1. Single or multi-section vertically sliding doors shall be so counterweighted and vertically sliding, bi-parting counterbalanced doors shall be so counterbalanced that they will not open or close by gravity.

2. Suspension means and their connections, for vertically sliding bi-parting counterbalanced doors and for the counterweights of vertically sliding counterweighted doors, shall have a factor of safety of not less than 5. Fastenings shall be provided to prevent the detachment or dislodgment of counterbalancing weights of doors.

3. Bi-parting counterbalanced hoistway doors shall have the lower edge of the upper door section provided with a fire-resistive, non-shearing, non-crushing member to provide a space of not less than ¾ inch between the rigid members of the door sections when closed. Any rigid astragal overlapping the meeting edge and/or any fire-resistive astragal overlapping the door sections when closed is prohibited. Center latches are prohibited.

4. Manually operated vertically sliding bi-parting counterbalanced hoistway doors on elevators which can be operated from the landings shall be provided with pull straps on the inside and outside of the doors.

5. Horizontal sliding doors shall conform with the requirements of Wis. Adm. Code Ind 4.31 (1) (c) to (c) 4., inclusive.

6. Vision panels shall be provided in all hoistway landing doors; except where car position indicators are installed at each floor, or where car and landing doors are power operated. Where required or used, vision panels shall conform with the requirements as described in this subsection.

a. The total area of any single panel shall not be less than 25 square inches or more than 80 square inches, and no single glass panel shall have a width exceeding 6 inches.

b. Where mullions or division strips are used between panels, they shall be of fire-resistive material and of substantial construction.

c. Panel openings shall be glazed clear wire glass not less than ¼ inch thick and shall be substantially flush with the surface of the landing side of the door.

d. The center of a panel shall be not less than 54 inches nor more than 66 inches above the elevator landing.

7. Every new freight elevator with counterbalanced doors and every car switch controlled elevator equipped with horizontally sliding doors, shall be equipped with an emergency key which cannot be easily duplicated, which will, irrespective of the position of the car, unlock the lowest terminal landing door. This emergency key shall be placed in a receptacle having a transparent breakable cover, clearly marked, "Elevator Door Key for Fire Department and Emergency Use Only", and shall be located at the lowest landing. Where an emergency key opening has been provided for opening a hoistway landing door, the key opening shall be provided with a cover fastened with Phillips head-type screws.

8. Emergency keys not easily duplicated, shall be provided to open certain hoistway landing doors from the landing side regardless of the car position. Emergency key opening shall be provided for landing doors for every automatic or continuous pressure push button

controlled elevator installed with horizontally sliding or swinging doors outlined as follows:

a. Single hoistway—at each floor.

b. Multiple hoistway—the lowest terminal and the landing door immediately above it.

c. All emergency key openings shall be provided with a cover fastened securely with Phillips head-type screws.

Exception. Emergency key openings not greater than $^1/_2$ inch in diameter which require the use of keys of the jointed design and the hinged action cause the release of the door interlocks.

d. Emergency keys shall be kept in a receptacle having a transparent breakable cover. This receptacle shall be located at the lowest landing and shall be clearly marked "Elevator Door Key for Fire Department and Emergency Use Only".

9. An elevator installed in a single blind hoistway shall conform with Wis. Adm. Code section Ind 4.31 (10).

(c) Every elevator shall have an access provided to its related hoistway at the lowest landing as required in section Ind 4.31 (6) (c) for purposes of emergency, inspection, maintenance or repairs.

1. Where additional access to hoistway is provided, such access shall be by a hoistway unlocking device as specified in section Ind 4.31 (6) (c).

(d) An elevator installed in a single blind hoistway shall conform with Wis. Adm. Code section Ind 4.31 (10).

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64; r. and recr. (1) (a) 7., and cr. (2) (c) and (d), Register, October, 1970, No. 178, eff. 11-1-70.

Ind 4.39 Power door operation. New installations.

(1) (a) Power operation of horizontally sliding car and hoistway landing doors shall conform with the requirements as outlined in this subsection.

1. Both the car and hoistway door shall be of the horizontally sliding type.

2. Power opening of the car door shall occur only when the car is stopping, or is leveling, or is at rest.

3. Power opening of the hoistway landing door shall occur only at the landing where the car is stopping within the leveling zone or is at rest.

4. Where power hoistway doors are automatically opened as the car is leveling, the car shall be at rest or substantially level with the landing before the hoistway door is fully opened.

(b) Where a car door or gate of an automatic operation elevator is closed by power, or is of the automatically self-closing type, and faces a manually operated or self-closing hoistway door, the closing of the car door or gate shall not be initiated unless the hoistway door is in the closed position; and the closing mechanism shall be so designed that the forces necessary to prevent closing of a car door or gate from rest shall be not more than 30 pounds.

(c) A re-opening device shall be provided for every power-operated car door which will function to stop and re-open a car door and the adjacent hoistway door in the event that the car door is obstructed

while closing. Where the hoistway door and the car door are closed in such a manner that stopping either one manually will stop both.

(2) Power operation of vertically rising or vertically bi-parting hoistway doors or gates shall conform with the requirements outlined in this subsection.

(a) Both hoistway door or gate and car door or gate shall be of the vertically sliding type and:

1. Power opening of the car door or gate shall occur only when the car is stopping or is leveling, or is at rest.

2. Power opening of the hoistway landing door or gate shall occur at the landing where the car is stopping within the leveling zone.

3. Where power hoistway doors are automatically opened as the car is leveling, the car shall be at rest or substantially level with the landing before the hoistway door is fully opened.

4. Where a car door or gate of an automatic operation elevator is closed by power, or is of the automatically self-closing type, and faces a manually operated or self-closing hoistway door, the closing of the car door or gate shall not be initiated unless the hoistway door is in the closed position.

(b) Power closing of vertically sliding hoistway doors or gates shall be by means of continuous pressure operation from the car and/or at the landing where the car is stationed.

(c) The operation of the closing means shall not close the hoistway door or gate or car door or gate when the elevator is at any other landing.

(d) For elevators having more than one hoistway opening at any landing level, a separate closing means shall be provided in the car for each car door or gate and its adjacent hoistway door or gate. Any closing means at a landing shall close only that hoistway door or gate and the car door or gate at the side where such means is located.

(e) Power-operated hoistway landing gates shall be not less than 5½ feet in height.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.41 Factors of safety for cables. New and existing installations. (1) The factor of safety based on static loads for cables for passenger and freight elevators shall be not less than the values given in Table 8 corresponding to the contract speed of the car.

TABLE 8

FACTORS OF SAFETY FOR HOISTING CABLES

Car Speed in Feet Per Minute	Elevators
50 or less	7.60
100	7.95
200	8.60
300	9.20
400	9.75
500	10.25
600	10.70
700	11.00
800	11.25
900	11.45

Note: Intermediate car speeds and factors of safety can be obtained by interpolation.

(a) Unless the ultimate strength and material of a cable are known, the load shall be limited to the load allowed for an iron cable of the same diameter.

(b) No car or counterweight cable shall be repaired or lengthened by splicing.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.42 Cable data. (1) There shall be posted for permanent record in a conspicuous place on the car beam of every elevator hereafter installed a metal sign bearing the following original data:

CABLE SPECIFICATIONS

Kind of Cable	Number of Cables	Diameter in Inches	Rated Ultimate Strength	Date of Installation
Hoisting				

(2) On elevators hereafter installed and thereafter whenever cables are renewed on elevators, there shall be attached to the cable fastening or car beam a tag or plate bearing the following data:

CABLE INSTALLATION DATA

Diameter of Cables _____
Material and Type of Cable _____
Rated Ultimate Strength _____
Date Installed _____

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.43 Renewing of cables. Cables are considered unsafe and shall be renewed when through broken wires, wear, rust, undue strain, or other deterioration, the strength has decreased more than 25% of the manufacturers rated strength of the cable. When for any reason it becomes necessary to renew one or more cables of a group supporting a common load, all cables in that group shall be renewed.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.44 Number and size of cables required. (1) Every elevator which requires hoisting cables shall have not less than 2 hoisting cables.

(a) *Exception.* On existing installations a single hoisting cable will be permitted providing the factor of safety is not less than 10.

(2) Every traction elevator hereafter installed shall have not less than 4 cables.

(a) *Exception.* For 2 to 1 roping where the capacity does not exceed 2500 pounds and the speed does not exceed 100 feet per minute 3 cables may be used.

(b) *Exception.* When the capacity does not exceed 1200 pounds 3 cables may be used.

(3) Hoisting cables less than ½ inch in diameter shall not be used for power elevators.

(4) The number of hoisting cables shall be determined by using the factor of safety in Wis. Adm. Code section Ind 4.41 (1) Table 8. The computed load on the car-hoisting cables shall be the weight of the elevator car, plus the contract load, plus the weight of the car-hoisting cables and the compensation minus the weight of the independent car counterweight, if any.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.45 Cable guards for sheaves and idlers. Every sheave or idler under which is led any hoisting, counterweight, or governor cable, shall be provided with a guard that will keep the cable on the sheave or idler if the cable becomes slack.

Note: See Wis. Adm. Code section Ind 1.18 in the "General Orders on Safety" for guarding of pinch points.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.46 Cable (wire rope) terminal fastenings, and turns required on drums. (1) The car and counterweight ends of car and counterweight cable, or the stationary hitch-ends where multiple roping is used, shall be fastened in such a manner that all portions of the cable except the portion inside the cable socket shall be readily visible.

(a) Cable fastenings shall be individual tapered babbitted sockets.

(b) The car ends, or the car or counterweight dead ends where multiple roping is used, of all suspension cable traction type elevators shall be provided with shackle rods of a design which will permit individual adjustment of the cable lengths. Similar shackle rods shall be provided on the car or counterweight ends of compensating cables.

(c) The cable socket shall be either cast or forged steel providing that where the rope socket and the shackle rod are in one piece (unit constructed), the entire fastening shall be of forged steel.

(d) Where the shackle rod is separate from the rope socket, the shackle rod shall be forged or rolled steel and the fastening between the two parts shall be positive and such as to prevent their separation under all conditions of operation of the elevator. Where the connection of the two parts is threaded, the length of the threaded engagement of the rod in the socket shall be not less than 1½ times the root diameter of the thread on the rod, and a cotter pin shall in addition be provided to restrict the turning of the rod in the socket and prevent unscrewing of the connection in normal operation.

(e) Cast or forged steel cable sockets, shackle rods and their connection shall be made of unwelded steel, having an elongation of not less than 20% in a length of 2 inches.

