and Platform-Frame Members.....	62
2.15.15 Platform Side Braces.....	62
2.15.16 Hinged Platform Sills.....	63
2.15.17 Fastening of Compensation Means.....	63
2.16 Capacity and Loading	63
2.16.1 Minimum Rated Load for Passenger Elevators.....	63
2.16.2 Minimum Rated Load for Freight Elevators.....	63
2.16.3 Capacity and Data Plates.....	65
2.16.4 Carrying of Passengers on Freight Elevators.....	65
2.16.5 Signs Required in Freight Elevator Cars.....	65
2.16.6 Overloading of Freight Elevators.....	66
2.16.7 Carrying of One-Piece Loads Exceeding the Rated Load.....	66
2.16.8 Additional Requirements for Passenger Overload in the Down Direction	67
2.16.9 Special Loading Means.....	67
2.17 Car and Counterweight Safeties	67
2.17.1 Where Required and Location.....	67
2.17.2 Duplex Safeties.....	67
2.17.3 Function and Stopping Distance of Safeties.....	67
2.17.4 Counterweight Safeties.....	67
2.17.5 Identification and Classification of Types of Safeties.....	67
2.17.6 Reserved for Future Use.....	68
2.17.7 Governor-Actuated Safeties and Car-Safety Mechanism Switches Required.....	68
2.17.8 Limits of Use of Various Types of Safeties.....	69
2.17.9 Application and Release of Safeties.....	69
2.17.10 Minimum Permissible Clearance Between Rail-Gripping Faces of Safety Parts.....	69
2.17.11 Maximum Permissible Movement of Governor Rope to Operate the Safety Mechanism	70
2.17.12 Minimum Factors of Safety and Stresses of Safety Parts and Rope Connections.....	70
2.17.13 Corrosion-Resistant Bearings in Safeties and Safety-Operating Mechanisms.....	70
2.17.14 Marking Plates for Safeties.....	70
2.17.15 Governor-Rope Releasing Carriers.....	70
2.17.16 Rail Lubricants and Lubrication Plate.....	70
2.18 Speed Governors	71
2.18.1 Speed Governors Required and Location.....	71
2.18.2 Tripping Speeds for Speed Governors.....	71
2.18.3 Sealing and Painting of Speed Governors.....	71
2.18.4 Speed-Governor Overspeed Switch.....	71
2.18.5 Governor Ropes.....	72

2.18.6 Design of Governor Rope-Retarding Means for Type B Safeties.....	73
2.18.7 Design of Speed-Governor Sheaves & Traction Between Speed-Governor Rope & Sheave	73
2.18.8 Factors of Safety in Load-Bearing parts of Speed Governor.....	73
2.18.9 Speed-Governor Marking Plate.....	73
2.19 Ascending Car Overspeed and Unintended Car Movement Protection	74
2.19.1 Ascending Car Overspeed Protection.....	74
2.19.2 Protection Against Unintended Car Movement.....	74
2.19.3 Emergency Brake.....	74
2.19.4 Emergency Brake Supports.....	75
2.20 Suspension Ropes and Their Connections	75
2.20.1 Suspension Means.....	75
2.20.2 Wire Rope Data.....	76
2.20.3 Factor of Safety.....	76
2.20.4 Minimum Number and Diameter of Suspension Ropes	76
2.20.5 Suspension-Rope Equalizers.....	77
2.20.6 Securing of Suspension Wire Ropes to Winding Drums.....	77
2.20.7 Spare Rope Turns on Winding Drums.....	77
2.20.8 Reserved.....	77
2.20.9 Suspension Rope Fastening.....	77
2.20.10 Auxiliary Rope Fastening Devices.....	81
2.21 Counterweights	81
2.21.1 General Requirements.....	81
2.21.2 Design Requirements for Frames and Rods.....	82
2.21.3 Cars Counterbalancing One Another.....	82
2.21.4 Compensation Means.....	82
2.21.4.2 Tie-Down Compensation Means	82
2.22 Buffers and Bumpers	83
2.22.1 Type and Location.....	83
2.22.2 Solid Bumpers.....	83
2.22.3 Spring Buffers.....	83
2.22.4 Oil Buffers.....	83
2.23 Car and Counterweight Guide Rails, Guide-Rail Supports, and Fastenings	85
2.23.1 Guide Rails Required.....	85
2.23.2 Material.....	85
2.23.3 Rail Section.....	86
2.23.4 Maximum Load on Rails in Relation to the Bracket Spacing.....	86
2.23.5 Stresses and Deflections.....	87
2.23.6 Guide-Rail Surfaces.....	87
2.23.7 Rail Joints and Fishplates.....	87
2.23.8 Overall Length of Guide Rails.....	93
2.23.9 Guide-Rail Brackets and Building Supports.....	93
2.23.10 Fastening of Guide Rails to Rail Brackets.....	94
2.24 Driving Machines and Sheaves	94
2.24.1 Type of Driving Machines.....	94
2.24.2 Sheaves and Drums.....	94
2.24.3 Factor of Safety for Driving Machines and Sheaves.....	95
2.24.4 Fasteners Transmitting Load.....	95
2.24.5 Shaft Fillets and Keys.....	95
2.24.6 Cast-Iron Worms and Worm Gears.....	95
2.24.7 Friction Gearing and Clutches.....	95
2.24.8 Braking System and Driving-Machine Brakes.....	95
2.24.9 Indirect-Driving Machines.....	96
2.24.10 Means for Inspection of Gears.....	96
2.25 Terminal-Stopping Device	96
2.25.1 General Requirements.....	96
2.25.2 Normal Terminal Stopping Devices.....	97
2.25.3 Final Terminal Stopping Devices.....	97

2.25.4 Emergency Terminal Stopping Means.....	98
2.26 Operating Devices and Control Equipment	98
2.26.1 Operation and Operating Devices.....	98
2.26.2 Electrical Protective Devices.....	101
2.26.3 Contractors and Relays for Use in Critical Operating Circuits.....	103
2.26.4 Electrical Equipment and Wiring.....	103
