SUBPART 32
GENERAL PROVISIONS

Section 32.1 Title and citation. Within and for the purposes of the Department of Labor this Part may be known as Industrial Code Rule No. 32 relating to ski tows and other passenger tramways and may be cited as Rule 32 as an alternative and without prejudice to its designation and citation established by the Secretary of State.

32.2 Application. Except as otherwise specifically provided, this Part applies to all ski tows and other passenger tramways to which section 202-c of the Labor Law applies and to the owners and operators of such equipment and to their employees. It does not apply to cog railways, or to material handling equipment.

32.3 Purpose and intent of Part.

(a) It is the purpose and intent of this Part to require reasonable and proper precaution against personal injuries to employees and the public from the use and operation of ski tows and other passenger tramways. It is recognized that certain dangers and risks are inherent in the operation of machines of this type. It is also recognized that inherent and other risks or dangers exist for those who are in the process of approaching, loading, unloading, and departing from passenger tramways. This Part is intended to result in passenger tramways that are designed, constructed, operated, and maintained in a manner that helps reduce danger and exposure to risk to passengers, as to maintenance and operational personnel. This part is intended to be construed accordingly and to be read, construed and applied with sections 27, 200 and 202-c of the Labor Law.

(b) No provision of this Part as amended effective the date adopted requires or is intended to require any modifications to any passenger tramway whose plan review was completed prior to the effective date of this code, and which complies with prior editions or versions of this Part or with variations granted and in effect thereto, except as may be needed to carry out the provisions of subdivision (d). Existing passenger tramways, when removed and reinstalled, shall be classified as new installations.

(c) New installations and those with plan reviews completed after the effective date of this Code shall be in compliance with this Part.

(d) “A passenger tramway modification” shall be defined as an alteration of the current design of the passenger tramway which results in:

(1) a change in the design speed of the system;
(2) a change in the rated capacity by changing the number of carriers, spacing of carriers, or load capacity of carriers;
(3) a change in the path of the rope;
(4) any change in the type of brakes and/or backstop devices or components thereof;
(5) a change in the structural arrangements;

(6) a change in power or type of prime mover or auxiliary engine;
(7) a change to control system logic.

(e) Adoption of technological improvements in materials and advances in techniques is essential to enable the industry to keep pace with progress. If a designer or manufacturer proposes to use materials or methods not covered by this standard, those materials, methods, or both, shall be clearly identified and complete design and test information shall be provided to the purchaser or owner and the Commissioner.

32.4 Definitions.

(a) *ADA accessible*. Describes a site, building, facility, or portion thereof that complies with ADAAG (Americans with Disabilities Act Accessibility Guidelines).
(b) *Aerial lift*. Ropeways on which passengers are transported in cabins or on chairs and that circulate in one direction between terminals without reversing the travel path.
(c) *Aerial Tramway*. Ropeways on which passengers are transported in cable-supported carriers and are not in contact with the ground or snow surface, and in which the carrier(s) reciprocate between terminals. Also called a reversible.
(d) *Approved.* In respect to a device or material: in compliance with a subsisting resolution of approval adopted by the board (prior to 1975); in respect to action by the Commissioner: made the subject of a resolution of approval.
(e) *Attendant.* The individual assigned to particular duties or functions in the operation of a passenger tramway (also see conductor).
(f) A*uxiliary power unit (APU*). Generic term to generally describe a gas or diesel engine generally used as a backup to the prime mover. It can be designated as a prime mover or evacuation power unit depending upon use and configuration. On aerial tramways an APU can power the rescue drive.
(g) *Basic Life Support (BLS)*. Medically acceptable non-invasive procedures used to sustain life.
(h) *Bicable system*. A system that uses separate track cable(s) to support the carriers and separate rope(s) to control motion of the carriers.
(i) *Board*. The Industrial Appeals Board of the State of New York and prior to 1975, the Board of Standards and Appeals of the State of New York.
(j) *Brake*. A device consisting of one or more friction devices-which, if applied, accomplishes braking.
(k) *Braking*. Braking is the process of absorbing energy in order to maintain or reduce the speed of the tramway.

Note: The typical resistance's effective in absorbing the energy of a tramway include:
(1) the inherent resistance in the system (e.g., friction);
(2) incidental resistance (e.g., slope, gravity, wind);
(3) applied resistance (e.g., brake, power unit ramping down).

(l) *Bull wheel*. A bull wheel is a terminal sheave that deflects the haul rope 150 degrees or more. When under power, the sheave is referred to as a drive sheave (or drive bull

wheel); when acting as a movable tensioning device, it is referred to as a tension sheave (or tension bull wheel); and when it is acting simply as a fixed return for the haul rope, it is referred to as a fixed return sheave (or fixed return bull wheel).
(m) *Cabin*. An enclosed or semi-enclosed compartment for transporting passengers; most often used on aerial tramways and detachable grip aerial lifts.
(n) *Carrier*. The structural and mechanical assemblage in or on which the passenger of a tramway system is transported. Unless qualified, the carrier includes, for example, the carriage or grip, hanger, and cabin or chair.
(o) *Chair.* A chair is an open or semi-open seat used on an aerial lift.
(p) *Chair height*. Chair height (seat height) is the distance between the top surface, including padding, of the chair seat to the loading or unloading point surface. This distance shall take into account the longitudinal swing of the chair, which lowers the chair height.
(q) *Circuit, Electrical Power*. The electrical power circuit is a normally de-energized circuit which when energized provides electrical power to the drive motor, other lift-related electrical power equipment, or both.
(r) *Circuit(s), Bypass*. A circuit(s) that partially or entirely circumvents monitoring devices and remote signal inputs of a malfunctioning operating circuit to allow operation of the system, under the specific conditions set forth for each tramway type.
(s) *Complex electronic element*. An electrical device composed of one or more solid state components for which the failure modes are not well defined or detectable, or for which the behavior of the device under fault conditions cannot be completely determined.

EXAMPLE – A photocell operating a relay to implement a stop gate function.

(t) *Commissioner*. The Commissioner of Labor of the State of New York.
(u) *Conductor.* An attendant assigned to duties or functions in an enclosed carrier (also see supervisor).
(v) *Continuous diagnostic coverage*. A test function(s) provided to detect the failure of a complex electronic element at a period of no greater than the minimum time between each required functional operation of the element.
(w) *Conveyor*. A class of outdoor transportation wherein skiers, or passengers on recreational devices, are transported uphill on a flexible moving element
(x) *Conveyor Belt*. The flexible moving element on a conveyor that consists of multiple tread plates or belting.
(y) *Deropement*. The term used when a rope or cable leaves its operating position relative to the groove of a sheave, carriage wheel, or saddle.
(z) *Design Capacity*. The number of passengers per hour (pph) established by the designer as the current ultimate operating capability of the facility in the direction specified.
(aa) *Detachable grip lifts*. Tramway systems on which carriers circulate around the system alternately attaching to and detaching from a moving haul rope(s). The tramway system may be monocable or bicable.
(ab) *Diesel.* A Class II liquid fuel.
(ac) *Electromagnetic Wire Rope Testing*. Electromagnetic wire rope testing (EWRT) is any of several nondestructive testing procedures which derive indications of wire rope

condition from sensors measuring electromagnetic flux in or adjacent to the rope resulting from imposition of a known flux within the wire rope.
(ad) *Emergency Shutdown.* A stop that when initiated causes one or more brakes (if installed) to be applied and power to be removed from the power unit. An emergency shutdown shall occur when it is detected that the normal stop, or other stops have failed to function properly and takes priority over all other stop functions or devices. Removing power from the power unit shall mean:

(1) *Electric Motor*: Full load rated contactor or circuit breaker disconnect devices operates to shut down the motor.
(2) *Internal Combustion Engine*: Engine shuts down (see also stops and shutdowns).

(ae) *Emergency shutdown circuit*. A protection circuit that effects an emergency shutdown.
(af) *Evacuation power unit.* A power unit utilized for the evacuation of a ropeway that once engaged, passenger loading ceases and the ropeway operation is shutdown once the ropeway has been unloaded.
(ag) *Factor of safety (wire rope).* The ratio of the nominal breaking strength of the rope and the maximum static design tension of the rope.
(ah) *Fiber rope*. A stranded or braided rope made from natural or synthetic fibers.
(ai) *Fixed Grip Lifts*. Tramway systems on which carriers remain attached to a haul rope. The tramway system may be either continuous or intermittent circulating, and either monocable or bicable.
(aj) *Foot Passenger*. A foot passenger is any person utilizing a passenger tramway who is not a skier.
(ak) *Flue gas temperatures*: The temperatures of the flue products at the point or points of passing close to or through combustible materials, whichever is applicable.
(al) *Gasoline*: A Class I liquid fuel.
(am) *Gondola*. A name used to describe detachable grip aerial lifts using cabins.
(1) A cabin used on an aerial lift.
(an) *Gravity Foundation*. A Foundation designed to stand by itself, relying only on soil bearing conditions and it's own weight to support a structure without movement.
(ao) *Grips, Detachable*. Haul rope grips that are detached from the moving haul rope at station(s) or terminal(s) during normal operation.
(ap) *Grips, Fixed.* Haul rope grips that remain continuously attached to the haul rope during normal operation.
(aq) *Grips, Haul Rope*. Haul rope grips are those devices by which carriers are attached to the haul rope.
(ar) *Guard rail*. A horizontal rail secured to uprights erected along sides of loading and unloading areas not used for access or egress to prevent persons from falling or contacting dangerous moving parts.
(as) *Hanger*. Structural element connecting a cabin, chair, or other passenger-carrying device to the track cable carriage or haul rope grip.
(at) *Haul Rope*. A wire rope used on a passenger tramway that provides motion to a carrier(s) and is powered by the drive sheave.

(au) *Hereafter*. On or after effective date of this code.
(av) *Length*. Of a tramway, the maximum possible distance of point to point passenger travel.
(aw) *Monocable system*. A system that uses a single haul rope to both support and control motion of the carriers.
(ax) *Nominal voltage*. A nominal value assigned to a circuit or system. The actual voltage at which a circuit or system operates can vary from the nominal within a range that permits satisfactory operation of the equipment.
(ay) *Non-complex element*. An electrical element in which the failure modes are well defined and the behavior of the element under fault conditions can be determined.

> EXAMPLE – A system comprising one or more limit switches operating one or more contactors or relays to de-energize a motor.