(f) The threaded length of each shackle rod shall be provided with lock nuts and cotter pinned.

(g) Cable sockets shall be of such strength that the cable will break before the socket is perceptibly deformed.

(h) The shackle rod or eye bolt used to connect the cable socket to the car or counterweight, shall have a strength at least equal to the manufacturer's rated strength of the cable.

(j) Where a cable is fastened in a socket, the strand ends of the cable shall be separated and turned in toward the center. The portion

turned in shall have a length of not less than 2½ times the diameter of the cable. The knot thus formed shall be drawn tightly into the socket. The loop of the wire strands shall be visible above the surface of the babbitt after the socket is poured.

1. Only babbitt-metal free from dross shall be used to secure cable ends in tapered babbitted sockets.

2. Seizing of cable ends shall be made with annealed iron wire, and the length of each seizing shall be not less than the diameter of the cable.

(k) The cables of every drum type elevator hereafter installed shall have at least one and one-half turns on the drum when the car is at either the bottom or top landing. This requirement shall also apply, in recabling of existing installations. The winding drum end of every car or counterweight cable shall be secured on the inside of the drum by clamps or by tapered babbitted sockets.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.48 Warning chains; new and existing installations. Warning chains shall be hung within 2 inches from the edge of the car platform entrance side or sides of every power freight elevator. Such chains to be of No. 10 U. S. Standard gauge wire; to extend at least 5 feet below the platform and spaced not more than 5 inches apart.

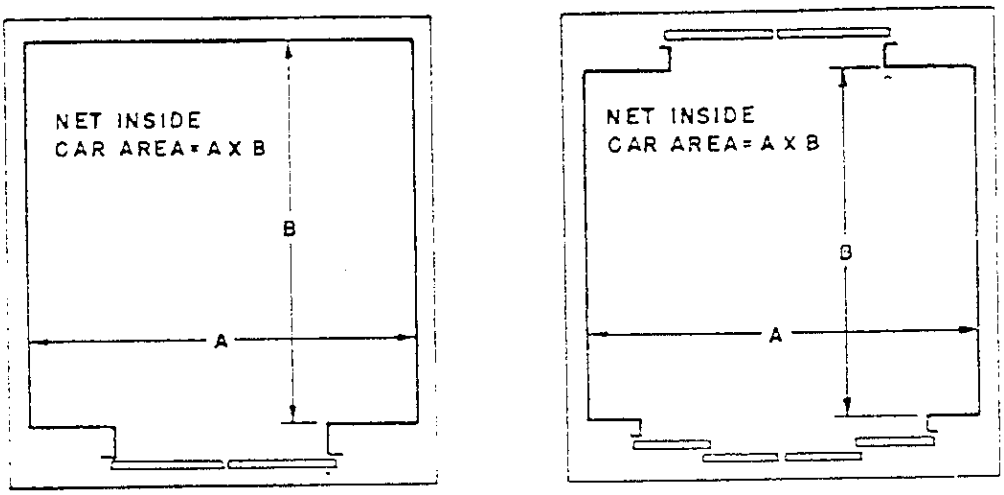
(1) *Exception.* Where hoistway landing doors with electric contacts or interlocks are provided.

Ind 4.52 Capacity and loading of elevators. (1) Every passenger elevator hereafter installed shall have a minimum rated load in pounds based on net inside platform area, and the contract load shall not be less than that given in Table 9. The net inside platform area shall be the product of the inside distance between the inside walls and the inside distance from the front return wall to the rear wall, or the rear return wall where a rear opening is provided.

TABLE 9

MAXIMUM INSIDE NET PLATFORM AREAS FOR THE VARIOUS RATED LOADS

Effective Platform Area Square Feet	Rated Capacity	Loading of Car Per Square Foot in Pounds
10	700	70
13.5	1000	74
15.6	1200	76
19	1500	79
24	2000	83
29	2500	87
33	3000	90
37.6	3500	93
42	4000	95
46.2	4500	97
50	5000	98
58	6000	103
74	8000	108
87.5	10000	114



INSIDE NET PLATFORM AREAS FOR PASSENGER ELEVATORS

(2) Every power freight elevator platform hereafter installed shall have a metal outside frame and shall be designed and constructed for one of the following classes of loading:

(a) *Class A. General freight loading.* Where the load is distributed, the weight of any single piece of freight or of any single hand truck and its load is not more than ¼ the rated load of the elevator, and the load is handled on and off the car platform manually or by means of hand trucks. For this class of loading, the rated load shall be based on not less than 50 pounds per square foot of inside net platform area.

(b) *Class B. Motor-vehicle loading.* Where the elevator is used solely to carry automobile trucks or passenger automobiles up to the rated capacity of the elevator. For this class of loading, the rated load shall be based on not less than 50 pounds per square foot of inside net platform area.

(c) *Class C. Industrial truck loading.* Where the load is carried in transit by, or is handled on and off the car platform by means of industrial power trucks or by hand trucks having a loaded weight more than ¼ the rated load of the elevator. For this class of loading the following requirements shall apply:

1. The rated load shall be based on not less than 50 pounds per square foot of inside net platform area.

2. The weight of the loaded industrial truck shall not exceed the rated load of the elevator.

3. The weight of the industrial truck plus any other material carried on the elevator shall not exceed the rated load when the industrial truck is also carried.

(3) No cast iron shall be used in the construction of any member of the car frame or platform, subject to tension or bending except for compensating cable anchorages, releasing carriers and guide shoe stands.

(4) If there is a railroad track on an elevator car, the tops of the rails shall be flush with the car floor.

(5) The car frame members of every elevator car shall be securely welded, bolted and/or riveted and braced. Welding, where used, shall meet the requirements of the industrial commission.

Note: See Wis. Adm. Code section Ind 4.56 for Guide Rails and Supports; Stresses and Deflections.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.53 Capacity and data plates. New and existing installations. (1) PASSENGER ELEVATORS. There shall be a metal plate which shall be located in a conspicuous place in each passenger elevator car, the letters and figures in each plate to be not less than ¼ inch in height and to be stamped in, etched or raised on the surface of the plate and shall bear the following information:

(a) The contract load of the elevator in pounds.

(b) The number of persons allowed on the car.

Note: The estimated number of persons allowed on the car is based on the contract load divided by 150.

(2) FREIGHT ELEVATORS. A metal plate with stamped or raised letters not less than ½ inch in height, stating the contract load of the elevator, shall be located in a conspicuous place in each freight elevator car.

(3) PLATE ON CROSSHEAD. A metal plate or plates shall be placed upon the car crosshead of each power elevator hereafter installed bearing the information outlined as follows:

(a) The total weight of the complete car, including the safeties and all auxiliary equipment attached to the car.

(b) The contract load and speed.

(c) Cable data, as required in Wis. Adm. Code section Ind 4.42 (1).

(d) Manufacturer's name, and date of installation.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.54 Structural connections and stresses allowed in design. New installations. (1) Connections between members of car frames and platforms shall be riveted, bolted or welded and shall conform with the requirements outlined in this subsection. (See Wis. Adm. Code section Ind 4.27.)

(a) Bolts, where used through sloping flanges of structural members, shall have bolt heads of the tipped-head type or shall be fitted with beveled washers.

(b) Nuts, used on sloping flanges of structural members, shall seat on beveled washers.

(2) The design stresses in the car-frame and platform members and their connections based on the static load imposed upon them shall not exceed the stresses permitted by the Wisconsin Building code,

Wis. Adm. Code sections Ind 53.22 and Ind 53.24. Structural members stresses shall not exceed the unit values as described in Wis. Adm. Code section Ind 4.54, Table 10.

TABLE 10

MAXIMUM ALLOWABLE STRESS IN CAR-FRAME AND PLATFORM MEMBERS AND CONNECTIONS FOR STEELS

Member	Type of Stress	Max. Stress Lbs. Per Sq. Inch	Area Basis
Car Crosshead	Bending	12,500	Gross Section
Car-Frame Plank Normal Loading	Bending	12,500	Gross Section
Car-Frame Plank Buffer Reaction	Bending	25,000	Gross Section
Car-Frame Uprights (Stiles)	Bending plus Tension	15,000	Gross Section
		18,000	Net Section
Hoisting-Rope Hitch Shapes	Bending plus Tension	8,000	Net Section
Platform Framing	Bending	12,500	Gross Section
Platform Stringers	Bending	15,000	Gross Section
Threaded Brace Rods and Other Tension Members except Bolts	Tension	8,000	Net Section
Bolts	Tension	7,000	Net Section
Bolts in Clearance Holes	Shear	7,000	Actual Area in Shear Plane
Bolts in Clearance Holes	Bearing	16,000	Gross Section
Rivets or Tight Body-fit Bolts	Shear	10,000	Actual Area in Shear Plane
Rivets or Tight Body-fit Bolts	Bearing	18,000	Gross Section
Any Framing Member, Normal Loading	Compression	$14{,}000 - \frac{59L}{R}$	Gross Section

(3) The deflection allowed in design of car-frame and platform members shall be based on the static load imposed upon them and shall be not more than permitted by this subsection.

(a) For crosshead—1/960th of the span.

(b) For safety or car frame plank—1/960th of the span.

(c) For platform frame members—1/960th of the span.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.55 Guide rails. New installations. (1) Every passenger and freight elevator shall have T section steel guide rails for car and counterweight.

(a) Guide rails, brackets, clips, fish plates and their fastenings shall be of steel to conform with the requirement as follows:

1. Rails, brackets, fish plates and rail clips shall be made of open-hearth steel or its equivalent having a tensile strength of not less than 55,000 pounds per square inch and having an elongation of not less than 22% in a length of 2 inches.

(2) Guide rails shall conform to the nominal weights and dimensions shown in Figure 4.55 and Table 11.

