MINISTRY OF LABOUR AND EMPLOYMENT
SECRETARIAT OF LABOUR INSPECTION

GOVERNMENTAL DECREE No. 197, OF 17 DECEMBER 2010

(Brazilian Official Journal Dec 24th, 2010 - Section I page 211)

Changes the Regulatory Standard No. 12 - Machinery and Equipment, approved by Governmental Decree No. 3214 of June 8th, 1978.

SECRETARIAT OF LABOUR INSPECTION and DIRECTOR OF OCCUPATIONAL HEALTH AND SAFETY DEPARTMENT - SUBSTITUTE, using the rights conferred by articles 14, clause II, and 16, clause I of Decree No. 5063 of May 3rd, 2004 and due to the provisions of articles 155 and 200 of the Consolidation of Labour Laws - CLT, approved by Decree No. 5452 of May 1st, 1943 and article 2 of Governmental Decree No. 3214 of June 8th, 1978, decides:

Article 1 - The Regulatory Standard No. 12 - NR 12, approved by Governmental Decree No. 3214 of June 8th, 1978, under the title "Machinery and Equipment" is effective with the wording of this Governmental Decree.

Article 2 - Create the Thematic Tripartite National Commission – CNTT of NR 12 with the aim of follow the implementation of the new regulation, as established in article 9 of Governmental Decree No. 1127 of October 2nd, 2003.

Article 3 – Repeal the SSMT Governmental Decree No. 12, of June 6th, 1983 and SSMT Governmental Decree No. 25, December 3rd, 1996.

Article 4 - This Governmental Decree shall enter into force upon the date of its publication, except as to the items described below, which will enter into force in the determined stated periods, counted upon publication of this act.

I - New machinery:

12 (twelve) months	Sub-item 12.20.2 and item 12.22.
15 (fifteen) months:	Items 12.36, paragraph 'a', and 12.37.
18 (eighteen) months	Items and sub-items: 12.38.1, 12.39, 12.40, 12.43, 12.44, 12.45, 12.46, 12.47.1, 12.51, 12.55, 12.55.1, 12.65, 12.69, 12.73, 12.74, 12.75, 12.94, 12.95, 12.96, 12.125 to 12.129, 12.133, and 12.133.1 12.133.2.
30 (thirty) months	Items and sub-items: 12.86, 12.86.1, 12.86.2 and 12.92.

II - Used machinery:

4 (four) months	Items 12.135 to 12.147.
12 (twelve) months	Items 12.22, 12.26, 12.27, 12.28, 12.29, 12.30, 12.30.1, 12.30.2, 12.30.3, 12.31 and 12.116 to 12.124.
18 (eighteen) months	Items and sub-items: 12.20.2; 12.153 and 12.154.
24 (twenty four) months	Items and sub-items: 12.111.1; 12.125 to 12.129.
30 (thirty) months	Items and sub-items: 12.36, paragraph 'a', 12.37, 12.39, 12.40, 12.43, 12.44, 12.45, 12.46, 12.47.1, 12.51, 12.55, 12.55.1, 12.65, 12.69, 12.73, 12.74, 12.75, 12.86, 12.86.1, 12.86.2 and 12.92.

III – The stated periods for compliance of the items shall be observed for all of their sub-items, except when there are different stated periods specified in clauses I, II, IV and VIII.

IV – The stated period of eighteen months for compliance under the item 12.133 and sub-items 12.133.1 and 12.133.2, with respect to the adequacy of machinery and equipment designs manufactured or imported, is not applicable to the items that have lesser stated periods, prevailing, in such circumstances, the short stated period.

V - For machinery and equipment that already meet the requirements of this standard, where the stated periods are important, it´s not allowed the removal or non-replacement of systems and other parts related to the previously existing safety.

VI - The stated periods for the entry into force of the items does not apply to conditions of serious and imminent risk to health or physical integrity of workers and involve the machinery or equipment only when the situation is evidenced.

VII - The bakeries and butcher shops or companies with butcher shops or bakeries that have five or more establishments can meet the stated periods upon adequacy of all machinery and equipment by 20% (twenty percent) of their establishments each year, according to the schedule to be protocolized in Regional Superintendence of Labour and Employment - SRTE from Unit of Federation in which the company is situated or in SRTE of the main house for companies that have establishments in more than one State, of which one copy shall remain in the establishment.

VIII - Stated periods for compliance with Annexes VII, IX and XI of Regulatory Standard No. 12:

ANNEX VII – MACHINES FOR BUTCHER SHOP AND GROCERY

Stated periods set by establishment, as a function of machine type and number of workers. For new machines, the stated period for adequacy will be of 6 (six) months in any situation.

Machine Type	Up to 10 (ten) employees	11 (eleven) up to 25 (twenty five) employees	26 (twenty six) up to 50 (fifty) employees	Over 50 (fifty) employees
Band saw	36 (thirty six) months	(30) months	24 (twenty four) months	18 (eighteen) months
Meat grinder	36 (thirty six) months	(30) months	24 (twenty four) months	18 (eighteen) months
Cold cuts slicer	66 (sixty six) months	66 (sixty six) months	36 months	24 (twenty four) months
All other	66 (sixty six) months	66 (sixty six) months	60 (sixty) months	48 (forty eight) months

ANNEX IX – PLASTIC INJECTION MACHINE

Each year the company shall be adjust or replace the indicated percentage, so that at the end of 5 (five) years all injection machines meet the requirements of Annex IX.

Stated periods by establishment, regardless of the number of workers.

When the percentage is less than 1.5 (one point five), shall be considered 01 (one) machine; when equal or less than 1.5 (one point five), shall be considered two (2) machines.

1st (first) year	2nd (second) year	3rd (third) year	4th (fourth) year	5th (fifth) year
25% (twenty five percent)	25% (twenty five percent)	20% (twenty percent)	20% (twenty percent)	10% (ten percent)

ANNEX XI – MACHINERY AND IMPLEMENTS FOR AGRICULTURAL AND FORESTRY USE Stated periods set by establishment, as a function of machine type, regardless of the number of workers.	
Stated period of 12 (twelve) months	Item 7, item 8, in which the stated period applies only to the requirement "backup alarm coupled to the transmission system" for the models of narrow agricultural tractors, with width gauge less than or equal to 1280 mm (one thousand two hundred eighty millimeters) and item 9, in which the stated period applies only to the requirement of "seat belt of trainer seat."
Stated period of 18 (eighteen) months	Items and Sub-items: 4, 5, 6, 6.1, 6.1.1, 6.3.1, 6.5, 6.10, 6.12, 11, 12, 12.1, 12.2, and 14; Sub-items 6.5.2, 6.5.4, 6.6 and 6.6.1 for stationary machinery; Sub-items 15.1.2, 15.3, 15.4, 15.5, 15.12, 15.16, 15.21, 15.22, 15.23 and 15.24 for implements.
Stated period of 24 (twenty four) months	Sub-item 6.5.1, except harvesters, and sub-item 6.4, paragraphs "j" and "m".
Stated period of 36 (thirty six) months	Sub-item 6.5.1 for harvesters; Sub-items 15.1.2, 15.3, 15.4, 15.5, 15.12, 15.16, 15.21, 15.22, 15.23, 15.24 and 15.25 for self-propelled machinery; Sub-items 6.5.2, 6.5.4, 6.6, 6.6.1 and 15.25.

RUTH BEATRIZ VASCONCELOS VILELA
Secretary of Labour Inspection

RINALDO MARINO COSTA LIMA
Director of Occupational Health and Safety Department - Substitute

NR 12 - SAFETY IN MACHINERY AND EQUIPMENT WORK

General Principles

12.1. This Regulatory Standard and its annexes provides technical references, basic principles and protective measures to ensure the health and physical integrity of workers and establishes minimum requirements for the prevention of accidents and occupational diseases in the design stages and use of machinery and equipment of all kinds, and also to its manufacture, importation, trading, exhibition and cession in any way, in all economic activities, without prejudice to the provisions of all other Regulatory Standards - NR approved by Governmental Decree No. 3214 of June 8th, 1978, in the technical standards and, in the absence or omission thereof, in applicable international standards.

12.1.1. It is understood as using phase the construction, transportation, assembly, installation, adjustment, operation, cleaning, maintenance, inspection, disabling and dismantling of machinery or equipment.

12.2. The provisions of this Standard refer to new and used machinery and equipment, except for the items where there is specific mention about its applicability.

12.3. The employer shall take protective measures for working on machinery and equipment, capable to ensure the health and physical integrity of workers and appropriate measures whenever there are disabled persons directly or indirectly involved in the work.

12.4. Are considered protective measures to be adopted in this order of priority:

a) collective protective measures;

b) administrative measures or of working organization; and

c) personal protective measure.

12.5. The machinery design shall attend the fail safe principle.

Physical layout and facilities

12.6. At the installation sites of machinery and equipment, the circulation areas shall be properly marked and in accordance with the official technical standards.

12.6.1. The main traffic routes in the workplaces and those that leading to exits shall be at least a width of 1.20 m (one meter and twenty centimeters).

12.6.2. The circulation areas shall be kept permanently clear.

12.7. The materials in use at the production process shall be allocated in specific areas of storage, duly marked with colored strips indicated by the official technical standards or signalized for outside areas.

12.8. The spaces around the machinery and equipment shall be suitable to their type and to the type of operation in order to prevent accidents and diseases related to work.

12.8.1. The minimum distance between machinery, in accordance with their characteristics and applications, shall ensure workers' safety during operation, maintenance, adjustment, cleaning and inspection, and to permit the movement of body segments, due to the nature of the task.

12.8.2. The circulation and storage areas of materials and the spaces around the machinery shall be designed, sized and maintained so that workers and materials transporters, mechanized and manual, can move safely.

12.9. The floors of workplaces where are installed machinery and equipment and circulation areas shall:

a) be kept clean and free of objects, tools and any materials that have risks of accidents;

b) have characteristics to prevent risks from grease, oils and other substances and materials that make them slippery; and

c) be leveled and resistant to the loads they are subjected.

12.10. The tools used in production process shall be organized and stored or arranged in specific locations for this purpose.

12.11. The stationary machinery shall have preventive measures regarding its stability, so the machines does not swing and does not move unexpectedly due to vibration, shock, predictable external forces, internal dynamic forces or any other accidental reason.

12.11.1. The installation of stationary machinery shall comply with the requirements provided by the manufacturers or, missing these, the project prepared by a legally qualified professional, in particular on the foundation, mounting, cushioning, leveling, ventilation, electrical, pneumatic and hydraulic power, grounding and cooling systems.

12.12. On moveable machines that have rotations, at least two of them shall have locks.

12.13. The machines, the circulation areas, worksites and other locations where there may be workers shall be positioned so that no aerial transport and handling of materials occurs on the workers.

Installations and electrical devices

12.14. The electrical installation of machinery and equipment shall be designed and maintained in order to prevent, by safe means, the risks of electrical shock, fire, explosion and other accidents, as prescribed in NR 10.

12.15. They shall be grounded, according to current official technical standards, the installations, casings, housings, shielding or conductive parts of machinery and equipment that are not part of electrical circuits, but that may be under voltage.

12.16. The electrical installation of machinery and equipment that are or may be in direct or indirect contact with water or corrosive agents shall be designed with means and measures to assure their shielding, tightness, insulation and grounding, in order to prevent accidents.

12.17. The power lead of machinery and equipment shall meet the following minimum safety requirements:

a) provide mechanical strength commensurate with its use;

b) have protection against the possibility of mechanical failure, abrasive contacts and contact with lubricants, fuel and heat;

c) located so that no segment is in contact with moveable parts or sharp edges;

d) facilitate and not obstruct the transit of persons and materials or the operation of machinery;

e) does not offer any other types of risks on your location; and

f) be made of materials that do not propagate the fire, i.e., self-extinguishing, and that do not emit toxic substances in case of heating.

12.18. The power enclosure of machinery and equipment shall meet the following minimum safety requirements:

a) have access door, kept permanently closed;

b) have signs about the danger of electrical shock and restricting access by unauthorized persons;

c) be maintained in good conservation state, clean and free of objects and tools;

d) have protection and identification of circuits; and

e) meet the appropriate degree of protection as a function of the usage environment.

12.19. The connections and drifts of the electrical leads of machinery and equipment shall be made with appropriate devices and according to current official technical standards, in order to ensure appropriate mechanical strength and electrical contact, with characteristics equivalent to the used electrical leads and protection against risks.

12.20. The electrical installation of machinery and equipment which use electrical energy supplied by external source shall have overcurrent protective device, sized according to consumption demand of the circuit.

12.20.1. The machinery and equipment shall have protective device against overvoltage when the voltage arising can cause risks of accidents.

12.20.2. When the power supply allows the inversion of phases of machine that can cause work accidents, there shall be detection monitored device of phases sequence or other measure of protection with the same effectiveness.

12.21. Are prohibited in the machinery and equipment:

a) the use of disconnect switch as a start or stop device;

b) the use of switches such as a knife-type in electrical circuits; and

c) the existence of exposed live parts of circuits that use electrical power.

12.22. The batteries shall meet the following minimum safety requirements:

a) located so that their maintenance and replacement can be performed easily from the ground or from a support platform;

b) setting up and fixing in order to have no accidental displacement; and

c) positive terminal protection in order to prevent accidental contact and short circuit.

12.23. The services and replacement of batteries shall be performed according to indication shown in the operating manual.

Starting, actuation and stop devices

12.24. The starting, actuation and stop devices of machinery shall be designed, selected and installed so that they:

a) are not localized in their hazardous areas;

b) can be activated or turn off in case of emergency by a person other than the operator;

c) prevent inadvertent actuation or shutdown by the operator or any other accidental way;

d) do not provide additional risks; and

e) cannot be juggled.

12.25. The starting or actuation commands of the machinery shall have devices to prevent their automatic operation when energized.

12.26. When actuation devices of bimanual control type are used in order to keep the operator's hands off the danger zone, they shall meet the following minimum requirements for the control:

a) have synchronous actuation, i.e. an output signal shall be generated only when the two actuation devices of the command - buttons - are actuated with a time delay less than or equal to 0.5 s (five seconds);

b) be under automatic monitoring by safety interface;

c) have a relationship between input and output signal, so that the input signals applied to each of the two actuation devices of the command shall together start and maintain the output signal of the bimanual control device only during the application of the two signals;

d) the output signal shall end when there is deactivation of any of the control actuation devices;

e) have control devices that require a deliberate action to minimize the likelihood of accidental command;

f) have distance and barriers between the control actuation devices to make difficult the juggle of the protective effect of the bimanual control device; and

g) making possible the restart of the output signal only after the deactivation of the two control actuation devices.

12.27. On machinery operated by two or more bimanual control devices, the synchronous actuation is required only for each of the bimanual control devices and not between different devices that shall maintain concurrency between each other.

12.28. The bimanual control devices shall be placed at a safe distance from the danger zone, taking into account:

a) the shape, arrangement and response time of the bimanual control device;

b) the maximum time required for the machine stoppage or to danger removal, after the end of the output signal of the bimanual control device; and

c) the projected utilization for the machine.

12.29. The moveable bimanual controls installed on pedestals shall:

a) remain stable in their working position;

b) have height compatible with the worksite to stay close to the operator in his working position.

12.30. In machinery and equipment whose operation requires the participation of more than one person, the number of simultaneous actuation devices shall match the number of operators exposed to the dangers arising of its actuation, so that the level of protection is the same for each worker.

12.30.1. There shall be selector of the number of actuation devices in use with lock that prevents its selection by unauthorized persons.

12.30.2. The actuation circuit shall be designed to prevent the operation of controls enabled by the selector while all other non enabled commands are not disconnected.

12.30.3. The simultaneous actuation devices, when used two or more, shall have the luminous signal to indicate its operation.

12.31. The machinery or equipment designed and manufactured to allow the use of several modes of control or operation that shows different safety levels shall have a selector that meets the following requirements:

a) lock at each position, preventing its change by unauthorized persons;

b) correspondence of each position in a single command or operation mode;

c) control mode selected with priority over all other control systems, with the exception of emergency stop; and

d) the selection shall be visible, clear and easily identifiable.

12.32. The machinery and equipment, whose actuation by unauthorized persons may show a risk to health or safety integrity of any person shall have a system that allows the lock of their actuation devices.

12.33. The simultaneous actuation and shutdown by a single control from a set of machinery and equipment or machinery and equipment of large size shall be preceded by an audible alarm signal.

12.34. Shall be taken, when necessary, additional measures of alertness, such as visual signals and telecommunication devices, considering the characteristics of the productive process and of the workers.

12.35. The machinery and equipment operated by radio frequency shall be protected against accidental electromagnetic interference.

12.36. The starting, stop and actuation components and other controls that constitute the operation interface of the machinery shall:

a) operate in extra low voltage up to 25V (twenty-five volts) in alternating current or up to 60V (sixty volts) in direct current; and

b) permit the installation and operation of emergency stop system, according to items 12.56 to 12.63 and its sub-items.

12.37. The electrical circuit of the starting and stop control of the electrical motor of machines shall have, at least, two contactors with positively guided contacts, connected in series, monitored by safety interface or in accordance with the standards established by current national technical standards, and in the missing of that, by international technical standards, if so indicated by the risk analysis, as a function of the severity of injury and frequency or duration of exposure to the risk.

Safety systems

12.38. Danger zones of machinery and equipment shall have safety systems, characterized by fixed protections, moveable protections and interconnected safety devices to ensure protection to health and physical integrity of workers.

12.38.1. The adoption of safety systems, particularly in the areas of operation that shows danger, shall consider the technical characteristics of the machine and the working process and the existing measures and technical choices in order to achieve the necessary safety level provided in this Standard.

12.39. The safety systems shall be selected and installed to meet the following requirements:

a) have safety category in accordance with previous risk analysis provided in the current official technical standards;

b) be under the technical responsibility of legally qualified professional;

c) have technical compliance with the control system to which they are integrated;

d) installation so that cannot be neutralized or juggled;

e) remain under automatic surveillance, i.e. monitoring, according to the required safety category, except for exclusively mechanical safety devices; and

f) stop of dangerous movements and all other risks when occur failures or abnormal conditions of work.

12.40. The safety systems, according to the required safety category, shall require manual reset, after correcting the failure or abnormal condition of work that caused the stoppage of the machine.

12.41. For the purposes of applying this standard, is considered protection the element used specifically to provide safety through a physical barrier, where can be:

a) fixed protection, which shall be kept in its permanent position or by means of fixing elements which allow their removal or opening with the use of specific tools only; and

b) moveable protection, which can be opened without the use of tools, usually by mechanical elements connected to the machine structure or a near fixed element, and shall be joined with the interlocking devices.