2.26.5 System to Monitor and Prevent Automatic Operation of the Elevator w/Faulty Door Contact Circuits	103
2.26.6 Phase Protection of Motors.....	105
2.26.7 Installation of Capacitors or Other Devices to Make Electrical Protective Devices Ineffective	106
2.26.8 Release and Application of Driving Machine Brakes.....	106
2.26.9 Control and Operating Circuits.....	106
2.26.10 Absorption of Regenerated Power.....	107
2.26.11 Car Platform to Hoistway Door Sills Vertical Distance.....	107
2.26.12 Symbols.....	107
2.27 Emergency Operation and Signaling Devices	109
2.27.1 Car Emergency Signaling Devices.....	109
2.27.2 Emergency or Standby Power System.....	110
2.27.3 Firefighters’ Emergency Operation: Automatic Elevators.....	111
2.27.4 Firefighters’ Emergency Operation: Non-Automatic Elevators.....	116
2.27.5 Firefighters’ Emergency Operation: Automatic Elevators w/Designated Attendant Operation	117
2.27.6 Firefighters’ Emergency Operation: Inspection Operation.....	117
2.27.7 Firefighters’ Emergency Operation: Operating Procedures.....	117
2.27.8 Switch Keys.....	118
2.27.9 Elevator Corridor Call Station Pictograph	118
2.28 Layout Drawings	118.1
2.28.1 Information Required on Layout Drawings.....	118.1
2.29 Identification	118.1
2.29.1 Identification of Equipment.....	118.1
2.29.2 Identification of Floors.....	119
 Part 3 Hydraulic Elevators	 120
3.1 Construction of Hoistways and Hoistway Enclosures	120
3.1.1 Strength of Pit Floor.....	120
3.1.2 Floors Over Hoistways.....	120
3.2 Pits	120
3.2.1 Minimum Pit Depths Required.....	120
3.3 Location and Guarding of Counterweights	120
3.4 Bottom and Top Clearances & Runbys for Cars & Counterweights	120
3.4.1 Bottom Car Clearance.....	120
3.4.2 Minimum Bottom and Top Car Runby.....	121
3.4.3 Car Top and Bottom Maximum Runby.....	121
3.4.4 Top Car Clearance.....	121
3.4.5 Equipment Projecting Above the Car Top.....	121
3.4.6 Top Clearance and Bottom Runby of Counterweight.....	121
3.4.7 Refuge Space on Top of Car Enclosure.....	121
3.4.8 Vertical Clearances with Underslung Car Frames.....	121
3.5 Horizontal Car and Counterweight Clearances	122
3.6 Protection of Spaces Below Hoistway	122
3.6.1 Jack-Supporting Structure.....	122
3.6.2 Counterweight Safety Actuation.....	122
3.6.3 Buffer Types.....	122
3.6.4 Buffer Supports.....	122
3.7 Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms	122
3.7.1 Location of Machine Rooms.....	122

3.8 Electrical Equipment, Wiring, Pipes, and Ducts in Hoistway, Machinery Spaces, Machine Rooms, Control Spaces, and Control Rooms	123
3.9 Machinery and Sheave Beams, Supports and Foundations	123
3.10 Guarding of Exposed Auxiliary Equipment	123
3.11 Protection of Hoistway Landing Openings	123
3.11.1 Emergency Doors	123
3.12 Hoistway Door Locking Devices, Car Door/Gate Electric Contacts, Hoistway Access Switches	123
3.12.1 Hoistway Door Locking Devices and Electric Contacts and Hoistway Access Switches.....	123
3.12.2 Car Door or Gate Electric Contacts and Car Door Interlocks.....	123
3.13 Power Operation, Power Opening and Power Closing of Hoistway Doors/Car Doors/Gates	123
3.14 Car Enclosures, Car Doors and Gates, and Car Illumination	123
3.15 Car Frames and Platforms	123
3.15.1 Requirements.....	123
3.15.2 Maximum Allowable Stresses & Deflections in Car Frame and Platform Members.....	124
3.15.3 Calculations of Stresses & Deflections in Car Frame and Platform Members.....	124
3.16 Capacity and Loading	124
3.16.1 Minimum Rated Load for Passenger Elevators.....	124
3.16.2 Minimum Rated Load for Freight Elevators.....	124
3.16.3 Capacity and Data Plates.....	124
3.16.4 Carrying of Passengers on Freight Elevators.....	124
3.16.5 Signs Required in Freight Elevators.....	124
3.16.6 Overloading of Freight Elevators.....	124
3.16.7 One-Piece Loads Exceeding the Rated Load.....	124
3.16.8 Additional Requirements for Passenger Overload.....	124
3.16.9 Special Loading Means.....	124
3.17 Car Safeties, Counterweight Safeties, Plunger Gripper, and Governors	124
3.17.1 Car Safeties.....	124
3.17.2 Counterweight Safeties.....	125
3.17.3 Plunger Gripper.....	125
3.17.4 Governors	126
3.18 Hydraulic Jacks	126
3.18.1 Hydraulic Jack and Connections.....	126
3.18.2 Plungers.....	127
3.18.3 Cylinders.....	127
3.18.4 Plunger Stops.....	128
3.18.5 Welding.....	128
3.18.6 Marking of Hydraulic Jack	128
3.19 Valves, Pressure Piping and Fittings	129
3.19.1 Materials and Working Pressures.....	129
3.19.2 Pressure Piping.....	129
3.19.3 Connections and Fittings.....	129
3.19.4 Valves.....	130
3.19.5 Piping Buried in the Ground.....	131
3.19.6 Welding.....	131
3.19.7 Electrical Requirements.....	131
3.20 Ropes and Rope Connections	131
3.21 Counterweights	131
3.21.1 Counterweights	131
3.21.2 Counterweight Sheaves.....	132
3.22 Buffers and Bumpers	132
3.22.1 Car Buffers or Bumpers.....	132
3.22.2 Counterweight Buffers.....	132
3.23 Guide Rails, Guide-Rail Supports, and Fastenings	132
3.23.1 Direct-Acting Hydraulic Elevators.....	132
