

Lasers

Part 50 of Title 12 of the Official Compilation of Codes, Rules, and Regulations of the State of New York (Cited as 12 NYCRR 50)



As Amended

Effective March 2, 1994

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Part 50

LASERS

(Statutory authority: Labor Law, §§27, 27-a, 29, 200; General Business Law, §§482, 483, 484)

Sec.

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Historical Note: Part (§§50.1-50.23) filed July 14, 1972; amd. filed Feb. 14, 1994 eff. March 2, 1994. Amended statutory authority.

§ 50.1 Findings of fact.

The board finds that certain industries, trades, occupations and processes involving the use or presence of lasers involve elements of potential danger to the lives, health and safety of persons employed therein. The board finds, therefore, that special regulations are necessary for the protection of such persons in that lasers emit infrared, visible or ultraviolet coherent light which may have the property of producing deleterious effects upon the human body and within the human eye and in that other hazards associated with lasers may be present.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.2 Application.

(a) *General* Except as herein provided, this Part (rule) shall apply throughout the State of New York to every person subject to the jurisdiction of the Labor Law who, in any industry, trade, occupation or process, transfers, receives, possesses or uses any laser while such laser is free from and not subject to the regulatory powers and jurisdiction of the New York State Department of Health or the New York City Department of Health. This Part (rule) also applies to every person subject to the jurisdiction of the Labor Law who, in any industry, trade, occupation or process, engages in the installation, testing or servicing of any such laser or laser equipment that may result in the exposure of such person to laser radiation and other hazards associated with lasers.

(b) *Human use.* Nothing in the Part (rule) shall be construed as limiting the use of lasers in the healing of humans when done by or under the supervision of an individual licensed to practice medicine in the State of New York.

(c) *Animal use.* Nothing in this Part (rule) shall be construed as limiting the use of lasers in the healing of animals when done by or under the supervision of an individual licensed to practice veterinary medicine in the State of New York.

(d) *Federal statute.* Nothing in this Part (rule) effects requirements promulgated pursuant to any Federal statute and applicable in the State of New York.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.3 Specific exemptions.

The transfer, receipt, possession or use of lasers under the following conditions shall be exempt from the requirements of this Part (rule):

(a) *Exemption No. 1.* Lasers during the time period of their storage, shipment or sale when such equipment is not readily capable of emitting laser radiation. However, the laser labeling requirements of this Part (rule) shall apply during such time periods.

(b) *Exemption No. 2.* Lasers which by reason of their design and construction cannot emit radiation that exceeds 1×10^{-7} joules/cm² or 1×10^{-5} watts/cm² when measured 10 centimeters from the exterior surfaces of such lasers. This exemption does not apply to the testing or servicing of such laser during their production or repair.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.4 Definitions.

As used herein or in connection with this Part (rule), the following terms mean:

(a) *Angstrom (A).* A unit of length used mainly to expressing length of electromagnetic waves. An Angstrom is equal to 10^{-10} meter, 10^{-8} centimeter or 10^{-4} micron.

(b) *Approved.* In respect to a device or material: in compliance with an existing resolution of approval adopted by the commissioner; in respect to action by the commissioner: made the subject of a resolution of approval.

(c) *Beam divergence.* The full angle of laser beam spread usually measured at the half power points in radians or milliradians.

(d) *Certificate of competence.* A document issued to the operator of a mobile laser by the commissioner in accordance with the provisions of this Part (rule).

(e) *Certified mobile laser operator.* Any individual holding a valid certificate of competence issued by the commissioner in accordance with the provisions of this Part (rule).

(f) *Closed installations.* Any installation where lasers are used and the entry to which is controlled while any laser therein is being operated.

(g) *Commissioner.* The Commissioner of Labor of the State of New York or his duly authorized representative.

(h) *C.W. laser.* A continuous wave laser.

(i) *Designated individual.* An individual selected and directed by a laser safety officer to supervise the operation of a laser.

(j) *Employee.* An individual employed; one who works for wages or salary in the service of another.

(k) *Energy density.* The energy per unit area expressed in the units of joules per square centimeter. (J/cm²).

(l) *Gas laser.* A type of laser in which the lasing action occurs in a gas medium, such as a helium-neon mixture.

(m) *High-intensity laser.* A laser with an output energy or power density that exceeds the values listed in Table 3 of section 50.23 of this Part (rule).

(n) *Individual.* Any human being.

(o) *Irradiance.* An expression for incident power density.

(p) *Joule (J).* A unit of energy equal to 10^7 erg or one watt-second.

(q) *Joule per square centimeter (J/cm²).* The energy per unit area and a unit of energy density and radiant exposure.

