

Chapter E 610

CRANES AND HOISTS

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A. SCOPE AND USE

E 610.01 Scope. The provisions of this chapter shall apply to the installation of cranes, crane runways, hoists and monorails, and shall be additional to, or amendatory of, the requirements prescribed in chapters E 100 to E 480, inclusive, of this code.

Note: For definition of various kinds of cranes and hoists see American Standard Safety Code for Cranes, Derricks, and Hoists, ASA B30.2-1943.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.02 Particular locations. (1) **IGNITIBLE MATERIAL HAZARDS.** Installations in hazardous locations shall comply with the provisions of section E 503.13.

(2) **COMBUSTIBLE MATERIALS.** Where a crane operates over readily combustible material, the resistors shall be placed in a well-ventilated cabinet composed of noncombustible material so constructed that it will not emit flames or molten metal.

(a) *Exception:* Resistors may be located in a cage or cab constructed of noncombustible material which encloses the sides of the cage or cab from the floor to a point at least 6 inches above the top of the resistors.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

B. WIRING

E 610.11 Wiring method. Conductors shall be enclosed in raceways or be type ALS cable or type MI cable.

(1) **EXCEPTION NO. 1. BARE CONDUCTORS.** Bare conductors used as contact conductors.

(2) **EXCEPTION NO. 2. OPEN CONDUCTORS.** Short lengths of open conductors at resistors, collectors, and other equipment.

(3) **EXCEPTION NO. 3. FLEXIBLE CONNECTIONS.** Where flexible connections are necessary to motors and similar equipment, flexible metal conduit, armored cable, multiple conductor rubber-covered cable or an approved non-metallic enclosure may be employed.

(4) **EXCEPTION NO. 4. PENDENT PUSH-BUTTON STATIONS.** Where multiple conductor cable is used with a suspended pushbutton station, the station must be supported in some satisfactory manner that will protect the electrical conductors against strain.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.12 Raceway terminal fittings. Conductors leaving raceways shall comply with the provisions of section E 300.16.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.13 Types of conductors. Conductors shall be of the rubber-covered or the thermoplastic type except:

(1) **EXCEPTION NO. 1. CONTACT CONDUCTORS.** Contact conductors along runways, crane bridges and monorails may be bare and may be of hard drawn copper, or aluminum, or steel in the form of tees, angles, tee rails, or other stiff shapes.

(2) **EXCEPTION NO. 2. FLEXIBLE CONDUCTORS.** Flexible conductors may be used to convey current and where practicable, cable reels or take-up devices may be employed.

(3) **EXCEPTION NO. 3. VARNISHED CAMBRIC CONDUCTORS.** Varnished-cambric conductors (type V) or asbestos varnished cambric (types AVA and AVB) may be used in dry locations.

(4) **EXCEPTION NO. 4. TYPE MI CABLE.** Type MI cable may be used in wet or dry locations within its specified temperature ratings.

(5) **EXCEPTION NO. 5. EXPOSED TO HIGH TEMPERATURES.** Conductors exposed to external heat or connected to resistors shall have an insulation approved for the temperature and location as specified in section E 310.02. Where conductors not having a flame-resistant outer covering are grouped together, the group shall be covered with a flame-resistant tape.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.14 Conductors. (1) **CURRENT-CARRYING CAPACITY.** The allowable current-carrying capacity of conductors shall be as shown in table E 610.14 (1). For the carrying capacity of conductors between controllers and resistors, see section E 430.023.

TABLE E 610.14 (1)
CURRENT-CARRYING CAPACITY IN AMPERES OF INSULATED CONDUCTORS IN RACEWAY OR CABLE USED WITH SHORT TIME RATED CRANE AND HOIST MOTORS

Max. Operating Temp.	60°C		75°C		90°C		110°C	
	Type R, RW, T, TW		Type RH, RHW		Type TA, AVB, RHH, SA		Type AVA	
	60 min	30 min	60 min	30 min	60 min	30 min	60 min	30 min
16	10	10	10	12				
14	20	20	25	26	31	32	38	40
12	25	25	30	33	36	40	45	50
10	35	35	40	43	49	52	60	65
8	45	50	55	60	63	69	78	80
6	57	70	76	86	83	94	93	105
5	65	80	85	95	95	106	109	121
4	77	95	100	117	111	130	126	147
3	90	115	120	141	131	153	145	168
2	107	130	137	160	148	173	163	190
1	130	150	143	175	158	192	177	215
0	160	180	190	233	211	259	239	294
00	195	225	222	267	245	294	275	331
000	245	280	280	341	305	372	339	413
0000	295	350	300	369	319	399	352	440
250	350	375	364	420	400	461	447	516
300	410	475	455	532	497	536	554	707
350	460	550	486	646	542	716	616	809
400	515	580	538	688	593	760	666	856
450	565	640	600	765	660	836	740	930
500	620	700	660	847	726	914	815	1004

Other insulations shown in section E 310.02 and approved for the temperatures and location may be substituted for those shown in table E 610.14 (1). The allowable current-carrying capacity of conductors used with 15-minute motors shall be the 30-minute ratings increased by 12%.

(2) **MINIMUM.** Conductors shall not be smaller than No. 14.

(a) *Exception:* No. 16 may be used for crane and hoist motor and control circuits only when the application meets subsection E 610.14 (1) current-carrying capacity, and provided the conductors are protected against physical damage.

(3) **CONTACT CONDUCTORS.** The size of contact wires shall be not less than the following:

Distance between end strain insulators	Size of wire
0-30 feet.....	No. 6
31-60 feet.....	No. 4
over 60 feet.....	No. 2

(4) **CALCULATION OF MOTOR LOAD.** The current-carrying capacity of the power supply conductors on the crane shall be not less than the combined short time full load ampere rating of the largest motor or group of motors for any single crane motion plus 50% of the combined short time full load ampere rating of the next largest motor or group of motors.