12.42. For the purposes of applying this Standard, are considered safety devices the components, alone or connected or related to protections, that reduce risks of accidents and other health injuries being classified as:

a) electrical controls and safety interfaces: devices responsible to perform the monitoring, that verifies the connection, position and operation of other system devices and prevent the occurrence of a failure that causes the loss of safety function, such as safety relays, safety configurable controllers and safety programmable logic controller - PLC;

b) interlocking devices: electromechanical safety switches, with positive and break action, magnetic and electronic coded, optoelectronics, safety inductive sensors and other safety devices that have the purpose of preventing the operation of machine elements under specific conditions;

c) safety sensors: mechanical and no-mechanical presence detectors devices, that act when a person or part of your body penetrate the danger zone of a machine or equipment, sending a signal to stop or prevent the start of hazardous actions such as light curtains, optoelectronics presence detectors, laser of multiple beams, optical barriers, area monitors or scanners, stops, carpets and position sensors;

d) valves and safety blocks or pneumatic and hydraulic systems with the same effectiveness;

e) mechanical devices, such as: restraint devices, limiters, separators, pushers, inhibitors, baffles and retractable; and

f) validation devices: supplementary hand-operated control devices, that when applied on a permanent mode, enable the actuation device, such as lockable switches and lockable devices.

12.43. The components related to safety systems and actuation and stop controls of the machines, including the emergency, shall ensure the safe state of the machinery or equipment when there are fluctuations in energy level beyond the limits considered in the design, including the power outage and reestablishing of energy supply.

12.44. The protection shall be moveable when the access to a danger zone is required one or more times per shift, noting that:

a) the protection shall be associated with an interlocking device when its opening does not allow access to the danger zone before the elimination of risk; and

b) the protection shall be associated with an interlocking device with lock when its opening allow access to the danger zone before the elimination of risk.

12.45. The machinery and equipment with a moveable protections associated with interlocking devices shall:

a) operate when the protections are closed only;

b) stop their hazardous functions when the protections are opened during operation; and

c) ensure that the closing of the protections alone cannot initiate the dangerous functions.

12.46. The interlocking devices with lock associated to the moveable protections of machinery and equipment shall:

a) allow operation while the protection is closed and locked only;

b) keep the protection closed and locked until the injury risk have been eliminated due to hazardous functions of the machinery or equipment;

c) ensure that the closure and lock of the protection by itself can not initiate the dangerous functions of the machinery or equipment.

12.47. The power transmissions and the moveable components connected to them, accessible or exposed, shall have fixed or moveable protections with interlocking devices, which prevents access from all sides.

12.47.1. When used moveable protections to confine the power transmissions that have inertia, shall be used interlocking devices with lock.

12.47.2. The drive shaft (cardan) shall have adequate protection, in perfect condition in its full length, fixed in the machine power take-off from the cross head to the coupling of the implement or equipment.

12.48. The machinery and equipment that provide a risk of rupture of its parts, projection of materials, particles or substances, shall have protections to ensure health and safety of workers.

12.49. The protections shall be designed and built to meet the following safety requirements:

a) perform their functions appropriately during the useful life of the machine or permit the replacement of damaged or deteriorated parts;

b) be built of resistant and suitable materials to contain the projection of parts, materials and particles;

c) firm fixation and guarantee of stability and mechanical strength compatible with the required stresses;

d) not create gripping or crushing points with machine parts or other protections;

e) cannot have ends and sharp edges or other dangerous projections;

f) withstand the environmental conditions of the place where they are installed;

g) prevent from being juggled;

h) provide hygiene and cleanliness conditions;

i) prevent access to the danger zone;

j) have their interlocking devices adequately protected from dirt, dust and corrosion, if necessary;

k) take positive action, i.e. acting in a positive mode; and

l) not entail additional risks.

12.50. When the protection is made of a discontinued material, shall be noted the safety distances to prevent access to danger zones, as provided in Annex I, Item A.

12.51. During the use of protections away from machine or equipment with possibility of someone getting into the danger zone, shall be adopted additional safety measures of collective protection to prevent starting the machine while there are persons in that area.

12.52. The protections also used as mean of access by the exigency of the machinery or equipment characteristics shall meet the safety and strength requirements appropriate for both purposes.

12.53. There shall be protection on the bottom of the ladder steps, i.e., in the risers, whenever a protruding part of the foot or hand can contact a hazardous area.

12.54. The protections, devices and safety systems shall integrate the machinery and equipment, and can not be considered optional items for any purpose.

12.55. Due to the risk, can be required design, diagram or schematic representation of the machinery safety systems with respective technical specifications into Portuguese Language.

12.55.1. When the machine does not have the required technical documentation, its owner shall constitute it, under the responsibility of legally qualified professional and with the respective Technical Responsibility Annotation of the Regional Council of Engineering and Architecture - ART/CREA.

Emergency stop devices

12.56. The machinery shall be equipped with one or more emergency stop devices, through which can be avoided latent and existent danger situations.

12.56.1. The emergency stop devices shall not be used as starting or actuation device.

12.56.2. Are excepted from the requirement of sub-item 12.56.1 the manual machines, self-propelled machinery and those in which the emergency stop device does not allow risk reduction.

12.57. The emergency stop devices shall be positioned in locations of easy access and viewing by the operators in their worksites and by other persons, and kept permanently clear.

12.58. The emergency stop devices shall:

a) be selected, assembled and interconnected in order to withstand the prescribed operating conditions as well as the influences of the environment;

b) be used as auxiliary measure, and not as an alternative measure appropriate to the protection or to the automatic safety systems;

c) have actuators designed for easy operation of the operator or others who may require their use;

d) take precedence over all other commands;

e) causing the stoppage of operation or dangerous process in period of time as small technically as possible, without creating additional hazards;

f) be kept under surveillance through safety systems; and

g) be maintained in perfect operating condition.

12.59. The emergency stop function shall not:

a) impair the effectiveness of safety systems or devices with functions related to safety;

b) prejudice any means designed to rescue accident victims; and

c) generating additional risk.

12.60. The actuation of the emergency stop device shall also result in the retention of the actuator, so that when the actuator action is discontinued, it remains retained until it is deactivated.

12.60.1. The deactivation shall only be possible as a result of an intentional manual action on the actuator, through appropriate operation;

12.61. When used cable-type actuators, shall:

a) use emergency-stop switches that work tensioned so as to automatically stops the machinery hazardous functions in case of breakage or loosening of the cables;

b) consider the displacement and the force applied to the actuators, required for the actuation of the emergency stop switches; and

c) follow the maximum distance between the emergency stop switches recommended by the manufacturer.

12.62. The emergency stop switches shall be located so that all the actuator cable is visible from the position of emergency stop deactivation.

12.62.1. If is not possible to comply with the requirement in item 12.62, it shall ensure that, after the actuation and before the deactivation, the machinery or equipment is inspected throughout the length of the cable.

12.63. The emergency stop shall require reset or manual reset, to be performed only after the correction of the event that caused the emergency stop actuation.

12.63.1. The location of the reset actuators shall allow a full view of the area protected by the cable.

Permanent means of access

12.64. The machinery and equipment shall have accesses permanently fixed and secured at all their points of operation, supply, raw materials insertion and removal of products worked, preparation, maintenance and constant intervention.

12.64.1. Are considered means of access lifts, ramps, walkways, platforms or stairs.

12.64.2. In the technical impossibility of applying the technical means provided on sub-item 12.64.1, may be used a ship-type ladder.

12.64.3. In machinery and equipment, the permanent means of access shall be located and installed to prevent accidents risks and facilitate the access and use by the workers.

12.65. The use of the means of access shall consider the pitch angle as shown in Figure 1 of Annex III.

12.66. The places or worksites above ground level where there is access of workers to control or any other usual interventions in the machinery and equipment, such as operation, supply, maintenance, preparation and inspection, shall have stable and safe working platforms.

12.66.1. In the technical impossibility of applying the provisions of item 12.66, may be adopted the use of moveable or elevatory platforms.

12.67. The moveable platforms shall be stable, so as not to allow their movement or tipping during the work.

12.68. The catwalks, platforms, ramps and stairs shall provide safe working conditions, circulation, movement and handling of materials and:

a) be sized, built and secured in a safe and resistant manner, in order to withstand the stresses and safe movement of workers;

b) have floors and steps made of slip-resistant materials or coatings;

c) be kept clear; and

d) be located and installed as to prevent risk of falling, slipping, tripping and excessive physical efforts by workers to use them.

12.69. The ramps with slopes between 10º (ten) and 20º (twenty) degrees from the horizontal plane shall have horizontal cross parts securely attached to prevent slipping, spaced with each other 0.40 m (forty centimeters) in all its entire length when the floor is not slip-resistant.

12.69.1. It is prohibited to build ramps with slopes greater than 20º (twenty) degrees from the floor.

12.70. The means of access, except elevator and ship-type ladder, shall have falling protection system with the following characteristics:

a) be sized, built and secured in a safe and resistant manner, in order to withstand the stresses;

b) be made of material resistant to weathering and corrosion;

c) having upper cross member from 1.10 m (one meter and ten centimeters) to 1.20 m (one meter and twenty centimeters) in height from the floor along the entire length on both sides;

d) the upper cross member shall not have flat surface, in order to prevent the placement of objects; and

e) have skirting-board of at least 0.20 m (twenty centimeters) in height and intermediate cross member to 0.70 m (seventy centimeters) in height from the floor, located between the skirting-board and the upper cross member.

12.71. If there is danger of falling objects and materials, the clearance between the skirting-board and the upper cross member of the railing shall receive fixed, full and resistant protection.

12.71.1. The protection cited on item 12.71 may be formed of resistant screen, provided its mesh does not allow the passage of any object or material that can cause injuries to the workers.

12.72. For the falling protection system in platforms used in supply operations or that accumulate dirts is allowed the adoption of the dimensions of Figure 5 of Annex III.

12.73. The catwalks, platforms and ramps shall have the following characteristics:

a) minimum width of 0.60 m (sixty centimeters);

b) means of drainage, if necessary; and

c) can not have skirting-board in the access clearance.

12.74. The stairs without riser shall have:

a) width of 0.60 m (sixty centimeters) to 0.80 m (eighty centimeters);

b) steps with a minimum depth of 0.15 m (fifteen centimeters);

c) uniform steps and flights, leveled and without protrusions;

d) maximum height between steps of 0.25 m (twenty-five centimeters);

e) rest platform with 0.60 m (sixty centimeters) to 0.80 m (eighty centimeters) of width and length at intervals of not more than 3.00 m (three meters) in height;

f) minimum projection of at least 0.01 m (ten millimeters) of one step on the other; and

g) steps with depth that meets the formula: $600 \leq g + 2h \leq 660$ (dimensions in millimeters) as shown in Figure 2 of Annex III.

12.75. The stairs with riser shall have:

a) width of 0.60 m (sixty centimeters) to 0.80 m (eighty centimeters);

b) steps with a minimum depth of 0.20 m (twenty centimeters);

c) uniform steps and flights, leveled and without protrusions;

d) height between the steps of 0.20 m (twenty centimeters) to 0.25 m (twenty-five centimeters);

e) rest platform with 0.60 m (sixty centimeters) to 0.80 m (eighty centimeters) of width and length at intervals of not more than 3.00 m (three meters) in height.

12.76. The fixed ship-type ladders shall have:

a) dimension, construction and secure and resistant mounting, to withstand the applied stresses;

b) provision of materials or coatings resistant to weathering and corrosion, if they are exposed to corrosive or external environment;

c) roll cages, in the event to have a height greater than 3.50 m (three meters and fifty centimeters), installed from 2.0 m (two meters) from the floor, exceeding the rest platform or the top floor in at least 1.10 m (one meter and ten centimeters) to 1.20 m (one meter and twenty centimeters);

d) handrail or continuation of the stair pillars exceeding the rest platform or the top floor of 1.10 m (one meter and ten centimeters) to 1.20 m (one meter and twenty centimeters);

e) width of 0.40 m (forty centimeters) to 0.60 m (sixty centimeters), as shown in Figure 3 of Annex III;

f) maximum total height of 10.00 meters (ten meters), if a single flight;

g) maximum height of 6.00 meters (six meters) between two rest platforms, if multiple flights, built in consecutive flights with parallel axes, spaced by at least 0.70 m (seventy centimeters), as shown in Figure 3 of Annex III;

h) spacing between bars of 0.25 m (twenty-five centimeters) to 0.30 meters (thirty centimeters), as shown in Figure 3 of Annex III;

i) spacing between the floor of the machine or the first bar not exceeding 0.55 m (fifty-five centimeters), as shown in Figure 3 of Annex III;

j) distance from the structure that is attached to at least 0.15 m (fifteen centimeters), as shown in Figure 4 of Annex III;

k) bars of 0.025 m (twenty-five millimeters) to 0.038 m (thirty-eight millimeters) in diameter or thickness; and

l) bars with surfaces, shapes or grooves to prevent slippage.

12.76.1. The roll cages shall have:

a) diameter of 0.65 m (sixty-five centimeters) to 0.80 m (eighty centimeters), as shown in Figure 4 of Annex III; and

b) clearance between guardrails of no more than 0.30 meters (thirty centimeters), as shown in Figure 3 of Annex III.

Pressurized components

12.77. Shall be adopted additional protection measures of hoses, piping and other pressurized components subject to possible mechanical impacts and other aggressive agents when there is risk.

12.78. Hoses, piping and other pressurized components shall be located or protected so that a situation of rupture of these components and fluid leaks cannot cause accidents of work.

12.79. The hoses used in pressurized systems shall have an indication of the maximum allowable working pressure specified by the manufacturer.

12.80. The machinery pressurized systems shall have means or devices intended to ensure that:

a) the maximum allowable working pressure in the circuits cannot be exceeded; and

b) progressive or abrupt pressure drops and vacuum loss can not generate danger.

12.81. When the machine's energy sources are isolated, the residual pressure of reservoirs and similar containers, such as hydropneumatic accumulators, cannot create a risk of accidents.

12.82. The containers containing compressed gases used in machinery and equipment shall remain in perfect condition and operation and be stored in reservoirs well ventilated, protected from falling, heat and accidental impacts.

12.83. In tires assembly and dismantling activities of machinery and equipment wheels not stationary, which have risks of accidents, shall be noted the following conditions:

a) the tires shall be completely depressurized, removing the calibration valve core before the dismantling and of any intervention that may cause accidents; and

b) the filling of tires can only be performed inside an enclosure device enclosure or roll cage properly sized until is reached a sufficient pressure to force the bead over the rim and create a pneumatic sealing.

12.84. In pneumatic and hydraulic systems that use two or more stages with different pressures as a protective measure, the force exerted on the path or safety circuit – approximation - cannot be enough to cause injuries to the physical integrity of workers.

12.84.1. To meet the provisions of item 12.84, the force exerted on the path or safety circuit shall be limited to 150 N (one hundred and fifty Newtons) and the contact pressure limited to 50 N/cm^2 (fifty Newtons per square centimeter) except in cases where there is prevision of other values in current specific official technical standards.

Material conveyors

12.85. The hazardous movements of the continuous material conveyors shall be protected, especially at the crushing, gripping and trapping points formed by the tracks, belts, rollers, clutches, brakes, pulleys, samplers, flywheel, drums, gears, racks, chains, guides, aligners, stretching region and counterweight, and other moveable parts accessible during normal operation.

12.85.1. The continuous belt conveyors whose height from the belt edge that carries the load is greater than 2.70 m (two meters and seventy centimeters) from the floor are exempted from the provisions of item 12.85, provided there is no circulation nor permanency of persons in hazardous areas.

12.85.2. The continuous belt conveyors where there is distant fixed protection, coupled with moveable interlocked protection that restricts access to specialized personnel to perform inspections, maintenance and other necessary interventions, are exempted from the provisions of item 12.85, provided that the provisions under item 12.51 are met.

12.86. The continuous belt conveyors, whose height from the belt edge that carries the load is greater than 2.70 m (two meters and seventy centimeters) from the floor, shall have in their entire length, walkways on both sides, if the requirements of item 12.66 are met.

12.86.1. The conveyors whose belt has a width of up to 762 mm (seven hundred sixty-two millimeters or 30 (thirty) inches can have catwalk on one side only and the use adoption of moveable or elevatory platforms for any interventions and inspections.

12.86.2. The articulated moveable conveyors where there is the possibility to perform any interventions and inspections from the floor are exempted from the requirement in item 12.86.

12.87. The material conveyors shall only be used for the type and load capacity for which they were designed.

12.88. The wire ropes, chains, slings, hooks and other suspension or traction elements and their connections shall be adequate for the type of material and sized to withstand the stresses.

12.89. In the continuous material conveyors that require stoppage during the process is prohibited the reversal of movement for this purpose.

12.90. It is prohibited the permanency and circulation of persons on moveable parts, or that can move, of the material conveyors, when not designed for these purposes.

12.90.1. In situations where there is a technical unfeasibility of compliance with the provisions of item 12.90, shall be taken measures to ensure the stop and blockage of the risk movements, as provided on item 12.113 and sub-item 12.113.1.

12.90.2. The permanency and circulation of persons on the continuous conveyors shall be performed by means of catwalks with falling protection system, according to item 12.70.

12.90.3. It is allowed the permanency and circulation of persons under the continuous conveyors only in protected locations that offers appropriate dimensions and strength against falling of materials.

12.91. The continuous conveyors accessible to workers shall be provided, along its length, of emergency stop devices, so that they can be actuated in all working positions.

12.91.1. The continuous conveyors accessible to workers are exempted from compliance with the requirement on item 12.91 if the risk analysis indicates in that manner.

12.92. The continuous belt conveyors shall have devices to ensure safety in case of failure during normal operation and that stops their operation when the safety limits are reached as specified in design, and shall cover at least the following conditions:

a) abnormal belt misalignment; and

b) material overload.

12.93. During the transport of suspended materials shall be taken safety measures aiming to ensure that no persons are under the load.

12.93.1. The safety measures provided on item 12.93 shall prioritize the existence of exclusive areas for the circulation of suspended loads properly delimitated and signalized.

Ergonomic aspects

12.94. The machinery and equipment shall be designed, built and maintained to comply with the following aspects:

a) meeting of the anthropometric characteristics variability of the operators;

b) compliance with the postural, cognitive requirements, movement and physical efforts demanded by the operators;

c) the components such as displays, signals and commands, shall enable the clear and precise interaction with the operator to reduce possibilities for misinterpretation or information feedback errors;

d) the controls and indicators shall represent, whenever possible, the direction of movement and all other corresponding effects;

e) the interactive systems, such as icons, symbols and instructions shall be consistent in its appearance and function;

f) facilitate the performance and reliability of operations, reducing the likelihood of failures in the operation;

g) reduction of requirement for power, pressure, deflection, extension or twisting of the body segments;

h) the illumination shall be adequate and be available in emergency situations when required to enter in its interior.

12.95. The machinery and equipment controls shall be designed, built and maintained in compliance with the following aspects:

a) location and distance in order to allow easy and safe handling;

b) installation of the commands used in positions more accessible to the operator;

c) visibility, identification and marking that permits to be distinguished from each other;

d) installation of the hand or pedal actuation elements in order to facilitate the execution of the maneuver taking into account the biomechanical and anthropometric characteristics of operators; and

e) ensuring the safe and quick maneuvers and protection to prevent unintended movements.

12.96. The machinery and equipment shall be designed, built and operated taking into account the necessity of adapting for working conditions to the psychophysiological characteristics of workers and the nature of the works to be performed, offering comfort and safety conditions at work, in compliance with NR 17.