(az) *Normal Stop*. A normal stop is a stop in which the prime mover or other systems may be involved in braking and in which the tramway comes to rest in a controlled manner.
(ba) Operation circuit. An electrical circuit that provides power to or controls the ropeway machinery.
(bb) *Operator*. A person qualified to operate a tramway, lift or tow (see also attendant).
(bc) *Overhauling.* Overhauling is an operating condition in which unbalanced loading is sufficient to overcome line and drive friction and create a torque, acting to produce rotation of drive sheave in either direction when all brakes and the prime mover are inactive.
(bd) *Owner*. The owner of the tramway, or the lessee of the whole thereof, or the agent who manages, or directs the operations and maintenance of a passenger ropeway. The term includes the State of New York, any political subdivision thereof, and any body corporate.
(be) *Passenger Ropeway*. Passenger ropeway includes all devices that carry, pull, or push passengers along a level or inclined path (excluding elevators) by means of a haul rope or other flexible element that is driven by a power unit remaining essentially at a single location.
(bf) *Passenger Tramway*. Passenger Tramways shall include Aerial Tramways, Aerial Lifts, Passenger ropeways , other towing devices, and conveyors.
(bg) *Prime mover*. Power unit utilized for the continuous operation of a passenger ropeway.
(bh) *Programmable Logic Controller (PLC).* Any solid-state automatic device that has programmable memory and is used to process input and output logic functions.
(bi) *Protection circuit.* Electrical circuits designed to stop the ropeway in the event of a malfunction or failure of the ropeway system.
(bj) *Qualified Engineer*. A Qualified Engineer is an engineer who is registered as a Professional Engineer in his/her state of residency or primary practice.
(bk) *Rated capacity*. The maximum load which a tramway is designed and installed to handle at the rated speed.
(bl) *Rated speed*. The speed at which a tramway is designed to operate.

(bm) *Recreational Device*. Tube, sled, luge, cart, etc. Except a skier, which is pulled uphill on the surface with a passenger riding on device.
(bn) *Rollers*. Sheaves of small diameter used to guide or restrain the rope from leaving its proper alignment.
(bo) *Rope*. Unless otherwise specified, the term, rope, shall mean wire rope, which consists of several strands twisted together. (The terms, rope, wire rope, and cable, are interchangeable, except where, by the context, the general term, cable, refers to either a wire rope or strand used as a track cable.)
(bp) *Ropeway*. See Passenger Ropeway.
(bq) *Rotation-resistant rope*. Wire rope consisting of inner strands laid in one direction covered by a layer of strands laid in the opposite direction. This has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.
(br) *Shall*. The word "Shall" is always mandatory.
(bs) *Sheaves*. Sheaves are pulleys or wheels grooved for rope.
(bt) *Sheave unit.* A sheave unit is the largest assembly of sheaves that are independently articulated on a common shaft.
(bu) *Sheave, deflection*. A deflection sheave is a terminal sheave that deflects the haul rope at least 10 degrees but less than 150 degrees.
(bv) *Sheave, tension system.* A sheave used in the tension reeving system.
(bw) *Sheave, terminal*. A terminal sheave is a haul rope sheave at a terminal that rotates continuously when the haul rope is moving and deflects the haul rope by an angle of 10 degrees or more.
(bx) *Sheaves, diameter of*. Wherever the term, diameter, is used in specifying sheaves, it refers to the diameter at the bottom of sheave grooves (tread diameter).
(by) *Sheaves, haul rope*. Haul rope sheaves are sheaves that support or hold down the haul rope at towers or terminals. (The angle of rope deflection is usually small.)
(bz) *Skier*. A skier is any person utilizing a device that attaches to at least one foot or the lower torso for the purpose of sliding on a slope. The device slides on the snow or other surface of a slope and is capable of being maneuvered and controlled by the person using the device.
(ca) *Stop gate*. A stop gate is a type of automatic stopping device that, when actuated by a passenger's weight, contact, or passage, will automatically stop the tramway.
(cb) *Stop.* A stop is function initiated by a command that decelerates the tramway and brings it to rest (also see brake).
(cc) *Strand*. Unless otherwise specified, "strand" shall mean wire strand, consisting of several wires twisted together, as compared with wire rope which consists of several strands twisted together.
(cd) *Supervision circuit.* Electrical circuits that provide communications, that monitor or supervise the performance of various ropeway systems, and provide the operator with system information.
(ce) *Supervisor*. A person in responsible charge of passenger tramway operations and personnel (also see operator).
(cf) *Surface lifts*. Surface lifts are those tramways on which passengers are propelled by means of a circulating overhead wire rope while remaining in contact with the ground or snow surface. Connection between the passengers and the wire rope is by means of a device attached to and circulating with the haul rope, known as a "towing device".

(cg) *Tank, atmospheric storage.* A storage tank that has been designed to operate at pressures from atmospheric through 0.5 psig measured at the top of the tank. All fuel tanks shall be atmospheric tanks.
(ch) *Tank, day.* A fuel tank, located inside a structure that provides fuel to an engine.
(ci) *Tank, integral.* A fuel tank furnished by the engine or lift manufacturer and mounted on the engine.
EXCEPTION – The lift manufacturer or a qualified engineer may supply an integral tank to be mounted on the engine or day tank for mounting on a combined drive tension carriage or an overhead fixed drive terminal.
(cj) *Tank, supply.* A separate fuel tank for supplying fuel to the engine or to a day or integral tank.
(ck) *Towing device*. A carrier, fixed or detachable, used on surface lifts to pull passengers. Classification or description is by the seat configuration and action of the extension element (i.e., J-Bar, T-Bar, Platter or similar).
(cl) *Tow path*. The path along which a passenger is towed on a surface lift or tow from the load point to a point beyond the stop gate equal to 150% of the distance required to stop the empty surface lift or tow operating at full speed.
(cm) *Tows, fiber rope*. Fiber rope tows are those ropeways on which the passengers grasp the circulating fiber rope and are thus propelled while supported by the ground or snow surface. The haul rope remains adjacent to the passenger track at an elevation that permits passengers to maintain their grasp on that rope throughout that portion of the tow length that is designed to be traveled.
(cn) *Tows, wire rope*. Wire rope tows are those ropeways on which the passengers are pulled by a towing device attached to a circulating wire rope and are propelled in one direction only by that rope while remaining in contact with the ground or snow surface. The haul rope remains adjacent to the tow path at an elevation such that the skier or recreational device remains on the surface throughout the length of the tow path.
(co) *Track cable saddle*. A track cable saddle is a component designed to directly support a track cable.
(cp) *Track cable*. A wire rope or strand used to support a carrier or carriers on a bicable system.
(cq) *Tramway*. As used in this Part, this term refers to passenger tramway and its definition.
(cr) *Transmission line*. A light, power or communication conductor operating at a potential exceeding 50 volts.
(cs) V*oltage.* Voltage of a circuit is the greatest root-mean square difference of the potential between any two conductors of the circuit.
(ct) V*oltage, low.* A voltage limited to 24 volts nominal.
(cu) V*oltage, high.* A voltage of more than 600 volts.

32-1.5 Quality program.

(a) The manufacturer, supplier, and installer shall maintain quality programs to verify that the installed parts conform to design requirements.

(b) *Design*. A Qualified Engineer shall design, or be in responsible charge of the design of, new and modified passenger tramways.
(c) *Construction.* For all tramways, other than rope tows and wire rope tows, a Qualified Engineer shall certify to the owner that the construction and installation has been completed in accordance with the final design plans and specifications.

32.6 General requirement of safety. A ski tow or other passenger tramway shall be so designed, constructed, operated and maintained as to provide reasonable protection against personal injuries to employees and the public.
No person knowingly shall permit such device to be used for passenger transportation when it is so defective in any respect as to be reasonably capable of causing personal injury. When so defective, a ski tow or other passenger tramway shall constitute machinery in a dangerous condition within the meaning of subdivision 2 of section 200 of the Labor Law.

32.7 Approval of materials and devices. Except as hereinafter specifically provided, approval by the Commissioner is not required in respect to a passenger tramway or any material or device associated therewith. A material or device which the board (prior to 1975) or Commissioner has approved pursuant to section 21 of the Labor Law for use in complying with this Part may be used, subject to the requirement of the resolution of approval, as if by the Part specifically authorized, any general or special provision of this Part notwithstanding.

32.8 Plans and specifications.

(a) *Acceptance required*. No person shall make an installation of a passenger tramway or make a major alteration thereto except in accordance with plans and specifications thereof previously found acceptable by the Commissioner on the basis of indicated compliance with this Part. Plans and specifications shall be in the English language and dimensions shall be in inches and feet.

(b) *Submission for acceptance*. Plans and specifications and such alterations or revisions thereof as may be necessary shall be submitted in triplicate to the Commissioner by the owner or his authorized agent, together with such additional information as the Commissioner may require. Assembly drawings for all installations except, rope tows and wire rope tows, shall bear the seal and signature of a New York State licensed Professional Engineer. Tower structure, terminal structure, footing and foundation drawings, except for rope tows and wire rope tows, shall also bear the seal and signature of a New York State licensed Professional Engineer.
(1) Drawings shall contain: A list of major components, a statement confirming compatibility of the major components to the total system, and of the system to the site. Certification for each major component that it meets the requirements of this Code given by a Qualified Engineer and/or officer of the company which supplies the component.

Major components are:

Drive motors
Gear reducers
Tensioning systems
Carriers
Rope grips
Tower sheave assemblies
Bullwheel assemblies
Brakes
Safety Circuits

32.9 Registration.

(a) *Registration required.* Operation of any passenger tramway without having filed with the Commissioner an application for a certificate of registration, or while a registration certificate is suspended, is prohibited. Operation of any passenger tramway without a current registration certificate is prohibited.

(b) *Application for registration.* The owner of each passenger tramway shall apply to the Commissioner on forms supplied by the Commissioner for initial registration of the tramway. The Commissioner, if satisfied on the basis of test and inspection that the tramway is in compliance with this Part, shall issue a registration certificate to the owner. Each certificate shall relate to a specific tramway at a specific location and shall expire one year from the date of its initial issuance and thereafter on a date in each succeeding year as specified by the Commissioner unless renewed prior to such date. The Commissioner's signature and the date shall be placed upon the certificate when annual reinspection and test indicate conformity with this Part. Where non-conformance with the provisions of this Part is found in the course of inspection or test the Commissioner may, at his discretion, remove and retain the certificate until the tramway is found to comply with the provisions of this Part at which time the Commissioner may reissue the certificate by endorsement thereof.

(c) *Posting of certificate of registration.* The certificate of registration for a tramway shall be posted in an appropriate, conspicuous place.

(d) *Control of certificate*. The Commissioner may by order repossess a certificate of registration and after a hearing on due notice suspend or cancel the same for good cause.

32.10 Personal injury report. By the close of the first business day following notification that any person may have sustained a serious personal injury connected with the operation or use of a tramway or a part thereof, the owner shall by telephone or otherwise report the same to the Commissioner.