(r) *Laser*. An acronym for light amplification by stimulated emission of radiation, also referred to as an optical maser.

(s) *Laser installation*. Any location where, for a period of more than 30 days, one or more lasers are used or operated. The confines of a laser installation shall be designated by the owner of such installation. An entire building or other structure, a part thereof or a plant may be designated as a laser installation. For the purposes of this Part (rule), a construction site shall not be considered a laser installation.

(t) *Laser radiation area*. Any area containing one or more high- or low-intensity lasers and the access to which is controlled for the purpose of protecting individuals from exposure to laser radiation.

(u) *Laser safety officer*. An individual, designated at a particular laser installation or for a particular mobile laser, who is qualified by training and experience in the occupational and public health aspects of lasers to evaluate the radiation hazards of such laser installation or mobile laser and who is qualified to establish and administer a laser radiation protection program for such laser installation or mobile laser.

(v) *Low-intensity laser*. A laser with an output energy or power density at any point along the path of the laser beam to which the eye may be exposed which is less than or equal to the values listed in Table 3 of section 50.23 of this Part (rule).

(w) *Maser*. An acronym for microwave amplification by the stimulated emission of radiation. A maser emits microwave radiation instead of light.

(x) *Maximum permissible energy density for corneal and skin exposure*. The energy density of laser radiation from a pulsed laser which, in accordance with present medical knowledge, is not expected to cause detectable corneal or other bodily injury to an individual at any time during his lifetime. The maximum permissible levels are listed in Tables 1 and 2 of section 50.23 of this Part (rule).

(y) *Maximum permissible power density for corneal and skin exposure*. The power density of laser radiation from a C.W. or pulsed laser which, in accordance with present medical knowledge, is not expected to cause detectable corneal or other bodily injury to an individual at any time during his lifetime. The maximum permissible levels are listed in Tables 1 and 2 of section 50.23 of this Part (rule).

(z) *Mobile laser*. A laser which is used or operated outside a laser installation.

(aa) *Nanometer (nm)*. A unit of length equal to 10^{-9} meter, 10^{-7} centimeter, 10^{-3} micron or 10 Angstroms. The nanometer is gradually replacing the Angstrom as the unit of measurement of electromagnetic wave lengths.

(bb) *Optical density (O.D.)*. A number equal to the common logarithm (base 10) of the attenuation afforded by a filter.

(cc) *Optically pumped lasers*. Types of lasers that derive energy from high-intensity light sources, such as xenon flash lamps.

(dd) *Output energy*. The energy emitted by a laser. This term is used to evaluate pulsed lasers.

(ee) *Output power*. Laser output defined by energy per unit time. This term is used to evaluate continuous wave lasers.

(ff) *Owner*. Any person conducting the business or activities carried on within a laser installation or with a mobile laser and having by law the administrative control of a laser, whether as owner, lessee, contractor or otherwise.

(gg) *Person*. Any of the following: an individual; a corporation; a partnership; or a firm.

(hh) *Power density*. The power per unit area usually expressed in watts per square centimeter (w/cm^2).

(ii) *Pulsed laser*. A laser that delivers its energy in pulses of short duration.

(jj) *Pulse length*. The duration of a pulsed laser flash measured in units of milliseconds (msec) which equals 10^{-3} second, microseconds (μsec) which equals 10^{-6} second, nanoseconds (nsec) which equals 10^{-9} second or picoseconds (psec) which equals 10^{-12} second.

(kk) *Pulsed re-occurrence frequency (P.R.F.)*. The frequency of occurrence of laser pulses in units of pulses per second. Pulsed re-occurrence frequency is also referred to as pulsed repetition frequency or rate.

(ll) *Q-switching, Q-spoiling*. A technique used to obtain extremely high peak powers for very short durations from pulsed lasers.

(mm) *Radiant exposure*. An expression for incident energy density.

(nn) *Repetitive pulse laser*. A pulsed laser with re-occurring pulsed output.

(oo) *Research and development*.

(1) Theoretical analysis, exploration or experimentation; or

(2) The extension of investigative findings and theories of a scientific or technical nature into practical application for experimental, demonstrative and specialized purposes including the experimental or limited production and testing of models, devices, equipment, materials and processes involving the use of lasers.

(pp) *Semi-conductor or junction laser*. A type of laser in which the lasing action occurs in a semi-conductor, such as gallium arsenide. Such semi-conductors are sometimes cooled to cryogenic temperatures for more efficient operation.

(qq) *Shall*. The word "shall" is always mandatory.