3.23.2 Roped-Hydraulic Elevators.....	132

3.24 Hydraulic Machines and Tanks	132
3.24.1 Hydraulic Machines (Power Units).....	132
3.24.2 Tanks.....	132
3.24.3 Atmosphere Storage and Discharge Tanks.....	132
3.24.4 Welding.....	132
3.25 Terminal-Stopping Devices	133
3.25.1 Normal Terminal Stopping Devices.....	133
3.25.2 Terminal Speed Reducing Devices.....	133
3.25.3 Final Terminal Stopping Devices.....	134
3.26 Operating Devices and Control Equipment	134
3.26.1 Operating Devices and Control Equipment.....	134
3.26.2 Inspection Operation.....	134
3.26.3 Anti-Creep and Leveling Operation.....	134
3.26.4 Electrical Protective Devices	134
3.26.5 Phase Reversal and Failure Protection.....	135
3.26.6 Control and Operating Circuits.....	135
3.26.7 Recycling Operation for Multiple or Telescopic Plungers.....	135
3.26.8 Pressure Switch.....	135
3.26.9 Low Oil Protection.....	135
3.26.10 Auxiliary Power Lowering Operation.....	135
3.27 Emergency Operation and Signaling Devices	136
3.27.1 Phase I Emergency Recall Operation After Device Actuation	136
3.27.2 Phase I Emergency Recall Operation Prior to Device Actuation.....	136
3.27.3 Device Actuation at Recall Level.....	136
3.27.4 Device Actuation w/Phase II Emergency In-Car Operation in Effect	136
3.28 Layout Data	136
3.28.1 Information Required on Layout Drawing.....	136
3.29 Identification	137
Part 4 Elevators with Other Types of Driving Machines	138
4.1 Rack and Pinion Elevators	138
4.1.1 Hoistways, Hoistway Enclosures, and Related Construction.....	138
4.1.2 Machinery Rooms and Machinery Spaces.....	138
4.1.3 Equipment in Hoistways or Machine Rooms.....	138
4.1.4 Supports and Foundations.....	138
4.1.5 Emergency Doors.....	138
4.1.6 Car Enclosures, Car Doors and Gates, and Car Illumination.....	138
4.1.7 Car Frames and Platforms.....	138
4.1.8 Capacity and Loading.....	139
4.1.9 Car Safeties and Speed Governor.....	139
4.1.10 Counterweights.....	139
4.1.11 Car Buffers.....	139
4.1.12 Guide Rails, Guide-Rail Supports and Fastenings.....	139
4.1.13 Rack and Pinion Driving Machine.....	139
4.1.14 Terminal Stopping Devices.....	139
4.1.15 Operating Devices and Control Equipment.....	139
4.1.16 Emergency Operation and Signal Devices.....	140
4.1.17 Layout Drawings.....	140
4.1.18 Welding.....	140
4.2 Screw-Column Elevators	140
4.2.1 Hoistways, Hoistway Enclosures, and Related Construction.....	140
4.2.2 Vertical Clearance and Runby for Cars.....	141
4.2.3 Horizontal Car Clearance.....	141
4.2.4 Protection of Spaces Below Hoistway.....	141
4.2.5 Machine Rooms and Machinery Spaces.....	141
4.2.6 Equipment in Hoistways and Machine Rooms.....	141
4.2.7 Supports and Foundations.....	141
4.2.8 Car Enclosures, Car Doors and Gates, and Car Illumination.....	142

4.2.9 Car Frames and Platforms.....	142
4.2.10 Capacity and Loading.....	142
4.2.11 Car Safeties and Speed Governor.....	142
4.2.12 Safety Nut and Data Tag.....	142
4.2.13 Car Buffers.....	142
4.2.14 Guide Rails, Guide-Rail Supports and Fastenings.....	142
4.2.15 Driving Machine and Screw Column.....	142
4.2.16 Terminal Stopping Devices	143
4.2.17 Operating Devices and Control Equipment.....	143
4.2.18 Emergency Operation and Signaling Devices.....	144
4.2.19 Layout Drawings.....	144
4.2.20 Welding.....	144
4.3 Hand Elevators.....	144
4.3.1 Hoistways, Hoistway Enclosures, and Related Construction.....	144
4.3.2 Pits.....	144
4.3.3 Top Clearances.....	144
4.3.4 Enclosures for Machines and Control Equipment.....	144
4.3.5 Overhead Beams and Supports, and Access to Machines and Sheaves.....	144
4.3.6 Hoistway Entrances.....	144
4.3.7 Hoistway Gates for Landing Openings.....	145
4.3.8 Hoistway Door and Hoistway Gate Locking Devices.....	145
4.3.9 Car Enclosures.....	145
4.3.10 Use of Glass in Cars.....	145
4.3.11 Car Frames and Platforms.....	145
4.3.12 Car Compartments.....	145
4.3.13 Cars Counterbalancing One Another.....	145
4.3.14 Capacity and Loading.....	145
4.3.15 Car Safeties.....	146
4.3.16 Suspension Means.....	146
4.3.17 Counterweights.....	146
4.3.18 Guide Rails and Fastenings.....	146
4.3.19 Driving Machines and Sheaves.....	146
4.3.20 Power Attachments.....	146
4.3.21 Layout Data.....	146
4.3.22 Inspections and Tests.....	146
Part 5 Special Application Elevators	147
5.1 Inclined Elevators.....	147
5.1.1 General Requirements.....	147
5.1.2 Construction of Hoistway and Hoistway Enclosures.....	147
5.1.3 Pits and Work Spaces.....	147
5.1.4 Counterweight Pit Guards.....	148
5.1.5 Clearances for Cars and Counterweights.....	148
5.1.6 Protection of Spaces in Line With the Direction of Travel.....	148
5.1.7 Equipment in Hoistways and Machine Rooms.....	148
5.1.8 Protection of Hoistway Openings.....	148
5.1.9 Restricted Opening of Hoistway or Car Doors	148
5.1.10 Access to Hoistways for Inspection, Maintenance, and Repairs.....	148
5.1.11 Car Enclosures.....	148
5.1.12 Car Frames and Platforms.....	149