FIGURE 4.55

ELEVATOR GUIDE RAILS

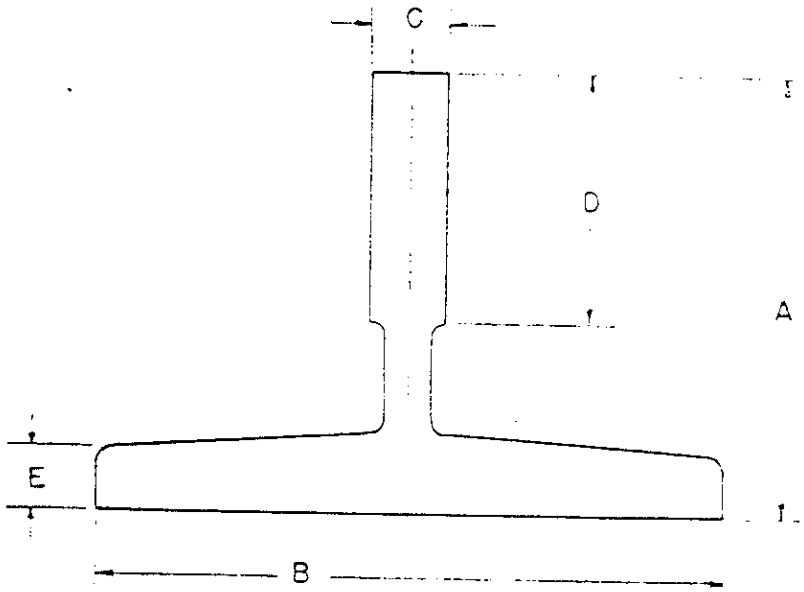


TABLE 11

T SECTION RAIL

Nominal Weight Per Foot in Lb.	Nominal Dimension in Inches				
	A	B	C	D	E
8	2 7/16	3 1/2	3/8	1 1/4	5/16
11	3 1/2	4 1/2	3/8	1 1/2	5/16
12	3 1/2	5	3/8	1 3/4	5/16
15	3 1/2	5	3/8	1 31/32	1/2
18 1/2	4 1/4	5 1/2	3/4	1 31/32	1/2
22 1/2	4	5 1/2	1 1/8	2	9/16
30	5	5 1/2	1 1/4	2 1/4	11/16

(3) The joints of metal guide rail shall conform to the requirements as outlined in this subsection.

(a) The ends of the rails shall be accurately machined with a tongue and matching groove centrally located in the center of the web.

(b) The ends of each rail shall be joined together with fish plate and with not less than 4 bolts.

(c) The width of the fish plate shall be not less than the width of the back of the rail.

(d) The thickness of the fish plates and the diameter of the bolt for each size of guide rail shall be not less than specified in Table 12.

TABLE 12

MINIMUM THICKNESS OF FISH PLATES AND MINIMUM DIAMETER OF FASTENING BOLTS

Nominal Weight of Guide Rail in Pounds Per Foot	Minimum Thickness of Fish Plates in Inches	Minimum Diameter of Bolts in Inches
8	7/16	1/2
11	11/16	5/8
12	11/16	5/8
15	11/16	5/8
18½	13/16	3/4
22½	13/16	3/4
30	15/16	7/8

(e) Guide rails shall have finished guiding surfaces.

(4) The top and bottom ends of each run of guide rail shall be so located in relation to the extreme positions of travel of the car and counterweight that the car and counterweight guiding members cannot travel beyond the ends of the guide rails.

(5) Steel plates or other structural shapes shall be mounted under and fastened to the bottom ends of car guide rails where safeties are used.

(6) The guide rails of power elevators shall not be used to support the overhead machinery.

(a) *Exception.* Governors.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64; am. tables 11 and 12, Register, October, 1970, No. 178, eff. 11–1–70.

Ind 4.56 Guide rails and supports; stresses and deflections; new installations. (1) The stresses in a guide rail or in the rail and its reinforcements, due to the horizontal forces imposed on the rail during loading, unloading or running, calculated without impact, shall not exceed 15,000 pounds per square inch based upon the class of loading; and the total deflection shall not exceed ¼ inch.

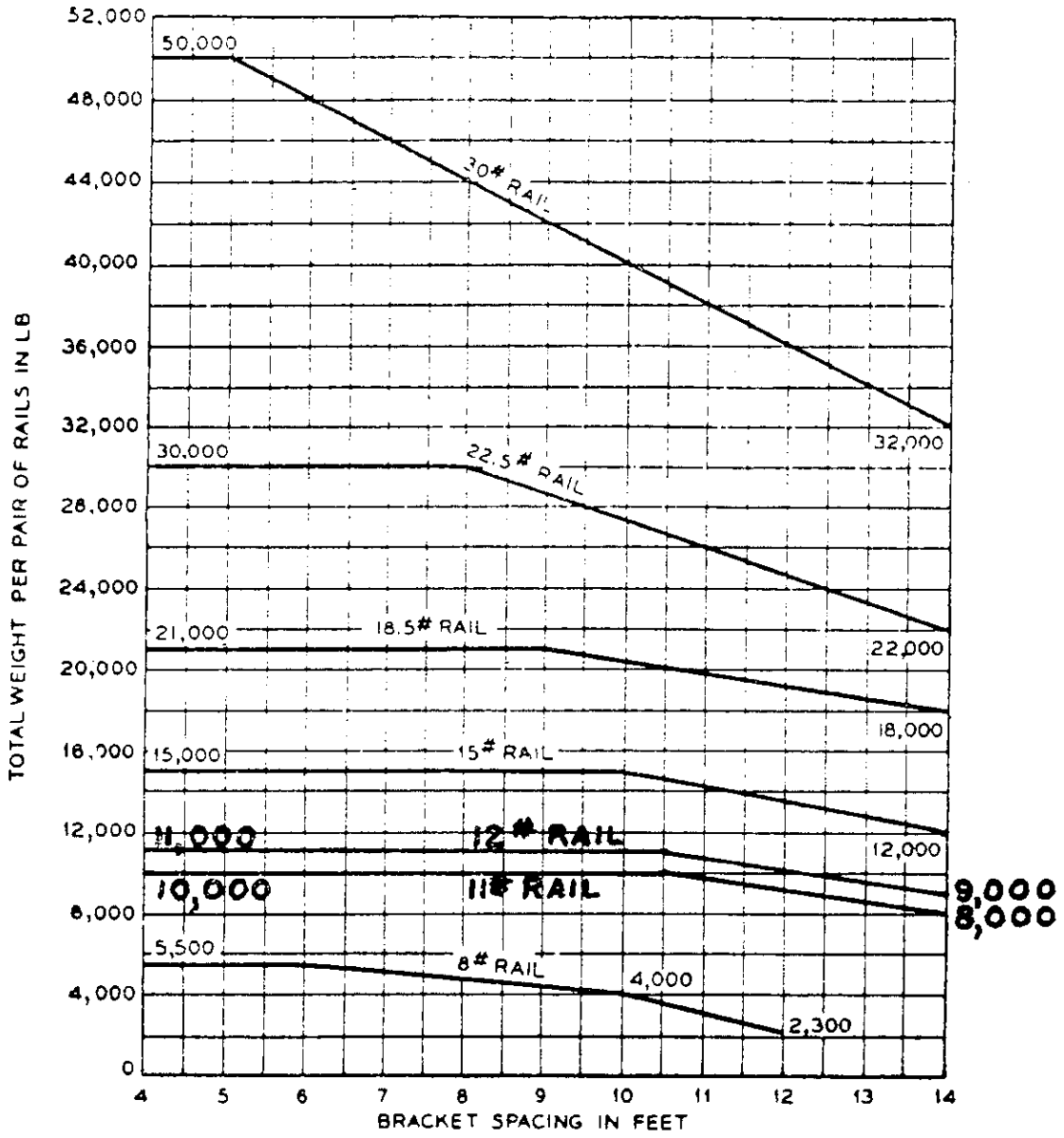
(2) The guide rail brackets, their fastenings and supports, such as building beams and walls, shall be capable of resisting horizontal forces imposed by the class of loading; the total deflection shall not exceed ⅛ inch at the point of support.

(3) Where a car with safety or counterweight with safety is used, the maximum suspended weight of the car and its rated load per pair of guide rails, or maximum suspended weight of the counterweight per pair of guide rails, including the weight of any compensating ropes or chains and of any traveling cables suspended therefrom, shall not exceed the maximum specified in Figure 4.56 for the size of rails and the bracket spacing used. Where conditions require greater bracket spacing the guide rails shall be reinforced or a larger size

rail used providing the reinforced or larger rail is of equal strength per pair of guide rails to conform with the requirements of Figure 4.56.

FIGURE 4.56

MAXIMUM WEIGHT OF CAR WITH RATED LOAD OR OF COUNTERWEIGHT WITH SAFETY FOR A PAIR OF GUIDE RAILS



(4) The weight of the counterweight per pair of guide rails and the bracket spacings where no safety is used shall not exceed that specified in Table 13.

TABLE 13

GUIDE RAILS FOR COUNTERWEIGHTS WITHOUT SAFETIES

Weight of Counterweight in Pounds	Nominal Weight of Guide Rail in Pounds Per Foot	Maximum Bracket Spacing Without Reinforcement in Feet
15,000	8	16
27,000	11	16
29,000	12	16
40,000	15	16
56,000	18½	16
80,000	22½	16

(a) Intermediate tie brackets, equally spaced shall be provided between counterweight guide rails at intervals as specified in Table 14.

TABLE 14

INTERMEDIATE TIE BRACKETS

Nominal Distance Between Fastenings to Building Structure in Feet	Number of Intermediate Tie Brackets
0 to 12	0
12 to 14	1
14 to 16	2

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64; am. figure 4.56 and table 13, Register, October, 1970, No. 178, eff. 11–1–70.

Ind 4.57 Fastening of guide rails. New installations. (1) Guide rails shall be secured to their brackets by clips or by bolts which shall conform with Wis. Adm. Code section Ind 4.54 (1) (a) and (b) or by welding which shall conform with section Ind 4.54 (1) (c).

(2) The size of bolts used for fastening the guide rails or clips to the brackets shall be not less than specified in Table 15 outlined as follows:

TABLE 15

MINIMUM SIZE OF RAIL-FASTENING BOLTS

Nominal Weight of Guide Rail in Pounds Per Foot	Minimum Diameter of Bolts in Inches
8	½
11	⅝
12	⅝
15	⅝
18½	⅝
22½	¾
30	¾

(3) Material used for shimming steel rails shall be metal so secured as not to drop from its position if the fastenings become loose.

(4) The building construction shall be adequate to support the guide rails and their brackets in accordance with the requirements outlined in this subsection.

(a) Safely withstand the application of the car safety when stopping the car at governor tripping speed with its rated load or application of the counterweight safety at governor tripping speed.

(b) Withstand the forces specified in Wis. Adm. Code section Ind 4.56 (2) within deflection limits.

(5) Guide rails shall be located in essentially a vertical plane and the distance between the plane of the rails shall not vary more than ¼ inch.

(6) Fastenings shall be by means of metal inserts, expansion bolts, or by through bolts in the beams or walls and shall conform with the requirements of Wis. Adm. Code section Ind 4.56 (2).

(a) Expansion bolts shall not be used unless the wall or beam construction is such as to rigidly and permanently hold the fastenings in place.