(rr) *Shield*. An enclosure for a laser, a laser beam and/or a target. Typical laser shielding materials are rigid plastics, metals, opaque ceramics and light-impervious cloth. The term applies to a radiation shield, an explosion shield or to a combination radiation and explosion shield.

(ss) *Specular or regular reflection*. Mirror-like reflection.

(tt) *Survey*. An evaluation of the laser radiation hazards incident to the production, use, disposal, servicing or presence of any laser including, if appropriate, a physical evaluation of the laser installation or mobile laser and the measurement of laser output and reflected laser radiation.

(uu) *Trainee*. An individual, at least 18 years of age, who is being trained in the proper and safe use and operation of lasers.

(vv) *Uncontrolled area*. Any area the access to which is not controlled for the purpose of protecting individuals from exposure to any laser radiation and any area used as residential quarters.

(ww) *Watt (w)*. A unit of power.

(xx) *Watt per square centimeter (w/cm²)*. The power per unit area and a unit of power density and irradiance.

Historical Note: Sec. filed July 14, 1972; amd. filed Feb. 14, 1994 eff. March 2, 1994.

§ 50.5 Responsibility of employers.

Every employer or owner shall effect compliance with the provisions of this Part (rule) relating to laser radiation and other associated hazards. No employer or owner shall suffer or permit any individual to be exposed to laser radiation above the maximum permissible levels specified in Tables 1 and 2 of section 50.23 of this Part (rule) or to other associated hazards without such individual wearing the personal protective equipment required by this Part (rule).

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.6 Responsibility of employees.

Every employee shall properly use the protective equipment provided for his protection and shall comply with all the provisions of this Part (rule) relating to his personal conduct.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.7 Approval of low-intensity lasers required.

(a) After January 1, 1973, any low-intensity laser used or operated in New York State, except for any such laser used exclusively in research and development, shall be approved. For purposes of this Part (rule), lasers certified pursuant to 21 *Code of Federal Regulations*, part 1010, section 1010.2 as Class I, Class IIa, Class II and Class IIIa laser products as defined in 21 *Code of Federal Regulations*, part 1040, section 1040.10(b) (5)-(8), are considered approved.

(b) Approved low-intensity lasers are exempt from the registration requirement of section 50.8 of this Part (rule) but such lasers and their use shall be in compliance with other applicable provisions of this Part (rule). Low-intensity lasers used exclusively in research and development are not exempt from the registration requirement of section 50.8 of this Part (rule) and are not exempt from the other applicable provisions of this Part (rule).

Historical Note: Sec. filed July 14, 1972; amd. filed Feb. 14, 1994 eff. March 2, 1994. Amended (a).

§ 50.8 Registration of laser installations and mobile lasers.

All laser installations and mobile lasers, including low-intensity lasers used exclusively in research and development, shall be registered with the commissioner at such times and on such forms as prescribed by him. After August 1, 1972, such registration shall be made prior to receipt or assembly of any laser. Laser installations and mobile lasers in use on or before August 1, 1972 shall be registered within 90 days after August 1, 1972.

Exception: Laser installations and mobile lasers utilizing approved low-intensity lasers exclusively are exempt from this registration requirement.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.9 Certificate of competence required by operators of mobile lasers.

(a) *General.* No individual shall operate, nor shall any person or employer designate any individual to operate, any mobile laser unless such individual holds a valid certificate of competence which has been issued by the commissioner in accordance with the provisions of this Part (rule).

Exception: (1) Professional engineers and land surveyors licensed to practice in the State of New York.
(2) Operators of mobile lasers used exclusively in research and development.

(b) *Categories of certificates of competence.* There shall be two categories of certificates of competence issued to operators of mobile lasers, as follows:

(1) Class A certificates. The holder of a Class A certificate of competence may operate any low-intensity mobile laser.

(2) Class B certificates. The holder of a Class B certificate of competence may operate any high-intensity or low-intensity mobile laser.

(c) *Application forms and photographs.* An application for a certificate of competence or for a renewal thereof shall be made on forms provided by the commissioner. Along with such application forms, every applicant shall submit photographs of himself in such numbers and sizes as the commissioner shall prescribe. Such photographs shall have been taken within 30 days of such submission.

(d) *Physical condition.* No person suffering from an uncontrolled physical handicap or illness, such as epilepsy, heart disease, or from an uncorrected defect in vision or hearing, which might diminish his competence in the operation of laser equipment, shall be certified by the commissioner.

(e) *Age and experience required.* (1) Every applicant for a certificate of competence shall be at least 18 years of age.