5.1.13 Capacity and Loading.....	149
5.1.14 Car and Counterweight Safeties.....	149
5.1.15 Speed Governor Drive.....	151
5.1.16 Suspension Ropes and Their Connections.....	151
5.1.17 Car and Counterweight Buffers.....	151
5.1.18 Car and Counterweight Guide Rails, Guide-Rail Supports, and Fastenings.....	151
5.1.19 Driving Machines.....	152
5.1.20 Operating Devices and Control Equipment.....	152

5.1.21 Emergency Operations and Signaling Devices.....	152
5.1.22 End-Loading Inclined Elevators.....	153
5.1.23 Special Requirements for Inclined Elevator Layout Drawings	153
5.2 Limited-Use/Limited-Application Elevators	153
5.2.1 Electric Limited-Use/Limited-Application Elevators	153
5.2.1.1 Construction of Hoistway and Hoistway Enclosure	153
5.2.1.2 Pits.....	153
5.2.1.3 Location and Guarding of Counterweights	153
5.2.1.4 Vertical Clearances and Runbys for Cars and Counterweights	153
5.2.1.5 Horizontal Car and Counterweight Clearances	154
5.2.1.6 Protection of Spaces Below Hoistways	154
5.2.1.7 Machinery Spaces, Machine Rooms, Control Spaces and Control Rooms	154
5.2.1.8 Equipment in Hoistways, Machinery Spaces, Machine Rooms, Control Spaces and Control Rooms	154
5.2.1.9 Machinery and Sheave Beams, Supports, and Foundations	154
5.2.1.10 Guarding	154
5.2.1.11 Protection of Hoistway Landing Openings	154
5.2.1.12 Hoistway Door Locking Devices and Electric Contacts, and Hoistway Access Switches	154
5.2.1.13 Power Operation of Hoistway Doors and Car Doors	155
5.2.1.14 Car Enclosures, Car Doors, and Car Illumination	155
5.2.1.15 Car Frames and Platforms	155
5.2.1.16 Capacity, Loading, Speed, and Rise.	155
5.2.1.17 Car and Counterweight	155
5.2.1.18 Speed Governors	155
5.2.1.19 Ascending Car Overspeed and Unintended Car Movement Protection	155
5.2.1.20 Suspension Ropes and Their Connections	155
5.2.1.21 Counterweights	156
5.2.1.22 Buffers and Bumpers	156
5.2.1.23 Car and Counterweight Guide Rails, Guide-Rail Supports, and Fastenings	156
5.2.1.24 Driving Machine and Sheaves	156
5.2.1.25 Terminal Stopping Devices	156
5.2.1.26 Operating Devices and Control Equipment	157
5.2.1.27 Emergency Operations and Signaling Devices	157
5.2.1.28 Manual Operation	157
5.2.1.29 Layout Data	157
5.2.1.30 Welding	157
5.2.1.31 Identification	157
5.2.2 Hydraulic Limited-Use/Limited-Application Elevators	157
5.2.2.1 Bottom and Top Clearances and Runbys	157
5.2.2.2 Machinery Spaces, Machine Rooms Control Spaces and Control Rooms	157
5.2.2.3 Car Frames and Platforms.....	157
5.2.2.4 Capacity and Loading	157
5.2.2.5 Alternative to Speed Governor for Roped-Hydraulic Elevators	157
5.2.2.6 Hydraulic Jacks and Sheaves	157
5.2.2.7 Valves, Pressure Piping, and Fittings	157
5.2.2.8 Counterweights	157
5.2.2.9 Buffers and Bumpers	157
5.2.2.10 Guide Rails, Guide-Rail Supports, and Their Fastenings	157
5.2.2.11 Hydraulic Machines and Tanks	157
5.2.2.12 Terminal Stopping Devices	157
5.2.2.13 Operating Devices and Control Equipment	157
5.2.2.14 Emergency Operations and Signaling Devices	158
5.2.2.15 Layout Data	158
5.3 Private Residence Elevators	158
5.3.1 Private Residence Electric Elevators	158
5.3.1.1 Construction of Hoistway and Hoistway Enclosures	158
5.3.1.2 Pits	158

5.3.1.3 Top Car Clearances	158
5.3.1.4 Horizontal Car Clearances	158
5.3.1.5 Pipes in Hoistways	158
5.3.1.6 Guarding of Suspension Means	158
5.3.1.7 Protection of Hoistway Openings	159
5.3.1.8 Car Enclosures, Car Doors and Gates, and Car Illumination	159
5.3.1.9 Car Frames and Platforms	160
5.3.1.10 Capacity, Loading, Speed, and Rise	160
5.3.1.11 Safeties and Governors	160
5.3.1.12 Suspension Means	161
5.3.1.13 Counterweights	161
5.3.1.14 Buffers and Buffer Supports	162
5.3.1.15 Car and Counterweight Guide Rails and Guide Fastenings	162
5.3.1.16 Driving Machine, Sheaves, and Their Supports.....	162
5.3.1.17 Terminal Stopping Devices	163
5.3.1.18 Operating Devices and Control Equipment	163
5.3.1.19 Emergency Signaling Devices	164
5.3.1.20 Marking Plates	164
5.3.2 Private Residence Hydraulic Elevators	164
5.3.2.1 General Requirements for Hydraulic Private Residence Elevators	164
5.3.2.2 Driving Machines, Sheaves, and Supports for Direct-Plunger and Roped-Hydraulic Driving Machines	165
5.3.2.3 Terminal Stopping Devices.....	165
5.3.2.4 Anticreep Leveling Devices	165
5.4 Private Residence Inclined Elevators	165
5.4.1 Runway Protection	165
5.4.2 Landing Enclosures and Gates (Where Required).....	165
5.4.3 Machinery Beams and Supports.....	166
5.4.4 Car Enclosures, Car Doors, and Gates.....	166
5.4.5 Car and Chassis Construction.....	166
5.4.6 Capacity.....	167
5.4.7 Safeties and Governors.	167
5.4.8 Suspension Means.....	167
5.4.9 Counterweight Guiding and Construction.....	168
5.4.10 Bumpers and Buffers.....	168
5.4.11 Car and Counterweight Guide and Track Supports and Fastenings.....	168
5.4.12 Track(s)/Guides(s) Supporting Structure.....	168
5.4.13 Driving Machines and Sheaves.....	168