12.97. The seats used in the machinery operation shall have cushion and be adjustable to the nature of work performed, beyond that provided on sub-item 17.3.3 of NR 17.

12.98. The worksites shall be designed to allow the alternation of posture and adequate movement of body segments, ensuring enough space for operation of the installed controls.

12.99. The worksites surfaces shall not have sharp edges, rough and sharp surfaces and corners in acute angles or burrs on the points of contact with the operator's body segments, and the fixing elements such as nails, rivets and screws, shall be kept so as not to add risk to the operation.

12.100. The machinery and equipment worksites shall allow the full support of the soles on the floor.

12.100.1. Shall be provided footrests support when the operator's feet do not reach the floor even after the seat adjustment.

12.101. The dimensions of the machinery and equipment worksites shall:

a) meet the biomechanical and anthropometric characteristics of the operator, with respect to the reaches of the body segments and vision;

b) ensure the proper posture, in order to assure comfortable positions of the body segments in the working position; and

c) avoid torso deflection and twist in order to observe the angles and natural paths of body movements during the tasks.

12.102. The locations intended for the material handling in processes on machinery and equipment shall have height and be positioned to ensure good posture conditions, visualization, movement and operation.

12.103. The machinery and equipment worksites shall have permanent lighting system that allows good visibility of the work details, to avoid shadow or penumbra areas and stroboscopic effect.

12.103.1. The illumination of the inner parts of machinery and equipment that require adjustment operations, inspection, maintenance and other periodic interventions shall be appropriate and be available in emergencies situations, when is required the entry of persons observing the specific requirements for classified areas.

12.104. The work rhythm and the machinery and equipment speed shall be compatible with the physical ability of operators in order to prevent health problems.

12.105. The filler neck of fuel tank and other materials shall be located no more than 1.50 m (one meter and fifty centimeters) above the floor or support platform for the task.

Additional risks

12.106. For the purposes of this Standard, shall be considered the following additional risks:

a) any hazardous substances, whether chemical or biological agents in solid, liquid or gaseous state, which shows a risk to health or physical integrity of workers through inhalation, ingestion or contact with skin, eyes or mucous membranes;

b) ionizing radiations generated by machinery and equipment or from radioactive substances used, processed or produced by them;

c) non-ionizing radiations that could cause damage to health or physical integrity of workers;

d) vibrations;

e) noise;

f) heat;

g) fuels, flammables, explosives and substances that react dangerously; and

h) accessible heated surfaces that shows a risk of burns caused by contact with skin.

12.107. Shall be adopted measures to control the additional risks from the emission or release of chemical, physical and biological agents by machinery and equipment, with priority to its removal, reduction of its emission or release and reduction of workers' exposure, in that order.

12.108. Machinery and equipment which use, process or produce fuels, flammables, explosives or substances which react dangerously shall provide protective measures against its emission, release, combustion, explosion and accidental reactions, as well as the occurrence of fire.

12.109. Shall be adopted measures to protect against burns caused by skin contact with hot surfaces of machinery and equipment, such as reducing the surface temperature, insulation with suitable materials and barriers, whenever the surface temperature is greater than the threshold of burns of the material of which is constituted for a certain period of contact.

12.110. Shall be developed and applied safety procedures and work permission to ensure the safe use of machinery and equipment for work in confined spaces.

Maintenance, inspection, preparation, adjustments and repairs

12.111. The machinery and equipment shall be subjected to preventive and corrective maintenance in the manner and frequency determined by the manufacturer according to current official national technical standards and, missing those, international technical standards.

12.111.1. The preventive maintenances with the potential to cause accidents at work shall be subject to planning and management performed by a legally qualified professional.

12.112. The preventive and corrective maintenance shall be recorded in own book, index card or information system, with the following data:

a) maintenance schedule;

b) interventions performed;

c) date of completion of each intervention;

d) service performed;

e) parts repaired or replaced;

f) safety equipment conditions;

g) conclusive indication for the machine safety conditions; and

h) name of the person responsible for performing of interventions.

12.112.1. The record of maintenance shall be available to the workers involved in operation, maintenance and repairs, as well as the Internal Commission of Accident Prevention, CIPA, to the Service of Safety and Occupational Medicine - SESMT and to the supervision of the Ministry of Labour and Employment.

12.113. The maintenance, inspection, repairs, cleaning, adjustments and other interventions that are necessary shall be performed by trained, qualified or legally skilled professionals, formally authorized by the employer, with machinery and equipment stopped and adoption of the following procedures:

a) insulation and discharge of all energy sources of machinery and equipment, in a visible manner or easily identifiable by means of the control devices;

b) electrical and mechanical lock in "off" or "closed" position of all cut devices of energy sources, in order to prevent re-energizing, and signaling with lock card or tag containing the time and date of locking, the reason for the maintenance and the name of the person responsible;

c) measures to ensure that downstream of the cut energy points there is no possibility of generating risk of accidents;

d) additional safety measures, when is performed maintenance, inspection and repairs of equipment or machinery supported by hydraulic and pneumatic systems only; and

e) restraints systems with mechanical lock to prevent accidental back movement of tilted or articulated open parts of the machinery and equipment.

12.113.1. For special situations of setting, adjustment, cleaning, troubleshooting and non-conformances, where it is not possible the accomplishment of conditions established on item 12.113, and in other situations involving the safety level reduction of machinery and equipment and there is a need to access the danger zones shall be possible to select a mode of operation that:

a) becomes inoperative the automatic control mode;

b) allow the completion of services with the use of actuation device of continued action associated to speed reduction or control devices by limited movement;

c) prevent the change by unauthorized workers;

d) the selection corresponds to a single command or operation mode;

e) when selected, has priority over all other control systems, with the exception of emergency stop; and

f) makes the selection visible, clear and easily identifiable.

12.114. The maintenance of machinery and equipment will include, among other items, the attainment of non-destructive testing - NDT, in the structures and components subject to forces and whose breakage or wear can cause accidents.

12.114.1. The non-destructive testing - NDT, when performed, shall conform to current official national technical standards and, missing those, international technical standards.

12.115. In maintenance of machinery and equipment, whenever a defect is detected in the part or component which implicates the safety, shall be provided its repair or immediate replacement with another original part or component or equivalent, to ensure the same characteristics and use safe conditions.

Signs

12.116. The machinery and equipment, as well as the facilities where they are, shall have safety signs to warn workers and others about the risks they are exposed to, the operation and maintenance instructions and other information necessary to ensure the physical integrity and health of workers.

12.116.1. The safety signs include the use of colors, symbols, markings, luminous or audible signals, among other forms of communication with the same efficiency.

12.116.2. The signs, including colors, of machinery and equipment used in the food, medical and pharmacist sectors shall obey the current sanitation law, without prejudice to the safety and health of workers or third parties.

12.116.3. The safety signs shall be adopted at all phases of use and life of machinery and equipment.

12.117. The safety signs shall:

a) be emphasized on the machine or equipment;

b) be in clearly visible location; and

c) be of easy understanding.

12.118. The symbols, markings and luminous or audible signals shall follow the standards established by the current national technical standards and, missing those, by international technical standards.

12.119. The markings of the machinery and equipment shall:

a) be written in Portuguese Language - Brazil;

b) be legible.

12.119.1. The markings shall clearly indicate the risk and the part of the machinery or equipment to which they relate, and shall not be used the marking "danger" only.

12.120. The markings and symbols shall be used in machinery and equipment to indicate its specifications and technical limitations.

12.121. Shall be adopted, where appropriate, active warning or alert signs, such as intermittent luminous and audible signals, indicating the imminence of a hazardous event, such as starting or overspeed of a machine, so that:

a) be emitted before the hazardous event occurs;

b) are not ambiguous;

c) be clearly understood and distinguished from all other signals used; and

d) can be positively recognized by the workers.

12.122. Except when there is prevision in other Regulatory Standards, shall be used the following colors for safety signs of machinery and equipment:

a) yellow:

1. fixed and moveable protections - except when the dangerous movements are confined in their own fairing or structure of the machinery or equipment, or when technically feasible;

2. restraint mechanical components, devices and other parts intended for the safety; and

3. ladder cages, handrails and railing and skirting board systems.

b) blue: communication of safety stoppage and locking for maintenance.

12.123. The machinery and equipment made from the date of this standard shall have in a visible place the indelible information, containing at least:

a) legal name, corporate identity number (CNPJ) and address of manufacturer or importer;

b) information on type, model and capacity;

c) serial number or identification number and year of manufacture;

d) registration number of the manufacturer or importer in the CREA; and

e) weight of the machinery or equipment.

12.124. To warn workers about possible hazards shall be installed, if necessary, indicator devices of qualitative and quantitative reading or safety control.

12.124.1. The indicators shall be easy to read and distinguishable from each other.

Manuals

12.125. The machinery and equipment shall have instruction manuals supplied by the manufacturer or importer with information relating to safety at all stages of use.

12.126. When missing or lost, the machinery or equipment manual which shows risks shall be reconstituted by the employer, under the responsibility of a legally qualified professional.

12.127. The manuals shall:

a) be written in Portuguese Language - Brazil, with characters of type and size to allow the better readability possible, followed by explanatory illustrations;

b) be objective, clear, unambiguous and easy understanding language;

c) have signs or warnings regarding to safety; and

d) remain available to all users in the workplaces.

12.128. The manuals of machinery and equipment manufactured or imported from the date of this standard shall contain, at least, the following information:

a) legal name, corporate identity number (CNPJ) and address of manufacturer or importer;

b) type, model and capacity;

c) serial number or identification number and year of manufacture;

d) observed standards for design and construction of machinery or equipment;

e) detailed description of the machinery or equipment and their accessories;

f) diagrams, including electrical circuits, especially the schematic representation of the safety functions;

g) definition of the intended use of the machinery or equipment;

h) risks where the users are exposed, with the respective quantitative assessments of emissions generated by the machinery or equipment at their full capacity utilization;

i) definition of existing safety measures and those to be adopted by the users;

j) technical specifications and limitations for its use with safety;

k) risks that can result from tampering or removal of protections and safety devices;

l) risks that can result from uses other than those prescribed in the design;

m) procedures for the use of machinery or equipment safely;

n) procedures and schedule for inspections and maintenance;

o) procedures to be adopted in emergencies;

p) indication of the useful life of the machinery or equipment and components related to safety.

12.129. In case of machinery and equipment manufactured or imported before the entry into force of this standard, the manuals shall contain at least the information specified in the paragraphs "b", "e" "f", "g", "i", "j", "k", "l", "m", "n" and "o" on item 12.128.

Work and safety procedures

12.130. Shall be developed specific, standardized work and safety procedures, with detailed description of each task, step by step, from the risk analysis.

12.130.1. The Work and safety procedures cannot be the only protective measures adopted to prevent accidents and are considered supplements and not substitutes for collective protective measures needed to ensure the safety and health of workers.

12.131. At the beginning of each work shift or after a new preparation of the machinery or equipment, the operator shall perform routine inspection of operational and safety conditions and, if detected abnormalities that affect the safety, the activities shall be discontinued, with the communication for his superior.

12.132. The services in machinery and equipment that involve risk of accidents at work shall be planned and performed in accordance with the work and safety procedures, under supervision and express consent of a qualified and skilled professional, since authorized.

12.132.1. The services in machinery and equipment that involve risk of accidents at work shall be preceded by specific work orders - OS -, containing at least:

a) a description of the service;

b) the date and place of work performance;

c) the name and role of workers; and

d) the persons responsible for the service and for the issue of the OS, according to work and safety procedures.

Design, manufacture, importation, sale, lease, auction, cession in any way, exposure and use

12.133. The design shall take into account the safety of machinery or equipment during the construction, transport, assembly, installation, adjustment, operation, cleaning, maintenance, inspection, deactivation, dismantling and scrapping phases through the technical references listed in this standard, to be observed to ensure the health and physical integrity of workers.

12.133.1. The design of the machinery or equipment shall not allow errors in assembly or reassembly of certain parts or elements that can create hazards during its operation, especially regarding the speed direction or displacement.

12.133.2. The design of the machinery or equipment manufactured or imported after the entry into force of this standard shall provide adequate means for their lifting, loading, installation, removal and transportation.

12.133.3. Shall be foreseen safe means for the installation, removal, dismantling or transportation activities, even in parts, of machinery and equipment manufactured or imported before the entry into force of this standard.

12.134. It is prohibited the manufacture, importation, sale, auction, lease, cession in any way, exposure and use of machinery and equipment that do not meet the provisions of this standard.

Technical training

12.135. The operation, maintenance, inspection and all other interventions in machinery and equipment shall be performed by skilled, qualified, trained or authorized workers for this purpose.

12.136. The workers involved in the operation, maintenance, inspection and all other interventions in machinery and equipment shall receive technical training provided by the employer and compatible with their roles that cover the risks they are exposed and the protective measures available and necessary, in accordance with this Standard, for the prevention of accidents and diseases.

12.137. The operators of machinery and equipment shall be over eighteen years of age, except as an apprentice condition under the current law.

12.138. The technical training shall:

a) occur before the employee assumes the roles;

b) be made by the employer, without cost to the employee;

c) have minimum workload assuring the workers to perform their activities safely, being distributed in a maximum of eight daily hours and performed during normal working hours;

d) have a content of training program as set out in Annex II of this standard; and

e) be given by qualified professionals or workers for this purpose, supervised by legally qualified professional who will be responsible for the suitability of the content, form, workload, instructors qualification and assessment of qualified persons.

12.139. The teaching material in written or audiovisual used on training and that provided to the participants, shall be produced in suitable language to the workers, and be kept available for inspection, as well as the attendance list or certificate, the curriculum vitae from the teachers and assessment of qualified persons.

12.140. It is considered a qualified worker or professional who can prove completion of specific course in the area, recognized by the official educational system, compatible with the course to be taught.

12.141. It is considered a legally qualified professional to supervise the technical training who can prove completion of specific course in the area, compatible with the course to be taught, with registration in competent class council.

12.142. The technical training is only valid for the employer who made it and in the established conditions by the legally qualified professional responsible for the technical training supervision.

12.142.1. It is exempted from the requirement of item 12.142 the plastic injector machine operators with technical training course as provided on item 12.147 and its sub-items.

12.143. Are considered authorized the skilled, qualified workers or legally qualified professionals, with authorization given by a formal document of the employer.

12.143.1. Until the effective date of this standard, will be considered skilled the worker who has evidence, through registration in the Labour Evidence Booklet, CTPS or employee registration of at least two years of experience in the activity and who receives recycling as required on item 12.144 of this standard.

12.144. Technical training shall be performed for recycling of the worker whenever significant changes occur in the facilities and in operation of machinery or changes in methods, processes and work organization.

12.144.1. The content of training program for recycling shall meet the needs of the situation that motivated, with minimum workload assuring the workers to perform their activities safely, being distributed in a maximum of eight daily hours and performed during normal working hours.

12.145. The role of the employee who operates and performs interventions on machinery shall be noted on the employee registration, recorded in book, index card or electronic system and in his Labour Evidence Booklet, CTPS.

12.146. The self-propelled machinery operators shall carry identification card with name, role and photo in a visible place, renewed with intervals not exceeding one year upon a medical examination, according to provisions of the NR 7 and NR 11.

12.147. The technical training course for plastic injector machine operators shall have a minimum workload of eight hours per machine type cited in Annex IX of this Standard.

12.147.1. The technical training course shall be specific to the machine type where the operator will exercise its functions and meet the following content of training program:

a) history of safety regulation on the specified machinery;

b) description and operation;

c) risks in the operation;

d) main danger zones;

e) measures and safety devices to prevent accidents;

f) protections - doors, and safety distances;

g) minimum safety requirements set out in this Standard and in NR 10;

h) safety measures for electrical and hydraulic injection machinery of manual control; and

i) practical demonstration of the hazards and safety devices.

12.147.2. The technical training course instructor for injection machinery operators shall have at least:

a) technical training in high school;

b) technical knowledge of machinery used in the plastic material processing;

c) knowledge of technical standardization related to safety;

d) specific technical training.

Other specific safety requirements

12.148. The tools and materials used in interventions in machinery and equipment shall be appropriate to operations performed.

12.149. The accessories and tooling used by the machinery and equipment shall be appropriate to operations performed.

12.150. It is prohibited carrying of hand tools in pockets or places not suitable for that purpose.

12.151. The tractive machinery and equipment shall have standardized coupling systems for towing by the drive system, in order to ensure the easy and safe coupling and decoupling, as well as to prevent the accidental decoupling during use.

12.151.1. The indication for use of standardized coupling systems cited on item 12.151 shall be in place for easy visualization and fixed in a place near the connection.

12.151.2. The tractive equipment, if the weight of the tow bar so requires, shall have support device that enables the reduction of efforts and the safe connection to the drive system.

12.151.3. The coupling operation shall be performed in an appropriate place with the equipment in traction, safely immobilized with chock or similar.

12.152. For the purposes of apply this standard, the Annexes are additional obligations, with special provisions or exceptions to a specific machine type or equipment, beyond those already established in this standard, without prejudice to the provisions in specific Regulatory Standard.

Final provisions

12.153. The employer shall maintain updated inventory of machinery and equipment with identification by type, capacity, safety systems and location on floor plan, prepared by a qualified professional or legally skilled.

12.153.1. The inventory information shall subsidize the management actions to apply this standard.

12.154. All documentation referred to in this standard, including the inventory referred to on item 12.153, shall be available for the SESMT, CIPA or Internal Commission of Accident Prevention in Mining - CIPAMIN, union representatives of the professional category and supervision of the Ministry of Labour and Employment.

12.155. The self-propelled agricultural, forestry and construction machinery in agroforestry applications and its implements shall meet the provisions of Annex XI of this Standard.

12.156 The self-propelled machinery not covered on item 12.155 shall meet the requirements of items and sub-items 12.1, 12.1.1, 12.2, 12.3, 12.4, 12.5, 12.22, 12.23, 12.38, 12.38.1, 12.47, 12.47.2, 12.48, 12.49, 12.52, 12.53, 12.54, 12.64, 12.64.3, 12.66, 12.77, 12.78, 12.94, 12.95, 12.96, 12.101, 12.105, 12.107, 12.108, 12.111, 12.112, 12.115, 12.116, 12.116.3, 12.117, 12.118, 12.121, 12.130, 12.130.1, 12.131, 12.132, 12.132.1, 12133, 12.133.1, 12.133.2, 12.133.3, 12.134, 12.135, 12.136, 12.137, 12.138, 12.139, 12.140, 12.141, 12.142, 12.143, 12.144, 12.144.1, 12.145, 12.146, 12.151, 12.151.1, 12.151.2, 12.151.3, and items and sub-items 14, 14.1 and 14.2 of Annex XI of this Standard.