(2) Every applicant for a certificate of competence shall have at least one year of practical experience in the operation of a laser. Such required experience may be obtained by a trainee who is designated by and working under the direct personal supervision of an individual permitted by this Part (rule) to operate such mobile laser equipment. Such experience shall include a knowledge of laser safety precautions and shall be acceptable to the commissioner. The commissioner may waive the one-year experience requirement if the applicant submits evidence of his successful completion of a laser operator training course acceptable to the commissioner.

(f) *Examining board.* (1) The commissioner shall appoint an examining board which shall consist of at least three members. At least one member of such board shall hold a valid Class B certificate of competence to operate a mobile laser.

(2) The members of such examining board shall serve at the pleasure of the commissioner and their duties shall include:

(i) The examination of applicants and their qualifications and the making of recommendations to the commissioner with respect to the experience and competence of such applicants.

(ii) The holding of hearings regarding appeals following denials of certificates.

(iii) The holding of hearings prior to determinations of the commissioner to suspend or revoke certificates or to refuse to issue renewals of certificates.

(iv) The reporting of findings and recommendations to the commissioner with respect to such hearings.

(3) The commissioner may designate panels to conduct such examinations and hearings on behalf of the examining board. Each such designated panel shall consist of at least three examining board members.

(4) The acts and proceedings of such examining board and of such panels shall be in accordance with regulations issued by the commissioner.

(g) *General examination required.* Each applicant for a certificate of competence shall, and each applicant for a renewal of such certificate may, be required by the commissioner to take an appropriate general examination.

Exceptions: The commissioner may issue a certificate of competence or a renewal thereof without examination of any kind to any applicant who:

(1) has successfully completed a four-year course of study at a college or university which included a study of lasers and laser safety precautions and such course is acceptable to the commissioner; or

(2) has filed an application for a certificate of competence prior to February 1, 1973 and has submitted along with such application evidence of adequate experience with lasers and with laser safety precautions and who, in the judgment of the commissioner, meets all other qualifications required for certification as a competent mobile laser operator.

(h) *Contents of a certificate of competence.* Each certificate of competence issued by the commissioner shall include the name and address of the certified mobile laser operator, a brief physical description and photograph of such operator for identification purposes.

(i) *Term of certificate of competence.* Each such certificate or renewal thereof shall be valid for three years from the date of issuance, unless such term is extended, suspended or revoked by the commissioner.

(j) *Carrying certificate.* Each certified mobile laser operator shall carry his certificate of competence on his person whenever he is working with or operating any mobile laser. Failure to produce such certificate upon request by the commissioner shall be considered presumptive evidence that the operator is not certified.

(k) *Certificate renewal.* An application for the renewal of a certificate of competence shall be filed with the commissioner not more than six months nor less than three months prior to the expiration date of the certificate sought to be renewed, except that the commissioner may alter such time limitation to prevent undue hardship to any certified mobile laser operator.

(l) *Suspension, revocation, refusal to renew and denial of certificates of competence; hearings.*

(1) The commissioner may, upon notice to the interested parties and after a hearing before the examining board, suspend or revoke a certificate of competence upon finding that the certified mobile laser operator is not an individual of proper competence, judgment or ability in respect to mobile laser operation or for other good cause shown.

(2) Prior to a determination by the commissioner not to renew a certificate of competence, the commissioner shall require that a hearing be held by the examining board concerning such renewal application and that a notice of such hearing be sent to every interested party.

(3) Any applicant whose application for a certificate of competence has been denied by the commissioner may, upon his written request to the commissioner, have a hearing before the examining board. Such written request shall be made within 30 days after receipt of the notice of denial.

(4) Where a hearing has been held in connection with the suspension, revocation, refusal to renew or denial of a certificate of competence, the examining board shall make its recommendation to the commissioner within three days after the conclusion of such hearing. A written notice of the commissioner's

decision, containing the reasons therefor, shall be forwarded promptly to the applicant or certified mobile laser operator, as the case may be, as well as to any interested party who appeared at the hearing.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.10 Maximum permissible exposure limits.

(a) No person shall operate any laser so as to cause the cornea of the eye of any individual to be exposed to laser radiation beyond the limits listed in Table 1 of this Part (rule).

(b) No person shall operate any laser so as to cause the skin of any individual to be exposed to laser radiation beyond the limits listed in Table 2 of this Part (rule).

(c) All high-intensity lasers shall be placed in shielded and interlocked enclosures or operated only in laser radiation areas.

Exceptions: (1) No such high-intensity laser need be enclosed, interlocked or operated in a laser radiation area if the commissioner is notified at least before such planned operation on a form prescribed by him. A laser safety officer or designated individual shall be continuously present when such laser is operating.