32.11 Severability. If any provision of the Part or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of the Part which can be given effect without the invalid provisions or applications and to this end the provisions of this Part are declared to be severable.

32.12 Adoption of standards.

(a) The Commissioner adopts the following standards, as referenced in this Part and hereinafter referred to as provided below.

(1) NFPA 30 Flammable and Combustible Liquids Code, 2000 Edition, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101. (hereinafter "NFPA 30")

(2) NFPA 58 Liquefied Petroleum Gas Code, 2004 Edition, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101. (hereinafter "NFPA 58")

(3) Safety Standard for Mechanical Power Transmission Apparatus, 2000 Edition, The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990 (hereinafter "ASME B15.1")

(4) ANSI B77. 2006 American National Standard for Passenger Ropeways - Aerial Tramways, Aerial Lifts, Surface Lifts, Tows and Conveyors - Safety Requirements, 1999 Edition, American National Standards Institute, 11 West 42nd Street, New York, NY 10036 (hereinafter "ANSI B77.1")

(5) NFPA 780 Standard for the Installation of Lighting Protection Systems, 2004 Edition, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101. (hereinafter "NFPA 780")

(6) NFPA 70 National Electric Code, 2005 Edition, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101. (hereinafter "NFPA 70")

(7) C2- 2002 National Electrical Safety Code, 1997 Edition, Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017 (hereinafter "NES C2")

(b) Copies of referenced material are available for inspection at the New York State Department of Labor, Division of Safety and Health, Governor W. Averell Harriman State Office Building Campus, Building 12, Albany, New York or at the Department of State in Albany, New York.

32.13 Adoption of ANSI B77 standard. The following ANSI B77 2006 sections are to be modified as indicated. Text in brackets [] is to be deleted. Underlined text is to be added to the ANSI sections. ANSI B77 Section 1 is not adopted and is excluded in its entirety.

ANSI B77, Section 2.1.1.6.2 Foundations

In determining the resistance of the soil to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage [should] shall be designed as a gravity anchor, using a coefficient of friction appropriate to the general character of the soil. Bottoms of foundations shall be below the normal frost depth unless resting on non-frost susceptible soil or solid rock. Foundations on rock shall be firmly anchored to solid rock, unless designed as gravity foundations.

The top of concrete foundations shall not be less than 6 inches (150 mm) above finished grade unless specific direction for the protection of the foundation and structural steel below grade is specified by the designer. The design shall have a minimum factor of safety of 2 in resisting overturning and, concurrently, 2 against sliding, under dead-load and live-load conditions. The minimum factors shall be 1.5 under these loadings plus wind acting simultaneously.

ANSI B77, Section 2.1.1.11.1 Acceptance inspection
Before an aerial tramway that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given a thorough inspection by [qualified personnel] the Commissioner to verify compliance with the plans and specifications of the designer.

ANSI B77, Section 2.1.1.11.2 Acceptance tests
Before an aerial tramway that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given thorough tests by qualified personnel to verify compliance with the plans and specifications of the designer. The designer or manufacturer shall propose and submit an acceptance test procedure. The Commissioner shall be advised by the Owner 10 days prior to the date of the test.

Thorough load and operating tests done in the presence of the Commissioner shall be performed under full loading and any partial loadings that may provide the most adverse operating conditions.

ANSI B77, Section 2.1.2.6 Brakes
The aerial tramway shall have the following friction-type brakes:

– service brake (see 2.1.2.6.1);
– drive sheave brake (see 2.1.2.6.2)

NOTE – For requirements of systems with or without track cable brakes, see 2.1.4.4.2.

All drive braking systems shall be designed and monitored to ensure that:

a) once the aerial tramway begins movement in the intended direction, the brakes are maintained in the open position;

b) the service brake shall not open prior to the prime mover providing control for the ropeway;

c) multiple brakes or brake systems shall not be simultaneously applied such that excessive deceleration is applied to the aerial tramway under any design loading condition;

d) the failure of one braking system to stop the aerial tramway shall automatically initiate a second braking system, if any.

The service brake and drive sheave brake shall be designed such that failure of one braking system shall not impair the function of the other systems. All brakes shall have the braking force applied by springs, weights, or other approved forms of stored energy.

Hydraulic systems shall be designed to reduce the possibility of oil contaminating the braking surfaces in the event of a failure of a hose, cylinder or fitting.

The service brake and drive sheave brake shall be designed to assure operation under all anticipated conditions.

All drive braking systems shall be capable of operation to comply with the daily inspections and periodic testing.

The manufacturer or a Qualified Engineer shall furnish a written procedure to be followed and shall specify the auxiliary equipment necessary for periodic testing and adjustment of the holding force of each brake. Direction of travel, speed, percent load, and position of the carriers shall be determined and added to the procedure in the maintenance manual. The procedure shall additionally specify:

e) the minimum and maximum holding force for the service brake and drive sheave brake or other criteria which establishes the acceptable range of holding force, and;

f) the minimum and maximum deceleration rates for the service brake and drive sheave brake.

This baseline procedure shall be performed at the completion of the acceptance test, and then at the frequency specified, in order to demonstrate the ability of each brake to produce the required force (see 2.1.1.11.2).

Testing shall be accomplished as part of normal maintenance. As a minimum, testing shall be performed [monthly] weekly during the normal operating season(s) of the tramway. Testing shall not be done while the tramway is open for public operation.

If a device is permanently installed to cause a brake to be disabled for testing, it shall be monitored so that the tramway cannot be operated in its normal mode when the brake is so disabled.

ANSI B77, Section 2.1.2.8.1 General
All sheaves, including their mountings and frames, shall be designed to withstand static and dynamic loads. Sheave bearings and mountings shall be selected, designed, and installed in accordance with the recommendations of the manufacturers of the bearings.

When unlined sheave grooves are used for wire rope, they [should] shall be V-shaped and shall have rounded bottoms with a radius equal to approximately 55% of the rope diameter.

When lined sheave grooves are used, the allowable bearing pressures of the liner material shall not be exceeded.

ANSI B77, Section 2.2.1.2 Location
All electrical power transmission wiring located near or proposed to cross over aerial tramways shall comply with the applicable requirements of IEEE C2-2002. No aerial lift shall pass under any transmission lines operating at a potential exceeding 50 volts.

ANSI B77, Section 2.2.1.6.3 Haul rope grounding
Grounding sheaves with conductive liners or equivalent means [should] shall be provided at one location for the purpose of grounding haul ropes and track cables, as applicable, for static electrical discharge. For the haul rope on bicable systems or monocable systems with an isolated or insulated haul rope incorporated in the operating circuitry, no means of grounding are required when the operating circuit takes into consideration static electrical discharge.

ANSI B77, Section 2.3.2.5.7 Evacuation
The owner of each aerial tramway shall submit to the Commissioner a detailed written plan for evacuation of passengers from cabins or carriers in the event of a power failure or breakdown. The procedures set forth in the evacuation plan shall be tested, at any location on the lift, in the presence of the Commissioner at his request. The Commissioner, when satisfied with the evacuation plan and the results of the test, shall notify the owner in writing of such acceptance. A copy of the accepted plan shall be kept on the premises and shall be readily available to the Commissioner's representative. [A plan for evacuation of passengers from each aerial tramway shall be developed and documented.] The written plan shall include, but not be limited to:

a) the definition of the line of authority in the event of an evacuation. This line of authority shall list:

1) the individuals or positions responsible for determining the need for an evacuation;

2) the individuals or positions responsible for ordering an evacuation;

3) the individuals or positions responsible for performing the evacuation, for first aid, and for ground care of evacuated passengers.

b) a description of the equipment necessary for evacuation and where it will be stored;

c) provisions for adequate training in the functions performed in the evacuation process at least once each operating season. Such drills are to be recorded in the operational log of each aerial tramway (see 2.3.5.1);

d) an estimate of the time necessary for the total evacuation of each aerial tramway and any conditions which might cause the time to exceed 2 hours after the lift stoppage;

e) a description of unusual terrain conditions and how each of these conditions will be dealt with during an evacuation;

f) an estimate of when the evacuation should begin in the event the aerial tramway becomes inoperable;

g) provisions for communications with passengers of an inoperable aerial tramway, the frequency of such communication, how soon after the aerial tramway becomes inoperable such communication to the passengers will start, and the frequency of communications thereafter;

h) the methods of evacuation to be used for the typical passenger and the methods to be used for incapacitated passengers and non-ambulatory passengers;

i) provisions for communication with the evacuation teams;

j) provisions for suspending the evacuation in the event that the aerial tramway is made operable during the evacuation;

k) provisions for control and assistance of evacuated persons until released;

l) provisions for a post-evacuation report available for review by the Commissioner.

All nonmetallic rope used for evacuation shall be of nylon or polyester (Dacron) fiber of either laid or braided construction. Laid rope of nylon shall be of a hard lay.
These ropes shall be either of a static rescue type or a dynamic mountaineering type. Breaking strength, when new, shall be at least 15 times the maximum expected operating load, but in no case less than [4000]5000 pounds ([17.8] 22.3 kilonewtons). No natural fiber or polypropylene ropes shall be used.

These ropes shall be carefully stored when not in use and shall be examined after each completed aerial tramway evacuation and prior to each season of operation, both summer and winter, to ascertain that they are in satisfactory condition.

Carabiners, if used, shall be of the locking type.

ANSI B77, Section 2.3.2.5.9 Bypass requirements
The use of temporary circuits that have been installed for the purpose of bypassing failed electrical circuit(s) (see 2.2.6) shall meet these requirements in the following order:

a) The condition that the circuit indicated is in default shall be thoroughly inspected to ensure an electrical operating circuit malfunction, rather than the indicated condition, actually exists;

b) The bypass shall be authorized only by the aerial lift supervisor or his/her designated representative;

c) When a bypass is in operation, the function bypassed shall be under constant, close, visual observation;

d) The use of a bypass circuit shall be logged and shall indicate when, who authorized, and for what duration a bypass was used;

e) The operator control panel shall indicate that a bypass is in use.

f) When a required aerial lift control circuit is bypassed, all passengers shall be off loaded and no passengers other than maintenance personnel being transported to the repair site shall be allowed to board the lift until the malfunction is corrected.

ANSI B77, Section 3.1.1.6.2 Foundations
In determining the resistance of the soil to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage [should] shall be designed as a gravity anchor, using a coefficient of friction appropriate to the general character of the soil. Bottoms of foundations shall be below the normal frost depth unless resting on non-frost susceptible

soil or solid rock. Foundations on rock shall be firmly anchored to solid rock, unless designed as gravity foundations.