(5) **OTHER LOADS.** Additional loads, such as heating, lighting, and air conditioning, shall be provided for by application of the appropriate sections of this code.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.15 Common return. Where a crane or hoist is operated by more than one motor, a common-return conductor of proper current-carrying capacity may be used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

C. CONTACT CONDUCTORS

E 610.21 Installation of contact conductors. Bare contact conductors shall conform to the following:

(1) **CONTACT WIRES.** Wires that are used as contact conductors shall be secured at the ends by means of approved strain insulators and shall be so mounted on approved insulators that the extreme limit of displacement of the wire will not bring the latter within less than 1½ inches from the surface wired over.

(2) **SUPPORTS ALONG RUNWAYS.** Main contact conductors carried along runways shall be supported on insulating supports placed at intervals not exceeding 20 feet, and these supports shall be insulating except for grounded rail conductors as provided in subsection E 610.21 (5). Such conductors shall be separated not less than 6 inches except for monorail hoists where a spacing of not less than 3 inches

may be used. Where necessary, intervals between insulating supports may be increased up to 40 feet, the separation between conductors being increased proportionately.

(3) **SUPPORTS ON BRIDGES.** Bridge contact conductors shall be kept at least $2\frac{1}{2}$ inches apart and, where the span exceeds 80 feet, insulating saddles shall be placed at intervals not exceeding 50 feet.

Note: It is recommended that the distance between wires be greater than $2\frac{1}{2}$ inches where practicable.

(4) **SUPPORTS FOR RIGID CONDUCTORS.** Conductors along runways and crane bridges, which are of the rigid type specified in section E 610.13, exception No. 1, shall be carried on insulating supports spaced at intervals of not more than 80 times the vertical dimension of the conductor, but in no case greater than 15 feet, and spaced apart sufficiently to give a clear electrical separation of conductors or adjacent collectors of not less than 1 inch. Hardwood supports covered with, or impregnated with, insulating paint shall be acceptable insulators.

(5) **TRACK AS CIRCUIT CONDUCTOR.** Monorail, tramrail or crane-runway tracks may be used as a conductor of current for one phase of a 3-phase alternating-current system furnishing power to the carrier, crane or trolley, provided all of the following conditions are fulfilled:

(a) The conductors for supplying the other 2 phases of the power supply shall be insulated.

(b) The power for all phases shall be obtained from an insulating transformer.

(c) The voltage shall not exceed 300 volts.

(d) The rail serving as a conductor shall be effectively grounded at the transformer and may also be grounded by the fittings used for the suspension or attachment of the rail to a building or structure.

(6) **ELECTRICAL CONTINUITY OF CONTACT CONDUCTORS.** All sections of bare rigid contact conductors shall be mechanically joined to provide a continuous electrical connection.

(7) **NOT TO SUPPLY OTHER EQUIPMENT.** Contact conductors shall not be used as feeders for any equipment other than the crane or cranes which they are primarily designed to serve.

(8) **LOCATING OR GUARDING CONTACT CONDUCTORS.** Contact conductors shall be located or guarded in such a manner that unqualified persons cannot inadvertently touch energized current-carrying parts.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.22 Collectors. Collectors shall be so designed as to reduce to a minimum sparking between them and the contact conductor, and when operated in rooms used for the storage of easily ignitable combustible fibers and materials the requirements of section E 503.13 shall be complied with.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

D. CONTROL

E 610.31 Runway conductor disconnecting means. A disconnecting means shall be provided between the runway contact conductors and the power supply. Such disconnecting means shall consist of a motor-circuit switch or circuit-breaker, except that a general-use switch may be used when the disconnecting means is provided in accordance with section E 610.32. This disconnecting means shall be readily accessible and operable from the ground, shall be arranged to be locked in the open position, shall open all ungrounded conductors simultaneously, and shall be placed within sight of the crane or hoist and the runway contact conductors.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.32 Disconnecting means for crane. A motor-circuit switch or circuit-breaker shall be provided in the leads from the runway contact conductors on all bridge cranes. If cranes are operated from cages or cabs, the switch or circuit-breaker shall be in the cage or cab or mounted on the bridge and operable from the cage or cab when the trolley is at one end of the bridge.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.33 Rating of disconnecting means for crane. On both alternating-current and direct-current crane protective panels, the continuous ampere rating of the switch or circuit-breaker required by section E 610.32, and mainline contactors, shall be not less than 50% of the combined short-time ampere ratings of the motors, nor less than 75% of the sum of the short-time ampere ratings of the motors required for any single crane motion.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.34 Limit switch. A limit switch shall be provided for upper limit of travel of crane hoists.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E. OVERCURRENT PROTECTION

E 610.41 Contact conductors. The main contact conductors shall be protected by an overcurrent device.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 610.42 Crane motors. Where more than one motor is employed on a crane, each motor shall have individual overcurrent protection as provided in chapter E 430, except that where two motors operate a single hoist, carriage, truck, or bridge, and are controlled as a unit by one controller, the pair of motors with their leads may be protected by a single overcurrent device. Where the overcurrent device is not readily accessible, it shall be enclosed or guarded until it is electrically disconnected from the source of supply. See subsection E 240.16 (1).

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

F. GROUNDING

E 610.51 Grounding. All exposed metal parts of cranes, hoists, and accessories, including pendant controls, shall be metallically joined together into a continuous electrical conductor so that the entire crane or hoist will be grounded on installation in accordance with chapter E 250. Moving parts, other than removable accessories or attachments having metal-to-metal bearing surfaces, i.e., such as bridge wheels running on a track, shall be considered to be electrically connected to each other through the bearing surfaces for grounding purposes.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.