5.4.14 Terminal Stopping Devices.....	169
5.4.15 Operating Devices and Control Equipment.....	169
5.4.16 Marking Plates.....	169
5.5 Power Sidewalk Elevators.....	169
5.5.1 Electric Sidewalk Elevators	170
5.5.2 Direct-Plunger Hydraulic Sidewalk Elevators	173
5.6 Rooftop Elevators.....	173
5.6.1 Electric Rooftop Elevators.....	174
5.6.2 Direct-Plunger Hydraulic Rooftop Elevators	176
5.7 Special Purpose Personnel Elevators	177
5.7.1 Construction of Hoistways and Hoistway Enclosures.....	177
5.7.2 Pits.....	177
5.7.3 Location and Enclosing of Counterweights.....	177
5.7.4 Vertical Clearances and Runby.....	177
5.7.5 Horizontal Car and Counterweight Clearances.....	178
5.7.6 Protection of Spaces Below Hoistway.....	178
5.7.7 Overhead Machinery Beams and Supports.....	178
5.7.8 Hoistway Doors and Gates.....	178
5.7.9 Locking Devices for Hoistway Doors or Gates.....	178
5.7.10 Car Enclosures, Car Doors and Gates, and Car Illumination.....	179

5.7.11 Car Construction.....	179
5.7.12 Capacity and Loading.....	179
5.7.13 Car Safeties and Governors.....	179
5.7.14 Suspension Ropes.....	180
5.7.15 Counterweight Guiding and Construction.....	180
5.7.16 Car and Counterweight Buffers.....	180
5.7.17 Car Guide and Guide-Rail Fastenings.....	181
5.7.18 Driving Machines and Sheaves.....	181
5.7.19 Operating Devices and Control Equipment.....	181
5.7.20 Operation.....	181
5.7.21 Emergency Signal and/or Communication.....	182
5.7.22 Layout Drawings.....	182
5.7.23 Welding.....	182
5.8 Shipboard Elevators	182
5.8.1 Electric Shipboard Elevators	182
5.8.2 Hydraulic Shipboard Elevators.....	183
5.8.3 Rack and Pinion Shipboard Elevators.....	183
5.9 Mine Elevators	183
5.9.1 Construction of Hoistways and Hoistway Enclosures.....	184
5.9.2 Pits.....	184
5.9.3 Location and Guarding of Counterweights.....	184
5.9.4 Vertical Clearances and Runbys for Cars and Counterweights.....	184
5.9.5 Horizontal Car and Counterweight Clearances.....	184
5.9.6 Protection of Space Below Hoistways.....	184
5.9.7 Machine Rooms and Machinery Spaces.....	184
5.9.8 Equipment in Hoistways and Machine Rooms.....	184
5.9.9 Machinery and Sheave Beams, Supports and Foundations.....	184
5.9.10 Guarding.....	184
5.9.11 Protection of Hoistway Openings.....	184
5.9.12 Hoistway-Door Locking Devices & Electric Contacts & Hoistway Access Switches.....	185
5.9.13 Power Operation of Hoistway Doors and Car Doors.....	185
5.9.14 Car Enclosures, Car Doors and Gates, and Car Illumination.....	185
5.9.15 Car Frames and Platforms.....	185
5.9.16 Capacity and Loading.....	185
5.9.17 Car and Counterweight Safeties.....	185
5.9.18 Speed Governors.....	186
5.9.19 Ascending Car Overspeed and Unintended Car Movement Protection.....	186
5.9.20 Suspension Ropes and Their Connections.....	186
5.9.21 Counterweights.....	186
5.9.22 Buffers and Bumpers.....	186
5.9.23 Car and Counterweight Guide Rails, Guide-Rail Supports and Fastenings.....	186
5.9.24 Driving Machines and Sheaves.....	186
5.9.25 Terminal Stopping Devices.....	186
5.9.26 Operating Devices and Control Equipment.....	186
5.9.27 Emergency Operations and Signaling Devices.....	186
5.9.28 Layout Drawings.....	186
5.9.29 Identification.....	186
5.9.30 Welding.....	186
5.10 Elevators Used for Construction	186
5.10.1 Electric Elevators Used for Construction	186.1
5.10.2 Hydraulic Elevators Used for Construction	191
Part 6 Escalators and Moving Walks	192
6.1 Escalators	192
6.1.1 Protection of Floor Openings.....	192
6.1.1.1 Protection Required.....	192
6.1.2 Protection of Trusses and Machines Spaces Against Fire	192
6.1.2.1 Protection Required.....	192

6.1.3 Construction Requirements.....	192
6.1.3.1 Angle of Inclination	192
6.1.3.2 Geometry	192
6.1.3.3 Balustrades	192
6.1.3.4 Handrails	195
6.1.3.5 Steps.....	195
6.1.3.6 Entrance and Egress Ends	196
6.1.3.7 Trusses or Girders	196
6.1.3.8 Step Wheel Tracks	196
6.1.3.9 Rated Load	196
6.1.3.10 Design Factors of Safety	197
6.1.3.11 Chains	197
6.1.3.12 Headroom.....	197
6.1.3.13 Welding	197
6.1.3.14 Non-Escalator-Related Equipment	197
6.1.3.15 Pit Drains	197
6.1.4 Rated Speed	197
6.1.4.1 Limits of Speed	197
6.1.5 Driving Machine, Motor, and Brake.....	197
6.1.5.1 Connection Between Driving Machine and Main Drive Shaft	197
6.1.5.2 Driving Motor	197
6.1.5.3 Brakes.....	198
6.1.6 Operating and Safety Devices.....	198
6.1.6.1 General	198
6.1.6.2 Starting and Inspection Control Switches	198
6.1.6.3 Electrical Protective Devices.....	199
6.1.6.4 Handrail Speed Monitoring Device	201
6.1.6.5 Missing Step and Missing Dynamic Skirt Devices.....	201
6.1.6.6 Tandem Operation	201
6.1.6.7 Step Demarcation Lights	201
6.1.6.8 Escalator Smoke Detectors.....	201
6.1.6.9 Signs	201
6.1.6.10 Control and Operating Circuits	201
6.1.6.11 Electrically Powered Safety Devices	202
6.1.6.12 Installation of Capacitors or Other Devices to Make Electrical Protective Devices Ineffective	203