ANSI B77, Section 3.1.1.7 Communications
A permanently installed two-way voice communication system shall be provided between the prime mover, evacuation power unit control point, machinery areas, loading stations, and unloading stations. The power for this system shall be independent of the primary power and the communication system shall be functional and audible during a power failure (see 3.2.5(a)).

On lifts installed prior to 1995, radiophones or suitable public address systems may be used.

Audio indicators shall be audible over all ambient noise levels, and visual indicators (e.g., Light Emitting Diodes) shall be visible even in bright sunlight.

ANSI B77, Section 3.1.1.9.1.1 Loading areas for chair lifts
The loading area length, profile, and loading point shall be installed according to the carrier speed, carrier type, carrier conveyance system, passenger type, and aerial lift design. Load Gates, artificial surfaces, and other loading aids when used shall be designed and installed with regards to all passengers including adaptive. Load Gates shall have an override control to hold them in the open position by the lift operator. At least one point of access to the lift shall have a minimum clearance width of 36 inches (915 mm) to accommodate passengers using adaptive equipment.

Approach paths to the loading platform shall be approximately level or slightly downsloped to facilitate passengers moving to the loading point. The approach path shall be such that waiting passengers have a view of the loading area. The maze or corral area shall be approximately level, free of obstructions and marked, roped, or fenced in a manner to guide passengers to the “Wait Here” and “Load Here” markers. The corral and maze [should] shall be as straight as possible with gradual turns.

ANSI B77, Section 3.1.1.10 Provisions for evacuation
Aerial lifts shall be provided with means to evacuate passengers from stranded carriers. Provisions shall be made in the design of the aerial lift for emergency evacuation of [common passenger types] all passengers (see 3.3.2.5.7).

ANSI B77, Section 3.1.1.11.1 Acceptance inspection
Before an aerial [tramway] lift that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given a thorough inspection by [qualified personnel] the Commissioner to verify compliance with the plans and specifications of the designer.

ANSI B77, Section 3.1.1.11.2 Acceptance tests
Before an aerial [tramway] lift that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given

thorough tests by qualified personnel to verify compliance with the plans and specifications of the designer. The designer or manufacturer shall propose and submit an acceptance test procedure. The Commissioner shall be advised by the Owner 10 days prior to the date of the test.

Thorough load and operating tests done in the presence of the Commissioner shall be performed under full loading and any partial loadings that may provide the most adverse operating conditions.

ANSI B77, Section 3.1.2.1 Power units
All aerial lifts shall be equipped with at least two power units, one of which, at a minimum, meets the requirements of 3.1.2.1.2.

All power units shall have the capacity to handle the most unfavorable design loading conditions, including the starting of the aerial lift loaded to 110% of capacity in weight. If downhill capacity is desired, the aerial lift shall comply with 3.1.2.4. Where manual multispeed transmissions are used on a power unit, they shall not be shifted when the aerial lift is moving.

Where reverse capability is provided on a power unit for an aerial lift, provisions shall be made to prevent accidentally shifting into reverse whenever the aerial lift is operating. No aerial lift shall be operated using a single power unit without a second operable power unit being available except for unloading passengers or for maintenance purposes.

> [EXCEPTION – An aerial lift may continue loading passengers if the following requirements are met:
>
> a) The power unit in use meets the requirements of a prime mover (see 3.1.2.1.1);
>
> b) Evacuation gear and personnel shall be immediately available in sufficient number and quantity to evacuate the entire aerial lift in a period specified in the evacuation plan (see 3.3.2.5.7).]

If changes are made to the drive train components that affect rotational inertia (i.e. removal of electric motor), the changes to stopping distances and deceleration rates shall meet the requirements of 3.1.2.5.

ANSI B77, Section 3.1.2.6 Brakes and rollback devices
The aerial lift shall have the following friction-type brakes and other devices as specified in table 3-2:

- service brake (see 3.1.2.6.1);
- drive sheave brake (see 3.1.2.6.2);
- rollback device (see 3.1.2.6.3).

All braking systems shall be designed and monitored to ensure that:

a) once the aerial lift begins movement in the intended direction, the brakes are maintained in the open position;

b) the service brake shall not open prior to the drive system developing sufficient torque to prevent overhauling;

EXCEPTION – For an aerial lift that overhauls only in the reverse direction, a drive train backstop (3.1.2.6.4) may be used in lieu of the above.

c) multiple brakes or brake systems shall not be simultaneously applied such that excessive deceleration is applied to the aerial lift under any anticipated conditions of loading;

d) the failure of one braking system to properly decelerate the aerial lift shall automatically initiate a second braking system, if any.

The service brake, drive sheave brake, and rollback device shall be designed such that failure of one braking system will not impair the function of the other systems.
All brakes shall have the braking force applied by springs, weights, or other approved forms of stored energy.

The service brake, drive sheave brake, and rollback device shall be designed to assure operation under all anticipated conditions.

Each braking system shall be capable of operation to comply with daily inspections and periodic testing.

The manufacturer or a Qualified Engineer shall furnish a written procedure to be followed and specify the auxiliary equipment necessary for periodic testing and adjustment of the holding force of each brake, rollback, and backstop device.

The procedure shall additionally specify:

e) the minimum and maximum holding force for the service brake and drive sheave brake independently, and;

f) the minimum and maximum stopping distance for the service brake and drive sheave brake independently, with a specified loading condition.

This baseline procedure shall be performed at the completion of the acceptance test and then at the frequency specified in order to demonstrate the ability of each brake to produce the required force.

Testing shall be accomplished as part of normal maintenance during the operating season, but shall not be performed when the aerial lift is open to the public. As a minimum, this testing shall be performed [monthly] weekly during the operating season.

ANSI B77, Section 3.1.2.8.1 General
All sheaves, including their mountings and frames, shall be designed to withstand static and dynamic loads. Sheave bearings and mountings shall be selected, designed, and installed in accordance with the recommendations of the manufacturers of the bearings.

When unlined sheave grooves are used for wire rope, they [should] shall be V-shaped and shall have rounded bottoms with a radius equal to approximately 55% of the rope diameter.

When lined sheave grooves are used, the allowable bearing pressures of the liner material shall not be exceeded.

ANSI B77, Section 3.1.4.4.2 Cabin
Fully enclosed passenger cabins shall be ventilated. They shall be equipped with doors that fill the entire entrance opening. The minimum clearance width opening shall be 32 inches (815 mm). Each door shall be provided with a lock located in such a manner that it can be unlocked only by authorized persons or by automatic means.

The horizontal gap between the cabin door opening floor edge and platform edge shall not be greater than 1 inch (25.4 mm). The height of the cabin floor to the platform shall be within ± ½ inch (±12.7 mm). Where it is not operationally or structurally practical to meet these requirements, platform devices, vehicle devices, system devices, or bridge plates shall be provided for independent loading.

All windows shall be of shatter-resistant material.

Means of emergency evacuation of passengers shall be provided.

The maximum capacity of each cabin, both in pounds and kilograms and number of passengers, shall be posted in a conspicuous place in each cabin (see table D-1(r)).
The minimum clear floor space in accessible cabins shall be 48 inches by 30 inches (1220 mm x 760 mm). Where special accessible cabins are used, [it is recommended] the waiting interval shall [should] not exceed 10 minutes.

All carriers shall be clearly identified with numbers located on each end of each carrier. Semi-open carriers shall meet applicable requirements for enclosed cabins and open chairs.

ANSI B77, Section 3.1.4.4.4 Chairs
Chair lift carriers shall be designed to support a vertical load 4 times the design load without permanent deformations of the assembly or component parts.

All carriers shall be uniquely identified with numbers visible to the operator and attendant.

Each chair shall be equipped with a railing at each side, to a height of not less than 4 inches (100 mm) above the seat for a distance of not less than 12 inches (305 mm) from the back of the seat.

For aerial lifts operating primarily for skiers, the thickness of the chair seat front, including padding, shall not exceed 5 inches (125 mm) from the top of the seating surface to the bottom of the curl. Tilt back angle of the seat bottom [should] be a minimum of 7 degrees when loaded. Loaded shall mean an evenly distributed load using load test criteria. Provisions shall be made to keep the tails of skis from passing through and becoming trapped in open spaces between framework, safety restraints and chair seat underside.

[For aerial lifts operating primarily for foot passengers, each chair shall be equipped with a restraining device that will not open under forward pressure] Each chair shall be equipped with a restraining device referred to as a restraint bar that will not open under forward pressure.

The chair shall be designed to accommodate equipment for the purpose of emergency evacuation of passengers.

ANSI B77, Section 3.2.1 General design and installation testing
Prior to operation of newly installed aerial lifts or after any modification thereafter of the electrical system, the electrical system shall be tested and shown to meet [the requirements of] this [standard] Part and the test results shall be recorded. Design of all electronic controls and drives shall consider minimum sensitivity to electrical noise and electrical emissions, such as noise spikes from power lines and lightning, radio transmitters, thyristors (SCR), or solenoid or relay noise at levels and frequencies that could initiate loss of control.

(a) Electrical system acceptance test. Upon the completion of the acceptance test and before public operation of the aerial lift, the design and function of software and/or replay logic shall be certified by the Qualified Engineer of record and the certification shall be included in the acceptance test report. Any modifications made to the electrical design shall be clearly marked on the on-site documentation and signed by a Qualified Engineer. (see also section 32-3.12)

(b) Software security. The “as built” documents shall include a procedure, developed by the lift manufacturer or Qualified Engineer, to ensure the security of the software logic and operating parameters that will control the aerial lift. Upon completion of the acceptance testing, this procedure shall be implemented in a manner that will prevent unauthorized personnel from making changes to the

logic or operating parameters. All programmable logic and parameters shall be documented."

ANSI B77, Section 3.2.1.6.3 Haul rope grounding
Grounding sheaves with conductive liners or equivalent means [should]shall be provided at one location for the purpose of grounding haul ropes and track cables, as applicable, for static electrical discharge. For the haul rope on bicable systems or monocable systems with an isolated or insulated haul rope incorporated in the operating circuitry, no means of grounding are required when the operating circuit takes into consideration static electrical discharge.