(b) Through bolts shall be backed on the outside of the wall or beam with a metal plate to adequately distribute the load.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64; am. table 15 in (2), Register, October, 1970, No. 178, eff. 11-1-70.

Ind 4.58 Minimum size of drums and sheaves. (1) The minimum diameter of drums and sheaves for hoist and counterweight cables for every power elevator shall be not less than 40 times the diameter of the cable as outlined in Table 16.

Exception. Existing sidewalk elevators and existing elevators of a sidewalk type installed within a building.

TABLE 16

Diameter in Inches of Cables	Minimum Diameter in Inches of Drums and Sheaves
1/2	20
9/16	22
5/8	24
3/4	30
7/8	36
1	40

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.59 Machinery. General requirements. (1) The factor of safety to be used in the design of driving machines and in design of sheaves used with hoisting and compensating cables (ropes) shall conform with the requirements as outlined in this subsection.

(a) Eight (8) for steel, bronze, or for other metals having an elongation of at least 14% in a length of 2 inches.

(b) Ten (10) for cast iron, or for other metals having an elongation of less than 14% in a length of 2 inches.

Note: The load to be used in determining the factor of safety shall be the resultant of the maximum tensions in the cables (ropes) leading from the sheave or drum with elevator at rest and with rated load in the car.

(2) Bolts or other means used to transmit torque between the driving sheave and the gearing, and their supports, shall be tightly fitted without play. Set screws or threaded portions of bolts or screws shall not be used to transmit torque.

(3) A fillet shall be provided at any point of change in the diameter of driving-machine shafts and sheave shafts to prevent excessive stress concentrations in the shaft.

(a) Shafts which support drums, sheaves, couplings and other members, and which transmit torque, shall be provided with tight-fitting keys.

(4) Gear housings for elevator machines shall have openings so located as to permit proper inspection of the gears, and gear spider fastenings.

(a) *Exception.* A gear housing cover that is not integral with the bearing cap, does not require gaskets to prevent oil leakage, and is not to exceed 30 pounds in weight, will be acceptable in lieu of subsection (4).

(5) The motor drive on geared traction elevators shall be directly connected to the gearing provided and mounted on continuous steel or cast iron bed plates.

(a) *Exception.* Existing drum type machines, hydraulic elevators and new installations of winding drum machines installed in compliance with the requirements of Wis. Adm. Code section Ind 4.61.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.60 Prohibited installations. (1) NEW AND EXISTING INSTALLATIONS. (a) Freight elevators shall not be used for transporting passengers.

(b) Belt or chain driven machines shall not be used for any passenger elevator installation.

1. *Exception.* Oil hydraulic elevators.

(c) Friction gearing or a clutch mechanism shall not be used to connect a driving-machine drum or sheave to the main driving gear of any elevator.

(d) Continuous pressure button operation from the landings shall not be used for passenger elevators.

(e) An emergency hoistway landing door and/or car gate by-pass switches are prohibited.

(f) Drum type freight elevator installations equipped with a mechanical brake shall not have hoistway limit switches, car door or gate electric contacts, hoistway landing door or gate electric contacts or any combination thereof.

(g) No power attachment, such as worm reduction units, rope clutch or rope grip devices, belts to improvised rope wheels, or any similar device, shall be installed on any hand elevator unless all requirements for power elevators are complied with.

(h) *Floorless elevators and dumbwaiters.* Elevators and dumbwaiters without platforms are prohibited.

(2) NEW INSTALLATIONS. (a) There shall be not more than 2 entrances to any passenger or freight elevator car.

(b) Chains shall not be used for hoisting in connection with a power elevator.

1. *Exception.* See Wis. Adm. Code section Ind 4.82 special requirements.

(c) Sidewalk elevator installations are prohibited. (See Wis. Adm. Code section Ind 4.81 for grade level elevators.)

(d) Winding drum machines are prohibited, except as indicated in Wis. Adm. Code section Ind 4.61.

(e) Cast iron worm gears shall not be used in the hoisting mechanism of any elevator.

(f) No elevator of any type shall have more than one compartment, nor shall elevator cars counterbalance each other.

(g) Continuous pressure push button operation elevators shall not have a contract speed in excess of 100 feet per minute.

(h) Sheaves or idlers shall not be suspended in cast iron stirrups from the supporting beams.

(j) Hand power operated elevators shall be limited to one story of travel, and not to exceed 14 feet.

(k) Hand cable power operated elevators and dumbwaiters are prohibited.

(m) Carriage type elevators supported by cables attached at 4 or more points are prohibited.

(n) A platform or equipment not required for the operation of the elevator shall not be located above the top of any elevator car.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64; cr. (1) (h); r. and recr. (2) (j), Register, September, 1967, No. 141, eff. 10–1–67; cr. (2) (n), Register, October, 1970, No. 178, eff. 11–1–70.

Ind 4.61 Winding drum machines. (1) Winding drum machines shall be used for freight elevators only; shall not have counterweights; and shall be limited to a capacity not to exceed 2,500 pounds. The speed shall not exceed 50 feet per minute and the travel not to exceed 35 feet.

(2) *Exception.* Material handling elevators.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64; r. and recr. Register, September, 1967, No. 141, eff. 10–1–67.

Ind 4.62 Slack cable devices. Slack cable switches. (1) Every drum type power elevator with a mechanical brake shall be provided with a mechanical slack cable device which will automatically stop the machine in the event the hoist cables loosen or break.

(2) A slack cable switch shall be provided for every drum type power elevator equipped with an electric brake which will automatically shut off the power and stop the machine in the event the hoist cables loosen or break. This switch shall not reset automatically when the slack in the cable is removed.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.63 Limit stops. New and existing installations. (1) Every elevator hereafter installed shall be equipped with final limit switches. These switches shall automatically interrupt the power circuit and stop the car in case of overtravel at each terminal of travel.

Exception. Electric oil hydraulic elevators.

(a) The operation of final limit switches shall prevent movement of the car by normal operating controls in both directions of travel. (See Wis. Adm. Code section Ind 4.72 (2).)

(b) Final limit switches shall be located in relation to oil buffers so that the engagement of the buffer and the opening of the final limit switches will occur as near simultaneously as possible; to cause the electric power to be removed automatically from the elevator driving-machine motor and brake after the car has passed the terminal land-

ing. For spring buffers, the final limit switches shall be opened before the buffer is engaged.

(c) Final limit switches shall be mounted to the guide rails and directly operated by a cam attached to the car. The cam shall be of sufficient length to maintain the switches in the open position to the extreme car travel.

(2) Every power elevator hereafter installed shall be equipped with directional limit switches at each terminal of travel. These switches shall function independently of the operation of the floor selector stopping devices; and operated by the movement of the car and shall stop the car approximately level at each terminal landing.

(a) Where final limit switches are not required, directional limit switches shall be mounted to the guide rails and directly operated by a cam attached to the car.

(3) Every drum type elevator machine shall be equipped with an approved machine automatic terminal stopping device which will automatically stop the machine in the event the car over-travels either of the terminal landings.

(a) For alternating current drum type elevator machines hereafter installed, the terminal stopping device as outlined in subsection (3) shall also open the electric circuit to the motor and brake. This device shall be in addition to the final limit switches required in Wis. Adm. Code section Ind 4.63 (1).

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64. r. (3); renum. (4) to be (3), Register, December, 1967, No. 144, eff. 1–1–68.

Ind 4.64 Car safety devices. (1) An approved car safety device capable of stopping and sustaining the car with contract load in the down direction shall be attached to every elevator except:

(a) Freight elevators which travel not more than 10 feet.

(b) Direct lift plunger elevators.

(c) Existing carriage type elevators which travel not more than 18 feet.

(2) For speeds greater than 125 feet per minute Type B (sliding type) or Type C (combination instantaneous and oil-buffer) car safety device shall be required.

(3) Every car safety device shall be attached to and located within or below the lower members of the car frame (safety plank). The gripping surfaces of a car or counterweight safety device shall not be used to guide the car or counterweight. Safeties shall be applied mechanically and shall be so designed that on their application the forces which provide the stopping action shall be compressive forces on each side of the guide rail section.

(4) Multiple car safeties may be used subject to the approval of the industrial commission providing the lower safety shall be capable of developing not less than ½ of the force required to stop the entire car with rated load and the duplex safeties shall function simultaneously; these safeties shall be of the "B" type.

(5) Counterweight safeties, where required, shall meet the requirements of car safeties. (See Wis. Adm. Code section Ind 4.20 (3).)

(6) Every drum or idler sheave which is underneath the car and is used to actuate the car safety device shall be so guarded to prevent the cable leaving the drum or sheave and shall be securely fastened directly to the car frame or by means of metal brackets.

(7) A cutout switch shall be provided on the car safety device of every elevator hereafter installed, which shall remove the power from the driving-machine-motor and brake; at the initial movement of the safety device before or at the time of application of the governor.

(8) Car safety devices shall be identified and classified on the basis of performance characteristics after the safety begins to apply pressure on the guide rails as outlined in this subsection.

(a) *Type A Safeties.* Instantaneous type safeties shall be limited to elevators where the contract speed does not exceed 125 feet per minute.

Note: Type A safeties develop a rapidly increasing pressure on the guide rails during the stopping interval, the stopping distance being instantaneous to the inherent design of the safety. The operating force is derived entirely from the mass and the motion of the car or the counterweight being stopped. These safeties apply pressure on the guide rails through eccentric dogs or rollers without any flexible medium purposely introduced to limit the retarding force and increase the stopping distance.

(b) *Type B Safeties.* Shall be provided where the contract speed exceeds 125 feet per minute. The safeties shall when operated, stop the fully loaded car within the maximum stopping distances as specified in Table 17 of this section on the basis of the governor tripping speed.

TABLE 17

MAXIMUM STOPPING DISTANCES—TYPE B CAR SAFETIES WITH RATED LOAD

Rated Speed in Ft. Per Minute	Maximum Governor Tripping Speed in Ft. Per Min.	Stopping Distance in Feet—Inches	
		Wedge-Clamp Safety* / Gradual-Wedge-Clamp Safety**	Flexible Guide-Clamp Safety***
0 to 125	175	6- 0	1- 3
150	210	6- 1	1- 4
175	250	6- 2	1- 7
200	280	6- 3	1-10
225	308	6- 5	2- 0
250	337	6- 8	2- 3
300	395	6-11	2- 9
350	452	7- 3	3- 4
400	510	7-10	4- 0
450	568	8- 3	4-10
500	625	8-10	5- 8
600	740	9-11	7- 7
700	855	11- 1	9-10
800	970	12- 4	12- 6

Note: B safeties of the sliding type are divided into 3 classes outlined as follows:

* Wedge-clamp is one where the wedges are applied against the rails through the unwinding of a cable-operated drum, and threaded screws, and the connections between the safety drum and the safety wedges are rigid and no elastic member is provided in the jaw assembly. Travel of the wedges increases the pressure on the jaws.