(2) When repairing or servicing a high-intensity laser, the commissioner need not be so notified. However, a laser safety officer or designated individual shall be present during any period of operation without shielding or without interlocks in service. Such laser safety officer or designated individual shall insure that adequate precautions are taken to protect all individuals against exposure to hazardous laser radiation.

(d) The laser radiation exposure values produced by scanned laser beams shall be determined when such beams are operating in the scanning modes, providing the devices containing the beams are designed and constructed so as to prohibit the beams from operating in non-scanning modes.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.11 Laser safety officer.

The owner of any laser installation or mobile laser shall designate a laser safety officer who shall establish and administer a laser radiation safety program which is in compliance with this Part (rule). The laser safety officer for a high-intensity mobile laser may be the certified operator of such laser. The laser safety officer for one or more low-intensity lasers at a given site or location may be a certified mobile laser operator (Class A). When a laser safety officer does not personally supervise the safety aspects of laser operation, he may designate another individual, who has been sufficiently instructed and trained by the laser safety officer in appropriate safety techniques, to personally supervise the operation of a laser. The laser safety officer or any individual he designates to supervise the safety aspects of laser operation may also operate laser equipment subject to the other applicable provisions of this Part (rule).

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.12 Personal protection.

(a) *General.* Each person who possesses a laser shall instruct and advise every individual employed in or lawfully frequenting a laser radiation area in regard to the following:

(1) The presence of a laser in such area.

(2) The potential hazards associated with the use of the laser and the precautions and procedures necessary to minimize exposure to radiation from the laser.

(3) The applicable provisions of this Part (rule) for the protection of such individual from exposure to radiation from the laser.

(b) *Personal protective devices.*

(1) Approved safety eyewear. Approved safety eyewear, as required by this Part (rule), shall be provided by the owner or employer and shall be used by the individuals working with or operating any unshielded laser and by other individuals lawfully frequenting the laser radiation area who may be exposed to laser radiation under circumstances where the conditions of laser use can lead to accidental exposure to radiation above the maximum permissible exposure limits listed in this Part (rule). Such safety eyewear shall meet the following specifications:

(i) The optical density of such approved safety eyewear shall reduce the external laser radiation to the cornea of the eye to safe levels as listed in Table 4 of this Part (rule).

(ii) Such safety eyewear shall be designed and tested to insure that the eyewear retains its protective properties during use.

(iii) Such safety eyewear shall be legibly labeled with the optical density of the lens and the wave length at which it was measured.

(iv) Any individual requiring prescription lenses in the normal performance of his work shall be provided with approved prescription eye protection or with approved safety eyewear designed to fit over his regular prescription lenses.

(2) Other personal protective devices. Protective gloves, clothing and shields shall be provided by the owner or employer and used by individuals as determined by the laser safety officer.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.13 Special precautions.

(a) No individual shall look directly into a primary laser beam or directly at the specular reflections of such a beam when the intensities of such beam or of such reflections are greater than those listed in Table 1 of this Part (rule), unless such individual is wearing approved eye protection in compliance with the provisions of this Part (rule).

(b) Every laser beam shall be terminated whenever necessary by a material that is non-reflecting and fire-retardant. In cases of intentional beam interaction with targets, precautions shall be taken to prevent fires arising from flying particles. In cases of unavoidable reflections, precautions shall be taken to prevent the scatter of laser radiation in excess of the limits listed in this Part (rule) into uncontrolled areas.

(c) Under circumstances where the conditions of laser operation can lead to accidental exposure to laser radiation above the maximum permissible exposure limits as specified in this Part (rule), an area shall be cleared of all individuals for a reasonable distance on all sides of the anticipated path of the laser beam, except for those individuals protected in compliance with the provisions of this Part (rule).

(d) Special care shall be taken to assure that approved safety eyewear is matched to the specific wave length of the laser device with which it is to be used and that such eyewear provides the required attenuation.

(e) Any approved safety eyewear which has been exposed to high-intensity laser radiation shall not be reused until it has been reevaluated for shattering and effectiveness of its attenuation.

(f) Laser beam paths shall be cleared of all material or objects that may cause the scatter of laser radiation at levels in excess of the limits listed in this Part (rule) into uncontrolled areas.

(g) All unshielded lasers which are capable of emitting radiation above the maximum permissible exposure limits as listed in this Part (rule) shall be capped or otherwise effectively terminated when not in operation.

(h) Interlocks used on enclosures for high-intensity lasers shall not be used to actuate such lasers.

(i) Any closed laser installation with one or more access openings large enough for entry by individuals shall have at least one such opening provided with an exit door which can be manually opened with ease from inside the laser installation.

(j) General illumination in laser radiation areas shall be at least 30 lumens per square foot, except where conditions of laser operation require lower ambient illumination.

