

**MICHIGAN DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
RADIATION SAFETY SECTION
IONIZING RADIATION RULES GOVERNING THE USE OF RADIATION
MACHINES**

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PART 11. PARTICLE ACCELERATOR INSTALLATIONS

R 333.5431 Purpose and scope.

Rule 431. (1) This part establishes procedures for the registration of particle accelerators, a classification system for particle accelerator installations and use, and radiation safety requirements for persons utilizing all types of particle accelerators except those specifically exempted from this part.

(2) This part applies to all registrants who use particle accelerators for a purpose other than those exempted under R 333.5432.

(3) In addition to the requirements of this part, all registrants are subject to the applicable provisions of these rules.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5432 Definition.

Rule 432. "Particle accelerator" or "accelerator", as used in this part, means a radiation machine designed for or capable of accelerating electrically charged particles, such as electrons, protons or deuterons, with an electrical potential in excess of 1 MeV. Radiation machines designed and used exclusively for the production of electron beams or x-radiation for any of the following purposes except those capable of producing radioactive material in excess of exempt quantities listed in schedule B of R 325.5147 are excluded from this definition:

- (a) The diagnosis or treatment of patients.
- (b) Industrial radiography.
- (c) Examination of the microscopic structure of materials.
- (d) Manufacturing process control.
- (e) Research and development.
- (f) Demonstration of scientific principles for educational purposes.

History: 2016 MR 10, Eff. May 25, 2016

LICENSE OR REGISTRATION

R 333.5435 General provisions.

Rule 435. A person having a particle accelerator subject to this part shall comply with the registration requirements of R 333.5031 to R 333.5049.

History: 2016 MR 10, Eff. May 25, 2016

CLASSIFICATION

R 333.5437 Class enumeration.

Rule 437. (1) For registration and approval purposes, particle accelerator installations shall be classified as class AA, class A, class B, or class C.

(2) For the purpose of registering and approving mobile or portable particle accelerators intended for limited use at temporary job site locations, this use shall be classified as class D operation.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5438 Class AA installations.

Rule 438. (1) In class AA installations the accelerator and objects exposed thereto shall be contained within a permanent enclosure.

(2) The enclosure shall be constructed so that the dose equivalent rate as measured in air at a distance of 5 centimeters from an accessible point on the external surface shall not exceed 2 millirems per hour under conditions of maximum radiation output permitted by the design or operating characteristics of the accelerator.

(3) Mechanical or electrical limiters shall limit movement or alignment of the accelerated beam within the enclosure if necessary to comply with subrule (2) of this rule.

(4) A personnel barrier posted pursuant to R 333.5067 to R 333.5072 restricting access to the roof of the enclosure shall meet the requirement of subrule (2) of this rule.

(5) Reliable interlocks shall be provided which prevent an individual from opening the enclosure while the accelerator is in operation or which terminate machine operation if an individual opens the enclosure. These interlocks shall meet the requirements of R 333.5448.

(6) Enclosures of sufficient size to permit human occupancy shall be provided with visible or audible signals or both within the enclosure which are activated a minimum of 5 seconds before accelerator operation. Individuals shall at all times be able to escape from within the enclosure.

(7) An individual shall not be permitted to remain within the enclosure while the accelerator is in operation except as a human patient undergoing radiation treatment.

(8) Protective enclosures and equipment shall be kept in good repair.

(9) Electron beam welders shall meet class AA requirements.

(10) Class AA approval permits unlimited use at maximum capacity.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5439 Class A installations.

Rule 439. (1) Class A installations shall comply with all requirements of R 333.5438 except for a permissible dose equivalent rate of 7 millirems per hour at an accessible external point.

(2) An individual monitoring device, such as a film badge dosimeter or thermoluminescent dosimeter, shall be permanently assigned to each occupationally exposed individual. This monitoring shall be continuous during employment as a radiation worker.