** Gradual-wedge-clamp is similar in design and construction as the wedge-clamp safety except that an elastic member such as spring or springs are provided on the safety device to obtain a predetermined constant retarding force.

*** Flexible-guide-clamp. Safeties of this type have vertical sliding wedge-type jaws, in which the retarding force is derived from the proportional to the pressure exerted by the compression of spring or springs, directly applying the jaws to the rails. The retarding forces are reasonably uniform after the safety is fully applied.

(c) *Type C Safeties.* (Combination instantaneous and oil-buffer safety) shall, when provided and where the contract speed exceeds 125 feet per minute, be subject to the requirements as outlined in this subsection.

1. The rated car speed shall not exceed 500 feet per minute.

2. The oil buffers shall conform to all requirements specified in section Ind 4.19 for oil buffers, except that the stroke shall be based on governor tripping speed and on an average retardation not exceeding 32.2 feet per second per second.

3. After the buffer has been compressed, as applied in subsection (8) (c) 2. there shall be at least 10% of the buffer stroke remaining to prevent excessive impact on the buffer parts and the auxiliary safety.

4. Where the distance between guide rails exceeds 8 feet, the safety shall be provided with two oil buffers of substantially identical calibration, and the buffers shall be so located as to develop minimum stresses in the auxiliary safety plank during safety operation.

5. Buffers shall be located in line with and symmetrically between the guide rails.

6. The auxiliary safety plank shall be so supported and guided below the car frame that the proper clearances for the safety parts shall be maintained during normal operation.

7. The auxiliary safety plank shall be so designed that the maximum stresses in the plank shall not exceed those specified for similar car frame members.

8. An electric switch shall be provided and so arranged and connected that the elevator cannot be operated by means of the normal operating device if any buffer is compressed more than 10% of its stroke.

9. Means shall be provided to prevent operation of the elevator by means of the normal operating device if the oil level in any buffer is below the minimum allowable level.

Note: Type C safeties develop retarding forces during the compression stroke of one or more oil buffers interposed between the lower members of the car frame and a governor-operated Type A auxiliary safety plank applied on the guide rails. The stopping distance is equal to the effective stroke of the buffers.

(9) Safeties shall be so arranged that they can be released inside the car, or on top of the car, or by operating the machine in the "up" direction.

(10) Each safety shall be marked for identification by the manufacturer by a plate that shall be placed in a conspicuous location on the safety plank. This plate shall show the type and the manufacturer, the maximum weight and the maximum governor tripping speed for which the safety is approved.

(11) Every type of car safety device and speed governor hereafter installed shall be subjected to a drop test as outlined in this subsection.

(a) The test shall be made with the total load on the car safety device. The total load shall include the weight of the car structure, the safety device, the live load, and all appurtenances and devices attached to the car.

(b) The free fall shall be such that the safety under test shall have attained the maximum governor tripping speed before the safety actuating device starts to function, except that where approval is desired for speeds greater than 280 feet per minute the governor tripping speed need not exceed 280 feet per minute.

(c) The total drop from the starting point to rest for type B safeties shall not exceed 15 feet.

(d) The application of the car safety device shall not cause the car platform to become out of level in excess of ½ inch per foot.

(e) A drop test made on a car safety device that is designed and constructed to trip by inertia, when set within the drop test requirements, shall be considered as satisfactory. The governor in connection with the above car safety device shall be tested separately to determine the tripping speed as required in subsection (8) (b), Table 17.

(f) Complete plans and specifications for every car safety device and speed governor to be tested shall be submitted to the commission.

(g) Such tests shall be made at the risk and expense of the elevator manufacturer and witnessed by the industrial commission.

(12) Tests of car safety device and speed governor combination shall be made before the elevator is placed in regular service. Such tests shall be made with cables attached and all electric apparatus operative, except for the cutout switch required by subsection (7) and shall comply with the following:

(a) Elevators provided with *type A safeties* shall be tested with the contract load in the car and from contract speed shall stop and hold the car by tripping the governor by hand.

(b) An overspeed test shall be made on elevators provided *with type B and C safeties* equipped with "generator field control". The test shall be made with the contract load in the car, by increasing the speed of the car until the governor causes application of the safety.

1. The stopping distance for *type B safeties* and the governor tripping speed shall conform with requirements of subsection (8) (b), Table 17.

2. The stopping distance for *type C safeties* shall be equal to the stroke of the buffer located between the lower member of the car frame and auxiliary safety plank, and shall conform to the requirements of subsection (8) (c) 2.

(c) No person shall be permitted to ride on the elevator car during an overspeed test or drop test.

(d) For type B safeties the pull-out of the governor cable from its normal running position until the safety jaws begin to apply pressure to the guide rails shall not exceed 30 inches.

(e) Stopping distance is the actual slide as indicated by the marks on the rails.

(f) All winding drum-operated safeties, requiring continual unwinding of the safety drum cable (rope) to fully apply the safety shall be so designed that not less than 3 turns of the cable will remain on the safety drum after the overspeed test of the safety has been made with the rated load in the car.

(g) Tests of counterweight safeties shall be made with no load in the car.

(13) Every car safety device and speed governor shall be maintained in proper working condition and shall be subjected to a running test at intervals as outlined in this subsection.

(a) Safety tests for *type A, B and C safeties* shall be made with the contract load in the car, and at contract speed in the "down" direction, shall, by tripping the governor by hand stop and hold the car.

1. The governor tripping speed shall conform with requirements as specified in subsection (8) (b), Table 17.

(b) The test shall be made with all electric apparatus operative, except for the cutout switch as specified in subsection (7).

(c) Type B safeties shall stop the car with the contract load within the maximum stopping distances as specified in subsection (8) (b), Table 17.

(d) Tests as outlined in subsection (13) shall be made at every 5 year period thereafter.

(e) In the event the safety device or the governor fails to function as required, the owner or agent shall renew or replace any part or parts of the equipment and make a test or tests necessary to insure satisfactory operation of the safety device and governor.

(f) A tag shall be fastened to the governor releasing carrier, upon completion of a satisfactory test of the car safety device and speed governor. Reports of tests as specified in subsection (13) shall be submitted to the industrial commission with complete information on Form SB–2E "Test Report of Safety Devices" and "Tags" furnished by the Industrial Commission, Post Office Box 2209, Madison, Wisconsin 53701.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.65 Speed governors. (1) An approved speed governor shall be installed in connection with the required car safety for every power elevator as outlined in Wis. Adm. Code section Ind 4.64 (8) (a), (b), and (c).

(2) Every speed governor hereafter installed shall be of a type equipped with cable-grip jaws which will grip the governor cable. Governor jaws shall be of such shape and minimum length to prevent serious cutting, damage or deformation of the cable from the stopping action of the jaws in operating the safety device. The governor shall be located where it cannot be struck by the car or counterweight in case of overtravel. There shall be sufficient space for full movement of the governor parts.

(a) Governors for elevators with a contract speed in excess of 200 feet per minute and with type B safeties shall be equipped with spring loaded cable grip jaws. The maximum tension in the governor cable shall not exceed ⅛th of the rated ultimate strength of the cable.

Note: For counterweight safeties see Wis. Adm. Code section Ind 4.20 (3).

(3) Speed governors for car safeties shall be set to trip at overspeeds as follows:

(a) At not less than 115% of the contract speed.

(b) At not more than the tripping speed listed opposite the applicable speed specified in Table 18, this subsection.

TABLE 18

MAXIMUM SPEEDS AT WHICH SPEED GOVERNOR TRIPS AND GOVERNOR OVERSPEED SWITCH OPERATES

Rated Speed in Ft. per Minute	Maximum Governor Trip Speed in Ft. per Minute	Maximum Speed at Which Governor Overspeed Switch Operates Down Ft. per Minute
0–125	175	175
150	210	190
175	250	225
200	280	252
225	308	277
250	337	303
300	395	355
350	452	407
400	510	459
450	568	512
500	625	563
600	740	703
700	855	812
800	970	921

(4) Governors for elevators having a contract speed greater than 200 feet per minute shall be equipped with an overspeed switch. This switch shall be set to open in the "down" direction at a speed not greater than specified in Table 18, this subsection. This switch shall also be set to open in the "up" direction at not more than 100% of the speed at which the governor is set to trip in the "down" direction and shall, when operated in either direction, remove the power from the driving machine motor and brake and shall remain in the open position until manually reset.

(5) Speed governors, when provided for counterweight safeties shall be set to trip at an overspeed greater than, but not more than 10% above that at which the car speed governor is set to trip.

(6) Governor ropes (cable) shall be of iron, steel, monel metal, phosphor bronze, or stainless steel, of regular-lay construction and shall be not less than ⅜ inch in diameter. Tiller rope construction shall not be used. The factor of safety of governor cable shall be not less than 5.

(a) Governor sheaves shall be not less than 12 inches in diameter.

(b) The governor shall be marked for identification by a plate, which shall give the information outlined as follows:

1. Type _____
2. Tripping Speed _____
3. Cable Construction and Size _____
4. Cable Material _____
5. Manufacturer _____

(7) In replacing existing governor cable or rope they shall be of the same size, material and construction as the cable or rope originally furnished by the manufacturer.

(a) Where rope is used it shall be of the hawser laid type.

(8) Every friction type rope governor shall be replaced with an approved type governor to conform with subsection (6) (a) and (b) as outlined in this subsection.

Note: A friction type rope governor is dependent upon the pinch of the rope in the sheave groove.

(a) A safety test shall be made in accordance with subsection (13).

(b) A report shall be submitted to the industrial commission giving the information as follows:

1. Type, number and design of governor.
2. Governor tripping speed.
3. Type, number and design of car safety device.
4. Type and size of guide rails.
5. Car speed.
6. Car capacity.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64; cr. (7) (a), Register, September, 1967, No. 141, eff. 10-1-67.

Ind 4.66 Brakes. (1) Every electric elevator hereafter installed shall be equipped with an electrically released and spring applied brake so designed, installed and maintained so as to stop and hold the car with contract load when applied.

(a) No brake shall be arranged to be released until power has been applied to the machine-driving motor.

