

(b) *Installation.* The employers must ensure that:

(i) All sheaves revolve on shafts that rotate on bearings; and

(ii) The bearings are mounted securely to maintain the proper bearing position at all times.

(c) *Rope guides.* The employers must provide each sheave with appropriate rope guides to prevent the hoist rope from leaving the sheave grooves when the rope vibrates or swings abnormally.

(d) *Diameter.* The employers must use a sheave with a diameter that is at least 24 times the diameter of the hoist rope.

#### 9. Guide Ropes

(a) *Number and construction.* The employers must affix two (2) guide ropes by swivels to the cathead. The guide ropes must:

(i) Consist of steel safety cables not less than one-half (1/2) inch (1.3 cm) in diameter; and

(ii) Be free of damage or defect at all times.

(b) *Guide rope fastening and alignment tension.* The employers must fasten one end of each guide rope securely to the overhead support, with appropriate tension applied at the foundation.

(c) *Height.* The employers must rig the guide ropes along the entire height of the hoist-machine structure.

#### 10. Personnel Cage

(a) *Construction.* A personnel cage must be of steel-frame construction and capable of supporting a load that is four (4) times its maximum rated load capacity. The employers also must ensure that the personnel cage has:

(i) A top and sides that are permanently enclosed (except for the entrance and exit);

(ii) A floor securely fastened in place;

(iii) Walls that consist of 14-gauge, one-half (1/2) inch (1.3 cm) expanded metal mesh, or an equivalent material;

(iv) Walls that cover the full height of the personnel cage between the floor and the overhead covering;

(v) A sloped roof constructed of one-eighth (1/8) inch (0.3 cm) aluminum, or an equivalent material; and

(vi) Safe handholds (e.g., rope grips—but not rails or hard protrusions<sup>2</sup>) that accommodate each occupant.

(b) *Overhead weight.* A personnel cage must have an overhead weight (e.g., a headache ball of appropriate weight) to compensate for the weight of the hoist rope between the cathead and footblock. In addition, the employers must:

(i) Ensure that the overhead weight is capable of preventing line run; and

(ii) Use a means to restrain the movement of the overhead weight so that the weight does *not* interfere with safe personnel hoisting.

(c) *Gate.* The personnel cage must have a gate that:

(i) Guards the full height of the entrance opening; and

(ii) Has a functioning mechanical lock that prevents accidental opening.

(d) *Operating procedures.* The employers must post the procedures for operating the personnel cage conspicuously at the hoist operator's station.

(e) *Capacity.* The employers must:

(i) Hoist no more than four (4) occupants in the cage at any one time; and

(ii) Ensure that the rated load capacity of the cage is at least 250 pounds (113.4 kg) for each occupant so hoisted.

(f) *Employee notification.* The employers must post a sign in each personnel cage notifying employees of the following conditions:

(i) The standard rated load, as determined by the initial static drop test specified by Condition 10(g) ("Static drop tests") below; and

(ii) The reduced rated load for the specific job.

(g) *Static drop tests.* The employers must:

(i) Conduct static drop tests of each personnel cage, and these tests must comply with the definition of "static drop test" specified by section 3 ("Definitions") and the static drop-test procedures provided in section 13 ("Inspections and Tests") of American National Standards Institute (ANSI) standard A10.22-1990 (R1998) ("American National Standard for Rope-Guided and Nonguided Worker's Hoists—Safety Requirements");

(ii) Perform the initial static drop test at 125 percent of the maximum rated load of the personnel cage, and subsequent drop tests at no less than 100 percent of its maximum rated load; and

(iii) Use a personnel cage for raising or lowering employees only when no damage occurred to the components of the cage as a result of the static drop tests.

#### 11. Safety Clamps

(a) *Fit to the guide ropes.* The employers must:

(i) Fit appropriately designed and constructed safety clamps to the guide ropes; and

(ii) Ensure that the safety clamps do not damage the guide ropes when in use.

(b) *Attach to the personnel cage.* The employers must attach safety clamps to each personnel cage for gripping the guide ropes.

(c) *Operation.* The safety clamps attached to the personnel cage must:

(i) Operate on the "broken rope principle" defined in section 3 ("Definitions") of ANSI standard A10.22-1990 (R1998);

(ii) Be capable of stopping and holding a personnel cage that is carrying 100 percent of its maximum rated load and traveling at its maximum allowable speed if the hoist rope breaks at the footblock; and

(iii) Use a pre-determined and pre-set clamping force (i.e., the "spring compression force") for each hoist system.

(d) *Maintenance.* The employers must keep the safety-clamp assemblies clean and functional at all times.

#### 12. Overhead Protection

(a) The employers must install a canopy or shield over the top of the personnel cage that is made of steel plate at least three-sixteenth (3/16) of an inch (4.763 mm) thick, or material of equivalent strength and impact resistance, to protect employees (i.e., both inside and outside the chimney) from material and debris that may fall from above.

(b) The employers must ensure that the canopy or shield slopes to the outside of the personnel cage.<sup>3</sup>

#### 13. Emergency-Escape Device

(a) *Location.* The employers must provide an emergency-escape device in at least one of the following locations:

(i) In the personnel cage, provided that the device is long enough to reach the bottom landing from the highest possible escape point; or

(ii) At the bottom landing, provided that a means is available in the personnel cage for the occupants to raise the device to the highest possible escape point.

(b) *Operating instructions.* The employers must ensure that written instructions for operating the emergency-escape device are attached to the device.

(c) *Training.* The employers must instruct each employee who uses a personnel cage for transportation on how to operate the emergency-escape device:

(i) Before the employee uses a personnel cage for transportation; and

(ii) Periodically, and as necessary, thereafter.

<sup>2</sup> To reduce impact hazards should employees lose their balance because of cage movement.

<sup>3</sup> Paragraphs (a) and (b) were adapted from OSHA's Underground Construction Standard (§ 1926.800(t)(4)(iv)).