ANSI B77, Section 3.3.2.5.7 Evacuation
[A plan for evacuation of passengers from each aerial lift shall be developed and documented. The plan shall included:] The owner of each aerial lift shall submit to the Commissioner a detailed written plan for evacuation of passengers from cabins or carriers in the event of a power failure or breakdown. The procedures set forth in the evacuation plan shall be tested, at any location on the lift, in the presence of the Commissioner at his request. The Commissioner, when satisfied with the evacuation plan and the results of the test, shall notify the owner in writing of such acceptance. A copy of the accepted plan shall be kept on the premises and shall be readily available to the Commissioner's representative.The written plan shall include, but not be limited to:

a) The definition of the line of authority in the event of an evacuation. This line of authority shall list:

1) the individuals or positions responsible for determining the need for an evacuation;

2) the individuals or positions responsible for ordering an evacuation;

3) the individuals or positions responsible for performing the evacuation, for first aid, and for ground care of evacuated passengers.

b) a description of the equipment necessary for evacuation and where it will be stored;

c) provisions for adequate training in the functions performed in the evacuation process at least once each operating season. Such drills are to be recorded in the operational log of each aerial lift (see 3.3.5.1);

d) a statement that sufficient number of experienced evacuation personnel will be readily available to evacuate the entire lift within 2 hours of the lift stoppage and any conditions which might cause this time to be exceeded; [an estimate of the time necessary for the total evacuation of each aerial lift;]

e) a description of unusual terrain conditions and how each of these conditions will be dealt with during an evacuation;

f) an estimate of when the evacuation should begin in the event the aerial lift becomes inoperable;

g) provisions for communications with passengers of an inoperable aerial lift, the frequency of such communication, how soon after the aerial lift becomes inoperable such communication to the passengers will start, and the frequency of communications thereafter;

h) the methods of evacuation to be used for the typical passenger, incapacitated passenger, common adaptive ski equipment, and nonambulatory passengers.

i) provisions for communication with the evacuation teams;

j) provisions for suspending the evacuation in the event that the aerial lift is made operable during the evacuation;

k) provisions for control and assistance of evacuated persons until released;

l) provisions for a post-evacuation report <u>available for review by the Commissioner;</u>

m) <u>a special separate written evacuation plan shall be provided when the aerial lift is used primarily for foot passengers such as for sight seeing or amusement rides. This plan shall include a specific outline for the evacuation of the very old and/or very young, including babes in arms.</u>

All nonmetallic rope used for evacuation shall be of nylon or polyester (Dacron) fiber of either laid or braided construction. Laid rope of nylon shall be of a hard lay. These ropes shall be either of a static rescue type or a dynamic mountaineering type. Breaking strength, when new, shall be at least 15 times the maximum expected operating load but in no case less than [4000] <u>5000</u> pounds ([17.8]<u>22.3</u> kilonewtons). No natural fiber or polypropylene ropes shall be used.

These ropes shall be carefully stored when not in use and shall be examined after each completed aerial lift evacuation and prior to each season of operation, both summer and winter, to ascertain that they are in satisfactory condition.

Carabiners, if used, shall be of the locking type.

ANSI B77, Section 3.3.2.5.9 Bypass requirements
The use of temporary circuits that have been installed for the purpose of bypassing failed electrical circuit(s) (see 3.2.6) shall meet these requirements in the following order:

a) The condition that the circuit indicated is in default shall be thoroughly inspected to ensure an electrical operating circuit malfunction, rather than the indicated condition, actually exists;

b) The bypass shall be authorized only by the aerial lift supervisor or his/her designated representative;

c) When a bypass is in operation, the function bypassed shall be under constant, close, visual observation;

d) The use of a bypass circuit shall be logged and shall indicate when, who authorized, and for what duration a bypass was used;

e) The operator control panel shall indicate that a bypass is in use.

f) When a required aerial lift control circuit is bypassed, all passengers shall be off loaded and no passengers other than maintenance personnel being transported to the repair site shall be allowed to board the lift until the malfunction is corrected.

ANSI B77, Section 4.1.1.5.1 Vertical clearances
The following reference points will be used in determining vertical clearances for these carrier/passenger combinations:

a) For cabins and empty chairs - Vertical clearances shall be referenced from the lowest point of the carrier;

b) For chairs carrying foot passengers - Vertical clearances shall be referenced from a point 2 feet (0.61 meters) below the top of the chair seat;

c) For chairs carrying skiers - Vertical clearances shall be referenced from a point 5 feet (1.53 meters) below the top of the chair seat.

Along the line between terminals, the following vertical clearances shall exist between the above carrier reference points and the terrain or other obstacles, including maximum design snow depth:

d) Where skiing is permitted beneath the aerial lift, a minimum of 8 feet (2.44 meters) shall be maintained;

e) Where the clearance is less than 8 feet (2.44 meters), provisions shall be made to prevent access by unauthorized persons to the area beneath the aerial lift.

Under the most adverse design loading conditions, while the aerial lift is being operated, a minimum space of 5 feet (1.5 meters) shall be maintained between the lowest point of

the carrier(s) or rope(s) and the terrain, vehicles, or other possible obstacles, including snow.

When aerial lifts cross one another, the following conditions shall be met:

f) Under the most adverse design loading conditions, the minimum vertical clearance between the uppermost point or obstruction of the lower aerial lift and the lowest point of the carriers or rope(s) of the upper aerial lift shall be [10 feet (3 meters)]15 feet (4.57 meters);

g) Any deropement of the upper or lower lifts that reduces the vertical clearance (including dynamic affects) to less than 20 feet (6.1 meters) shall cause both lifts to stop (see 4.2.3.4).

ANSI B77, Section 4.1.1.6.2 Foundations
In determining the resistance of the soil to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage [should] shall be designed as a gravity anchor, using a coefficient of friction appropriate to the general character of the soil. Bottoms of foundations shall be below the normal frost depth unless resting on non-frost susceptible soil or solid rock. Foundations on rock shall be firmly anchored to solid rock, unless designed as gravity foundations.

The top of concrete foundations shall not be less than 6 inches (150 mm) above finished grade unless specific direction for the protection of the foundation and structural steel below grade is specified by the designer.

The design shall have a minimum factor of safety of 2 in resisting overturning and, concurrently, 2 against sliding, under dead-load and live-load conditions. The minimum factors shall be 1.5 under these loadings plus wind acting simultaneously.

ANSI B77, Section 4.1.1.7 Communications
A permanently installed two-way voice communication system shall be provided between the prime mover and evacuation power unit control point, drive machinery building, loading stations, and unloading stations. The power for this system shall be independent of the primary power and the communication system shall be functional and audible during a power failure (see 4.2.5(a)). On lifts installed prior to 1995 radiophones or suitable public address systems may be used.

ANSI B77, Section 4.1.1.9.1 Loading areas
The loading area length, profile, and loading point shall be installed according to the aerial lift's speed, terminal sheave location, and carrier type, such as to minimize carrier swing while loading passengers. Load gates, artificial surfaces, and other loading aids when used shall be designed and installed with regards to all passengers including adaptive. Load Gates shall have an override control to hold them in the open position by

the lift operator. At least one point of access to the lift shall have a minimum clearance width of 36 inches (915 mm) to accommodate passengers using adaptive equipment.

Approach paths to the loading platform shall be approximately level or slightly down sloped to facilitate passengers moving to the loading point. The approach paths shall be such that waiting passengers have a view of the loading area. The maze or corral area shall be approximately level, free of obstructions and marked, roped, or fenced in a manner to guide passengers to the "Wait Here" and "Load Here" markers. The corral and maze [should] shall be as straight as possible with gradual turns.

For aerial lifts used primarily by foot passengers, the loading area shall be provided with approximately level load platforms and the necessary handrails, steps, or ramps to provide access, guidance and public control.

The "Wait Here" point shall be marked. This marker shall be located to provide horizontal clearance between passengers at the "Wait Here" point and passing carriers.

The loading point shall be approximately level, marked as to where the passengers are to position themselves using a "Load Here" marker located on/in the platform/snow surface. The width of the "Load Here" marker shall not be greater than the carrier width.

Elevated loading areas shall be protected on all sides by guardrails, safety net or ramps.

ANSI B77, Section 4.1.1.9.2 Unloading areas
The unloading area length, profile, unload point, and exit ramp shall be installed according to the aerial lift's speed, terminal sheave location, and carrier type. The approach end of the unloading area shall be fitted with inclined guards as necessary to reduce the risk of passengers or their equipment from being entangled with the platform edges. The rope gradient shall not be more than 10 percent upward or downward.

For chair lifts, the unloading point where the passengers stand up and disembark shall be marked on or near the unloading surface. For unloading skiers on a snow surface, this point shall be at the breakover point where the exit ramp starts. The chair height shall not exceed 22 inches (560 mm). This point shall be signed "Unload Here," as required in table D-1 (j) in Annex D. An exit ramp for skiers shall not be sloped downward more than 30 percent.

Foot passengers shall be provided with approximately level unload platforms and the necessary handrails, steps, or ramps to exit the unload area. The exit route for foot passengers shall be designated.

The width of the unloading path on the unloading platform and the breakover point shall be greater than the carrier width.

For chair lifts, there shall be no impediment to obstruct passengers inadvertently failing to unload at the unload point. Appropriate guards are required to reduce the risk of injury

caused by catching equipment or passengers failing to unload and passing the unload point.

When an aerial lift is designed for skiers to unload in close proximity to the haul rope terminal sheave, normally designated as bull wheel unloading, the following requirements shall be met:

a) The unloading point and exit ramp shall be so located in relation to the point of tangency of the bull wheel that the unloading passengers skiing down the ramp shall be able to accelerate away from their carrier;

b) The automatic stop device (stop gate) required in 4.2.3.2 shall be located to stop the aerial lift in the event a passenger fails to unload. Provisions shall be made to unload such passengers from the carrier onto an unload platform without lift reversal or carrying passengers beyond the platform.

Elevated loading areas shall be protected on all sides by guardrails, safety net or ramps.

ANSI B77, Section 4.1.1.10 Provisions for evacuation
Aerial lifts shall be provided with means to evacuate passengers from stranded carriers. Provisions shall be made in the design of the aerial lift for emergency evacuation of [common passenger types] all passengers (see 4.3.2.5.7).

ANSI B77, Section 4.1.1.11.1 Acceptance inspection
Before an aerial lift that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given a thorough inspection by [qualified personnel] the Commissioner to verify compliance with the plans and specifications of the designer.

ANSI B77, Section 4.1.1.11.2 Acceptance tests
Before an aerial lift that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given thorough tests by qualified personnel to verify compliance with the plans and specifications of the designer. The designer or manufacturer shall propose and submit an acceptance test procedure. The Commissioner shall be advised by the Owner 10 days prior to the date of the test.

Thorough load and operating tests done in the presence of the Commissioner shall be performed under full loading and any partial loadings that may provide the most adverse operating conditions.

ANSI B77, Section 4.1.2.1 Power units
All aerial lifts shall be equipped with at least two power units, one of which, at a minimum, meets the requirements of 4.1.2.1.2.

All power units shall have the capacity to handle the most unfavorable design loading conditions, including the starting of the aerial lift loaded to 110% of capacity in weight. If downhill capacity is desired, the aerial lift shall comply with 4.1.2.4. Where manual multispeed transmissions are used on a power unit, they shall not be shifted when the aerial lift is moving.