(b) No single ground, short-circuit, motor field discharge or countervoltage shall prevent the action of the holding brake magnet or motor from allowing the brake to set in the intended manner during normal operation or during emergency stops.

(2) Every power elevator shall be equipped with a brake so designed, installed and maintained to be released when the control mechanism is shifted to the starting position and shall be applied when the control device is shifted to the stopping position.

(3) Every hand-power elevator shall be equipped with a brake to operate in either direction of motion of the elevator. When the brake has been applied it shall remain locked in position until manually released.

(4) Every hand-power elevator which does not have a limit stop at the top terminal landing, shall be provided with a solid footing for the counterweight to rest when the car is not more than 6 inches above the top landing.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.70 Control mechanism. (1) An externally operated circuit-breaker or disconnecting fused switch opening all lines shall be installed separately in the supply circuit of every elevator, escalator or moving walk or moving ramp. This breaker or switch shall be of the enclosed type, and shall be provided with proper over-current protection, and shall not be made to close from any other part of the building, and shall be located to be visible from the elevator machine in the machine room at the lock-jamb side of the entrance door. The switch shall be a horsepower rated motor circuit switch for motors up to and including 50 H. P.

(2) An externally operated circuit-breaker or disconnecting fused switch opening all lines, shall be installed separately in the supply circuit of every *power dumbwaiter* hereafter installed. This breaker or switch shall be of the enclosed type and shall be provided with

proper overcurrent protection and shall conform with the requirements as outlined in this subsection.

(a) Where the hoisting machine is located in the hoistway, directly above or below the dumbwaiter, the controller and circuit breaker or switch shall be mounted on the outside of the hoistway, on the adjacent hoistway wall at the machine location.

(b) Where a machine room is provided and isolated from the hoistway enclosure, the circuit breaker or fused disconnect switch shall be mounted adjacent to the controller to conform with subsection (1).

(3) Elevators hereafter installed where the travel exceeds 14 feet shall be provided with car top operating switches of the enclosed type, externally operable and permanently mounted vertically on the car crosshead and shall conform with the following:

(a) An operating switch to render all landing buttons and car switches or car buttons inoperative.

(b) An "Up" and "Down" button or switch which will enable the car to be operated in either direction as long as the button or switch is held in contact.

(c) The car speed shall not exceed 100 feet per minute.

(d) It shall operate the car only when all car doors and gates and all hoistway landing doors and gates are in the closed position.

(e) The operating switch shall be so arranged and connected that when operative, the movement of the car shall solely be under control of this device.

(4) Every elevator equipped with hand cable control shall be provided with adjustable stop balls, to center the control mechanism and stop the car at each terminal landing.

(5) Every hand cable controlled elevator shall be equipped with a properly adjusted centering rope which shall be accessible from the car and so arranged to be easily and safely used at any point of the car travel.

(a) *Exception.* Hydraulic elevators.

(6) The car of every power freight elevator with hand cable control shall be equipped with a cable lock so designed, installed and maintained that the hand cable can be locked at any landing to prevent the operation of the car by persons on other floors.

(a) *Exception.* Existing sidewalk elevators.

(b) *Exception.* Elevators equipped with an emergency stop switch in the car or electric contacted gates, provided they comply with subsection (4). (See Wis. Adm. Code section Ind 4.72 (5).)

(7) The car of every electrically driven elevator shall be provided with an emergency stop switch located in or adjacent to the car operating panel. When opened, this switch shall cause the electric power to be removed from the elevator-machine-motor, brake or solenoid valve and shall conform with the following:

(a) Be of the manually opened and closed type.

(b) Have red operating handles or buttons.

(c) Be conspicuously and permanently marked "stop".

(d) Be positively opened mechanically and the opening shall not be solely dependent on springs.

1. *Exception.* Existing hand cable controller elevators.

(8) The car switch or hand lever on every power elevator shall be so arranged that the movement of the switch handle or lever toward

the opening (which operator usually faces) will cause the car to descend and the movement of the switch handle or lever away from the opening will cause the car to ascend. The switch handle or lever shall return to the neutral position and automatically latch when released.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.71 Control and operating circuits. (1) The design and installation of the control and operating circuits, shall conform with the requirements outlined in this subsection.

(a) If springs are used to actuate switches, contactors or relays to break the circuit to stop an elevator at terminal landings, they shall be of the compression type.

(b) The completion or maintenance of an electric circuit shall not be used to interrupt the power to the elevator driving-machine motor or brake at the terminal landings nor to stop the car when the emergency stop switch is opened or any of the electrical protective devices operate.

1. *Exception.* Dynamic braking, nor to speed control switches.

(c) The failure of any single magnetically operated switch, contactor or relay to release in the intended manner, or the occurrence of a single accidental ground, shall not permit the car to start to run if any hoistway-door interlock is unlocked or if any hoistway-door or car-door or gate contact is in the open position.

(d) Where generator-field control is used, means shall be provided to prevent the generator from building up and applying sufficient current to the elevator driving-machine motor to move the car when the elevator-motor control switches are in the "off" position. The means used shall not interfere with maintenance of an effective dynamic-braking circuit during stopping and standstill conditions.

(e) Motor-generators driven by direct current motors used to supply direct current for the operation of elevator machine motors shall be provided with an overspeed switch which will automatically remove the power from the elevator machine-motor and brake should the motor-generator overspeed more than 125% of its rated speed.

(f) The installation of condensers, the operation or failure of which will cause an unsafe operation of the elevator, is prohibited. No permanent device shall be installed, except as provided in this code, which will make any required safety device inoperative.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.72 Electrical protection. (1) Every automatic operation elevator hereafter installed having polyphase alternating current power supply shall be provided with means to prevent the starting of the elevator motor if:

(a) The phase rotation is in the wrong direction, or

(b) There is a failure of any phase.

1. *Exception.* Additional protection shall not be required in the case of generator-field control having alternating current motor-generator driving motors, providing a reversal of phase will not cause the elevator driving-machine motor to operate in the wrong direction, nor in the case of controllers whose switches are operated by polyphase torque motors providing inherent protection against phase failure or reversal.

2. *Exception.* Electrically operated hydraulic elevators.

(2) Every existing elevator driven by a polyphase alternating current motor shall be protected against damage due to phase reversal by either:

(a) Limit switches as specified in Wis. Adm. Code section Ind 4.63 (1), or

(b) A reverse phase relay which will prevent starting the motor if the phase rotation is in the wrong direction, or there is failure in any phase.

(3) If an overload circuit breaker is used for a direct-current elevator, the wiring shall be arranged so that the circuit of the brake magnet coil is opened at the same time that the line circuit is opened.

(4) Every electrically driven cable type elevator hereafter installed shall be provided with an elevator potential switch which will cause and maintain interruption of power to the main circuit during failure of supply voltage, and the operation of any of the emergency stopping switches.

(5) Every electrically driven elevator with an emergency stop switch or electric contacted gates, which is controlled by a hand cable, lever or wheel, shall be equipped with a sequence device requiring the centering of the operating device after the power has been cut off the motor before the car can again be started.

(6) Every elevator which is changed from hand cable control to car switch, automatic or continuous pressure operation shall comply with the requirements of new installations.

(7) When any material change in electrical equipment is hereafter made on any power elevator or dumbwaiter, the wiring and equipment which is an integral part of that which is replaced or renewed shall comply with the requirements of new installations.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64; cr. (1) (b) 2., Register, September, 1967, No. 141, eff. 10–1–67.

Ind 4.73 Wiring and electrical protection. (1) VOLTAGE LIMITATIONS. The nominal voltage used for elevators, power dumbwaiters, escalators and moving walks or moving ramps for operating control and signal circuits, operating equipment, driving-machine motors, machine brakes, and motor-generator sets shall not exceed the requirements as outlined in this subsection.

(a) For operating control and signal circuits and related equipment including door operator motors: 300 volts, except that higher potentials may be used for frequencies of 25 through 60 cycles alternating current or for direct current, provided the current in the system cannot, under any conditions, exceed 8 milli-amperes for alternating current or 30 milli-amperes for direct current.

(b) Driving-machine motors, machine brakes, and motor-generator sets: 600 volts, except that higher potential may be used for driving motors of motor-generator sets.

(2) LIVE PARTS. All live parts of electrical apparatus in the hoistways, at the landings, or in or on the cars of elevators and power dumbwaiters or in the well-ways or the landings of escalators, moving walks or moving ramps shall be enclosed to protect against accidental contact.

(3) CONDUCTORS. The insulation of conductors installed in connection with elevators, power dumbwaiters, escalators, moving walks or moving ramps, shall comply with the following:

(a) Conductors from panels to main circuit resisters shall be flame-retardant and suitable for a temperature of not less than 90° C. (194° F.). All other wiring on control panels shall be flame-retardant, moisture-resistant.

(b) Traveling cables used as flexible connections between the elevator or dumbwaiter car and the hoistway shall be Type E, E0, or ET elevator cable or other approved types and shall have a flame-retardant, moisture-resistant outer covering.

(c) All other conductors in the raceways and in or on the cars of elevators and dumbwaiters and in the wellways of escalators and moving walks or moving ramps and in the machine room of elevators, dumbwaiters, escalators and moving walks or moving ramps shall have flame-retardant and moisture-resistant insulation.

(d) The thickness of the insulation of all conductors shall be suitable for the voltage to which the conductors are subjected.

(4) SIZE. The minimum size of conductors used for elevators, dumbwaiters, escalators, and moving walks or moving ramps wiring except for conductors which form an integral part of control equipment shall conform with the following:

(a) *Traveling cables.*

1. For lighting: No. 14, except that No. 18 or larger conductors may be used in parallel provided the carrying capacity is equivalent to at least that of No. 14 wire.

2. Operating, control and signal circuits: No. 18.

(b) *Other wiring.* All operating control and signal circuits: No. 18.

(5) LOCATION. Conductors and cables located in elevator and dumbwaiter hoistways and escalator and moving walks or moving ramp wellways, in or on elevator and dumbwaiter machine and control rooms, not including the traveling cable connecting the car and hoistway wiring and all wiring through floors and walls shall be installed in rigid conduit, electrical metallic tubing or raceways.

(a) *Exception* 1. Flexible metal conduit not over 3 feet in length may be used in hoistways and in escalator and moving walk or moving ramp wellways, between risers and limit switches, interlocks, operating buttons, and similar devices if securely fastened in place.

(b) *Exception* 2. Flexible metal conduit not over 3 feet in length may be used on cars where so located as to be free from oil and if securely fastened in place.