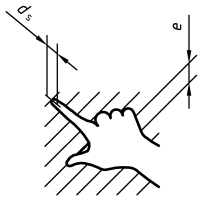
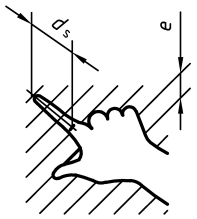
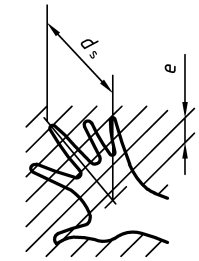
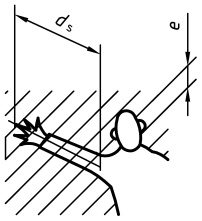
ANNEX I

SAFETY DISTANCES AND REQUIREMENTS FOR USE OF OPTOELECTRONICS PRESENCE DETECTORS

A) Safety distances to prevent access to danger zones when used physical barrier

TABLE I

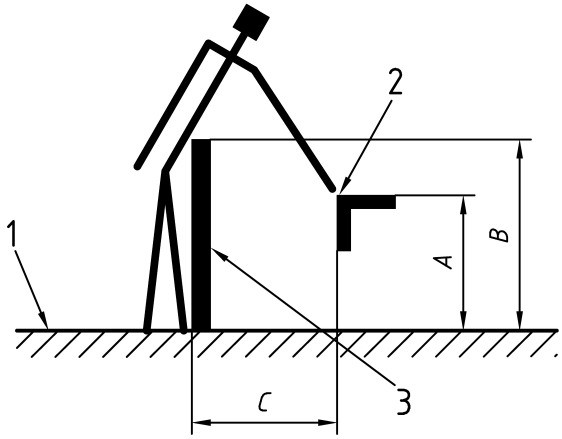
Safety distances to prevent access to danger zones by upper limbs (dimensions in millimeters - mm)

Part of body	**Illustration**	**Opening,** e	**Safety distance,** d_s		
			Slot	**Square**	**Round**
Finger tip		$e \leq 4$	≥ 2	≥ 2	≥ 2
		$4 < e \leq 6$	≥ 10	≥ 5	≥ 5
Finger up to knuckle joint or hand		$6 < e \leq 8$	≥ 20	≥ 15	≥ 15
		$8 < e \leq 10$	≥ 80	≥ 25	≥ 20
		$10 < e \leq 12$	≥ 100	≥ 80	≥ 80
		$12 < e \leq 20$	≥ 120	≥ 120	≥ 120
		$20 < e \leq 30$	≥ 850[a]	≥ 120	≥ 120
Arm up to junction with shoulder		$30 < e \leq 40$	≥ 850	≥ 200	≥ 120
		$40 < e \leq 120$	≥ 850	≥ 850	≥ 850

[a] If the length of the slot opening is ≤ 65 mm, the thumb will act as a stop and the safety distance may be reduced to 200 mm.

Source: ABNT NBR NM-ISO 13852:2003 - Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs.

Figure 1
Reach on protective structures. For use of Table II, note the key of Figure 1 below.



Key:

A height of danger zone
B height of protective structure
C horizontal distance to danger zone

1 reference plane
2 danger zone
3 protective structure

TABLE II
Reach on protective structures – High risk (dimensions in mm)

	Height of protective structure b [1]									
	1000	1200	1400 [2]	1600	1800	2000	2200	2400	2500	2700
Height of danger zone a	Horizontal distance to the danger zone "c"									
2700 [3]	-	-	-	-	-	-	-	-	-	-
2600	900	800	700	600	600	500	400	300	100	-
2400	1100	1100	900	800	700	600	400	300	100	-
2200	1300	1200	1000	900	800	600	400	300	-	-
2000	1400	1300	1100	900	800	600	400	-	-	-
1800	1500	1400	1100	900	800	600	-	-	-	-
1600	1500	1400	1100	900	800	500	-	-	-	-
1400	1500	1400	1100	900	800	-	-	-	-	-
1200	1500	1400	1100	900	700	-	-	-	-	-
1000	1500	1400	1100	800	-	-	-	-	-	-
800	1500	1300	900	600	-	-	-	-	-	-
600	1400	1300	800	-	-	-	-	-	-	-
400	1400	1200	400	-	-	-	-	-	-	-
200	1200	900	-	-	-	-	-	-	-	-
0	1100	500	-	-	-	-	-	-	-	-

[1] Protective structures less than 1000 mm (one thousand millimeters) in height are not included because they do not sufficiently restrict access of the body.

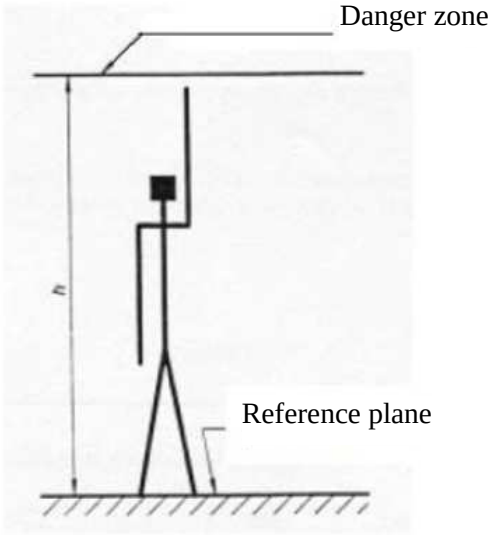
[2] Protective structures less than 1400 mm (one thousand four hundred millimeters) in height shall not be used without additional safety measures.

[3] For danger zones greater than 2700 mm (two thousand and seven hundred millimeters) in height, see Figure 2.

NOTE Shall not be made value interpolations of this Table, thus, when the known values of "a", "b" or "c" are between two values of this Table values, the values to be used will be those that provides better safety.

Source: ABNT NBR NM-ISO 13852:2003 - Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs.

Figure 2
Reach of upper danger zones



Key:

h height of danger zone

If the danger zone offers low risk, it shall be located at a height "h" equal to or greater than 2500 mm (two thousand and five hundred millimeters), for which no protections are needed.

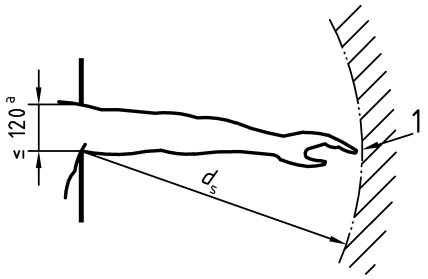
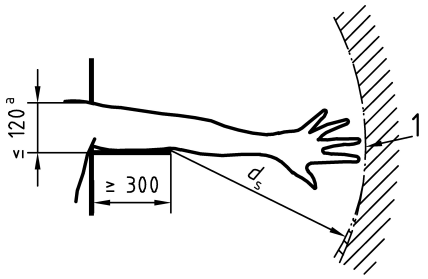
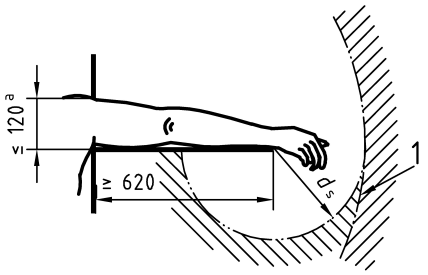
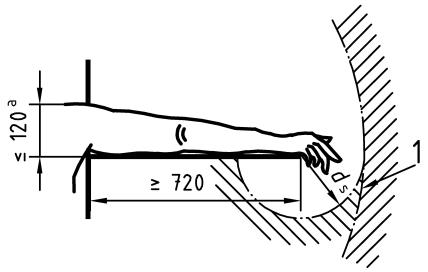
If there is a high risk in the danger zone:

- the height "h" of the danger zone shall be at least 2700 mm (two thousand and seven hundred mm); or

- shall be used other safety measures.

Source: ABNT NBR NM-ISO 13852:2003 - Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs.

TABLE III
Reach around the danger - Fundamental movements (dimensions in mm)

Limitation of movement	**Safety distance** d_s	**Illustration**
Limitation of movement only at shoulder and armpit	≥ 850	
Arm supported up to elbow	≥ 550	
Arm supported up to wrist	≥ 230	
Arm and hand supported up to knuckle joint	≥ 130	
1 Range of movement of arm. [a] Diameter of a round opening, the side of a square opening or the width of a slot opening.		

Source: ABNT NBR NM-ISO 13852 - Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs

B) Calculation of minimum safety distances for the installation of optoelectronics presence detectors - ESPS using light curtain - AOPD.

1. The minimum distance at which ESPS using light curtain - AOPD shall be positioned in relation to the danger zone, will observe the calculation according to ISO 13855. To a perpendicular approach, the distance can be calculated in accordance with the general formula shown in section 5 of ISO 13855, such as follows:

$S = (K \times T) + C$

Where:

S: is the minimum distance in millimeters, from danger zone to the point, line or plane of detection;

K: is a parameter in millimeters per second, derived from data of the approach speed of the body or body parts;

T: is the stop performance of the entire system - total response time in seconds;

C: is the additional distance in millimeters, based on the intrusion against the danger zone before the actuation of the protective device.

1.1. In order to determine K, an approach speed of 1600 mm/s (one thousand six hundred millimeters per second) shall be used for light curtains arranged horizontally. For light curtains arranged vertically, shall be used an approach speed of 2000 mm/s (two thousand millimeters per second) if the minimum distance is equal to or less than 500 mm (five hundred millimeters). An approach speed of 1600 mm/s (one thousand six hundred millimeters per second) can be used if the minimum distance is greater than 500 mm (five hundred millimeters).

1.2. The light curtains shall be installed so that its detection area covers the access to the danger zone, being careful not to provide spaces for the dead zone, i.e. space between the curtain and the machine body where can stay a worker without being detected.

1.3. In respect to the detection capacity of the light curtain, shall be used at least an additional distance C in Table IV when calculating the minimum distance S.

TABLE IV
Additional distance C

Detection capacity mm	Additional distance C mm
≤ 14	0
$> 14 \leq 20$	80
$> 20 \leq 30$	130
$> 30 \leq 40$	240
> 40	850

1.4. Other light curtain installation characteristics, such as a parallel approach, approach in angle and dual-position equipment shall meet the specific conditions provided on ISO 13855. The light curtain application in hydraulic press brakes shall meet EN 12622 standard.

Source: ISO 13855, Safety of machinery - The positioning of protective equipment in respect of approach speeds of parts of the human body.

C) Requirements for the use of laser optoelectronics presence detectors - AOPD in hydraulic press brakes.

1. The hydraulic press brakes can have AOPD laser of multiple beams since is accompanied by detailed work procedure that meets the manufacturer's recommendations, to EN 12622 and to the tests foreseen in this Annex.

1.1. The tests shall be performed by the worker in charge of maintenance or by tool change and repeated by the own operator for each tool change or any maintenance, and be performed by the operator at the beginning of each work shift and when the machine is with long separation.

1.2. The tests shall be performed with a test template provided by the AOPD laser device manufacturer, which consists of a piece of plastic with sections with certain dimensions for this purpose, according to Figure 3.

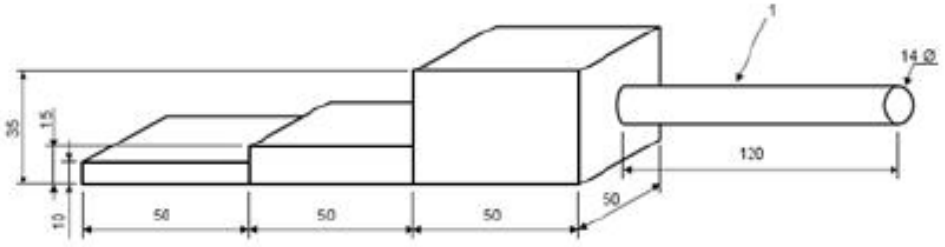
1.3. Testing system in hydraulic press brakes provided in laser optoelectronics presence detector:

a) Test 1: Verify the detection capacity between the tool tip and the laser beam, as close the tool as possible. The space shall be ≤ 14 mm (less than or equal to fourteen millimeters) throughout the area of the tool. The test shall be performed with the handle – cylindrical part with 14 mm (fourteen millimeters) of diameter of the test template, as shown in Figure 3;

b) Test 2: The section of 10 mm (ten millimeters) in thickness of the test template placed on the matrix - bottom of the tool - shall not be touched during the descending course of the tool. In addition, the section of 15 mm (fifteen millimeters) in thickness of the test template shall pass between the tools;

c) Test 3: The section of 35 mm (thirty five millimeters) in thickness of the test template placed on the matrix - bottom of the tool - shall not be touched during the high-speed course for descending of the hammer.

Figure 3
Test template



Key:

1 handle

2. On hydraulic press brakes provided with AOPD laser using descending actuation pedal, it shall be safe and have the following positions:

a) 1st (first) position = stop;

b) 2nd (second) position = operate; and

c) 3rd (third) position = stop in an emergency.

2.1. The tool opening can be activated, since controlled the falling risk of the product in process, with the pedal actuation to the 3rd (third) position or releasing it to the 1st (first) position.

2.2. After driving the actuator until the 3rd (third) position, the restart is only possible with your return to the 1st (first) position. The 3rd (third) position can be actuated through a pressure point; the required force shall not exceed 350 N (three hundred and fifty Newtons).

Source: EN 12622 - Safety of machine tools - Hydraulic press brakes

ANNEX II

CONTENT OF TRAINING PROGRAM

1. The technical training for safe operation of machinery shall cover theoretical and practical steps in order to allow proper skills of the operator for work safe, containing at least:

a) identification and description of risks associated with each machine and equipment and the specific protections against each of them;

b) protections operation, how and why they shall be used;

c) how and under what circumstances a protection can be removed, and by whom, being in most cases, performed by the inspection or maintenance personal only;

d) what to do, for example, contact the supervisor, if a protection was damaged or failed in its function, not ensuring an adequate safety;

e) the safety principles in use of machinery or equipment;

f) safety for mechanical and electrical risks and other relevant;

g) safe work method;

h) work permission; and

i) locking system of the machine and equipment operation during inspection, cleaning, lubrication and maintenance operations.

1.1. The technical training for operators of self-propelled machinery, shall consist of theoretical and practical steps and have the minimum technical content described in paragraphs of item 1 of this Annex and also:

a) notions about traffic laws and safety and occupational health laws;

b) notions about accidents and diseases resulting from exposure to existing risks in machinery, equipment and implements;

c) risk control measures: EPC and EPI;

d) safe operation of machinery or equipment;

e) safe inspection, adjustment and maintenance;

f) safety signs;

g) procedures in emergencies; and

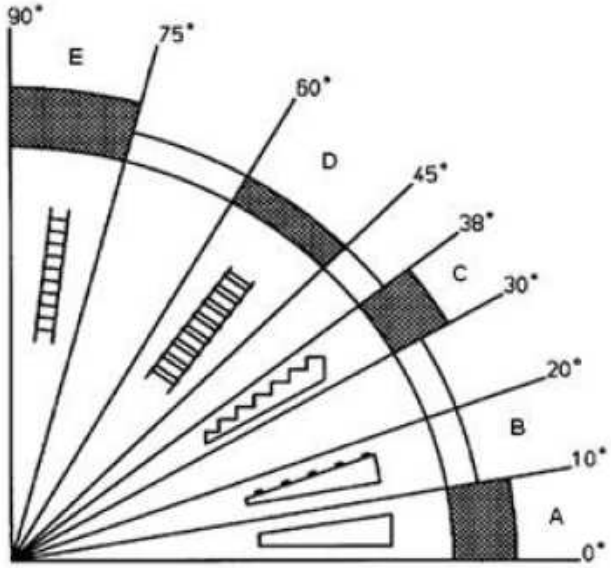
h) notions about first aids.

1.1.1. The practical step shall be supervised and documented and can be performed on the own machine that will be operated.

ANNEX III

PERMANENT MEANS OF ACCESS

Figure 1
Means of access choice according to the slope – Pitch angle

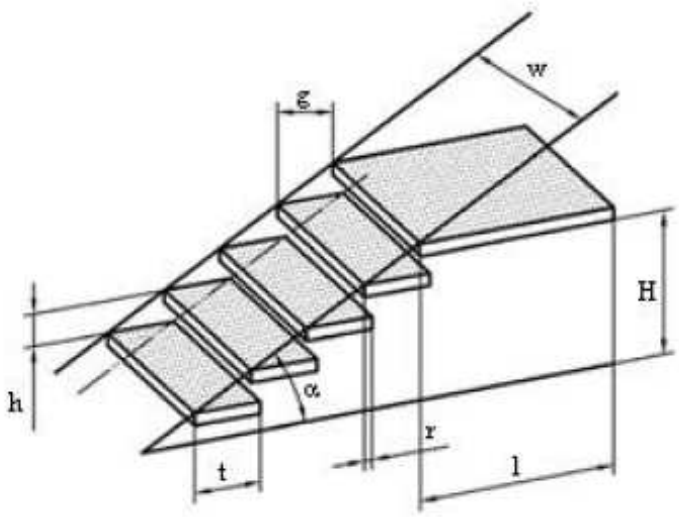


Key:

A ramp
B ramp with cross pieces to prevent slipping
C stair with riser
D stair without riser
E ship-type ladder

Source: EN 14122 - Safety of machinery - Permanent means of access to machinery.

Figure 2
Example of stair without riser

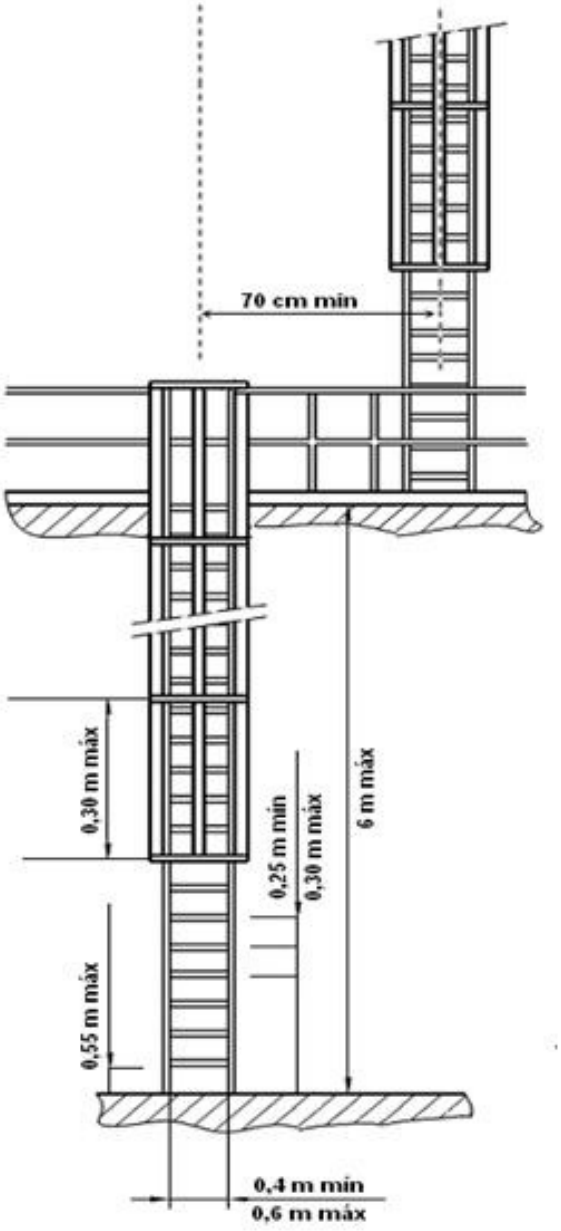


Key:

w ladder width
h height between steps
r projection between steps
g free depth of the step
α ladder inclination - pitch angle
l rest platform length
H ladder height
t total depth of the step

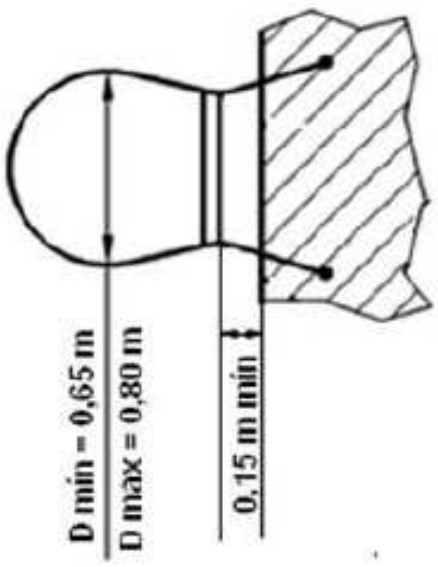
Source: EN 14122 - Safety of machinery - Permanent means of access to machinery.