6.1.6.13 Completion or Maintenance of Circuit	203
6.1.6.14 Escalator Manual Reset	203
6.1.6.15 Contactors and Relays for Use in Critical Operating Circuits	203
6.1.7 Lighting, Access, and Electrical Work.....	203
6.1.7.1 Lighting of Machine Room and Truss Interior	203
6.1.7.2 Lighting of Escalator	203
6.1.7.3 Access to Interior	203
6.1.7.4 Electrical Equipment and Wiring	203
6.1.8 Outdoor Escalators.....	204
6.1.8.1 Weatherproofing	204
6.1.8.2 Precipitation	204
6.1.8.3 Slip Resistance.....	204
6.2 Moving Walks.....	204
6.2.1 Protection of Floor Openings.....	204
6.2.1.1 Protection Required.....	204
6.2.2 Protection of Supports and Machine Spaces Against Fire.....	204
6.2.2.1 Protection Required.....	204
6.2.3 Construction Requirements.....	204
6.2.3.1 Angle of Inclination	204
6.2.3.2 Geometry	204
6.2.3.3 Balustrades	204
6.2.3.4 Handrails	205

6.2.3.5 Pallet-Type Treadway.....	206
6.2.3.6 Belt-Type Treadway.....	206
6.2.3.7 Width	206
6.2.3.8 Entrance and Egress Ends	206
6.2.3.9 Supporting Structure.....	207
6.2.3.10 Rated Load	207
6.2.3.11 Design Factors of Safety	208
6.2.3.12 Chains	208
6.2.3.13 Chain Drives	208
6.2.3.14 V-Belt Drives	208
6.2.3.15 Headroom.....	208
6.2.3.16 Welding	208
6.2.3.17 Nonmoving-Walk Related Equipment	209
6.2.4 Rated Speed.....	209
6.2.5 Driving Machine, Motor, and Brake.....	209
6.2.5.1 Connection Between Driving Machine and Main Drive Shaft	209
6.2.5.2 Driving Motor.....	209
6.2.5.3 Brakes	209
6.2.6 Operating and Safety Devices.....	209
6.2.6.1 General	209
6.2.6.2 Starting and Inspection Control Switches	209
6.2.6.3 Electrical Protective Devices.....	210
6.2.6.4 Handrail Speed Monitoring Device	212
6.2.6.5 Missing Pallet Device	212
6.2.6.6 Tandem Operation	212
6.2.6.7 Moving Walk Smoke Detectors.....	212
6.2.6.8 Signs	212
6.2.6.9 Control and Operating Circuits	212
6.2.6.10 Electrically Powered Safety Devices	213
6.2.6.11 Installation of Capacitors or Other Devices to Make Electrical Protective Devices Ineffective	213
6.2.6.12 Completion or Maintenance of Circuit	213
6.2.6.13 Moving Walk Manual Reset	213
6.2.6.14 Contactors and Relays for Use in Critical Operating Circuits	213
6.2.7 Lighting, Access, and Electrical Work.....	213
6.2.7.1 Lighting of Machine Room and Truss Interior	213
6.2.7.2 Lighting of Treadway	213
6.2.7.3 Access to Interior	213
6.2.7.4 Electrical Equipment and Wiring	214
6.2.8 Outdoor Moving Walks.....	214
6.2.8.1 Weatherproofing	214
6.2.8.2 Precipitation	214
6.2.8.3 Slip Resistance.....	214
Part 7 Dumbwaiters and Material Lifts	215
7.1 Power and Hand Dumbwaiters w/o Automatic Transfer Devices	215
7.1.1 Construction of Hoistways and Hoistway Enclosures	215
7.1.2 Pits.....	215
7.1.3 Location and Guarding of Counterweights.....	215
7.1.4 Vertical Car Clearances and Runbys for Cars and Counterweights.....	215
7.1.5 Horizontal Car and Counterweight Clearances.....	216
7.1.6 Protection of Spaces Below Hoistway.....	216
7.1.7 Machine Rooms and Machinery Spaces.....	216
7.1.8 Electrical Equipment, Wiring, Pipes, Ducts and HVAC in Hoistways and Machine Rooms.....	216
7.1.9 Machinery and Sheave Beams, Supports and Foundations.....	217
7.1.10 Guarding of Equipment.....	217
7.1.11 Protection of Hoistway Openings.....	217

7.1.12 Hoistway Door Locking Devices, Access Switches, and Unlocking Devices.....	218
7.1.13 Power Operation of Hoistway Doors and Car Doors or Gates.....	219
7.1.14 Identification.....	219
7.2 Electric and Hand Dumbwaiters w/o Automatic Transfer Devices	219
7.2.1 Car Enclosures, Car Doors and Gates, and Car Illumination.....	219
7.2.2 Car Frames and Platforms.....	220
7.2.3 Capacity and Loading.....	221
7.2.4 Car and Counterweight Safeties.....	221
7.2.5 Speed Governors.....	222
7.2.6 Suspension Means.....	222
7.2.7 Counterweights.....	223
7.2.8 Buffers and Bumpers.....	223
7.2.9 Car and Counterweight Guide Rails, Guide-Rail Supports and Fastenings.....	223
7.2.10 Driving Machines and Sheaves.....	223
7.2.11 Terminal Stopping Devices.....	224
7.2.12 Operating Devices and Control Equipment.....	224
7.2.13 Layout Data.....	225
7.2.14 Welding for Dumbwaiters.....	225
7.3 Hydraulic Dumbwaiters w/o Automatic Transfer Devices	225
7.3.1 Car Enclosures, Car Doors and Gates and Car Illumination.....	225
7.3.2 Car Frames and Platforms.....	225
7.3.3 Capacity and Loading.....	225
7.3.4 Car and Counterweight Safeties.....	225
7.3.5 Hydraulic Driving Machines	225
7.3.6 Rope, Rope Connections, and Sheaves.....	225
7.3.7 Counterweights.....	225
7.3.8 Buffers and Bumpers.....	226
7.3.9 Guide Rails, Guide-Rail Supports, and Fastenings.....	226
7.3.10 Terminal Stopping Devices.....	226
7.3.11 Operating Devices and Control Equipment.....	226
7.3.12 Layout Data.....	226
7.4 Material Lifts w/o Automatic Transfer Devices	227
7.4.1 General Requirement.....	227
7.4.2 Classification.....	227
7.4.3 Construction of Hoistways and Hoistway Enclosures.....	227
7.4.4 Pits.....	227