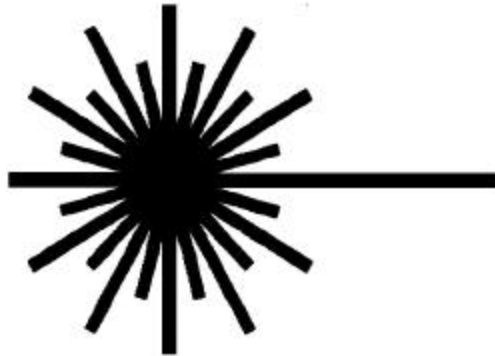
(k) Electronic firing systems for pulsed lasers shall be so designed that accidental discharges of stored charges are prevented.

(l) "Fail-safe" safety circuitry shall be used with lasers wherever necessary.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.14 Designation of laser radiation area.

(a) *Laser radiation symbol.* The laser radiation symbol, as shown below, shall be used to designate lasers and laser radiation areas. The symbol shall be in red and the background area shall be yellow or white.



LASER RADIATION SYMBOL

(b) *Laser radiation area.* Except as below provided, each person who possesses a laser shall post conspicuously at the entrance to and inside of each laser radiation area a sign constructed of durable material bearing the laser radiation symbol and the words "CAUTION" or "DANGER" and "LASER RADIATION AREA". Such words shall be in black letters at least one inch in height.

Exception: No such area need be posted with any sign or equipped with any required control device solely because of the presence therein of any laser for any period of not more than eight hours, provided, however, that during such period the laser safety officer or a designated individual is constantly in attendance and such safety officer or designated individual shall take all precautions necessary to prevent any individual from receiving any exposure to laser radiation that exceeds the applicable limits permitted by this Part (rule) and from receiving any other injury from any other hazard associated with the operation of any laser. Such area shall be subject to the control of the owner of such laser.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.15 Designation of lasers.

(a) Every laser not otherwise exempt by this Part (rule) shall have a label so attached as to be clearly visible and such label shall contain the following information:

- (1) The laser radiation symbol in red.
- (2) The words "CAUTION" or "DANGER" and "LASER" in black letters.
- (3) The wave length or lengths of the emitted laser radiation.
- (4) The maximum output power or energy density or densities of the emitted laser radiation.
- (5) The divergence of the emitted laser radiation in its lowest order transverse mode.

(b) Such required information shall be legibly stamped, etched or otherwise permanently marked on a yellow or white label with letters and numbers not less than three millimeters (one-eighth inch) in height where practicable.

Exceptions: (1) If such labeling of individual lasers is impractical because of laser size or location, such lasers shall be appropriately labeled in an alternative manner.

(2) The label on any laser used exclusively in research and development need not specify numerically the wave length, maximum output power or energy density or the divergence where such parameters may be unknown or difficult to obtain. However, such labels shall contain the laser radiation-symbol and other wording required by paragraphs (a)(1) and (2) of this section.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.16 Surveys, instrumentation and inventories.

(a) *Surveys.* Each person who possesses a registered laser shall make, or shall cause to be made, the applicable surveys required by this section and such additional surveys as may be necessary for such person to comply with the other provisions of this Part (rule) or as the commissioner may direct. Such surveys shall include:

(1) A survey of the output power or energy density of each registered mobile laser. Such determination shall be made by measurement or by calculation based on measurements made prior to initial use. If the laser beam is passed through an optical system, such determination shall be made at the point of maximum power or energy density along the path of the laser beam which is exposed to view.

(2) A survey shall be made of all laser protective devices, including safety interlocks, prior to initial use to make certain that such devices are in good working order and have been properly installed.

NOTE: For lasers installed or operated prior to August 1, 1972, the surveys cited in paragraphs (a)(1) and (2) of this section which are required to be performed prior to initial laser operation, shall be performed prior to the registration of such lasers.

(3) An inspection shall be made at least once every six month of all safety eyewear in use to make certain that the optical density and type of filter is appropriate for the laser in use and to determine visually that the eyewear has no optical defects. All safety eyewear found to be deteriorated or defective in any way shall be immediately withdrawn from use and repaired if possible or otherwise discarded.

(b) *Instrumentation.* All the necessary measurements performed in compliance with this Part (rule) shall be made with instrumentation designed and calibrated for use with the laser that is under surveillance.

(c) *Inventories.* An inventory shall be made of all lasers in any laser installation and all mobile lasers at least once a year. Such inventories shall be kept available for examination by the commissioner.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.17 Safeguarding and disposing of lasers.

(a) *Safeguarding.* Each laser shall be safeguarded against unauthorized use.