Figure 3
Example of fixed ship-type ladder.



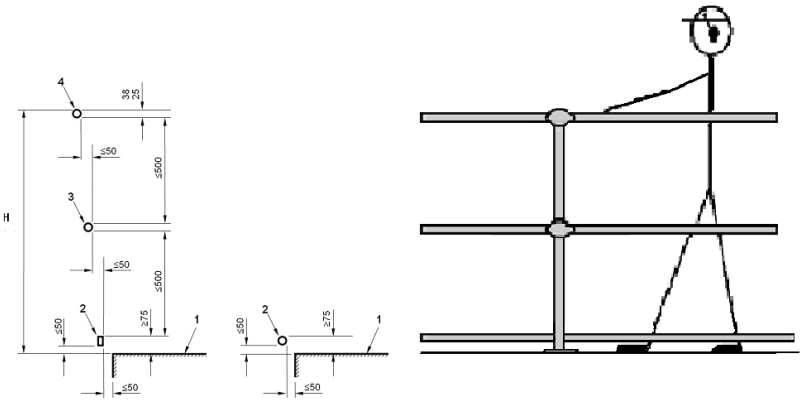
Source: EN 14122 - Safety of machinery - Permanent means of access to machinery.

Figure 4
Example of detail of the fixed ship-type ladder cage



Source: EN 14122 - Safety of machinery - Permanent means of access to machinery.

Figure 5
Protection system against falls from platform. (Dimensions in millimeters)



Key:

H top bar height, between 1000 mm (one thousand millimeters) and 1100 mm (one thousand hundred millimeters)
1 platform
2 skirting board-bar
3 intermediate bar
4 top bar - handrail

ANNEX IV

GLOSSARY

Positive action: when a moveable mechanical component inevitably moves another component with it, by direct contact or by rigid elements, the second component is said as actuated in a positive manner, or positively, by the first one.

Self-propelled fertilizer: machine intended for applying granulated solid fertilizer and developed for the sugar cane sector.

Tractive fertilizer: agricultural implement which, when coupled to a tractor, can perform the operation to apply powder or granulated solid fertilizers.

Meat tenderizers: machine with two or more tractive parallel toothed cylinders that rotates in reverse direction, where are passed pre-cut steak parts. It is composed by: structure, feeding neck, tractive toothed cylinders and discharge area. The softening operation comprises the introduction of the steak through the neck, passing it through the toothed cylinders, being collected from the discharge area.

Kneader: machine designed for industrial or commercial use to obtain a homogeneous mixture for pasta. Basic Composition: structure, actuation, mixer, bowl and protections. For its operation, the actuation system transmits power to the mixer that performs rotational movement without translation movement, making it to rotate and mix the ingredients for pasta production. The actuation system can transmit power to the mixer and to the bowl, simultaneously, keeping both in rotational movement. In some cases, the bowl rotates by the mechanical action of the mixer over the pasta. Both the mixer and bowl can have constant or variable rotational speed.

Pitch angle: angle formed between the means of access inclination and the horizontal plane.

AOPD (Active Optoelectronic Protective Device): device used to detect the interruption of the optical emission by an opaque object present at specified detection zone, as light curtain, laser presence detectors of multiple beams, laser area monitor, and safety photocells for access control. Its function is performed by sensors and optoelectronic receivers.

Trainer seat: seat of self-propelled machinery designed for instructional purposes only.

Self-test: functional test performed automatically by the device itself, at system startup and during certain periods, for verification of faults and defects, leading the device to a safe condition.

Low speed or reduced speed: speed less than the operation speed, consistent with the safe work.

Rocker of moveable manual arm: machine intended for leather cutting and similar materials, operated by a worker, having a non-moveable cut surface corresponding to the total useful area available and one arm containing the moveable impact surface i.e., press base, which is capable of moving in a horizontal arc movement on the cutting surface.

Rocker of manual bridge type - Rocker bridge: machine intended for leather cutting and similar materials, operated by a worker, in which the impact surface is connected or secured to the bridge that moves horizontally and vertically on a non-moveable cutting surface.

Trick: act of simply cancel the normal and safe operation of machine devices or systems, using for actuation any available objects, such as, screws, needles, pieces in metal plate, objects for daily use, such as, keys and coins or tools necessary for normal usage of the machine.

Category: Classification of parts of a control system related to safety, with respect to their resistance to faults and their subsequent behavior in the fault condition, which is achieved by the combination and interconnection of the parts and/or by its reliability. The performance with regard to the occurrence of defects, of a part of a control system, related to safety, is divided into five categories (B, 1, 2, 3 and 4) according to ABNT NBR 14153 - Safety of machinery - Parties of control systems related to safety - General principles for design, equivalent to EN 954-1, Safety of machinery - Safety related parts of control systems, which takes into account qualitative principles for their selection. In the international community, the EN 954-1, in substitution process, live together with Its successor, EN ISO 13849-1:2008 - Safety of machinery - Safety related parts of control systems, establishing quantitative criteria, no longer divided into categories, but at levels of "A" to "E", being "E" the highest. To select the level, called "performance level" - PL, it is necessary to apply complex mathematical formula according to the probability of failure of the selected safety components - Safety Integrity Level – SIL, informed by the component manufacturer. Can be said that a certain safety component with characteristic SIL3 meet the requirements of category 4.

Category 3: When the behavior of the system allows that:

a) when an isolated defect occurs, the safety function is always met;

b) some defects, but not all, are detected; and

c) the accumulation of defects not detected leads to the loss of safety function.

Category 4: when the parts of control systems related to safety shall be designed so that:

a) a single failure in any of these parts related to safety does not lead to loss of safety functions; and

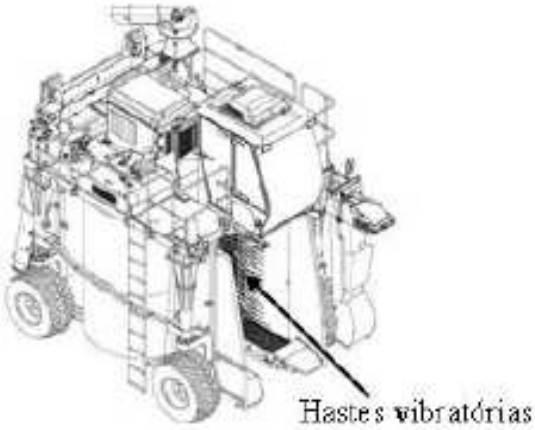
b) a single failure is detected before or during the next actuation on the safety function, for example, immediately, to turn on the command, to the end of machine operation cycle. If this detection is not possible, the accumulation of faults shall not lead to loss of safety functions.

Safety switch: component associated with the protection used to stop the danger movement and keep the machine stopped while the protection or door is open, with physical-mechanical contact, such as, electromechanical, or without contact, such as optical and magnetic. It shall have positive break, dual channel, normally closed contacts and be monitored by safety interface. The safety switch shall not allow its manipulation - trick by simple means, such as screwdrivers, nails, tapes, etc.

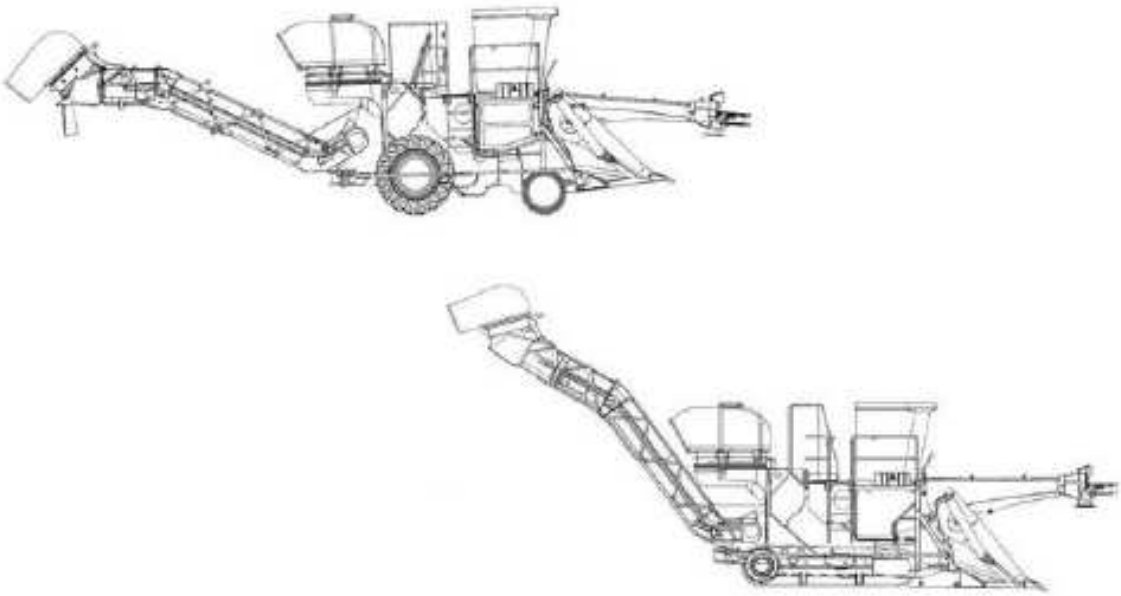
Electromechanical safety switch: component associated with a protection used to stop the danger movement and keep the machine shutdown while the protection or door is open. Its operation is through physical contact between the switch body and the actuator - key or by contact between their key elements into a single body, as the limit of safety. It is subject to mechanical wear and shall be used in a redundant manner, when the risk analysis requires, in order to prevent a mechanical failure, such as, the actuator breakage inside the switch, leads to the loss of the safety condition. It shall also be monitored by safety interface for electrical fault-detection and shall not allow its manipulation - trick by simple means, such as, screwdrivers, nails, tapes, etc. It shall be installed using the principle of action and positive break in order to ensure the stop of the electrical control circuit, while maintaining their contacts normally closed - NF - connected rigidly, when the protection is opened.

Cotton harvester: the cotton harvester has a rotating spindle system that remove the cotton fiber without damaging the vegetative part of the plant, i.e., stems and leaves. Certain models are characterized by the separation of fiber and seed, concurrent with the harvesting operation.

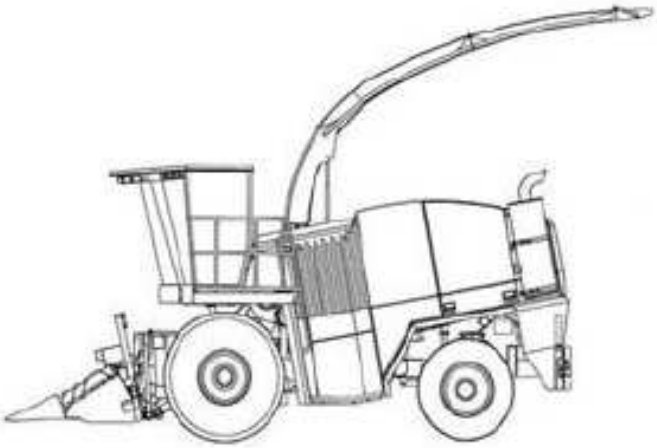
Coffee harvester: self-propelled agricultural equipment that performs the "detachment" and the coffee harvesting.



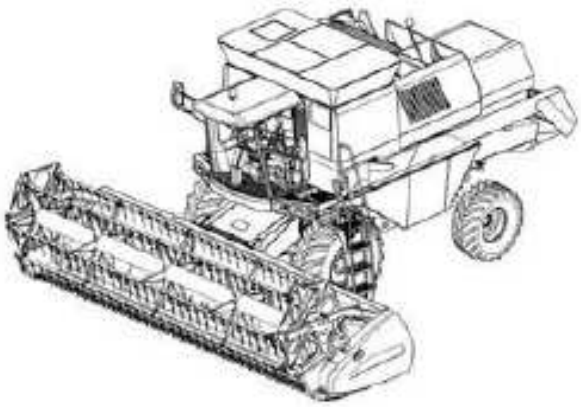
Sugar cane harvester: Equipment that allows the harvesting of sugar cane in a uniform manner, by having a cutting base system able to cut the sugar cane following the soil profile. It has an elevator system that moves the cut cane to the transfer unit.



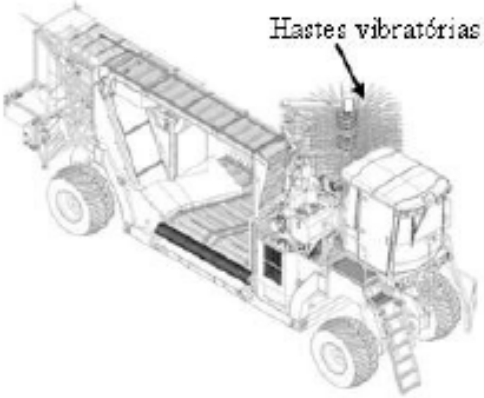
Forage harvester or self-propelled forager: self-propelled agricultural equipment suitable for the crop and forage of corn, sorghum, sunflower and others. It performs the cut of plant, being able to harvest or collect, triturate and collect the cut tillage in separate containers or vehicles for transfer.



Grain harvester: machine designed to harvest grains, such as, wheat, soybeans, corn, rice, bean, etc. The product is collected by means of a cutting platform and conducting to the thrashing and separation area, where the grain is separated from the straw, which is expelled, while the grain is transported to the grain tank.



Orange harvester: self-propelled agricultural machine that makes the harvest of orange and other similar citrus.



Safety Configurable Controller - CCS: computerized electronic equipment - hardware, which uses configurable memory to store and run internally interlocking of specific functions of program - software, such as, sequencing, timing, counting and safety blocks by controlling and monitoring through safety inputs and outputs, several types of machines or processes. It shall have three basic operation principles: redundancy, diversity and self-test. The installed software shall ensure its effectiveness so as to reduce the possibility of errors from human failure in design, in order to avoid compromising any function related to safety as well as not allow changing the specific safety function blocks.

Logic Programmable Controller – Safety CLP: computerized electronic equipment - hardware, which uses programmable memory to store and run internally specific instructions and functions of program - software, such as, logic, sequencing, timing, counting, arithmetic and safety block by controlling and monitoring through safety inputs and outputs, several types of machines or processes. The safety CLP shall have three basic operation principles: redundancy, diversity and self-test. The installed software shall ensure its effectiveness so as to reduce the possibility of errors from human failure in design, in order to avoid compromising any function related to safety as well as not allow changing the specific safety function blocks.

Bimanual control device: device that requires, at least, the simultaneous action by the use of both hands, aiming to initiate and maintain, while there is a dangerous condition, any machine operation, providing a measure of protection to the person which it operates only.

Control device of continued action: manual controlled device that initiates and maintains operation in parts of the machinery or equipment while is actuated only.

Control device by limited movement step by step: control device whose actuation allows only a limited displacement of a machine or equipment element, so reducing the risk as much as possible, excluding any further movement until the command is disabled and actuated again.

Interlocking device: mechanical, electromechanical, magnetic or optical safety switch designed for this purpose and safety inductive sensor, which acts by sending a signal to the danger power source and stopping the danger movement every time the protection is removed or open.

Mechanical restraint device: device that has the function to insert in a mechanism a mechanical obstacle, as a wedge, seam, spindle, chock, pad, etc., capable of opposing for its own resistance to any dangerous movement, for example, falling of a sliding situation in the event of failure of normal restraint system.

Inhibitor or baffle device: physical obstacle that without completely prevent access to a danger zone, reduce its probability, restricting the access possibilities.

Limiting device: device which prevents a machine or part of a machine exceeds a given limit, for example, space limit, pressure limit, etc.

Safety distance: distance that protects persons from reach of danger zones, under specific conditions for different access situations. When used protections, i.e. physical barriers that restrict access to the body or part thereof, shall be noted the minimum distances listed in section A of Annex I of this Standard, which shows the main charts and tables of ABNT NBR NM-ISO 13852 - Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs. The safety distances to prevent access of the lower limbs are determined by ABNT NBR NM-ISO 13853 and shall be used only when there is a risk for the lower limbs only, because when there is a risk for the upper and lower limbs, the safety distances provided in the standard for upper limbs shall be met. The ABNT NBR NM-ISO 13852 and ABNT NBR NM-ISO 13853 were joined into a single standard, EN ISO 13857:2008 - Safety of Machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs, without translation in Brazil yet.

Diversity: application of components, devices or systems with different principles or types, thus reducing the probability of a dangerous condition.

Mechanical coupling by key or similar: type of coupling which, once in operation or activated, can not be uncoupled until the hammer has performed a complete cycle. The concept also includes certain types of coupling that can only be uncoupled in certain positions of the operating cycle. Presses with this type of coupling are extremely dangerous, and its manufacture is prohibited.

Tractive equipment: equipment that develops the activity for which it was designed, by the displacement through the propulsion system on another machine conducting it.

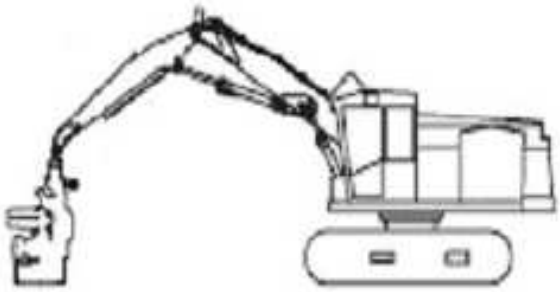
Stairs with riser: permanent means of access with a pitch angle of 20° (twenty degrees) to 45° (forty-five degrees), whose horizontal elements are steps with riser.

Stairs without riser: means of access with a pitch angle of 45° (forty-five degrees) to 75° (seventy-five degrees), whose horizontal elements are steps without riser.

Ship-type ladder: permanent means of access with a pitch angle of 75° (seventy-five degrees) to 90° (ninety degrees), whose horizontal elements are bars or crossbar.

Slippage: crankshaft, eccentric movement, beyond a defined stop point.

Hydraulic excavator in forestry application: excavator designed to perform construction work, which can be used in forestry application by installing of special devices that allow cutting, delimbing, processing or loading logs.



Confined space: any area or environment not designed for continuous human occupancy, which has limited means of entrance and exit, with insufficient ventilation to remove contaminants or where there might be deficiency or enrichment of oxygen.