7.4.5 Location and Guarding of Counterweights.....	227
7.4.6 Vertical Clearances and Runbys for Cars and Counterweights.....	227
7.4.7 Horizontal Car and Counterweight Clearances.....	229
7.4.8 Protection of Spaces Below Hoistways.....	229
7.4.9 Machine Rooms and Machinery Spaces.....	229
7.4.10 Equipment in Hoistways and Machine Rooms.....	229
7.4.11 Machinery and Sheave Beams, Supports, and Foundations	229
7.4.12 Guarding of Equipment and Standard Railing	229
7.4.13 Protection of Hoistway Landing Openings.....	229
7.4.14 Hoistway Door Locking Devices & Electric Contacts, & Hoistway Access Switches.....	230
7.4.15 Power Operation of Hoistway Doors and Car Doors and Gates.....	230
7.4.16 Identification of Equipment.....	230
7.5 Electric Material Lifts w/o Automatic Transfer Devices	230
7.5.1 Car Enclosures, Car Doors and Gates and Car Illumination.....	230.1
7.5.2 Car Frames and Platforms.....	231
7.5.3 Capacity and Loading.....	232
7.5.4 Car and Counterweight Safeties.....	232
7.5.5 Speed Governors.....	232
7.5.6 Suspension Ropes and Their Connections.....	232
7.5.7 Counterweights.....	233
7.5.8 Buffers and Bumpers.....	233
7.5.9 Car and Counterweight Guide Rails, Guide-Rail Supports and Fastenings.....	233

7.5.10 Driving Machine and Sheaves.....	233
7.5.11 Terminal Stopping Devices.....	234
7.5.12 Operating Devices and Control Equipment.....	234
7.5.13 Layout Data.....	236
7.5.14 Welding.....	236
7.6 Hydraulic Material Lifts w/o Automatic Transfer Devices	236
7.6.1 Hoistways, Hoistway Enclosures, and Related Construction.....	236
7.6.2 Mechanical Equipment.....	236
7.6.3 Hydraulic Driving Machines.....	236
7.6.4 Valves, Pressure Pippings, and Fittings.....	236
7.6.5 Counterweight Ropes, Rope Connections, and Sheaves.....	236
7.6.6 Hydraulic Machines and Tanks.....	236
7.6.7 Terminal Stopping Device.....	236
7.6.8 Operating Devices and Control Equipment.....	236
7.6.9 Layout Data.....	236
7.7 Automatic Transfer Devices	236
7.7.1 General.....	236
7.7.2 Clearances.....	236
7.7.3 Guarding.....	236
7.7.4 Floor Level	237
7.8 Power Dumbwaiter with Automatic Transfer Devices	237
7.8.1 Requirements.....	237
7.8.2 Safety Devices.....	237
7.8.3 Emergency Stop Switch.....	237
7.8.4 Structural Capacity Load.....	237
7.9 Electric Material Lifts with Automatic Transfer Devices	237
7.9.1 Hoistways, Hoistway Enclosures, and Related Construction.....	237
7.9.2 Machinery and Equipment.....	238
7.10 Hydraulic Material Lifts with Automatic Transfer Devices	239
7.11 Material Lifts with Obscured Transfer Devices	239
Part 8 General Requirements	240
8.1 Security	240
8.1.1 General.....	240
8.1.2 Group 1: Restricted.....	240
8.1.3 Group 2: Authorized Personnel.....	240
8.1.4 Group 3: Emergency Operation.....	240
8.1.5 Group 4: Other.....	241
8.2 Design Data and Formulas	241
8.2.1 Minimum Rated Load for Passenger Elevators.....	241
8.2.2 Electric Elevator Car Frame and Platform Stresses and Deflections.....	241
8.2.3 Impact on Buffer Supports.....	244
8.2.4 Gravity Stopping Distances.....	245
8.2.5 Governor Tripping Speeds.....	245
8.2.6 Stopping Distances for Car and Counterweight Safeties.....	245
8.2.7 Factors of Safety for Suspension Wire Ropes for Power Elevators.....	245
8.2.8 Hydraulic Jack and Piping.....	245
8.2.9 Hydraulic Elevator Car Frame and Platform Stresses and Deflections.....	256
8.2.10 Minimum Oil Buffer Strokes: Inclined Elevators.....	258
8.2.11 Stopping Distances for Car and Counterweight Safeties for Inclined Elevators.....	258
8.2.12 Material Lifts with Automatic Transfer Devices, Design, Data, and Formulas.....	259
8.3 Engineering Tests, Type Tests, and Certification	259
8.3.1 General Requirements for Tests and Certification.....	259
8.3.2 Type Tests of Car and Counterweight Oil Buffers.....	260
8.3.3 Type Tests of Interlocks, Combination Mechanical Locks & Electric Contacts, & Door Or Gate Electric Contacts.....	262
8.3.4 Entrance Fire Type Tests.....	264
8.3.5 Type Tests for Hydraulic Control Valves.....	264

8.3.6 Escalator Brake Type Test.....	265
8.3.7 Vertical Burn Engineering Test.....	265
8.3.8 Test Method for Evaluating Room Fire Growth Contribution of Textile Wall Covering...	265
8.3.9 Engineering Tests for Hydraulic Overspeed Valves.....	266
8.3.10 Engineering Tests – Safety Nut & Speed Limiting Devices of Screw-Column Elevators.	266
8.3.11 Step and Pallet Fatigue Engineering Test.....	266
8.4 Elevator Safety Requirements for Seismic Risk Zone 2 or Greater	267
8.4.1 Horizontal Car and Counterweight Clearances.....	267
8.4.2 Machinery and Sheave Beams, Supports, and Foundations.....	267
8.4.3 Guarding of Equipment.....	267
8.4.4 Car Enclosures, Car Doors and Gates, and Car Illumination.....	268
8.4.5 Car Frames and Platforms.....	268
8.4.6 Car and Counterweight Safeties.....	268
8.4.7 Counterweights.....	268
8.4.8 Car and Counterweight Guide Rail Systems.....	269
8.4.9 Driving Machines and Sheaves.....	280