(3) Personnel exposure records shall be kept on permanent available file at the facility where the exposure occurs.

(4) Class A approval permits unlimited use at maximum capacity.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5440 Class B installations.

Rule 440. (1) Class B installations shall comply with all requirements of R 333.5439.

(2) Accelerator beam current and potential controls shall be mechanically or electrically limited so as not to exceed the normal operating conditions as specified in the application for specific license or registration.

(3) Class B approval permits unlimited use under normal operating conditions as specified by subrule (2) of this rule.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5441 Class C installations.

Rule 441. (1) Class C installations shall comply with all requirements of R 333.5439 except for a permissible dose equivalent rate of 50 millirems per hour at an accessible external point.

(2) The maximum weekly accelerator beam on time shall be established by the department under the conditions specified in the application for specific license or registration.

(3) Warning signs shall be posted in those areas outside the enclosure in which the radiation exposure dose equivalent rate in air at an accessible external point exceeds 2 millirems per hour under conditions of maximum radiation output permitted by the design or limited operating characteristics of the accelerator.

(4) A daily usage log shall be maintained to record machine operation. The record shall be available at the accelerator site for examination by the department.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5442 Class D operations.

Rule 442. (1) Particle accelerator operations conducted under conditions not meeting the provisions and requirements of R 333.5438 to R 333.5441 shall be classified as class D operations and shall not be operated longer than 30 days unless written authorization is granted by the department.

(2) Written authorization in the form of a registration condition may be granted by the department for class D operations longer than 30 days but not longer than 6 months at 1 location when an undue and unnecessary hardship may result from the 30-day limitation. Written request by the applicant for this authorization is required and shall describe the hardship involved as well as provide written assurance of compliance with the requirements of these rules for class D operation. This assurance shall be in the form of satisfactory written procedures which shall be approved by the department before the issuance of a certificate of registration.

History: 2016 MR 10, Eff. May 25, 2016

SAFETY REQUIREMENTS FOR THE USE OF PARTICLE ACCELERATORS

R 333.5445 General provisions.

Rule 445. (1) R 333.5445 to R 333.5452 establish radiation safety requirements for the use of particle accelerators. These requirements are in addition to, and not in substitution for, other applicable provisions of these rules.

(2) A registrant shall be responsible for assuring that all requirements of this part are met.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5446 Limitations.

Rule 446. (1) A registrant shall not permit an individual to act as an accelerator operator until the individual has met all of the following:

- (a) Been instructed and demonstrated an understanding of radiation safety.
- (b) Received copies of, instruction in, and demonstrated an understanding of R 333.5431 to R 333.5452 and the applicable requirements of all of the following:
 - (i) R 333.5051 to R 333.5089.
 - (ii) Pertinent registration conditions.
 - (iii) The registrant's operating and emergency procedures.

- (c) Demonstrated competence to use the particle accelerator, related equipment, and survey instruments employed in his or her assignment.

(2) The radiation safety committee or the radiation protection supervisor shall have the authority to terminate the operations at an accelerator facility or of a class D operation if this action is necessary to protect and minimize danger to public health and safety or property.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5447 Shielding.

Rule 447. (1) The design and shielding specifications for an accelerator shall be submitted to and approved by the department before issuance of a certificate of registration. After construction, the radiation safety of the installation shall be established by a protection survey conducted pursuant to R 333.5063. A written report of the initial survey shall be submitted to the department and approved in writing before continued operation of the accelerator.

(2) An accelerator installation shall be provided with primary or secondary barriers as are necessary to ensure compliance with R 333.5057 to R 333.5061.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5448 Accelerator controls and interlock systems.

Rule 448. (1) Instrumentation, readouts, and controls on the accelerator control console shall be clearly identified and easily discernible.

(2) All entrances or openings into a target room or other high radiation area shall be provided with interlocks.

(3) When an interlock system has been tripped, operation of the accelerator shall only be resumed by first manually resetting controls at the position where the interlock has been tripped, and lastly at the main control console.