Specification and technical limitation: for the purposes of this Standard are detailed information in the machine or manual, such as: capacity, rotational speed, maximum dimensions of tools, mass of disassembly parts, adjustment data, need to use EPI, inspections and maintenance frequency, etc.

ESPS (Electro-Sensitive Protective Systems): system composed of devices or components operating together, with the purpose of sensing and protection of human presence, comprising at least: sensing device, monitoring or control device and switching device of the output signal.

Cognitive requirement: requirement linked to mental processes such as perception, attention, memory, reasoning, mental agility, language and interpretation. It involves the need to absorb information, of memorization through sensitive capture, i.e., vision, hearing, tactile sense, etc. to interpret, understand, evaluate, discriminate and then react, take a decision or perform an action on interaction between the humans and other system or machine elements.

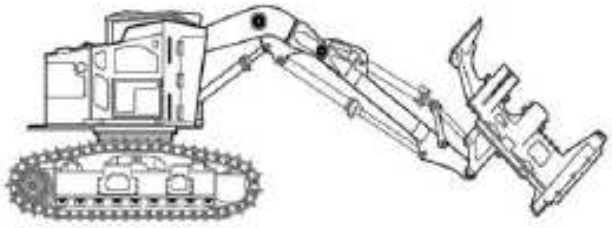
Worker fatigue: manifestation, mental or physical, local or general, not pathological, of an excessive work stress, completely reversible by rest.

Fail safe: the failsafe principle requires that a system enters in a safe state, when a failure occurs of a component relevant to safety. The main pre-condition for the application of this principle is the existence of a safe state in which the system can be designed to enter in this state when failures occur. The typical example is the train protection system (safe state = stopped train). A system may not have a safe state, for example, an airplane. In this case, shall be used the principle of safe life, which requires the redundancy application and of high reliability components to be sure that the system always work.

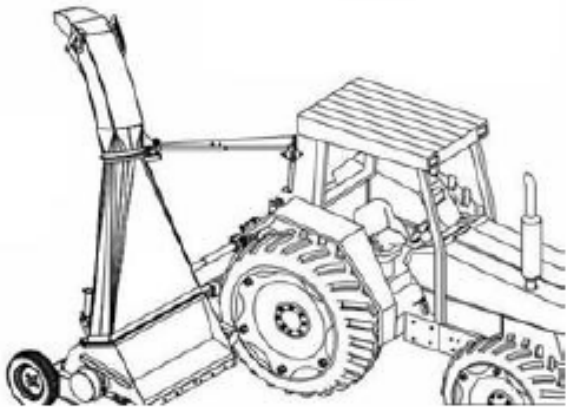
Utilization phase: phase that includes all stages of construction, transport, assembly, installation, adjustment, operation, cleaning, maintenance, inspection, deactivation and dismantling.

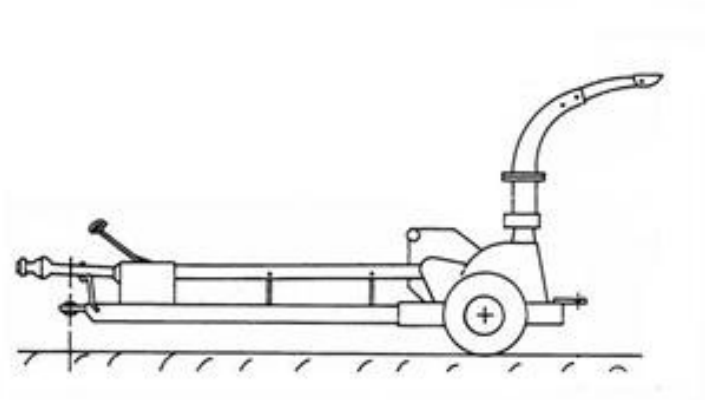
Cold cuts slicer: machine with tractive blade in disc format used for slicing cold cuts. The most common type has a rotating blade in disc-shaped with adjustable protection to cover it, as disc edge and cold cuts-holder carriage. The slicing operation is performed by back and forth movement of the cold cuts-holder carriage, which leads the material to be processed on the rotating blade. This type of machine offers accident risk to workers during the operation, manual adjustment of protection to expose the blade for cutting, cleaning and sharpening operation. More modern machines have rotating blades in disc-shaped with back and forth movement on a horizontal table without access to workers to the blade movement area. The cutting zone is accessed through a vertical cold cuts-holder chute, which works as feeder, and interlocked moveable protection, which prevents the access to the blade. The discharge of the processed material occurs by conveyor belt or tray.

Feller buncher: skidder tractor to logging for whole feeling tress through the use of cutting implements with disc or circular saw and claws to secure and bundling several logs simultaneously.



Tractive forage: agricultural implement which, when coupled to a tractor, can perform the operation of harvesting or gathering and triturating of fodder plant, being the material triturated as forage, stored in separate containers or vehicles for transfer.





Degree of protection – IP: numerical representation with two-digit that identifies the characteristics of the envelope for the penetration of solid or liquid objects, as described below.

1 (first) digit - determines the degree of protection of the equipment, for the solid objects:

0 - unprotected;

1 - Protected against solid objects with diameter larger than 50 mm (fifty millimeters);

2 - Protected against solid objects with diameter larger than 12 mm (twelve millimeters);

3 - Protected against solid objects with diameter larger than 2.5 mm (two millimeters and half);

4 - protected against solid objects with diameter larger than 1 mm (one millimeter);

5 - protected against dust;

6 - totally protected against dust;

2 (second) digit - determines the degree of protection of the equipment, for the water inlet:

0 - unprotected;

1 - protected against vertical falling of water drops;

2 - protected against vertical falling of water drops to a maximum tilt of 15° (fifteen degrees);

3 - protected against water sprayed at an angle of ±69º (plus or minus sixty-nine degrees);

4 - protected against water splashing;

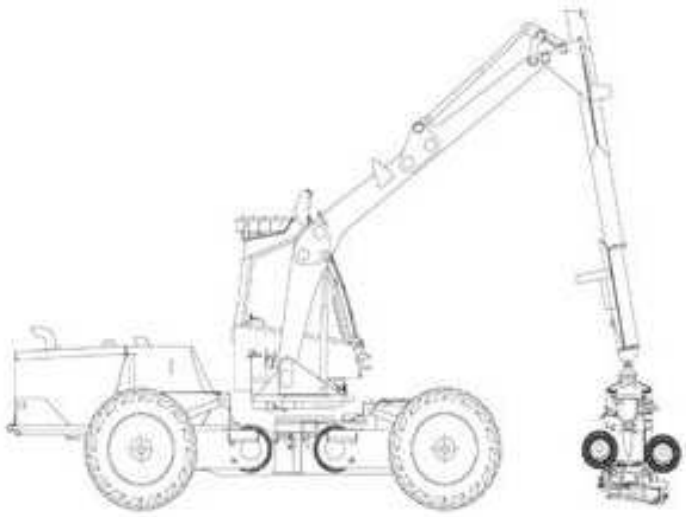
5 - protected against water jets;

6 - protected against sea waves or powerful jets;

7 - protected against immersion;

8 - protected against submersion.

Harvester: skidder tractor to cut logs for felling trees, using a processing head that cut logs at a time, and that has the capacity to process the branches cleaning and subsequent cut into logs of standardized size.



Agricultural and forestry implement: device without drive power that is connected to a machine and that, when pulled, dragged or operated, allows the execution of specific operations aimed for agriculture, livestock and forestry, such as soil preparation, cultivation, planting, harvesting, trenching for irrigation and drainage, transportation, distribution of feed or fertilizer, pruning and felling trees, etc.

Indelible information or symbol: that applied directly on the machine, which shall be kept in a legible and integral manner during all time to use the machine.

Safety interface: device responsible to perform monitoring, verifying the connection, location and operation of other devices in the system, preventing the occurrence of a failure that causes the loss of safety function, such as safety relays, configurable safety controllers and safety CLP.

Interlocking with blockage: protection associated with an interlocking device with locking device, such that:

- the hazardous functions covered by the protection cannot operate while the machine is not closed and locked;

- the protection remains locked in the closed position until the risk of accidents has gone due to hazardous machinery functions; and

- when the protection is locked in the closed position, the hazardous machinery functions can operate, but the protection closure and blockage by themselves do not initiate the operation of these functions.

Generally is presented in the form of electromechanical safety switch of two parts: body and actuator - latch.

Rolling machine: machine designed for professional use in the food industry. It is intended to roll the pasta by passing in a back and forth movement between tractive rotating rollers with height adjustment. It can have interchangeable cut rotating rolls, offering the option to press and cut the pasta.

Rear position lamp: device designed to emit a light signal to indicate the presence of a machine.

Burns threshold: surface temperature that defines the boundary between the absence of burns and a burn of partial superficial thickness caused by skin contact with a heated surface for a specific period of contact.

Handle or handgrip: auxiliary device, incorporated to the machine structure or affixed on it, which is intended to allow access.

Self-propelled agricultural and forestry machinery: machine designed for agricultural and forestry activities that travels on land environment with its own propulsion system.

Self-propelled machinery: for the purposes of this standard, a machine the moves on land environment with its own propulsion system.

Construction machinery in agroforestry application: machine originally designed to carry out work related to construction and earth movement and that receives specific devices to perform work related to agroforestry activities.

Machinery and equipment: for the purposes of applying this Standard, this includes machinery and equipment for non-domestic use and moved by non-human force only.

Stationary machinery: machine that remains fixed in a workstation, i.e., transportable for use in workbench or in another stable surface where it can be fixed.

Manual machinery or equipment: hand-held machine or equipment.

Designed machinery or implement: every device or equipment designed, built, sized and constructed by a qualified professional, for the proper and safe use.

Meat grinder - Mincer: machine that uses worm to grind meat. It is composed by neck installed in tray for meat passage and worm into the duct conducting it towards the cutting blade and then to the perforated neck - discharge zone.

Monitoring: intrinsic function of the component design or carried out by safety interface that provides the functionality of a safety system when a component or device has its function reduced or limited, or when there is a hazard situation due to changes in process conditions.

Power cultivators or microtractor: self-propelled two-wheeled equipment used to pull several implements, from soil preparation to harvesting. It is characterized by the fact the operator to walk behind the equipment during the work.

Pole chain saw: machine similar to chainsaw, equipped with extender cable for longer reach in pruning operations.

Chainsaw: powered saw with manual grip mainly used for cutting and pruning of trees compulsorily equipped with:

a) manual or automatic brake of chain, which consists of a safety device that stops the rotation of the chain, triggered by the left hand of the operator;

b) catch-chain pin, which consists of a safety device that reduces the chain course in the event of breakage, preventing it from striking the operator;

c) right hand protector, which consists of rear protection to prevent the chain from reaching the hand of the operator in case of breakage;

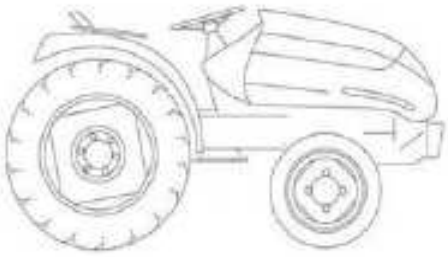
d) left hand protector, which consists of front protection to prevent the operator's hand involuntarily reach the chain during the cutting operation; and

e) throttle safety lock, which consists of device that prevents unintended acceleration.

Muting: automatic and temporary deactivation of a safety function through safety components or control circuits responsible for safety during normal operation of the machine.

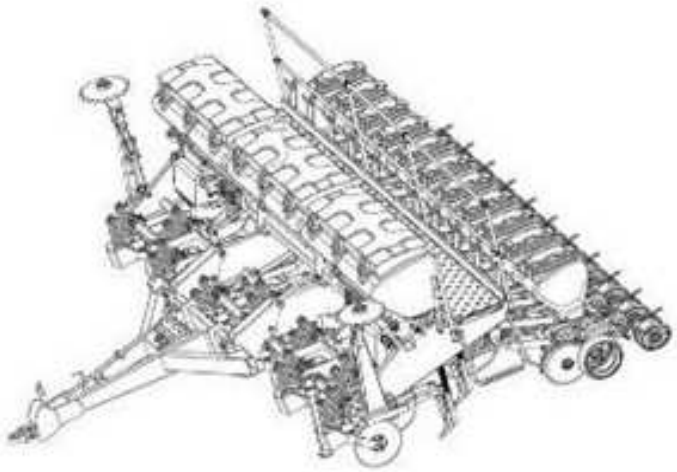
Optional: device or system not provided for in this Standard, such as auxiliary headlamps.

Another type of microtractor and self-propelled lawnmower: small machine intended for general services and maintenance of residential or commercial gardens. Its total gross weight without attachments does not exceed 600 kg (six hundred kilograms).



Work permission - Work order: written document, specific and auditable, than has, at least, the service description, date, location, name and role of workers and responsible persons by the service and by its issue and the work and safety procedures.

Tractive planter: agricultural implement which, when coupled to a tractor, can perform the operation of planting crops, such as seeds, seedlings, tubers or other.



Platform or external stairs for self-propelled agricultural, forestry and construction machinery in agroforestry applications: support device not fixed permanently on the machine.

Operator station: machine or equipment place where the worker operates the machine.

Workstation: any machinery and equipment place where is required the intervention of the worker.

Eccentrical servo-powered mechanical press: machine that uses torque motor or servomotor mechanically connected to the drive shaft of the machine. The servoactuation shall be interlocked with the safety system. This type of actuation shall have a restraint of the hammer, which can be incorporated in the motor itself. The redundant braking system shall be sized so that it can block the movement of the hammer at any angle of the eccentric, in case of emergency or in case of intervention for maintenance. The system shall be interlocked to the safety electrical control system and designed to meet the level of category 4 (four) of protection.

Qualified professional for the technical training supervision: professional certifying completion of specific courses in the area of operation, compatible with the course being taught, with registration in the relevant class council, if necessary.

Legally qualified professional: employee previously qualified and with registration on the competent class council, if necessary.

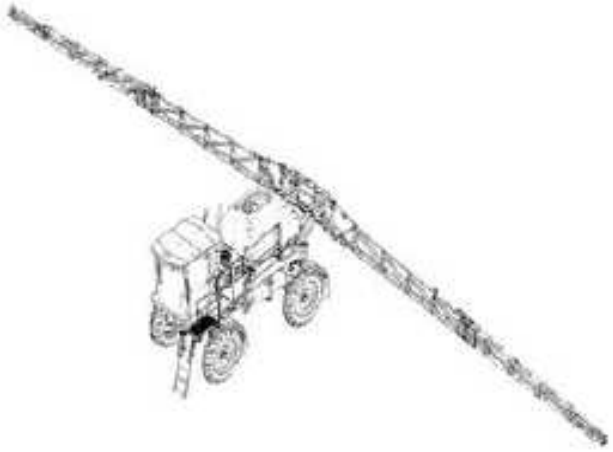
Technically trained professional or worker: who has received technical training under the guidance and responsibility of a qualified professional.

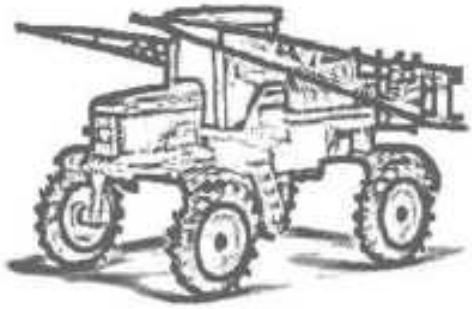
Qualified professional or worker: who that proves completion of specific course to his area and recognized by the official educational system.

Distant fixed protection: protection that do not completely covers the danger zone, but which prevents or reduces access due to its size and its distance from the danger zone, for example, perimeter grid or protection tunnel.

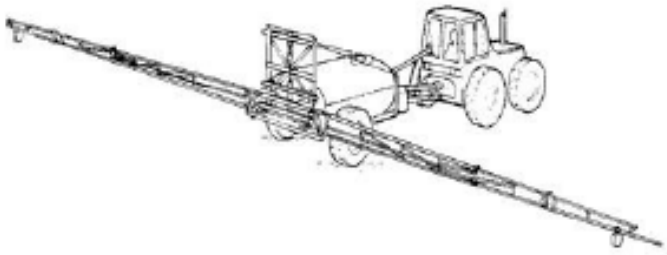
Psychophysiological: characteristic that encompasses what constitutes the distinctive character, particular of a person, including their sensory, motor, psychological and cognitive capabilities, emphasizing, among others, issues related to reflexes, posture, balance, motor coordination and the execution mechanisms of movements which vary within and between individuals. It includes, at least, anthropological, psychological, physiological knowledge relative to human. It also covers issues such as levels of vigilance, sleep, motivation and emotion, memory and learning.

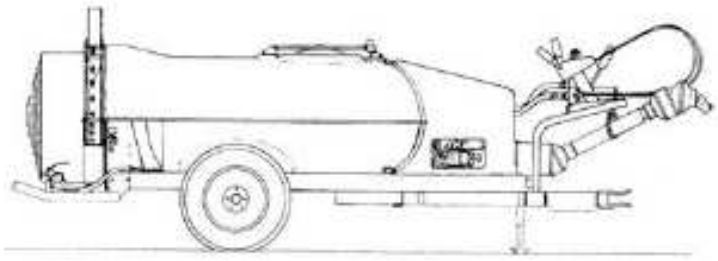
Self-propelled sprayers: instrument or machine used in agriculture in the fight against crop pests, weeds and insects. Its greater function is to allow the control of the dosage in the application of pesticides or fertilizers on certain areas.





Tractive sprayer: agricultural implement which, when coupled to a tractor, can perform the operation to apply pesticides.





Superficial partial thickness burn: burn in which the epidermis is completely destroyed, but the hair follicles and sebaceous glands and sweat glands, are spared.

Ramp: permanent means of access, continuous and tilted, in a pitch angle of 0° (zero degrees) to 20° (twenty degrees).

Redundancy: application of more than one component, device or system, to ensure that, if there is a failure in one of them in the execution of its function, the other will be available to perform this function.

Safety relay: component with redundancy and dedicated electronic circuit to actuate and supervise specific safety functions, such as safety switches, sensors, emergency stop circuits, ESPEs, valves and contactors, ensuring that in case of failure or defect or its wiring, the machine stop the operation and do not allow the startup of a new cycle until the defect is fixed. It shall have three basic operating principles: redundancy, diversity and self-test.

Positive break – Positive opening operation of a contact element: effective separation of contact as a direct result of a specific movement of the actuator of switch key through no resilient parts, i.e., not dependent on the springs action.

Selector - Selector switch, validation device: selector switch or command mode selector with access restricted or password so that:

a) can be locked in each position, preventing the change of position by unauthorized workers;

b) each position corresponds to a single command or mode of operation;

c) the control mode selected has priority over all other systems of control, with the exception of emergency stop; and

d) makes the selection visible, clear and easily identifiable.

Band saw for cutting meat at retail: machinery used in butcher for cutting meat, especially with bone, consisting of two pulleys that guide the serrated band, and the movement of the lower pulley is pulled. It is operated by a single worker located in front of the machine, leaving the sides and rear free. There is a constant exposure to the operator in the cutting area to handle the piece of meat to be cut.