Where reverse capability is provided on a power unit for an aerial lift, provisions shall be made to prevent accidentally shifting into reverse whenever the aerial lift is operating.

No aerial lift shall be operated using a single power unit, except for unloading passengers or for maintenance purposes.

> [EXCEPTION – An aerial lift may continue loading passengers if the following requirements are met:
>
> a) The power unit in use meets the requirements of a prime mover (see 4.1.2.1.1);
>
> b) Evacuation gear and personnel shall be immediately available in sufficient number and quantity to evacuate the entire aerial lift in a period specified in the evacuation plan (see 4.3.2.5.7).]

If changes are made to the drive train components that effect rotational inertia (i.e. removal of electric motor), the changes to stopping distances and deceleration rates shall meet the requirements of 4.1.2.5.

ANSI B77, Section 4.1.2.6 Brakes and rollback device
The aerial lift shall have the following friction-type brakes and other devices as specified in table 4-3:

> – service brake (see 4.1.2.6.1);
> – drive sheave brake (see 4.1.2.6.2);
> – rollback device (see 4.1.2.6.3);
> - drive train backstop (see 4.1.2.6.4).
>
> Exception: A drive train backstop is only required of lifts installed after 1995, existing lifts with drive train backstops shall comply with section 4.1.2.6.4.

All braking systems shall be designed to ensure that:

> a) once the aerial lift begins movement in the intended direction, the brakes are maintained in the open position;
>
> b) the service brake shall not open prior to the drive system developing sufficient torque to prevent overhauling;

EXCEPTION – For an aerial lift that overhauls only in the reverse direction, a drive train backstop may be used in lieu of the above.

c) multiple brakes or brake systems shall not be simultaneously applied such that excessive deceleration is applied to the aerial lift under any anticipated conditions of loading;

d) the failure of one braking system to properly decelerate the aerial lift shall automatically initiate a second braking system, on an overhauling forward direction aerial lift.

The service brake, drive sheave brake, rollback device, and drive train backstop device shall be designed such that failure of one system will not impair the function of the other systems. All brakes shall have the braking force applied by springs, weights, or other approved forms of stored energy.

The service brake, drive sheave brake, rollback, and drive train backstop devices shall be designed to assure operation under all anticipated conditions.
Each braking system shall be capable of operation to comply with daily inspections and periodic testing.

The manufacturer or a Qualified Engineer shall furnish a written procedure to be followed, and specify the auxiliary equipment necessary for periodic testing and adjustment of the holding force of each brake and backstop device. The procedure shall additionally specify:

e) the minimum and maximum holding force for the service brake and drive sheave brake independently;

f) the minimum and maximum stopping distance for the service brake and drive sheave brake independently, with a specified loading condition.

This baseline procedure shall be performed at the completion of the acceptance test and then at the frequency specified in order to demonstrate the ability of each brake to produce the required force.

Testing shall be accomplished as part of normal maintenance during the operating season, but shall not be performed when the aerial lift is open to the public.

As a minimum, this testing shall be performed monthly during the operating season.
If a device is permanently installed to cause a brake, rollback, or drive train backstop device to be disabled for testing, it shall be monitored so that the aerial lift cannot be operated in its normal mode when the brakes are so disabled.

ANSI B77, Section 4.1.2.6.2 Drive sheave brake
The drive sheave brake shall operate on the drive sheave assembly.

The drive sheave brake shall be capable of being activated both manually and automatically to stop and hold the aerial lift under the most unfavorable design loading condition. Deceleration rates or stopping distances specified in 4.1.2.5 shall be achieved by the drive sheave brake without the aid of other braking devices or drive regeneration.

Application of the drive sheave brake shall automatically disconnect the power source to the power unit in use. This brake shall act automatically when the speed of the haul rope exceeds the design value by 15% in either direction on an overhauling lift.

The controls for the brake shall not be located in a position that would require the operator or attendant to pass through the path of moving carriers in order to operate the controls. Controls shall not be more than 6 feet from the normal operating position of the operator.

ANSI B77, Section 4.1.2.6.4 Drive train backstop
A drive train backstop device shall conform to the following requirements:

a) A drive train backstop device is a one-way or overrunning clutch device. The drive train shall be so arranged that there is no belt, friction clutch, or similar friction-type device between the backstop device and the drive sheave;

b) The backstop device shall be rated for the maximum design load;

c) Under the most unfavorable design loading condition, the backstop device shall automatically prevent reverse rotation of the aerial lift before the aerial lift travels in excess of 36 inches (915 mm) in the reverse direction;

d) all backstops installed after 1995 shall be capable of being disengaged.

ANSI B77, Section 4.1.2.8.1 General
All sheaves, including their mountings and frames, shall be designed to withstand static and dynamic loads. Sheave bearings and mountings shall be selected, designed, and installed in accordance with the recommendations of the manufacturers of the bearings.

When unlined sheave grooves are used for wire rope, they [should] shall be V-shaped and shall have rounded bottoms with a radius equal to approximately 55% of the rope diameter.

When lined sheave grooves are used, the allowable bearing pressures of the liner material shall not be exceeded.

ANSI B77, Section 4.1.2.8.2 Haul rope terminal sheaves (Bull wheels and deflection sheaves)
Provisions shall be incorporated in the terminal design to retain the terminal sheaves in their approximate normal operating position in the event of failure of the bearings, shaft, or hub on lifts installed after 1995.

Provisions shall be incorporated in the terminal and rope retention design to control the position of the rope, including possible overhaul, to minimize the effects of its departure from its normal operating position.

The minimum diameter of terminal sheaves shall be 80 times the nominal diameter of the haul rope. The sheave assembly or related structures shall be designed to minimize the probability of a deropement. A flange extension of 1-1/2 times the rope diameter (measured radially from the bottom of the rope groove) shall be one acceptable means of minimizing the probability of deropement when in full compliance with the provisions of 4.1.2.8.4.

Haul rope terminal sheaves that act as driving, braking, or holding sheaves shall be so designed that the haul rope does not slip in the sheave groove. The design coefficient of friction for a particular sheave liner shall not exceed the values shown in table 4-4.

ANSI B77, Section 4.1.2.9.3 Floating tension sheave carriages
The sheave mounting shall be installed and operated in such a manner that the haul rope, in every case, considering every possibility of overloading, remains in the center of the sheave groove. The lateral tilt of the sheave shall not exceed [2] 1 degrees from the horizontal when in a stationary position, and when the up-going and down-going unloaded carriers are equidistant from the sheave.

To prevent excessive lateral tilt in case a loaded carrier passes around the sheave, the tension system or anchor cables shall be connected to at least two points on the mounting frame of the sheave. The connections of the tension system or anchor cables to the sheave frame and the support points of the cables shall be spaced a minimum of 70% of the pitch diameter of the sheave and increased as necessary to limit the allowable lateral tilt of the sheave to a maximum of 6 degrees from the static position when passing a carrier with full design load.

The design shall incorporate provision for adjustment to control the position of the haul rope entering the terminal sheave.

ANSI B77, Section 4.1.4.4.2 Cabin
Fully enclosed passenger cabins shall be ventilated. They shall be equipped with doors that fill the entire entrance opening. The minimum clearance width opening shall be 32 inches (815 mm). Each door shall be provided with a lock located in such a manner that it can be unlocked only by authorized persons or by automatic means.

The horizontal gap between the cabin door opening floor edge and platform edge shall not be greater than 1 inch (25.4mm). The height of the cabin floor and the platform shall be within ± ½ inch (±12.7mm). Where it is not operationally or structurally practical to meet these requirements, platform devices, vehicle devices, system devices, or bridge plates shall be provided for independent loading.

All windows shall be of shatter-resistant material.

Means of emergency evacuation of passengers shall be provided.

The maximum capacity of each cabin, both in pounds and kilograms and number of passengers, shall be posted in a conspicuous place in each cabin (see Annex D).

The minimum clear floor space in accessible cabins shall be 48 inches by 30 inches (1220 mm X 760 mm). Where special accessible cabins are used, [it is recommended] the waiting interval shall [should] not exceed 10 minutes.

All carriers shall be clearly identified with numbers located on each end of each carrier. Semi-open carriers shall meet applicable requirements for enclosed cabins and open chairs.

ANSI B77, Section 4.1.4.5.4 Chair safety details
Each chair shall be equipped with a railing at each side, to a height of not less than 4 inches (100 mm) above the seat for a distance of not less than 12 inches (305 mm) from the back of the seat.

For aerial lifts operating primarily for skiers, the thickness of the chair seat front, including padding, shall not exceed 5 inches (125 mm) from the top of the seating surface to the bottom of the curl. Tilt back angle of the seat bottom [should] shall be a minimum of 7 degrees when loaded. Loaded shall mean an evenly distributed load using load test criteria. Provisions shall be made to keep the tails of skis from passing through and becoming trapped in open spaces between framework, safety restraints and chair seat underside.

[For aerial lifts operating primarily for foot passengers, each chair shall be equipped with a restraining device that will not open under forward pressure.] Each chair shall be equipped with a restraining device referred to as a restraint bar that will not open under forward pressure.

ANSI B77, Section 4.2.1.2 Location
All electrical power transmission wiring located near or proposed to cross over aerial lifts shall comply with the applicable requirements of IEEE C2-2002. No aerial lift shall pass under any transmission line operating at a potential exceeding 50 volts.

ANSI B77, Section 4.2.13.3 Location
Lights shall be mounted on substantial poles or standards. Aerial lift towers and terminal structures may be used for supporting lights subject to the following requirements:

> a) Approval shall be obtained from a Qualified Engineer; Approval of a Qualified Engineer is not required for lights installed on towers prior to 1995, and is in compliance with AV-39.

b) The service conductors to each aerial lift tower or terminal structure shall be underground or in rigid raceways. No wiring shall be supported between towers and no open wiring shall pass over or under the aerial lift;

c) A separate enclosed disconnect or circuit breaker shall be required for each tower or terminal structure;

d) All metallic raceways on a tower or terminal structure shall be grounded;

e) The lighting installation shall not conflict with other requirements of this standard and shall not interfere with operations of the aerial lift in any manner.

ANSI B77, Section 4.3.1.2 Signs. See normative Annex D for public sign requirements. The requirements of Annex D shall only be required for lifts installed after the effective date of this standard. Lifts installed prior to the effective date of this standard may comply with Annex D of this standard or with the signage requirement of the 2003 edition of Code Rule 32-4.53.

See 4.2.1.3 for electrical wirings.

The sign "Personnel Working on Lift – Do Not Start" or a similar warning sign shall be posted as required by 4.2.10.