(c) *Exception* 3. Approved types, S, SO and ST cords may be used as flexible connections between the fixed wiring on the car and the switches in connection with the safety devices on the car doors.

(d) *Exception* 4. Where motor-generators and machine motors are located adjacent to or underneath control equipment, and are provided with extra length terminal leads not exceeding 6 feet in length, may be grouped together and taped or corded without being installed in raceways. Such leads may be extended to connect directly to controller terminal studs. Auxiliary gutters may be used in machine rooms between controllers, starters and similar apparatus.

(6) WIRING. The wiring of elevators in hazardous locations shall comply with the requirements of the Wisconsin Electrical Code, Wis. Adm. Code, Chs. E 500 to E 503, inclusive.

(7) RACEWAYS. Metal raceways, rigid metal conduit, flexible metal conduit or electrical metallic tubing shall be installed to conform with the requirements outlined in this subsection.

(a) Only rigid conduit or electrical metallic tubing shall be permitted for wiring runs totally enclosed within a concrete floor slab.

(b) Conduit, metallic tubing and metal raceways shall be securely fastened to guide rails, walls or beams at least once in every ten (10) foot length of installation.

(c) All changes enroute of runs shall be completed through fittings or boxes which will permit pulling of wiring without injury to the wire covering.

1. Where boxes or metal raceways are used, proper raceway fittings shall be installed and a radius of not less than two (2) inches included to provide a smooth bending surface for the conductors.

(d) Where auxiliary runs of conduit, metallic tubing or flexible metallic conduit are connected into metal raceways, the connection shall be securely fastened to the metal raceway and the entrance of conductors from the raceway into the auxiliary run shall be through smooth surfaced bushings.

(e) Where conductors or cables leave conduit, electrical metallic tubing or metal raceways for connections to or routing through controller, signal panels or switchboards, the exit shall be through an insulated bushing.

1. Where conduits or tubing terminate upward through the floor, the end of the conduit or tubing shall terminate not less than 2 inches above the floor.

2. Where conductors or a cable leave the conduit or tubing, an insulating bushing shall be placed on the end of the conduit and the conductors or cables shall be grouped together and taped or corded from the conduit or tubing end to the controller, signal panel, or switchboard connections.

(f) A run of conduit between outlet to outlet, between fitting and fitting, or between outlet to fitting shall not contain more than the equivalent of 4 quarter bends (360 degrees, total), including those bends located immediately at the outlet or fitting.

(g) Metal raceways, and other metal enclosures for conductors, shall be metallically joined together into a continuous electrical conductor and shall be so connected to all boxes, fittings and cabinets as to provide effective electrical continuity. Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets and other enclosures.

(8) NUMBER OF WIRES. The number of wires or conductors run in rigid metal conduit, flexible metal conduit, electrical metallic tubing or raceways shall not exceed the requirements of this subsection.

(a) The sum of the cross section area of all the wires or conductors in conduit, metallic tubing or raceways shall not exceed 40% of the inside area of the conduit, metallic tubing, or raceways. The number of conductors shall be based on the area of conductors and conduits

as tabulated in Table 19 and Table 20 and the normal maximum number of conductors in a conduit when all are of the same size shall not exceed the number indicated in Table 21.

TABLE 19

Conduit	Total 100%	Useable 40%
½	.30	.12
¾	.53	.21
1	.86	.34
1¼	1.50	.60
1½	2.04	.82
2	3.36	1.34

TABLE 20

Wire Size	Square Inch Area* Rubber Covered	Square Inch Area* Thermo-plastic
18	.0167	.0088
16	.0196	.0109
14	.0230	.0135
12	.0278	.0172
10	.0460	.0224

*Area based on 2/64 inch insulation.

TABLE 21

Wire Size	½ Inch	¾ Inch	1 Inch	1¼ Inch	1½ Inch	2 Inch
18 Rubber	7	12	20	35	49	80
18 Thermo	12	21	34	68	90	146
16 Rubber	6	10	17	30	41	68
16 Thermo	9	17	22	48	73	118
14 Rubber	4	6	10	18	25	41
14 Rubber	7	13	23	38	52	80

(b) The percentage of the total interior cross sectional area of a raceway occupied by conductors shall be not more than will permit a ready installation or withdrawal of the conductors and dissipation of the heat generated without injury to the installation of the conductors.

(9) CONDUCTORS. Conductors for operating, control, power, signal, and lighting circuits of 600 volts or less may be run in the same traveling cable or raceway system provided that all conductors are insulated for the maximum voltage found in the cables or raceway system and all live parts of the equipment are insulated from ground for this maximum voltage. Such a traveling cable or raceway may also include a pair of telephone conductors for the car telephone provided such conductors are insulated for the maximum voltage found in the cable or raceway system.

(10) TRAVELING CABLES. Traveling cables shall be so suspended at the car and hoistway end as to reduce the strain on the individual copper conductors to a minimum.

(a) Cables, exceeding 100 feet in length and which have steel supporting fillers, shall be suspended directly by the steel supporting fillers.

(b) Where non-metallic fillers are used, the cables shall be suspended by looping the cables around the supports.

(c) Traveling cable supports shall be so located as to reduce to a minimum the possibility of damage due to the cables coming in contact with the hoistway construction or equipment in the hoistway. Where necessary, suitable guards shall be provided to protect the cables against damage.

(d) All conductors run in vertical raceways shall be supported at intervals not to exceed 100 feet by one of the methods of supports or a method of equal effectiveness outlined as follows:

1. By clamping devices constructed of or employing insulating wedges inserted in the ends of the conduit.

2. By inserting boxes at the required intervals in which insulating supports are installed and secured in a satisfactory manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

(11) CONDUCTORS. Conductor cables and wires of Nos. 18 and 16 used for control and operating circuits and signal circuits shall be protected by overcurrent devices not to exceed 6 ampere for No. 18 and 10 ampere for No. 16 wire.

(12) CLEARANCES. Clearance around control panels for elevators and power dumbwaiters shall be provided for safe and convenient access to all live parts. The minimum clear working space about live parts shall be not less than the following:

(a) In the front—36 inches to live panel parts.

(b) In the rear—24 inches to live panel parts.

(c) On one side of a panel or a group of panels 18 inches.

(d) Escalator, moving walk or moving ramp control panels shall be totally enclosed.

(e) Where escalator, moving walk or moving ramp control panels are not located in the same place as the driving machine, the control panel doors shall be capable of being locked in the closed position.

(13) TERMINALS. Motor terminals shall be enclosed in a metal box of substantial construction. The box shall be of ample size to make proper connections.

(14) METALLIC TUBING. Electrical metallic tubing shall not be laid on the penthouse floor or pit floor or in any other location subject to mechanical damage.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.74 Grounding. For electric elevators, power dumbwaiters, escalators, moving walks or moving ramps, the frames of all motors, elevator machines, controllers, operating cable and metal enclosures for all electrical devices and wiring in or on the car or in the hoistway shall be grounded.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.

Ind 4.75 Signal system. New and existing installations. (1) Every existing hand cable operated power elevator or dumbwaiter shall be equipped with a warning bell so arranged that it can be safely and conveniently operated from any landing.

(a) *Exception.* Elevators or dumbwaiters equipped with hoistway landing door or gate electric contacts.

(2) Every automatic operated elevator shall be provided with an emergency electric call bell with a properly placarded push button in the car. This call bell shall be not less than 6 inches in diameter located inside the building and audible outside the hoistway. Only one bell is required for a group of elevators if operable from all cars in the group.

(3) All elevators located in acid towers, grain elevators and similar places, shall be provided with an emergency call bell or telephone to be used in case of emergency.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.76 Lighting. (1) Lighting and convenience outlets shall be provided to conform with the requirements outlined in this subsection.

(a) Elevator cars shall be provided with illumination of an intensity of not less than 5 foot-candles at the edge of the car platform.

(b) Every elevator hoistway landing entrance within or in connection with an occupied building shall be provided with illumination of an intensity of not less than 5 foot-candles at the landing sill.

(c) Every machine room and penthouse shall be provided with uniform artificial illumination of an intensity of not less than 5 foot-candles at the floor. Every area about a ceiling-type machine, including overhead sheave rooms or lofts shall be amply lighted. Control of such lighting shall be at the approach to the machine room, penthouse or overhead equipment.

(d) Every power elevator hereafter installed shall be equipped with work light and convenience outlets as follows:

1. Work light receptacle and convenience outlet on top of car.
2. Work light receptacle on underside of car platform.
3. Work light receptacle and convenience outlet located in the hoistway approximately level with the lowest terminal landing floor if hoistway landing doors are used.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.77 Elevators not in use. (1) Elevators reported as not being used shall not be subjected to the annual inspection provided the installation conforms with the requirements listed as follows:

(a) All hoistway landing doors or gates shall be securely sealed on the inside to prevent opening from the landings.

(b) Fuses and wires to the disconnect switch shall be removed.

(c) For hand elevators, the car platform shall be substantially blocked; and the hoist cables removed from the car crosshead.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

Ind 4.78 Maintenance. New and existing installations. (1) Elevators, dumbwaiters, escalators and moving walk or moving ramp equipment shall kept in safe operating condition, properly lubricated and clean, including pits, penthouses and machine rooms.

(2) Hatch covers of the vertical rising type used on elevators shall not be used for storage purposes, nor as passageways.

(3) Material which is not a permanent part of the elevator equipment shall not be permitted on the top or cover of an elevator car.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64.

POWER DUMBWAITERS

Ind 4.79 Power dumbwaiters. (1) NEW AND EXISTING INSTALLATIONS. (a) The hoistway landing openings of every power dumbwaiter shall be provided with doors or gates that cover the full entrance opening, so arranged that the dumbwaiter cannot be started unless all doors or gates are closed. The slats or bars for gates where used shall be vertical and the net width of an opening shall not exceed 3 inches. Collapsible gates are prohibited. Where a fire-resistive hoistway is required, all landing doors shall be of fire-resistive construction, (see Wis. Adm. Code section Ind 4.10).

(b) Every dumbwaiter shall conform with the requirements as outlined in this subsection.

1. The car platform area shall not exceed 9 square feet.
2. The car height shall not exceed 4 feet.
3. The capacity shall not exceed 500 pounds.
4. The car top and sides shall be solidly enclosed, except for the entrance openings.

a. *Exception.* Dumbwaiters installed before August 12, 1926.

(2) NEW INSTALLATIONS. (a) Power dumbwaiters hereafter installed shall be automatic or continuous pressure operation.

(b) Dumbwaiter machines shall be equipped with an electrically released and spring applied brake so designed, installed and maintained so as to stop and hold the car with contract load.