Symbol - Pictogram: standardized schematic drawing, intended to represent some single indications.

Falling protection system: structure fixed to the machine or equipment, designed to prevent the fall of persons, objects or materials.

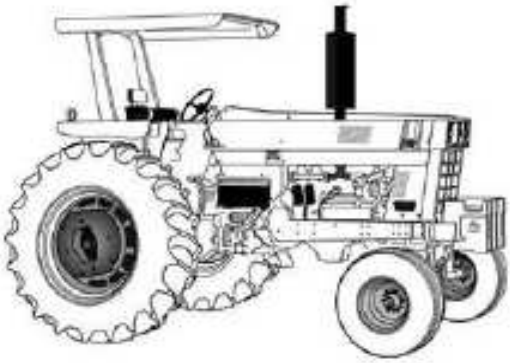
Mechanical braking system: mechanical system used to safely stop the movement of risk, ensuring a return to the braked position when there is an interruption of power supply.

Bead: most rigid part - reinforced of the tire that comes in contact with the rim, ensuring their fixation.

Work stress - Work strain: internal response of the worker to be exposed to pressure in work, dependent on their individual characteristics, for example, size, age, ability, skill, dexterity, etc.

Superimposed tractor: agricultural tractor which, due to the limited size, the operating platform consists of a small floor at the sides for the support feet and operation only.

Agricultural tractor: self-propelled medium to large machinery, designed to pull or drag agricultural implements. It has a wide range of applications in agriculture and livestock, and it is characterized by having at least two axes for tires or tracks and weight, without ballast or implements, greater than 600 kg (six hundred kilograms) and minimum tread between the rear tires, with the largest tire specified, more than 1280 mm (one thousand two hundred eighty millimeters).



Narrow agricultural tractor: small tractor intended for the production of fruits, coffee and other applications where the space is restricted and used for small implements. It has minimum tread between the rear tires, with the largest tire specified, less than or equal to 1280 mm (one thousand two hundred eighty millimeters) and total gross weight above 600 kg (six hundred kilograms).

Valve and safety block: component connected to the machine or equipment in order to allow or block, when activated, the passage of liquid or gaseous fluids such as compressed air and hydraulic fluids in order to initiate or cease the functions of the machine or equipment. It shall have monitoring for verification of their interconnection, position and operation, preventing the occurrence of failure causing the loss of safety functions.

Danger zone: Any area inside or around a machine or equipment where a person can be exposed to risk of injury or harmful to health.

ANNEX VII

BUTCHER SHOP AND GROCERY MACHINES

This Annex establishes specific safety requirements for butcher and grocery machines, new, used and imported, such as: band saw, steak slicer, meat tenderizer, meat grinder and cold cuts slicer.

1. Band saw: For cutting meat in retail.

1.1. For the purposes of this Annex is considered band saw the machine used in butcher to cut meat, especially with bone.

1.2. The band movements around the pulleys shall be protected with interlocked fixed or moveable protections, according to items 12.38 to 12.55 and its sub-items of this Standard, except for the operational area necessary to cut meat, where an adjustable sliding channel shall enclose the perimeter of the serrated band in the cutting region, releasing only the minimum serrated band area for operation.

1.3. Shall be adopted articulated vertical arm - pusher with pendulum movement in relation to the band, which serves to guide and push the meat and prevent the hand access to the cutting area.

1.3.1. The articulated arm shall be firmly attached to the machine structure and cannot show lateral free play that compromises the safety, and be rigid, so as not to allow deformation or bending.

1.4. The fixed table shall have adjustable guide parallel to the band saw used to limit the cut thickness of the meat.

1.5. The cutting tables of machines manufactured as from the date of this Standard shall have a moveable part to facilitate movement of the meat.

1.5.1. The moveable table shall have limiting device of its course so that the protection for the hands does not touch the band.

1.5.2. The moveable table shall have guide that facilitates the support of the meat on the table and its cutting movement.

1.6. The moveable table and the articulated arm – pusher – shall have handles, grips, with shields to protect the hands.

1.7. A handheld device shall be used to push the meat sideways against the adjustable guide, and perpendicularly to the band saw, for cutting small parts or for completion of the meat cut.

1.8. The band saw shall have, at least, one emergency stop button, according to the items 12.56 to 12.63 and its sub-items of this Standard.

2. Steak slicer

2.1. For the purposes of this Annex is considered steak slicer the machine with multiple tensioned blades used in butcher to slice meat pieces introduced by a nozzle or through a feeder belt.

2.2. The movements of the cutting blades and its mechanisms shall be enclosed by interlocked fixed or moveable protections according to the items 12.38 to 12.55 and its sub-items of this Standard, except the feeding tube, which shall meet the requirements of sub-item 2.3 of this Annex.

2.3. The feeding tube shall prevent access of the upper limbs acting as moveable interlocked protection provided with, at least, one safety switch with double channel, monitored by safety relay, dual channel, according to the items 12.38 to 12.55 and its sub-items and Table I, Item A of Annex I of this Standard.

2.4. The opening of the discharge area shall prevent the reach of the upper limbs in the cutting blade areas, according to the Table I, item A of Annex I of this Standard.

3. Meat tenderizer

3.1. For the purposes of this Annex is considered meat tenderizer a machine with two or more parallel tensioned toothed cylinders that rotates in reverse direction of rotation where are passed pre-cut meat parts.

3.2. The toothed cylinders movements and its mechanisms shall be enclosed by interlocked fixed or moveable protections, according to the items 12.38 to 12.55 and its sub-items of this Standard, except the feeding tube, which shall meet the requirements of sub-item 3.3 of this Annex.

3.3. The feeding tube shall prevent access of the upper limbs acting as moveable interlocked protection provided with, at least, one safety switch with double channel, monitored by safety relay, dual channel, according to the items 12.38 to 12.55 and its sub-items and Table I, Item A of Annex I of this Standard.

3.4. The opening of the discharge area shall prevent the reach of the upper limbs in the toothed cylinders convergence area, according to the Table I, item A of Annex I of this Standard.

4. Meat grinder - Mincer

4.1. For the purposes of this Annex is considered meat grinder the machine that uses worm to grind meat.

4.2. The worm movements and its mechanisms shall be enclosed by interlocked fixed or moveable protections, according to the items 12.38 to 12.55 and its sub-items of this Standard.

4.3. The feeding tube shall be built in mutual manner to the tray, forming a single piece, which shall serve as protection due to its geometry, or have protection that prevents the entrance of the upper limbs in the worm area.

4.4. The tray shall act as moveable interlocked protection provided with, at least, one safety switch with double channel, monitored by safety relay, dual channel, according to the items 12.38 to 12.55 and its sub-items and Table I, Item A of Annex I of this Standard.

4.5. The opening of the discharge area shall prevent the reach of the upper limbs in the worm danger area, according to the Table I, item A of Annex I of this Standard.

5. Cold cuts slicer

5.1. For the purposes of this Annex is considered cold cuts slicer the machine with tractive blade in disc format used for slicing cold cuts.

5.2. The blade movements, with the cut risk, and its mechanisms, including during the sharpening, except the area intended for slicing, shall be enclosed by fixed or moveable interlocked protection provided with, at least, one safety switch with double channel, monitored by safety relay, dual channel, according to the items 12.38 to 12.55 and its sub-items and Table I, Item A of Annex I of this Standard.

ANNEX VIII

PRESSES AND SIMILAR EQUIPMENT

1. Presses are machines used in shaping and cutting of several materials, in which the movement of the hammer - punch, is from a hydraulic or pneumatic system - hydraulic or pneumatic cylinder, or a mechanical system, in which the rotary movement is transformed into linear through connecting rods, cranks, levers or spindles systems.

1.1. The presses are divided into:

a) eccentric mechanical coupled by key or equivalent coupling;

b) eccentric mechanical with brake or clutch;

c) friction, driven by spindle;

d) servo-powered;

e) hydraulic;

f) pneumatic;

g) hydropneumatic; and

h) other types not listed in this sub-item.

1.2. Similar machines are those with equivalent functions and risks to those of presses, comprising:

a) drop hammers;

b) pneumatic hammers;

c) hammers;

d) press brakes;

e) depressors;

f) guillotine, scissors and shears;

g) compression and molding presses;

h) hydraulic and pneumatic devices;

i) straighteners;

j) baler presses; and

k) other similar machines not listed in this sub-item.

1.2.1. The provisions of this Annex do not apply to the machines called rocker of moveable manual arm and rocker of manual bridge type - Rocker bridge, which shall meet the requirements of Annex X of this standard.

1.3. Tools - tooling, dies or matrices are fixed elements in the table and hammer of the presses and similar, with function of cutting or forming of materials, and can incorporate the feeder or extraction systems related on sub-item 1.4.

1.4. Feeder or extraction systems are means used to put the raw material and remove the process part form the die, and can be:

a) manual;

b) by drawer;

c) by rotating tray or gun drum;

d) by gravity, whatever the means of extraction;

e) by mechanical hand;

f) by conveyor or robotic;

g) continuous - automatic feeders; and

h) other systems not listed in this sub-item.

2. Safety systems in pressing areas.

2.1. The safety systems in acceptable pressing or work areas are:

a) enclosing the pressing area, with breaches or passages that do not allow the entry of the fingers and hands in the danger zone in accordance with item A of Annex I of this Standard, and can consist of fixed or moveable protections provided with interlocking, according to the items 12.38 to 12.55 an its sub-items of this Standard;

b) closed tool, which means the enclosure of a pair of tools, with breaches or passages that do not allow the entry of the fingers and hands in the danger zone, according to Table I, section A of Annex I of this Standard;

c) light curtain with redundancy and self-test, monitored by safety interface properly sized and installed in accordance with item B of Annex I of this Standard and current official technical standards conjugated with bimanual control, met the provisions of items 12.26, 12.27, 12.28 and 12.29 of this Standard.

2.1.1. Having possibility of access to the danger zones not supervised by the curtains, there shall be fixed or moveable protections provided with interlocking, according to the items 12.38 to 12.55 an its sub-items of this Standard;

2.1.2. The number of bimanual controls shall match the number of operators in the machine, according to the item 12.30 and sub-items of this Standard.

2.1.3. The safety systems referred to in paragraph "c" of sub-item 2.1 and on item 2.1.1 of this Annex shall be classified as category 4, according to ABNT NBR 14153.

3. Protection of pressing or work zone

3.1. The eccentric mechanical presses coupled by key or equivalent coupling system of complete friction cycle with actuation by spindle and their similar, cannot allow the entry of hands or fingers of the operators in the pressing areas and shall be adopted the following safety systems:

a) enclosure with fixed protections and with the need for frequent change of tools with moveable protections provided with interlocking with blocking in order to allow the opening only after the complete stop of risk movement, according to paragraph "a", of sub-item 2.1 of this Annex and item 12.46 of this Standard; or

b) operation only with closed tools, according to paragraph "b", of sub-item 2.1 of this Annex.

3.2. The eccentric mechanical presses with brake and clutch, servo-powered, hydraulic, pneumatic, hydropneumatic and their similar shall adopt the following safety systems in pressing or work areas:

a) enclosure with fixed or moveable protections provided with interlocking, according to paragraph "a", of sub-item 2.1 of this Annex, or

b) operation only with closed tools, according to paragraph "b", of sub-item 2.1 of this Annex; or

c) use of light curtain conjugated with bimanual control, according to paragraph "c" of sub-item 2.1 and its sub-items of this Annex.

4. Hydraulic and pneumatic system for control

4.1. The eccentric mechanical presses with pneumatic brake or clutch, the pneumatic presses and similar, shall be controlled by specific safety valve with cross flow, dynamic monitoring and free of residual pressure.

4.1.1. The press or similar shall have manual reset, incorporated to the safety valve or in another system component, to prevent additional actuation in the event of a failure.

4.1.2. In valve models with external dynamic monitoring by pressure switch, micro-switches or proximity sensors, the monitoring shall be performed by safety interface.

4.1.3. Can only be used exhaust silencers that do not show clogging risk, or have free passage corresponding to the nominal diameter, so as not to interfere with the braking time.

4.1.4. When independent safety valves are used for the operation of presses and similar with separated brake and clutch, shall be interconnected in order to establish with each other a dynamic monitoring to ensure the brake is immediately applied when the clutch is released during the cycle, and also to prevent the clutch is engaged if the brake valve does not act.

4.1.5. The feeding systems of the compressed air for pneumatic circuits of presses and similar shall ensure the safety valves effectiveness, and have vents or air drying system and automatic lubrication system with specific oil for this purpose.

4.1.6. The requirement contained on sub-item 4.1.4 does not apply to their respective pneumatic presses and similar.

4.2. The eccentric mechanical presses with hydraulic clutch or brake and their similar shall be controlled by safety system consisting of redundant valves with dynamic monitoring.

4.2.1. The press or similar shall have manual reset, to prevent any additional actuation in the event of a failure.

4.2.2. In valve systems with external dynamic monitoring by pressure switch, micro-switches or proximity sensors, the monitoring shall be performed by safety interface.

4.2.3. When independent valves are used, they shall be interconnected in order to establish a dynamic monitoring with each other, ensuring that no residual pressure can affect the brake and clutch assembly operation in the event of a failure of the valves.

4.2.4. When independent valves are used for the control of presses and similar with separated brake and clutch, the provisions of sub-item 4.1.4 shall be applied.

4.3. The hydraulic presses and similar shall have safety hydraulic block or safety system composed by redundant valves that have the same features and effectiveness, with dynamic monitoring.

4.3.1. The press or similar shall have manual reset, to prevent any additional actuation in the event of a failure.

4.3.2. In valve systems with external dynamic monitoring by pressure switch, micro-switches or proximity sensors, the monitoring shall be performed by safety interface.

4.3.3. When independent valves are used, they shall be interconnected in order to establish a dynamic monitoring with each other, ensuring that no residual pressure can compromise the safety in the event of a failure of the valves.

4.3.4. The hydraulic presses and similar shall have valve or restraint system to prevent the fall of the hammer in the event of a failure of the safety block or hydraulic system.

4.3.5. When the hydraulic system is used, the valve or restraint system shall be located as close the cylinder as possible.

5. Emergency stop devices.

5.1. The presses and similar shall have emergency stop devices to ensure the safe stop of machinery or equipment movement, according to the items 12.56 to 12.63 and its sub-items of this Standard.

5.2. The press emergency stop system shall be prepared for interconnection with the emergency stop systems of peripheral equipment such as unwinders, straighteners and feeders, so that the emergency stop device activation of any of the equipment results in an immediate stop of all the others.

5.3. When used bimanual controls connectable by plug or socket, removable, containing emergency stop button, shall also have emergency stop device on the dash panel or on the machine body.

5.4. If there are several bimanual controls for the actuation of a press or similar, they shall be connected to ensure the proper operation of the emergency stop button for each of them, according to this Standard.

6. Hammer position monitoring

6.1. In eccentric mechanical presses with brake and clutch and similar, with no confined pressing zone, or whose tools are not closed, the hammer position shall be monitored by electrical signals produced by equipment connected mechanically to the machine shaft.

6.1.1. The hammer position monitoring, comprised of bottom dead center - BDC, top dead center – TDC and maximum permissible slip, shall include devices to ensure that if the braking slip exceeds the maximum permissible specified by ABNT NBR 13930, an action stop shall be started immediately and that cannot be possible the start of a new cycle.

6.1.2. The electrical signal shall be generated by safety switches with dual channel and positive break, monitored by safety interface classified as category 4 according to ABNT NBR 14153.

6.1.3. When used programmable safety interface that has programming blocks intended to the role of control and supervision of the TDC, BDC and slipping, the dual-channel requirement is waived.

6.2. In hydraulic and pneumatic presses and similar, with no confined pressing zone, or whose tools are not closed, the hammer position shall be monitored.

6.3. For presses in which cannot ensure the safe stop of the hammer due to its speed and response time of the machine, it is not allowed to use of light curtains to protect the pressing zone, exempting the requirement of sub-item 6.1 of this Annex, being the pressing zone protected with fixed or moveable protections with interlock with blocking, according to the items 12.38 to 12.55 and its sub-items of this Standard.

7. Actuation pedals

7.1. The presses and similar which have enclosed pressing or work area or that uses only closed tools can be operated by pedal with electrical, pneumatic or hydraulic actuation, not being allowed the use of pedals with mechanical actuation or levers.

7.2. The actuation pedals shall allow the access only by a single direction and by a foot, and shall be protected to prevent its accidental activation.

7.3. For warm and hot forging activities can be used the pedals as provided on sub-item 7.2 of this Annex, provided protection measures are taken to ensure the distance of worker from risk areas.

7.4. In operations with press brakes can be used the pedals as provided on sub-item 7.2 of this Annex, without the requirement of enclosing the pressing area, since appropriate measures are taken to protect against the existing risks.

7.5. The number of pedals shall match the number of operators according to the item 12.30 and sub-items of this Standard.

8. Warm and hot forging activities

8.1. For warm and hot forging activities can be used tweezers and pincers, provided measures are taken to ensure protection of the worker's distance from danger zones.

8.1.1. If necessary, tweezers and pincers shall be supported by weight-relief devices, such as moveable rockers or tripods in order to minimize work overload.

9. Power transmission protection

9.1. The power transmission, such as flywheels, pulleys, belts and gears shall be protected according to the items 12.38 to 12.55 and sub-items of this Standard.

9.1.1. In eccentric mechanical presses there shall be a fixed protection to the connecting rods and the tips of their axes, which have resistance related to stresses in case of a break.

9.1.2. The horizontal and vertical steering wheel of the friction presses with actuation by spindle shall be protected so that they are not thrown in the event of a break of the spindle.

10. Tools

10.1. The tools shall:

a) be built as to prevent the material projection on the operators;

b) be stored in proper and safe locations;

c) be attached to the machines properly, with no improvisation; and

d) not offer additional risks.

11. Mechanical restraints system

11.1. The presses and similar shall have mechanical restraint system that supports the weight of the hammer and the top of the tool to lock the hammer at the start of the changes, adjustments and maintenance of tools.

11.2. The component of mechanical restraint shall be painted in yellow and have interlocking monitored by safety interface in order to prevent, during use, the press operation.

11.3. The mechanical restraint component shall:

a) ensure the mechanical retention in different stop positions of the hammer; and

b) be designed and built to ensure resistance to static force exerted by the total weight of the moveable set to be supported and to prevent its projection or its simple releasing.

11.4. In situations where the use of mechanical restraints is not possible, alternative measures shall be taken to ensure the same result.

12. Similar specific machines

12.1. In pneumatic hammers:

a) the central screw of damper head shall be secured with wire rope;

b) the air intake hose shall be shielded to prevent its projection in case of breakage; and

c) all top and bottom studs, shall be locked with wire rope.

12.2. The guillotines, scissors and shears shall have fixed protections, requiring frequent intervention in the blades, shall have moveable protections with interlocking to prevent ingress of hands and fingers of the operators in the risk areas, according to the items 12.38 to 12.55 and sub-items of this Standard.

