Determining the Appropriate System

The voltage drop should be calculated to determine if the amperage requirements of the system will be met at all points along the length of the conductor bar system. Determining the amperage requirements (Amps) for cranes and hoists is outlined in NEC 610.14(e).

In applications where there is only one motor, NEC requires that 100% of the motor nameplate full-load rating be used. For multiple motors on a single crane of hoist, NEC states* "The minimum circuit ampacity of the power supply conductors shall be the nameplate full-load ampere rating of the largest motor or group of motors for any single crane motion, plus 50 percent of the nameplate full-load ampere rating of the next largest motor or group of motors using that column of Table 610.14(a) that applies to the longest time-rated motor.

For multiple cranes and/or hoists supplied by a common conductor system, compute the minimum ampacity for each crane as defined in Section 610.14(e), add them together, and multiply the sum by the appropriate demand factor from Table 610.14(e)."

Table 610-14(e)

Number of Cranes or Hoists	Demand Factor
2	0.95
3	0.91
4	0.87
5	0.84
6	0.81
7	0.78

**as published in the 1996 National Electrical Code (NEC) copyright 1999.*

Variables

- Amps: Amperage demand of system (refer to NEC 610-14(e)).
- Rdc: Resistance of conductor in ohms per foot.
- Zac: Impedance of conductor in ohms per foot.
- D: Maximum distance between power feed and system pick-up points.

Voltage Drop Calculation

Voltage Drop = 1.732 x Amps x (Rdc or Zac) x D (in feet)
% Drop = (Voltage Drop x 100) / 460 (Voltage)
Note: Voltage drop must be less than 3%

If the percent of drop exceeds 3%, an additional power feed may be added to shorten the distance between the power feed and the system pick-up points, or the conductor bar may be up-sized to the next highest ampacity and the voltage drop recalculated.

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Resistance/Impedance Data

Conductor Bar					
	FS-90	**FS-110**	**FS-125**	**FS-250**	**FS-350**
Rdc	0.000591	0.000485	0.000485	0.0000762	0.0000528
Zac	0.000596	0.000494	0.000494	0.0000834	0.0000634
	ohms per foot				

Temperature Considerations

Ambient temperatures in the environment where the conductor bar is installed can affect the current carrying capacity of the conductors. Please refer to the following table:

Ambient Temperature F	**95**	**100**	**115**	**120**	**130**
Conductor Bar					
FS-90	90 AMPS	87 AMPS	84 AMPS	82 AMPS	79 AMPS
FS-125	125 AMPS	121 AMPS	117 AMPS	114 AMPS	110 AMPS
FS-250	250 AMPS	232 AMPS	217 AMPS	205 AMPS	195 AMPS
FS-400	400 AMPS	372 AMPS	348 AMPS	328 AMPS	312 AMPS

Expansion Gap Settings

Each expansion section must have a gap set at the time of installation. Refer to the following table for the appropriate settings.

Operating Temperatures	Ambient Temperatures	Gap Width Setting
0°F to 100° F	25°F 50°F 75°F	2.00" 1.25" 0.50"
25°F to 125°F	50°F 75°F 100°F	2.00" 1.25" 0.50"
50°F to 150°F	75°F 100°F 125°F	2.00" 1.25" 0.50"

Mounting Note: The expansion assembly bracket must be fully supported by its own structural mounting bracket. This will prevent the weight of the expansion from creating excess vertical loading on the system.

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Power Feed Wire/Connection

Power feed cables must be sized to meet the ampere demands of the line elements and be connected to the power feed assembly by using properly sized and crimped ring terminals.

See below for typical feed cables and ring terminals:

Line Element Size	Ring Terminal	Minimum Cable Size
90Amp	S4-10R-E	4 AWG
110 Amp	S4-10R-X	2 AWG
125 Amp	S4-10R-X	2 AWG
250 Amp	S3-0-38R-5	#3/0
400 Amp	S250-38R-5	250 MCM

Disconnecting Means / Overcurrent Protection**

Disconnecting Means

2.1.(a): **610.31 Runway Conductor Disconnecting Means.** A disconnecting means, having a continuous ampere rating not less than that computed in sections 610.14(e) and (f), shall be provided between the runway contact conductors and the power supply. Such disconnecting means shall consist of a motor circuit switch, circuit breaker, or molded case switch.