ANSI B77, Section 4.3.2.1.2 Operators
An operator shall be in charge of each aerial lift. This operator shall be trained and experienced in normal operational and emergency procedures, and such training shall be documented.
Operators shall be at least 18 years of age.

ANSI B77, Section 4.3.2.5.7 Evacuation
The owner of each aerial lift shall submit to the Commissioner a detailed written plan for evacuation of passengers from cabins or carriers in the event of a power failure or breakdown. The procedures set forth in the evacuation plan shall be tested, at any location on the lift, in the presence of the Commissioner at his request. The Commissioner, when satisfied with the evacuation plan and the results of the test, shall notify the owner in writing of such acceptance. A copy of the accepted plan shall be kept on the premises and shall be readily available to the Commissioner's representative. [A plan for evacuation of passengers from each aerial lift shall be developed and documented.] The plan shall include:

a) The definition of the line of authority in the event of an evacuation. This line of authority shall list:

1) the individuals or positions responsible for determining the need for an evacuation;

2) the individuals or positions responsible for ordering an evacuation;

3) the individuals or positions responsible for performing the evacuation, for first aid, and for ground care of evacuated passengers;

b) a description of the equipment necessary for evacuation and where it will be stored;

c) provisions for adequate training in the functions performed in the evacuation process at least once each operating season. Such drills are to be recorded in the operational log of each aerial lift (see 4.3.5.1);

d) a statement that sufficient number of experienced evacuation personnel will be readily available to evacuate the entire lift within 2 hours of the lift stoppage and any conditions which might cause this time to be exceeded; [an estimate of the time necessary for the total evacuation of each aerial lift;]

e) a description of unusual terrain conditions and how each of these conditions will be dealt with during an evacuation;

f) an estimate of when the evacuation should begin in the event the aerial lift becomes inoperable;

g) provisions for communications with passengers of an inoperable aerial lift, the frequency of such communication, how soon after the aerial lift becomes inoperable such communication to the passengers will start, and the frequency of communications thereafter;

h) the methods of evacuation to be used for the typical passenger, incapacitated passenger, passengers using common adaptive ski equipment, and non-ambulatory passengers;

i) provisions for communication with the evacuation teams;

j) provisions for suspending the evacuation in the event that the aerial lift is made operable during the evacuation;

k) provisions for control and assistance of evacuated persons until released;

l) provisions for a post-evacuation report available for review by the Commissioner.

m) A special separate written evacuation plan shall be provided when the aerial lift is used primarily for foot passengers such as for sight seeing or amusement rides. This plan shall include a specific outline for the evacuation of the very old and/or very young, including babes in arms.

All nonmetallic rope used for evacuation shall be of nylon or polyester (Dacron) fiber of either laid or braided construction. Laid rope of nylon shall be of a hard lay. These ropes shall be either of a static rescue type or a dynamic mountaineering type. Breaking strength, when new, shall be at least 15 times the maximum expected operating load but in no case less than [4000] 5000 pounds ([17.8] 22.3 kilonewtons). No natural fiber or polypropylene ropes shall be used.

These ropes shall be carefully stored when not in use and shall be examined after each completed aerial lift evacuation and prior to each season of operation, both summer and winter, to ascertain that they are in satisfactory condition.

Carabiners, if used, shall be of the locking type.

ANSI B77, Section 4.3.2.5.9 Bypass requirements
The use of temporary circuits that have been installed for the purpose of bypassing failed electrical circuit(s) (see 4.2.6) shall meet these requirements in the following order:

a) The condition that the circuit indicated is in default shall be thoroughly inspected to ensure an electrical operating circuit malfunction, rather than the indicated condition, actually exists;

b) The bypass shall be authorized only by the aerial lift supervisor or his/her designated representative;

c) When a bypass is in operation, the function bypassed shall be under constant, close visual observation;

d) The use of a bypass circuit shall be logged and shall indicate when, who authorized, and for what duration a bypass was used;

e) The operator control panel shall indicate that a bypass is in use.

f) When a required aerial lift control circuit is bypassed, all passengers shall be off loaded and no passengers other than maintenance personnel being transported to the repair site shall be allowed to board the lift until the malfunction is corrected.

ANSI B77, Section 4.3.3.3 Rope grips
The initial installation and each relocation of a clamptype grip shall be field-checked by a method established by the designer to provide assurance that the requirement of the first sentence of 4.1.4.3.2 has been met and that the maximum slippage resistance is not exceeded. All grips shall be moved at least once every [24] 12 calendar months. The grips [should] shall be moved a uniform distance each time and in the same direction. A grip [should] shall never be installed or allowed to migrate closer than a distance of 20

haul rope diameters from a splice tuck or rope repair tuck. The designer's instructions shall be followed if they are more restrictive than these requirements. Movements shall be recorded in the maintenance records (see 4.3.5.2 and 4.3.5.3).

As each grip is relocated, the haul rope shall be examined for deterioration at or near the grip location. The initial location and each subsequent relocation shall be marked by a spray paint or other marking on the rope to identify slippage. A Qualified Engineer shall supply information to the operator to enable him/her to identify excessive slippage.

ANSI B77, Section 5.1.1.6.2 Foundations
In determining the resistance of the soil to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage [should] shall be designed as a gravity anchor, using a coefficient of friction appropriate to the general character of the soil. Bottoms of foundations shall be below the normal frost depth unless resting on non-frost susceptible soil or solid rock. Foundations on rock shall be firmly anchored to solid rock, unless designed as gravity foundations.

The top of concrete foundations shall not be less than 6 inches (150 mm) above finished grade unless specific direction for the protection of the foundation and structural steel below grade is specified by the designer.

The design shall have a minimum factor of safety of 2 in resisting overturning and, concurrently, 2 against sliding, under dead load and live-load conditions. The minimum factors shall be 1.5 under these loadings plus wind acting simultaneously.

ANSI B77, Section 5.1.1.7 Communications
A permanently installed two-way voice communication system shall be provided between the prime mover control point, drive machinery building if any, loading stations, and unloading stations. The communication system shall be functional and audible during operation. (see 5.2.5(c)). On lifts installed prior to 1995 radiophones or suitable public address systems may be used.

Audio indicators shall be audible over all ambient noise levels, and visual indicators (e.g., Light Emitting Diodes) shall be visible even in bright sunlight.

> NOTE – Voice communication systems are not required for those surface lifts qualifying for operation by a single operator, as defined in 5.3.2.2.

ANSI B77, Section 5.1.1.9.1 Loading areas
The loading area length, profile, and loading point shall be installed according to the surface lift's speed, terminal sheave location, and carrier type to provide a smooth transition from standing, to the towing device pulling the passenger, at full line speed. Load gates, artificial surfaces, and other loading aids when used shall be designed and installed with regards to all passengers including adaptive. At least one point of access to

the lift shall have a minimum clearance width of 36 inches (915 mm) to accommodate passengers using adaptive equipment.

Approach paths to the loading zone shall be approximately level or slightly downgraded to facilitate passengers moving to the loading point. The approach paths shall be such that waiting passengers have a view of the loading area. The maze or corral area shall be approximately level, free of obstructions and marked, roped, or fenced in a manner to guide passengers to the "Wait Here" and "Load Here" markers. The maze or corral [should] shall be as straight as practical.

The "Wait Here" point shall be marked. This marker shall be located to provide horizontal clearance between passengers and passing towing devices.

The loading point shall be marked as to where passengers are to stand using a loading marker located in/on the platform/snow surface.

ANSI B77, Section 5.1.1.11.1 Acceptance inspection
Before a surface lift that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given a thorough inspection by [qualified personnel] the Commissioner to verify compliance with the plans and specifications of the designer.

(b) *ANSI B77, Section 5.1.1.11.2 Acceptance tests*
Before a surface lift that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given thorough tests by qualified personnel to verify compliance with the plans and specifications of the designer. The designer or manufacturer shall propose and submit an acceptance test procedure. The Commissioner shall be advised by the Owner 10 days prior to the date of the test.

ANSI B77, Section 5.1.2.8.1 General
All sheaves, including their mountings and frames, shall be designed to withstand static and dynamic loads. Sheave bearings and mountings shall be selected, designed, and installed in accordance with the recommendations of the manufacturers of the bearings. When unlined sheave grooves are used for wire rope, they [should] shall be V-shaped and shall have rounded bottoms with a radius equal to approximately 55% of the rope diameter.

When lined sheave grooves are used, the allowable bearing pressures of the liner material shall not be exceeded.

ANSI B77, Section 5.1.3.3.4 Additional requirements
When single sheaves are used for other than guide sheaves, which normally carry no load other than the weight of the rope and towing devices, the sheave diameter [should] shall not be less than 20 times the nominal rope diameter. The sheaves for the return rope shall be installed in a manner to prevent a passenger from contacting the rope or being hit by

one of the returning towing devices. All line sheaves shall be so guarded that towing devices cannot become entangled in the sheaves or sheave supports while traveling in either a forward or reverse direction.

ANSI B77, Section 5.1.4.3.2 Slippage
The rope grip shall be designed and installed so as to resist a force which tends to slide it along the haul rope, and which is a minimum of 2 times the force required to move a carrier along a properly lubricated haul rope at its steepest incline, under the most adverse conditions of carrier loading.

The grip designer shall specify the proper grip installation and testing procedures, and for clamping type grips, the minimum force below which the grip [should] shall not slip on the rope and a maximum force above which the grip should slip on the rope.

ANSI B77, Section 5.1.4.3.3 Strength
The strength of the grip shall be based upon the following criteria:

a) A minimum factor of safety of 6 shall exist in all parts of the grip wherein stress is proportional to the dead and live load of the carrier. This factor of safety is defined as follows: With the grip in its operating position (gripping the rope or equivalent), a downward load, equal to the dead load of the carrier plus 6 times the design live load, shall not cause any part of the grip to fail;

b) Those parts whose stress is not changed by application of live load shall be designed on the basis of an allowable stress of not more than the yield point divided by 3.0. In the design of springs, where used, the allowable stress may be increased if load tests are conducted by an approved testing laboratory to provide assurances that the fatigue life of the actual spring is more than ample for the various applied loads;

c) The material of which the grip is made shall be selected or selected and treated to obtain optimum impact resistance;

d) Special attention shall be paid to fatigue considerations. A grip that has not been proved in service [should] shall be subjected to fatigue tests.

The manufacturer's quality control provision shall assure that the grips and their parts meet the designer's specifications and the foregoing criteria.

ANSI B77, Section 5.1.4.4.4 Towing Devices for Recreational Devices
The connection between the towing device and a recreational device shall be designed to minimize inadvertent detachment due to line surges including stops and starts and [should] shall not be detached by passenger movements without their reaching the towing device.