(b) *Disposing.* No person shall dispose of a high-intensity laser except by making such laser permanently inoperative or by transferring such laser to another person. The recipient of any such transferred laser, if subject to the provisions of the Labor Law, shall obtain the required registration in accordance with section 50.8 of this Part (rule) and shall display the proof of such registration to the person disposing of such high-intensity laser.

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.18 Associated hazards.

In addition to the protection against laser radiation, protection shall also be provided against any associated hazards which may be present during the operation of any laser. Such associated hazards include but are not limited to the following:

(a) *Air contaminants.* Vaporized target materials and toxic gases, vapors and fumes which may be associated with any laser may be present in a laser radiation area. Such dangerous air contaminants shall be removed or controlled in accordance with the provisions of Industrial Code Part (Rule No.) 12 relating to "Control of Air Contaminants" and Industrial Code Part (Rule No.) 18 relating to "Exhaust Systems". Adequate ventilation shall be maintained in each laser installation.

(b) *Ultra-violet radiation.* Ultra-violet radiation levels in excess of 0.5 microwatt/cm² for seven hours or 0.1 microwatt/cm² for continuous exposure shall be avoided. Because quartz transmits ultra-violet radiation efficiently, particular care shall be taken to protect individuals from such radiation when quartz tubes are used in the sales system.

(c) *Electrical hazards.* Any laser and its associated electrical system may present electrical hazards. Every laser, including all associated electrical equipment, shall be so designed, constructed, installed and maintained as to minimize the possibility of electrical hazards.

(d) *Cryogenic coolants.* The storage, handling and use of cryogenic coolants associated with lasers shall be such so as to minimize any hazards which such coolants may present.

(e) *Fire hazards.* Every laser and every laser installation shall be designed, constructed, installed, operated and maintained so as to eliminate or reduce any fire hazard. In addition, every laser radiation area shall be maintained clear of any unnecessary materials in order to minimize any fire hazard.

(f) *Explosion hazards.* Lasers and associated equipment may present explosion hazards. Such equipment shall be protected with explosion shields to prevent injury to individuals from such hazards.

(g) *Ionizing radiation.* A laser system may produce ionizing radiation in which case such system shall be in compliance with the provisions of Industrial Code Part (Rule No.) 38 relating to "Ionizing Radiation Protection" in respect to protection against ionizing radiation.

Historical Note: Sec. filed July 14, 1972; amd. filed Feb. 14, 1994 eff. March 2, 1994. Amended (g).

§ 50.19 Records.

Each person who possesses a registered laser shall maintain accurate and complete written records which shall be kept available for examination by the commissioner. Such records shall be kept of the following:

(a) The results of each required initial laser output check and system interlock check.

(b) Each transfer, receipt and disposal of any registered laser.

(c) Annual inventories, safety eyewear checks and equipment measurements obtained in accordance with the required surveys and instrumentation checks listed in section 50.16 of this Part (rule).

Historical Note: Sec. filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.20 Reports.

(a) *Reports to the commissioner.* Each person who possesses a laser shall report to the commissioner immediately upon the occurrence of any of the following:

(1) Any theft or loss of an intact laser.

(2) Any injury to an individual resulting from the operation of a laser or of any associated equipment. In addition, a written report of such injury shall be forwarded to the commissioner within seven days of such injury.

(b) *Reports to physicians.* In case of a required reportable exposure to laser radiation, all pertinent data relating to such exposure shall be made available to any physician who has been authorized by the exposed individual to receive such data.

Historical Note: Sec. added, filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.21 Inspection and tests.

(a) Each person who possesses a laser shall permit the commissioner to inspect, except as noted in subdivision (c) below, the following at all reasonable times:

(1) The laser, the laser radiation area and the laser installation or premises where such laser is located, possessed, stored or used.

(2) Each record required to be maintained by the provisions of this Part (rule).

(b) Each person who possesses a laser shall permit the commissioner to conduct such tests as he may deem necessary at any reasonable time except as noted in subdivision (c) below. Such tests shall utilize the advice and assistance of the laser safety officer where appropriate.

(c) If any inspection or test conducted in accordance with subdivisions (a) or (b) above may compromise national security, the commissioner shall, in lieu of such inspection or test, accept a statement from the owner and suitable reports from the laser safety officer concerning the proper operation of the laser and the safety precautions in force.

Historical Note: Sec. added, filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.22 Severability.

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

Historical Note: Sec. added, filed July 14, 1972 eff. Aug. 1, 1972.

§ 50.23 Tables.