8.4.10 Emergency Operation and Signaling Devices.....	280
8.4.11 Hydraulic Elevators.....	282
8.4.12 Design Data and Formulas for Elevators.....	285
8.4.13 Ground Motion Parameters.....	288
8.5 Escalator and Moving Walk Safety Requirement for Seismic Risk Zone 2 or Greater	288
8.5.1 Balustrade Construction.....	288
8.5.2 Truss Members.....	288
8.5.3 Supporting Connections Between the Truss and the Building.....	289
8.5.4 Earthquake Protective Devices.....	289
8.6 Maintenance, Repair, and Replacement	289
8.6.1 General Requirements.....	289
8.6.2 Repairs.....	291
8.6.3 Replacements.....	291
8.6.4 Maintenance and Testing of Electric Elevators.....	293
8.6.5 Maintenance and Testing of Hydraulic Elevators.....	298
8.6.6 Maintenance and Testing of Elevators with Other Types of Driving Machines	300
8.6.7 Maintenance and Testing of Special Application Elevators.....	300
8.6.8 Maintenance and Testing of Escalator	301
8.6.9 Maintenance and Testing of Moving Walks	302.2
8.6.10 Maintenance and Testing of Dumbwaiters and Material Lifts	302.3
8.6.11 Special Provisions.....	302.3
8.6.12 Maintenance of Elevators, Dumbwaiters, Escalators, and Moving Walks	302.5
8.7 Alterations	302.8
8.7.1 General Requirements.....	302.8
8.7.2 Alterations to Electric Elevators.....	303
8.7.3 Alterations to Hydraulic Elevators.....	310
8.7.4 Alterations to Elevators with Other Types of Driving Machines.....	313
8.7.5 Alterations to Special Application Elevators.....	314
8.7.6 Alterations to Escalators and Moving Walks.....	314
8.7.7 Alterations to Dumbwaiters and Material Lifts.....	316
8.8 Welding	316
8.8.1 Qualification of Welders.....	316
8.8.2 Welding Steel.....	316
8.8.3 Welding Metals Other Than Steel.....	317
8.9 Code Data Plate	317
8.9.1 Required Information.....	317
8.9.2 Location.....	317
8.9.3 Material and Construction.....	317
8.10 Acceptance Inspections and Tests	317
8.10.1 General Requirements for Acceptance Inspections and Tests.....	317
8.10.2 Acceptance Inspection and Tests of Electric Elevators.....	317
8.10.2.3 Inspection and Tests Requirements for Altered Installations	323

8.10.3 Acceptance Inspection and Tests of Hydraulic Elevators.....	324
8.10.3.3 Inspection and Tests Requirements for Altered Installations	327
8.10.4 Acceptance Inspection and Tests of Escalators and Moving Walks.....	328
8.10.4.2 Inspection and Tests Requirements for Altered Installations	330
8.10.5 Acceptance Inspection and Tests of Other Equipment.....	331
8.11 Periodic Inspections and Witnessing of Tests	332
8.11.1 General Requirements for Periodic Inspections and Witnessing of Tests.....	332
8.11.2 Periodic Inspections of Electric Elevators	333
8.11.2.1 Periodic Inspection Requirements	333
8.11.2.2 DELETED - REDESIGNATED AS 8.6.4.19	336
8.11.2.3 DELETED - REDESIGNATED AS 8.6.4.20	
8.11.3 Periodic Inspections of Hydraulic Elevators.....	336
8.11.3.1 Periodic Inspection Requirements	336
8.11.3.2 DELETED - REDESIGNATED AS 8.6.5.14	337
8.11.3.3 DELETED - REDESIGNATED AS 8.6.5.15	
8.11.3.4 DELETED - REDESIGNATED AS 8.6.5.16	
8.11.4 Periodic Inspections of Escalators and Moving Walls	338
8.11.4.1 Periodic Inspection and Test Requirements	338
8.11.4.2 DELETED - REDESIGNATED AS 8.6.8.15	338
8.11.5 Periodic Inspections of Other Equipment	338
8.12 Flood Resistances	339-343
8.12.1 Flood-Resistant Design and Construction.	339-343
 Part 9 Reference Codes, Standards, and Specifications	 344
9.1 Reference Documents.....	345
9.2 Procurement Information.....	352
 Nonmandatory Appendices	 353
Appendix A Control System.....	353
Appendix B Door Landing and Unlocking Zones.....	355
Appendix C Location of Top Emergency Exit.....	356
Appendix D Rated Load and Capacity Plates for Passenger Elevators.....	357
Appendix E CSA B44 Elevator Requirements for Persons with Physical Disabilities.....	358
Appendix F Ascending Car Overspeed and Unintended Car Movement Protection.....	366
Appendix G Top of Car Clearance (3.4.4).....	370
Appendix H Private Residence Elevator Guarding (5.3.1.6.2).....	372
Appendix I Escalator and Moving Walk Diagrams.....	373
Appendix J Relationship of Pit Ladder to Hoistway Door Unlocking Means	379
Appendix K Beveling and Clearance Requirements (7.4.7.4).....	380
Appendix L Index of Alteration Requirements for Electric Elevators, Hydraulic Elevators, Escalators, and Moving Walks.....	381
Appendix M Inertia Application for Type A Safety Device Location of Test Weight [8.10.2.2.2(bb)(2)].....	386
Appendix N Recommended Inspection and Test Intervals in “Months”.....	387
NONMANDATORY APPENDIX O DELETED.....	
Appendix P Plunger Gripper Stopping Distances.....	389
Appendix Q Explanatory Figures for the Definitions of Elevator Machinery Space, Machine Room, Control Space, Control Room, Remote Machine Room, or Remote Control Room ...	390
Appendix R Inspection Operation and Hoistway Access Switch Operation Hierarchy	393
 Index	 395