This disconnecting means shall:

2.1.(a).(i): Be readily accessible and operable from the ground or floor level.

2.1.(a).(ii): Be arranged to be locked in the open position.

2.1.(a).(iii): Open all ungrounded conductors simultaneously.

2.1.(a).(iv): Be placed within view of the crane or hoist, and the runway contact conductors.

610.32 Disconnecting Means for Crane and Monorail Hoists. A motor circuit switch or circuit breaker, arranged to be locked in the open position, shall be provided in the leads from the runway contact conductors or other power supply on all cranes and monorail hoists. Where disconnecting means is not readily accessible from the crane or monorail hoist operating station, means shall be provided at the operating station to open the power circuit to all motors of the crane or monorail hoists.

610.33 Rating of Disconnecting Means. The continuous ampere rating of the switch or circuit breaker, required by Section 610.32, shall not be less than 50 percent of the combined short-time ampere rating of the motors, or less than 75 percent of the sum of the short-time ampere rating of the motors required for any single motion.

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Overcurrent Protection

The use of the overcurrent protection shall be provided in accordance with NEC Standard 610.41 through 610.43. Excerpts from 2005 National Electrical Code, copyright 2004.

610.41 Feeders, Runway Conductors:

2.5.(a).(i): **Single Feeder.** The runway supply conductors and main contact conductors of a crane or monorail shall be protected by an overcurrent device(s) that shall not be greater than the largest rating or setting of any branch circuit protective device, plus the sum of the nameplate ratings of all the other loads with application of the demand factors from Table 610.14(e).

2.5.(a).(ii.): **More Than One Feeder Circuit.** Where more than one feeder circuit is installed to supply runway conductors, each feeder circuit shall be sized and protected in compliance with 610.41(A).

610.42 Branch-Circuit, Short Circuit Ground Fault Protection. Branch circuits shall be protected in accordance with 610.42(A). Branch-circuit taps, where made, shall comply with 610.42(B).

2.6.(a).(i): **Fuse or Circuit Breaker Rating.** Crane, hoist, and monorail hoist motor branch circuits shall be protected by fuses or inverse-time circuit breakers having a rating in accordance with Table 430-152. Where two or more motors operate a single motion, the sum of their nameplate current ratings shall be considered as that of a single motor.

2.6.(a).(ii): **Taps.**

(1) Multiple Motors. Where two or more motors are connected to the same branch circuit, each tap conductor to an individual motor shall have an ampacity not less than one-third that of the branch circuit. Each motor shall be protected from overload according to 610.43.

(2) Control Circuits. Where taps to control circuits originate on the load side of a branch-circuit protective device, each tap and piece of equipment shall be protected in accordance with 430.72.

(3) Brake Coils. Taps without separate overcurrent protection shall be permitted to brake coils.

610.43 Motor and Branch-Circuit Overload Protection. Each motor, motor controller, and branch-circuit conductor shall be protected from overload by one of the following means:

2.7.(a): A single motor shall be considered as protected where the branch-circuit overcurrent device meets the rating requirement of Section 610.42.

2.7.(a).(i): Overload relay elements in each ungrounded circuit conductor, with all relay elements protected from short circuit by the branch-circuit protection.

2.7.(a).(ii): Thermal sensing devices, sensitive to motor temperature or to temperature and current, that are thermally in contact with the motor winding(s). A hoist or trolley shall be considered to be protected if the sensing device is connected in the hoist's upper limit switch circuit so as to prevent further hoisting during an overload condition of either motor.

Note: Please reference the National Electric Code (NEC) for exemptions or additional information on disconnecting means and overcurrent protection.

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