The tables hereto annexed and designated: "Table 1-Maximum Permissible Corneal Exposure for Direct Illumination or Specular Reflection of Laser Radiation"; "Table 2-Maximum Permissible Skin Exposure"; "Table 3-Maximum Permissible Output Densities for Non-Enclosed Laser in an Uncontrolled Area (Limits for Low-Intensity Lasers)"; and "Table 4-Attenuation of Laser Safety Eyewear" are hereby made part of this Part (rule).

**TABLE 1
MAXIMUM PERMISSIBLE CORNEAL EXPOSURE FOR DIRECT ILLUMINATION OR SPECULAR REFLECTION
OF LASER RADIATION (*)**

Q-switched 1 nanosecond to 1 microsecond pulse [10 ⁻⁹ - 10 ⁻⁶ sec.] (joules/cm ²)	Non-Q-switched 1 microsecond to 0.1 of a second pulse [10 ⁻⁶ - 10 ⁻¹ sec.] (joules/cm ²)	Continuous wave or pulse width greater than 0.1 of a second duration [Greater than 10 ⁻¹ sec.](watts/cm ²)
1.0 X 10 ⁻⁷ (**)	1.0 X 10 ⁻⁶ **	1.0 X 10 ⁻⁵ **
1.0 X 10 ⁻³ (***)	1.0 X 10 ⁻² ***	1.0 X 10 ⁻² ***

(*) The values in this table assume a diffraction limited and zero order transverse mode beam. In the case of a higher order transverse mode in a gas laser where the intrinsic beam divergence exceeds one milliradian the values may be increased on the basis of experimental evidence. Because of the lack of data, no explicit value is listed for the maximum permissible corneal exposure for laser radiation in the wave length range below 400 nm. or for sub-nanosecond pulses; therefore the cornea shall not be directly exposed to this radiation until MPCE values have been established for these conditions.

(**) For lasers operating in the wave length range 400-1400 nm.

(***) For lasers operating in the wave length range above 1400nm.

TABLE 2
MAXIMUM PERMISSIBLE SKIN EXPOSURE (*)

Energy Density Pulsed [Q-switched, Non=Q-switched] (joules) (cm ²)	Pulsed Power Density, Continuous Wave (watts) (cm ²)
0.1	1.0

(*) For lasers operating in the visible, near-infrared and infrared regions of the electromagnetic spectrum. No information is available on permissible skin exposures to laser radiation in the wave length range below 400 nm. Therefore, caution must be used to avoid such exposure until experimental data is available on permissible levels.

TABLE 3
MAXIMUM PERMISSIBLE OUTPUT POWER OR ENERGY DENSITIES FOR A NON-ENCLOSED LASER IN AN UNCONTROLLED AREA (LIMITS FOR LOW-INTENSITY LASERS)

Q-switched 1 nanosecond to 1 microsecond pulse [10 ⁻⁹ - 10 ⁻⁶ sec.](joules/cm ²)	Non-Q-switched 1 nanosecond to 1 microsecond pulse [10 ⁻⁹ - 10 ⁻⁶ sec.](joules/cm ²)	Continuous wave or pulse width greater than 0.1 of a second duration [Greater than 10 ⁻¹ sec.] (watts/cm ²)
1.0 x 10 ⁻¹	1.0	3.0

TABLE 4
ATTENUATION OF LASER SAFETY EYEWEAR*

O.D.	Attenuation (db>**)	Attenuation Factor	Suggested Maximum Incident Density		
			1-switched Max. Energy Density (J/cm ²)	Non-Q-switched Max. Energy Density(j/cm ²)	Continuous Wave Maximum Power Density(W/cm ²)
1	10	10	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴
2	20	10 ²	10 ⁻⁵	10 ⁻⁴	10 ⁻³
3	30	10 ³	10 ⁻⁴	10 ⁻³	10 ⁻³
4	40	10 ⁴	10 ⁻³	10 ⁻²	10 ⁻¹
5	50	10 ⁵	10 ⁻²	10 ⁻¹	1
6	60	10 ⁶	10 ⁻¹	1	10
7	70	10 ⁷	1	10	
8	80	10 ⁸	10	10 ²	

(*) Because of limitations of safety eyewear material, no eyewear shall be exposed to more than 400 joules or 10 watts of incident laser energy or power, respectively.

(**) (db) = Decibel. A unit to express a beam intensity ratio. The decibel is equal to 10 times the logarithm of the beam intensity ratio expressed by the following equation:

$$n(\text{db}) = 10 \log_{10} (P^1)/(P^2)$$

where P1 and P 2 designate the input and output power density or energy density, respectively, and "n" designates the number of decibels corresponding to their ratio.

Historical Note: Sec. added, filed July 14, 1972 eff. Aug. 1, 1972.