The designer shall specify the following relative to any towing device:

a) The allowable loading to which the towing device may be subjected;

b) the specifications relating to how the towing device is to be used, (i.e. if it is designed for use with a recreational device.);

c) the characteristics of the connection details appropriate for the connection of the recreational device to the towing device.

ANSI B77, Section 5.3.1.2 Signs
See normative Annex D for public sign requirements. The requirements of Annex D shall only be required for lifts installed after the effective date of this standard. Lifts installed prior to the effective date of this standard may comply with Annex D of this standard or with the signage requirement of the 2003 edition of Code Rule 32-5.53.

See 5.2.1.3 for electrical warnings.

The sign "Personnel Working on Lift - Do Not Start" or a similar warning sign shall be posted as required by 5.2.10.

ANSI B77, Section 5.3.2.2 Minimum operating personnel
The following personnel are the minimum that shall be required:

a) an operator who shall be in charge of each surface lift;

b) one attendant who shall be on duty at each loading area;

c) one attendant who shall be on duty at each unloading area.

NOTE – An operator may serve concurrently as an operator and an attendant at a loading or unloading area that may be adjacent to the operator's station unless the duties of that area preclude his/her maintaining reasonable surveillance of the entire surface lift operation.

The above regulations for minimum operating personnel may be modified in the following cases:

d) Surface lifts may be operated with a single operator at the loading station provided the following conditions are met:

1) The length of the surface lift, measured from the loading area to the stop gate, shall not exceed 800 feet (244 meters);

2) The entire tow path and the entire haul rope system shall be visible to the operator;

3) The surface lift shall have a clearly identified stop switch located at the unloading area, in addition to the required stop gate;

4) The operator shall have all surface lift controls immediately available;

5) The restarting of the surface lift following actuation of an automatic or manual stopping device shall be impossible until clearance is assured and the automatic or manual stopping device(s) has been reset by an authorized person;

6) There shall be no obstructions at the top bull wheel area that could come into contact with a passenger who might fail to unload.

[e) Surface lifts provided with television surveillance of sections of the tow path and designated unloading stations not visible to the operator do not require an unloading attendant, provided conditions (3) through (6) are enforced and the unloading areas of the surface lift meet the requirements of 5.1.1.9.

NOTE – When specifically approved, platter lifts with single passenger hangers do not require either an unloading attendant or television surveillance providing conditions (3) through (6) are enforced and the unloading area of the platter lift meets all manufacturer's design specifications.]

ANSI B77, Section 5.3.2.5.9 Bypass requirements
The use of temporary circuits that have been installed for the purpose of bypassing failed electrical circuit(s) (see 5.2.6) shall meet these requirements in the following order:

a) The condition that the circuit indicated is in default shall be thoroughly inspected to ensure an electrical operating circuit malfunction, rather than the indicated condition, actually exists;

b) The bypass shall be authorized only by the surface lift supervisor or his/her designated representative;

c) When a bypass is in operation, the function bypassed shall be under constant, close visual observation;

d) The use of a bypass circuit shall be logged and shall indicate when, who authorized, and for what duration a bypass was used;

e) The operator control panel shall indicate that a bypass is in use.

f) <u>When a required surface lift control circuit is bypassed, all passengers shall be off loaded and no passengers other than maintenance personnel being transported to the repair site shall be allowed to board the lift until the malfunction is corrected.</u>

ANSI B77, Section 5.3.3.3.1 Fixed rope grips – Additional requirements
All fixed grips shall be moved at least once every 24 calendar months. The grips [should] shall be moved a uniform distance each time and in the same direction. A fixed grip [should] shall never be installed or allowed to migrate closer than a distance of 20 haul rope diameters from a splice tuck or rope repair tuck. The designer's instructions shall be followed if they are more restrictive than these requirements. Movements shall be recorded in the Maintenance records (see 5.3.5.2 and 5.3.5.3).

As each grip is relocated, the haul rope shall be examined for deterioration at or near the grip location. A Qualified Engineer shall supply information to the owner to enable him/her to identify excessive slippage.

ANSI B77, Section 6.1.1.6.2 Foundations
In determining the resistance of the soil to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage [should] shall be designed as a gravity anchor, using a coefficient of friction appropriate to the general character of the soil. Bottoms of foundations shall be below the normal frost depth unless resting on non-frost susceptible soil or solid rock. Foundations on rock shall be firmly anchored to solid rock, unless designed as gravity foundations.

The top of concrete foundations shall not be less than 6 inches (150 mm) above finished grade unless specific direction for the protection of the foundation and structural steel below grade is specified by the designer.

The design shall have a minimum factor of safety of 2 in resisting overturning and, concurrently, 2 against sliding, under dead-load and live-load conditions. The minimum factors shall be 1.5 under these loadings plus wind acting simultaneously.

ANSI B77, Section 6.1.1.7 Communications
A permanently installed two-way voice communication system shall be provided between the prime mover control point, drive machinery building if any, loading stations, and unloading stations. The communication system shall be functional and audible during operation. On lifts installed prior to 1995, radiophones or suitable public address systems may be used.

Audio indicators shall be audible over all ambient noise levels, and visual indicators (e.g., Light Emitting Diodes) shall be visible even in bright sunlight.

> NOTE – Voice communication systems are not required for those tows qualifying for operation by a single operator, as defined in 6.3.2.2.

ANSI B77, Section 6.1.1.9.2 Unloading areas

The unloading areas length, profile, and exit pathway shall be installed in accordance with the tow's speed, usage and manufacturer's recommendations. The exit pathway [should] shall be inclined downward in the direction of travel and outward from the line of the uphill tow path to provide passenger movement away from the tow.

ANSI B77, Section 6.1.1.11.1 Acceptance inspection
Before a tow that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given a thorough inspection by [qualified personnel] the Commissioner to verify compliance with the plans and specifications of the designer.

ANSI B77, Section 6.1.1.11.2 Acceptance tests
Before a tow that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given thorough tests by qualified personnel to verify compliance with the plans and specifications of the designer. The designer or manufacturer shall propose and submit an acceptance test procedure. The Commissioner shall be advised by the Owner 10 days prior to the date of the test.

ANSI B77, Section 6.1.2.8.1 General
All sheaves, including their mountings and frames, shall be designed to withstand static and dynamic loads. Sheave bearings and mountings shall be selected, designed, and installed in accordance with the recommendations of the manufacturers of the bearings. When unlined sheave grooves are used for wire rope, they [should] shall be V-shaped and shall have rounded bottoms with a radius equal to approximately 55% of the rope diameter.

When lined sheave grooves are used, the allowable bearing pressures of the liner material shall not be exceeded.

ANSI B77, Section 6.1.4.3 Towing devices
Rope grippers for skiers shall not be permitted. Towing devices shall be allowed on tows operating at 400 feet per minute (2.0 meters per second) or less.

Towing devices shall be designed to prevent sliding along the haul rope when subject to twice the pull required to move a passenger along the tow path at the steepest point. The towing device shall be designed to preclude entangling gloves or clothing, or pinching fingers between the towing device and the haul rope. Attaching the towing device to the haul rope shall in no way impair the strength of the haul rope.

The connection between the towing device and a recreational device shall be designed to minimize inadvertent detachment due to line surges including stops and starts and [should] shall not be detached by passenger movements without their reaching the towing device.

The designer shall specify the following relative to any towing device:

a) The allowable loading to which the towing device may be subjected;

b) The specifications relating to how the towing device is to be used, i.e. if it is designed for use with a recreational device;

c) The characteristics of the connection details appropriate for the connection of the recreational device to the towing device.

ANSI B77, Section 6.2.1.2 Location
All electrical power transmission wiring located near or proposed to cross over tows shall comply with the applicable requirements of IEEE C2-2002. No aerial lift shall pass under any transmission line operating at a potential exceeding 50 volts.

ANSI B77, Section 6.3.1.2 Signs. See normative Annex D for public sign requirements. The requirements of Annex D shall only be required for lifts installed after the effective date of this standard. Lifts installed prior to the effective date of this standard may comply with Annex D of this standard or with the signage requirement of the 2003 edition of Code Rule 32-6.53.

See 6.2.1.3 for electrical wirings.

The sign "Personnel Working on Lift – Do Not Start" or a similar warning sign shall be posted as required by 6.2.10.

ANSI B77, Section 6.3.3.3 Additional requirements for towing devices
All wire rope towing devices shall be moved at least once annually. The towing devices [should] shall be moved a uniform distance each time and in the same direction. The designer's instructions shall be followed if they are more restrictive than these requirements. Movements shall be recorded in the maintenance records (see 6.3.5.3).

As each towing device is relocated, the haul rope shall be examined for deterioration at or near the towing device location.

ANSI B77, Section 7.1.1.3.1 Conveyor gradient
The maximum grade of a conveyor shall be maintained within the design limits. In no case shall the conveyor belt grade exceed 40 percent.

ANSI B77, Section 7.1.1.6 Structures and foundations
All structures and foundations shall be designed and constructed in conformance with 1.3 and shall be appropriate for the site. Applied design loads shall include dead, live, snow, wind and dynamic loads due to normal conditions and for foreseeable abnormal conditions.

Structures and foundations located in snow creep areas shall be designed for such conditions and loads, or protective. A minimum live load of 100 lbs/ft^2 (488 kg.m^2) shall be used.

ANSI B77, Section 7.1.1.6.2 Foundations
In determining the resistance of the soil to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage [should] shall be designed as a gravity anchor, using the coefficient of friction appropriate to the general character of the soil. Foundations on rock shall be firmly anchored to solid rock, unless designed as gravity foundations.

The top of concrete foundations shall not be less than 6 inches (150 mm) above finished grade unless specific direction for the protection of the foundation and structural steel below grade is specified by the designer.

The design shall have a minimum factor of safety of 2 in resistance to overturning and, concurrently, 2 against sliding, under dead-load and live-load conditions; the minimum factors shall be 1.5 under these loadings plus wind acting simultaneously.

ANSI B77, Section 7.1.1.11.1 Acceptance inspection
Before a conveyor that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given a thorough inspection by [qualified personnel] the Commissioner to verify compliance with the plans and specifications of the designer.

ANSI B77, Section 7.1.1.11.2 Acceptance tests
Before a conveyor that is new or relocated or that has not been operated for routine maintenance within the previous 2 years is opened to the public, it shall be given thorough tests by qualified personnel to verify compliance with the plans and specifications of the designer. The designer or manufacturer shall propose and submit an acceptance test procedure. The Commissioner shall be advised by the Owner 10 days prior to the date of the test.

ANSI B77, Section 7.2.1.2 Location
All electrical power transmission wiring located near or proposed to cross over conveyors shall comply with the applicable requirements of IEEE C2-2002. No conveyor shall pass under any transmission line operating at a potential exceeding 50 volts.