1. *Exception.* Hydraulic dumbwaiters.

(c) Every dumbwaiter hoistway landing door or gate, shall be equipped with electric contacts and approved locks or interlocks.

(d) Power dumbwaiters with speeds greater than 100 feet per minute shall be equipped with interlocks.

(e) Power dumbwaiters shall be provided with limit switches to automatically stop the car at each terminal of travel. These switches shall be mounted to the guide rails and directly operated by a cam attached to the car.

(f) Power dumbwaiters equipped with winding drum machines shall be provided with a slack-cable switch, which will remove the power from the motor and brake if the car is obstructed in its descent.

(g) Where dumbwaiter hoistway landing doors are closed by power, the door operation shall conform with Wis. Adm. Code section Ind 4.39 (2) (b) or an audible signal shall be given for a minimum of 3 seconds before permitting the doors to close automatically.

(h) All terminal landing doors shall be provided with means to open the door irrespective of the position of the dumbwaiter car. The opening means shall be mounted adjacent to the door and shall be provided with a removable cover.

(j) Access shall be provided to the machines located in hoistways.

(k) Vision panels not less than 4 square inches nor more than 12 square inches shall be provided in hoistway door where position indicators are not provided.

1. Vision panels shall be ¼ inch clear wire glass mounted substantially flush with the surface of the landing side of the door.

(m) Access to the dumbwaiter machine room or penthouse shall not be through any toilet room, sleeping room or private quarters.

(n) The dumbwaiter circuit-breaker or disconnecting fused switch and controller shall comply with Wis. Adm. Code section Ind 4.70 **(2)**.

(o) Dumbwaiter cars shall be of such strength and stiffness that they will not deform appreciably if the load leans or falls against the sides of the car.

1. Cars shall be made of wood or metal and of solid construction.

2. Cars for power dumbwaiters shall be reinforced with metal from the bottom of the car to the point of suspension.

3. Metal cars shall be of metal sections rigidly riveted, welded or bolted together.

(p) Driving machines, car and counterweight suspension means, and overhead beams and supports shall be designed and installed to sustain the car with a structural capacity load not less than that specified in Table 22 based on the net inside platform area with the factors of safety as specified. The motive power shall not be required to be sufficient to lift the structural capacity load.

TABLE 22

ALLOWABLE STRUCTURAL CAPACITY LOAD CORRESPONDING TO NET INSIDE PLATFORM AREA

Net Platform Area in Square Feet	Structural Capacity Load in Pounds
4	100
5	150
6.25	300
9	500

(q) A metal plate shall be fastened in a conspicuous place in the car and shall give the rated capacity in letters and figures not less than ¼ inch high, stamped, etched or raised on the surface of the plate.

(r) Driving machines and sheaves shall be designed with a factor of safety based on the static load (the rated capacity plus the weight of the car, cables, counterweights, etc.), of not less than:

1. Six (6) for steel, and

2. Nine (9) for cast iron and other metals.

(s) There shall be no thoroughfare under the hoistway of a dumbwaiter or its counterweight, unless one of the requirements are provided as follows:

1. A structure shall be provided under the hoistway to withstand without failure the impact of the car with contract load or the impact of the counterweight when either is dropped freely in its guides from the upper limits of travel, or:

2. Broken rope safeties shall be provided for car and counterweight.

(t) Guide rails shall be securely fastened to the hoistway and the joints shall be tongued and grooved, doweled or fitted with splice plates.

(u) Counterweights for dumbwaiters having a capacity exceeding 100 pounds or having a speed exceeding 100 feet per minute shall be secured by at least 2 tie rods passing through holes in all sections, except where metal counterweight frames are provided. The rods shall have lock nuts secured by cotter pins.

(v) Cars and counterweights shall be suspended by one or more iron or steel-wire hoisting cables or chains secured to the car or counterweight or cable hitch by babbitted sockets or cable clamps.

1. *Exception.* Hydraulic dumbwaiters.

(w) The factor of safety, based on the static load, of car and counterweight suspension means of power dumbwaiters shall be not less than the value specified in Table 23 for the actual speed of the cable or chain corresponding to the rated speed of the dumbwaiters.

TABLE 23

FACTORS OF SAFETY

Cable or Chain Speed Feet per Minute	Factor of Safety	
	For Cables	For Chains
50	4.8	6.0
100	5.2	6.5
150	5.5	6.9
200	5.9	7.4
250	6.2	7.8

(x) The clearance between any point of car travel and any stationary part shall be not less than ½ inch.

1. The clearance between the dumbwaiter car sill or gate threshold and hoistway landing sill or door threshold shall not exceed 2 inches.

(y) The minimum car and counterweight clearance at terminal landings shall be not less than 4 inches.

(z) Suitable guards shall be provided over the machines mounted in the pits to protect driving cable sheaves and drums from falling objects.

History: Cr. Register, October, 1964, No. 106, eff. 11–1–64; r. and recr. (2) (k), Register, October, 1970, No. 178, eff. 11–1–70.

Ind 4.80 Sidewalk elevators. Existing installations. (1) Every sidewalk elevator shall be covered at the top with hinged or vertical lifting type covers, which shall when closed be capable of sustaining a live load of 300 pounds per square foot. The surface of the covers shall be rough and no part of them shall project above the sidewalk when closed. Hinges of hatch covers shall be of sufficient strength and be securely fastened to withstand the service of normal operation.

(a) Every power sidewalk elevator shall be provided with one of the following requirements:

1. A device to prevent its operation until the hatch covers over the top of the hoistway are open, or,

2. Flat metal tops or arched bows of sufficient strength to open the hatch covers.

(b) When hatch covers are left open, a full guard not less than 30 inches in height shall be provided in each side of the sidewalk opening not fully protected by the hatch covers. This guard shall be so fastened that it cannot be pushed into the sidewalk opening.

(c) Every elevator traveling not more than 15 feet, or more than 1 story, shall comply with Wis. Adm. Code sections Ind 4.02, 4.05, 4.06, 4.07, 4.10(1), 4.12, 4.15 and sections Ind 4.37 and 4.38 (as applied to the lower landing), 4.73 (2), (3), (4), (5), (7), 4.74, 4.76 (1), 4.78.

(11) Enclosed balustrades shall be provided for each side of the moving walks and moving ramps and shall conform with the requirements listed as follows:

(a) Balustrades without moving handrails shall be designed so as to provide no surface which can be gripped by a passenger. The treadway side of the balustrade shall have no areas or moldings depressed or raised more than ¼ inch from the parent surface. Such areas or moldings shall have all boundary surfaces beveled unless parallel to the direction of travel. The balustrades shall extend at normal height at least 12 inches beyond the end of the exposed treadway. Glass panels if used, shall be approved safety type.

(b) The height of a balustrade shall be not less than 30 inches measured perpendicular to the treadway surface. At this height, the inner surface of the balustrade shall be located not more than 8 inches outside the vertically protected edge of the exposed treadway.

(c) The clearance between the top surface of the treadway and the underside of the balustrade shall not exceed ⅛ inch.

(12) Where the intersection of the balustrade (deck board) and ceiling or soffit is less than 24 inches from the center line of the handrail, a solid guard shall be provided in the intersecting angle. The vertical face of the guard shall have a height of at least 7 inches and shall be rounded. Guards may be of glass, if of the approved safety type.

(13) The driving machine shall be connected to the main drive shaft by toothed gearing, a coupling or a chain.

(14) Each moving walk or moving ramp shall be provided with an electrically released, mechanically applied brake capable of stopping and holding the treadway with any load up to the load rating. This brake shall be located either on the driving machine or on the main drive shaft.

Exception. Slider bed and other moving walks which will not run in the down direction by gravity under any load condition up to their load rating with the power supply interrupted do not require brakes.

(a) Where a chain is used to connect the driving machine to the main drive shaft, a brake shall be provided on that shaft. It is not required that this brake be of the electrically released type if an electrically released brake is provided on the driving machine.

(b) Electrically released brakes shall stop the treadway automatically upon failure of power or when any of the safety devices specified in subsection (16) (b), (c), (d) and (e) operate. Brakes on the main drive shaft, if not of the electrically released type, shall be applied when the drive chain parts.

(15) Pallet propelling chains and drive components other than those specified shall have a factor of safety of not less than 10 based on the ultimate strength.

(16) Operating and safety devices shall be provided to conform with the requirements outlined as follows:

(a) A starting switch shall be of the key-operated type and shall be located within full sight of the moving walk or moving ramp treadway.

(b) Emergency stop buttons or other types of manually operated stop switches shall have red buttons or handles and shall be accessibly located at or near the top and bottom landings of each moving

walk or moving ramp, and shall be protected against accidental operation. The operation of either of these buttons or switches shall interrupt the power to the driving machine. It shall not be possible to start the driving machine by these buttons or switches.

(c) Moving walks and moving ramps equipped with a brake as required in subsection (14) and driven by a direct current motor, shall be provided with a speed governor which will cause interruption of power to the driving machine and brake, and where provided, the governor shall be set to trip at a speed not greater than 40% above the rated treadway speed.

Exception. A governor will not be required for moving walks or moving ramps which will not run by gravity under any load conditions up to their load rating and/or where driven by a low slip alternating current induction motor.

(d) A broken drive-chain device shall be provided to conform with subsection (14) (a).

(e) A treadway device shall be provided which will cause interruption of power to the driving machine and to the brake, if the connecting means between pallets or the treadway elongates excessively.

(17) An externally operated enclosed, fused disconnecting switch or circuit breaker shall be provided to conform with the requirements of Wis. Adm. Code section Ind 4.70 (1).

(18) Control panels which are not located in the machine room shall conform with the requirements of Wis. Adm. Code section Ind 4.73 (12) (e).

(19) All electrical wiring shall conform with the requirements of Wis. Adm. Code section Ind 4.73.

(20) Grounding of electrical equipment shall conform with the requirements of Wis. Adm. Code section Ind 4.74.

(21) Every machine room shall be provided with permanent artificial illumination of an intensity of not less than 5 foot-candles. The lighting switch shall be so located that it can be operated without passing over or reaching under any other part of machinery.

(a) The entire run of moving walk or moving ramp shall be provided with permanent uniform artificial illumination of not less than 5 foot-candles.

(22) All floor openings shall be protected against passage of flame, smoke or gases in accordance with the requirements of Wisconsin Building Code.

(23) The sides and undersides of moving walks or moving ramps shall be enclosed with fire-resistive material.

History: Cr. Register, October, 1964, No. 106, eff. 11-1-64.