(4) A safety interlock shall be on a circuit which will allow it to operate independently of all other safety interlocks.

(5) A safety interlock shall be fail safe. A defect or component failure in the interlock system shall prevent operation of the accelerator.

(6) A scram button or other emergency power cutoff switch shall be located and easily identifiable in all high radiation areas. This cutoff switch shall include a manual reset so that the accelerator cannot be restarted from the accelerator control console without resetting the cutoff switch.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5449 Warning devices.

Rule 449. (1) Locations designated as high radiation areas, and entrances to these locations, shall be equipped with easily observable warning lights that operate when, and only when, radiation is being produced.

(2) Except in installations designed for human exposure, a high radiation area shall have an audible warning device which shall be activated for 15 seconds before the possible creation of a high radiation area. This warning device shall be clearly discernible in all high radiation areas and all radiation areas.

(3) Barriers and pathways leading to high radiation areas shall be identified pursuant to R 333.5067 to R 333.5074.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5450 Equipment control and operations.

Rule 450. (1) A particle accelerator shall not be left unattended without locking the control panel in a manner which prevents its use by unauthorized individuals.

(2) A mobile or portable particle accelerator shall not be left unattended without locking the room or building in which it is housed in a manner which prevents its removal by unauthorized persons.

(3) Access to keys used to comply with the requirements of subrules (1) and (2) of this rule shall be limited to specific individuals authorized by the radiation protection supervisor.

(4) Only a switch on the accelerator control console shall be routinely used to turn the accelerator beam on and off. The safety interlock system shall not be used to turn off the accelerator beam except in an emergency or during periodic testing of the interlock system.

(5) All safety and warning devices, including interlocks, shall be checked for proper operability at least quarterly. Results of these tests shall be maintained for inspection by the department at the accelerator installation.

(6) Electrical circuit diagrams of the accelerator, and the associated interlock systems, shall be kept current and on file at each accelerator installation.

(7) If it is necessary to intentionally bypass a safety interlock or interlocks, the action shall be in conformance with all of the following:

- (a) Authorized by the radiation protection supervisor pursuant to R 333.5075.
- (b) Recorded in a permanent log and a notice posted at the accelerator control console.
- (c) Terminated as soon as possible.

(8) A copy of the operating and the emergency procedures shall be maintained at the accelerator control panel.

History: 2016 MR 10, Eff. May 25, 2016

R 333.5452 Radiation surveys.

Rule 452. (1) A registrant shall maintain at each accelerator installation or class D operation appropriate calibrated and operable portable radiation monitoring instruments to make physical radiation surveys as required by this part and R 333.5051 to R 333.5089.

(2) These instruments shall be capable by design, calibration, and operation of measuring the intensity of the various types and energies of radiation produced by the accelerator. These instruments shall be tested for proper operation at the beginning of each day they are to be used and calibrated at least quarterly.

(3) During repair or calibration of a radiation monitoring instrument, a spare calibrated and operable instrument shall be provided or accelerator operations which require the instrument shall be terminated until required instrumentation is available.

(4) A radiation protection survey shall be performed and documented pursuant to R 333.5063 when changes have been made in shielding, operation, equipment, or occupancy of adjacent areas.

(5) Radiation levels in all accessible high radiation areas shall be continuously monitored except in installations designed for human exposure. The monitoring devices shall be independent and capable of providing a remote and local readout with visual or audible alarms, or both, at the control panel and at the monitoring stations.

(6) All area monitors shall be calibrated at established periodic intervals approved by the department.

(7) All area surveys shall be made as specified in the written procedures established by a health physics consultant or the radiation protection supervisor of the accelerator facility and approved by the department.

(8) Records of all radiation protection surveys, calibration results, instrumentation tests, and smear results shall be kept current and on file at each accelerator facility.

History: 2016 MR 10, Eff. May 25, 2016