13. Presses brakes or reverse presses

13.1. The press brakes shall have safety system that prevents access from the sides and rear of the machine to danger zones, according to items 12.38 to 12.55 and sub-items of this Standard.

13.2. The press brakes shall have safety system that covers the front area of work, selected according to the characteristics of the machine construction and the part geometry to be formed, noting:

a) the press brakes with mechanical brake or clutch - belt, as a function to the inaccuracies in determining the stopping time, cannot have optoelectronics presence detectors devices for front guard protection in the working area, being prohibited the operation by more than one employee and the parts conformation that do not ensure the distance of the operator;

b) the press brakes with pneumatic brake or clutch and the hydraulic press brakes can have optoelectronics presence detectors devices for front protection in the working area, if properly selected and installed in accordance with item B of Annex I of this Standard;

c) the hydraulic press brakes may use laser optoelectronics presence detectors devices of multiple beams for working area protection in tasks with multiple folds, subject to the machine characteristics and limitations as a function of the low speed availability, if equal or more than 10 mm/s (ten millimeters per second) in height of course that does not allow access of the worker´s fingers, i.e. less than or equal to 6 mm (six millimeters);

d) in hydraulic press brakes equipped with laser optoelectronics presence detectors devices of multiple beams, its complete deactivation – muting, shall only occur when the clearance between the upper tool and the piece being conformed is less than or equal to 6 mm (six millimeters) associated with movement at low speed;

e) the laser optoelectronics presence detectors devices of multiple beams shall be installed and tested according to the manufacturer's recommendations, current specific technical standard and item C of Annex I of this standard; and

f) the hydraulic press brakes that have laser optoelectronics presence detectors devices of multiple beams shall be actuated by bimanual control according to the items 12.26, 12.27, 12.28 and 12.29 or safety pedal of 3 positions, in accordance with item C of Annex I, all of this Standard;

13.3. The press brakes operated only by robots can be exempted from the requirements of sub-items 13.1 and 13.2 of this Annex, provided they have protection system to prevent access of workers around the perimeter of the machine and the robot's movement, according to the items 12.38 to 12.55 and sub-items of this Standard.

13.4. Additional measures, such as the use of positioners or table or magnetized backup, shall be taken to avoid injury to the worker's hands between the worked piece and the structure - apron - of machine at the conformation time.

14. The winders, non-winders, straightener and other feeding equipment shall have protection around the perimeter, preventing access and the circulation of persons in risk areas, according to the items 12.38 to 12.55 and sub-items of this Standard.

15. Other provisions

15.1. Can be adopted, in exceptional cases, other protective measures and safety systems in the presses and similar, provided they ensure the same protections and devices effectiveness listed in this Annex, and comply with the provisions of current official technical standards.

15.2. It is prohibited the importation, manufacture, trading, auction, lease, cession in any way and exposure of eccentric mechanical presses and similar with coupling for the hammer through the coupling by key or similar and mechanical press brakes with band brake, new or used, throughout the national territory.

15.2.1. It is understood as similar mechanism that which does not allow the immediate stop of the hammer movement in any position of the work cycle.

16. Press transformation and similar equipment

16.1. Any substantial transformation of the operating system or coupling system for movement the hammer - presses "retrofitting" and similar equipment shall only be performed by mechanical design prepared by a legally qualified professional, accompanied by Technical Responsibility Annotation - ART.

16.2. The design shall have a calculation memory of components dimensioning, specification of the materials used and the descriptive history of all components.

ANNEX IX

PLASTIC INJECTION MACHINE

1. For the purposes for applying this Annex is considered injection machine the machine used for discontinuous manufacturing of molded products, by injecting material into the mold, which contains one or more cavities in which the product is formed, consisting essentially of closing unit – mold area and closing mechanism, injection unit and actuation and control systems, as shown in Figure 1 of this Annex.

1.1. Applicable definitions:

a) hydraulic injection machine: injection machine in which the axis actuation are performed by hydraulic power circuit, comprising of electrical motor, hydraulic pump and hydraulic cylinder;

b) mold area: zone comprised between the plates, where the mold is mounted;

c) closing mechanism: mechanism fixed to the moveable plate to move it and apply the closing force;

d) closing force: force exerted by the injection cylinder and thread assembly on the plastic part that solidifies into the mold of an injection machine, to ensure its feeding with additional material as it contracts as a function of solidification and cooling;

e) injection unit: unit responsible for plasticizing and injecting material into the mold through the nozzle;

f) injection: mass transfer from injection cylinder to the mold, cyclical process in which a material softened by heat is injected into a mold under pressure, that is maintained until the plastic has hardened sufficiently to be ejected from the mold;

g) power circuit: circuit that provides power for machine operation;

h) rotating carousel injection machine: machine with two or more closing units, mounted on moveable carousel, vertically or horizontally, linked to one or more fixed injection units;

i) multi-station injection machine with moveable injection unit: machine with moveable injection unit linked to two or more fixed closing units;

j) injection machine with mold-holder table of transverse displacement: machine designed to contain one or more mold lower parts attached to a mold-holder table of transverse displacement, which links the mold lower part by table displacement or rotation movement, to the top and to the injection unit;

k) electrical injection machine: injection machine in which the axis actuations are performed by electrical actuators - servomotors;

l) electrical motor: any motor type that uses electrical energy, such as servomotor or linear motor;

m) motor control unit: unit to control the movement, the stop process and movement interruption of an electrical motor, with or without integrated electronic device such as frequency converter and contactor;

n) electrical axis: system consisting by an electrical motor, a motor control unit and the additional contactors;

o) stop condition: condition in which there is no movement of one part of the machine with an electrical axis;

p) safe stop condition: stop condition during which additional measures are taken to avoid unexpected triggering;

q) stop: movement deceleration of one part of the machine until the stop condition is reached;

r) safe stop: stop during which additional measures are taken to prevent dangerous stop of movement;

s) monitored safety command input: input of an motor control unit used to provide a power outage to the electrical axis motor;

t) peripheral equipment: equipment that interacts with the injection machine, for example, handler for parts removal, equipment for mold exchange and automatic attaching clamps of the mold.

1.2. Specific safety requirements in the danger zone of the injection machines

1.2.1. Hazards related to the mold area.

1.2.1.1. The access to the mold area where the cycle is controlled, or front, shall be prevented by means of interlocked moveable protections - doors, equipped with two electromechanical safety switches monitored by safety interface, acting on the control unit so that the failure in any of the interlocking devices or interconnections are automatically recognized and still prevented the beginning of any danger subsequent movement, according to items 12.38 to 12.55 and subsequent sub-items of this Standard.

1.2.1.1.1. When magnetic, electronic coded or optoelectronics safety switches are used, among others without mechanical actuation, can be adopted one switch only for the interlocking and the monitoring shall be maintained safety interface.

1.2.1.2. In addition to the provisions of sub-item 1.2.1.1 of this Annex, the front protection shall act on the power circuit through a monitored valve or, indirectly, by means of two electromechanical safety switches monitored by safety interface, except for electrical injection machine.

1.2.1.2.1. When magnetic, electronic coded or optoelectronic safety switches are used, among others without mechanical actuation, can be adopted only one switch for this function, keeping the monitoring by safety interface.

1.2.1.3. When magnetic, electronic coded or optoelectronic safety switches are used, among others without mechanical actuation, can be adopted only one interlocking device, monitored by safety interface in order to attend each one of sub-items 1.2.1.1 and 1.2.1.2 of this Annex.

1.2.1.4. The access to the mold area where the cycle is not controlled, or rear, shall be prevented by means of interlocked moveable protections - doors, equipped with two electromechanical safety switches monitored by safety interface, acting on the power circuit, and shuts down the main motor.

1.2.1.4.1. When magnetic, electronic coded or optoelectronic safety switches are used, among others without mechanical actuation, can be adopted only one switch for this function, keeping the monitoring by safety interface.

1.2.5.1. There shall be protection on the parts unloading area so as to prevent that body segments reach the danger zones, according to the items 12.38 to 12.55 and sub-items of this Standard.

1.2.1.6. The moveable protections shall be designed so that it is not possible to stay a person between them and the mold area.

1.2.1.6.1. If it is necessary to stay or access of the whole body between the protections and the dangerous movement area or inside the mold area, shall be met the sub-items of 1.2.6.2 to 1.2.6.3.5 of this Annex.

1.2.1.7. Self-adjustable safety mechanical device shall be installed, so that it acts independently of the plate position when the protection - door is opened, stopping the movement of this plate without any adjustment, i.e. no adjustment at each mold change.

1.2.1.7.1. From the opening protection up to the effective safety actuation, it is allowed a displacement of the moveable plate, of maximum amplitude equal to the pitch of the self-adjustable safety mechanical device.

1.2.1.7.2. The self-adjustable safety mechanical device shall be sized to withstand the efforts of the beginning of closing movement of the moveable plate, not being its function to withstand the closing force.

1.2.1.8. The moveable interlocked protections - doors, shall also protect against other movements, and when opened, shall:

a) stop the cycle; the plasticization may continue if the plastic material splashing is prevented and the nozzle contact force cannot cause a hazard;

b) to prevent forward movement of the injection thread or piston;

c) to prevent forward movement of the injection unit; and

d) to prevent dangerous movements of the parts and male extractors and their actuation mechanisms.

1.2.1.9. Safety devices for machines with electrical axis – electrical injection machines.

1.2.1.9.1. The electrical injection machines shall meet the safety requirements of this Annex, except the sub-items 1.2.1.2 and 1.2.1.7.

1.2.1.9.2. For the closing movement of the electrical injection machines plate, the power circuit shall have serial connection with more than one motor control unit, such as follows:

a) a motor speed control unit having in its output two more contactors in series; or

b) a motor speed control unit with one monitored safety control input, having its output one more contactor in series; or

c) a motor speed control unit with two monitored safety control inputs of category 3, and in this case, the use of contactor in series is unnecessary.

1.2.1.9.3. The power circuit components shall have automatic monitoring, so that if one component fails, cannot be possible to initiate the next movement of the injection cycle.

1.2.1.9.3.1. The automatic monitoring shall be performed at least once every movement of the moveable protection - door.

1.2.1.9.4. The moveable protection - door of the electrical injection machine shall have interlocking device with lock that prevents its opening during the dangerous movement.

1.2.1.9.4.1. The interlocking device with lock shall:

a) conform to the provisions of items and 12.38 to 12.55 and sub-items of this Standard;

b) withstand an stress of up to 1000 N (one thousand Newtons);

c) keep the moveable protection locked in the closed position until the stop condition of the danger movement is met, and the stop condition detection be safe against individual failure.

1.2.1.9.5. The electrical injection machines shall meet a controlled emergency stop, with power supply to the power circuit needed to reach the stop and, then, when the stop is reached, the power is removed.

1.2.1.9.5.1. The emergency stop actuation shall stop all movements and discharge the hydraulic accumulators.

1.2.2. Closing mechanism area.

1.2.2.1. The access to the danger zone of the closing mechanism shall be prevented by mean of fixed or moveable interlocked protection - doors.

1.2.2.2. The moveable interlocked protection - door, front and rear, shall have a monitored safety switch by safety interface, which actuates in the power circuit and shuts down the main motor.

1.2.2.3. The electrical injection machines in which the shutdown of the engine can keep potential energy retention that brings risk of unexpected movements in the closing - extraction mechanism area in molds with springs, for example, shall have additional devices that prevent those movements, such as magnetic brakes.

1.2.3. Plasticization cylinder Protection and injection nozzle.

1.2.3.1. The plasticization cylinder shall have fixed protection to prevent burns resulting from unintended contact in hot parts of the injection unit in which the working temperature exceeds 80ºC (eighty degrees Celsius) and, in addition, shall be fixed a label indicating the statement "high temperature".

1.2.3.2. The injection nozzle shall have interlocked moveable protection with a monitored safety switch by safety interface, which stop all movements of the injection unit.

1.2.3.3. The protections design shall take into account the end positions of the nozzle and the risk of plasticized material splashing.

1.2.3.4. The moveable parts of the injector shall receive fixed protections or interlocked moveable protection with a safety switch monitored by safety interface, which stop all movements of the injection unit.

1.2.4. Feeding materials area - Funnel.

1.2.4.1. The access to the plasticizer thread shall be prevented, meeting the safety distances specified in section A of Annex I of this Standard.

1.2.4.2. In the case of horizontal injection units, it is allowed a lower opening in the nozzle protection.

1.2.4.3. The injection units positioned on the mold area shall be equipped with a restraint system to prevent downward movement by the gravity's action.

1.2.4.3.1. In the case of vertical movement of hydraulic actuation, a restraint valve shall be installed directly on the cylinder, or as close as possible to that, using flanged pipes only.

1.2.4.4. In specific maintenance situations, among them the access to the danger zone, shall be adopted additional measures provided on sub-item 12.113.1 of this Standard.

1.2.5. Parts discharge area.

1.2.5.1. There shall be protection on the parts discharge area so as to prevent that body segments reach the danger zones, according to the items 12.38 to 12.55 and sub-items and item A of Annex I of this Standard.

1.2.5.1.1. The existence of the conveyor belts in the discharge area does not exempt to meet the provisions on sub-item 1.2.5.1.

1.2.6. Additional safety requirements associated with large machines.

1.2.6.1. Large machines are defined when:

a) the horizontal or vertical distance between the closing links is greater than 1.2 m (one meter and twenty centimeters); or

b) if there are no links, the equivalent horizontal or vertical distance, which limits the access to the mold area is larger than 1.2 m (one meter and twenty centimeters); or

c) a person can stay between the mold area protection - door - and the dangerous movement area.

1.2.6.2. Additional safety components, such as mechanical locks, shall be installed in the protections on all sides of the machine where the cycle can be initiated to act on every opening movement of the protection and prevent their return to the "closed" position.

1.2.6.2.1. The components provided on sub-item 1.2.6.2 shall be reactivated separately before can be initiated another cycle.

1.2.6.2.2. The correct operation of the additional safety components shall be supervised by monitored safety devices by safety interface, at least once for each cycle of protection - door movement, so that any failure in such components, their safety devices or their interconnection is automatically recognized, so as to prevent the beginning of any closing movement of the mold.

1.2.6.3. The large injection machines shall have additional safety devices to detect the presence of a person between the moveable protection of the mold - door area and the own mold area, or detect a person inside the mold area, according to the item 12.42, paragraph "c" of this Standard.

1.2.6.3.1. The position from which these devices are reactivated shall enable a clear view of the mold area, with the use of auxiliary vision means, if necessary.

1.2.6.3.2. While these devices are operated, the control circuit of the plate closing movement shall be stopped and, in case of protections - door - with automatic actuation, the control circuit of the protection closing movement shall be stopped.

1.2.6.3.3. When the zone monitored by the presence detectors devices is invalidated, an automatic control shall:

a) stop the control circuit of the plate closing movement, and in the case of use automatic actuations protections - doors, stop the control circuit of the protection closing movement;

b) to prevent the injection into the mold area; and

c) prevent the beginning of the subsequent cycle.

1.2.6.3.4. At least one emergency button shall be installed, in accessible position, between the moveable protection of the mold - door area and the mold area, according to items 12.56 to 12.63 and sub-items of this Standard.

1.2.6.3.5. At least one emergency button shall be installed in accessible position inside the mold area, according to the items 12.56 to 12.63 and sub-items of this Standard.

1.2.7. Machines with vertical movement of the moveable plate.

1.2.7.1. Hydraulic or pneumatic machine with vertical closing shall be equipped with two restraints devices that can be, for example, hydraulic valves that prevent accidental downward movement of the plate.

1.2.7.1.1. The valves provided on sub-item 1.2.7.1 shall be installed directly into the cylinder, or as close as possible, using flanged pipes only.

1.2.7.2. At the location where the plate has a size greater than 800 mm (eight hundred millimeters) and the opening course can exceed 500 mm (five hundred millimeters), at least one of restraint devices shall be mechanical.

1.2.7.2.1. When the protection of the mold area is opened or when other safety device of the mold area actuates, this mechanical restraint device shall act automatically in the entire course of the plate.

1.2.7.2.1.1. When it is not possible moveable protection opening of the mold area before it reaches its maximum opening position, it is allowed that the mechanical restraint device actuate after the opening course only.

1.2.7.2.1.2. In the event of a failure of one of the restraint device, the other shall prevent the downward movement of the plate.

1.2.7.3. The restraint devices shall be automatically monitored so that the failure of one of them:

a) is automatically recognized; and

b) is prevented to begin any downward movement of the plate.

1.2.8. Carousel machines.

1.2.8.1. The access to dangerous movements of the carousel shall be prevented by interlocked fixed or moveable protections according to the items 12.38 to 12.55 and sub-items of this Standard.

1.2.8.2. The access to the mold area shall be prevented according to the sub-item 1.2.1.1 of this Annex.

1.2.9. Machine with mold-holder table of transverse displacement.

1.2.9.1. The access to dangerous movements of the table shall be prevented by the adoption of safety systems provided on items 12.38 to 12.55 and sub-items of this Standard and additionally by the adoption of actuation devices of bimanual control type, according to the items 12.26, 12.27, 12.28 and 12.29 of this Standard.

1.2.9.2. When the vertical movement of the table is possible, shall be prevented the accidental downward movement by the gravity's action.

1.2.10. Multi-station injection machine with moveable injection unit.

1.2.10.1. The access to the dangerous zones of the injection unit when it moves between the closing units, it shall be prevented by interlocked fixed or moveable protections, according to the items 12.38 to 12.55 and sub-items of this Standard.

1.2.10.2. The access to the mold area shall be prevented according to the sub-item 1.2.1.1 of this Annex.

1.2.11. Peripheral equipment.

1.2.11.1. The peripheral equipment installation shall not reduce the safety level, noting that:

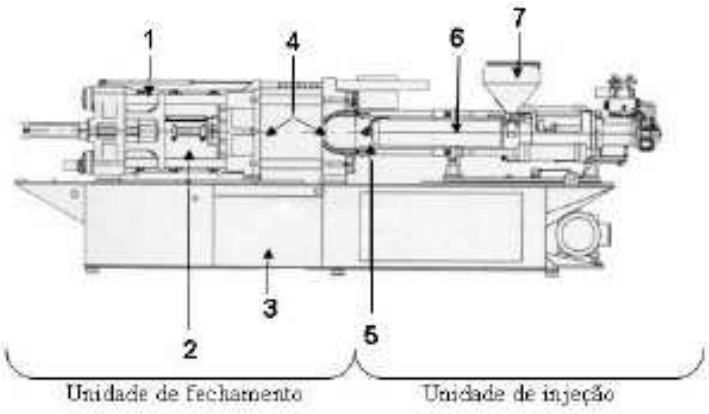
a) the peripheral equipment installation that involves the modification of the machine protections shall not allow the access to danger zones;

b) if the opening of a peripheral equipment protection allow access to a machine danger zone, this protection shall act the same way as that specified for that of the machine zone or, in the case of possibility to access the whole body, shall be applied the provisions of sub-item 1.2.6 of this Annex;

c) if the peripheral equipment prevents the access to the machine danger zone and can be removed without the use of tools, shall be interlocked with the machine control circuit in the same way to the protection specified for that area; and

d) if the opening of a machine moveable protection allow access to a danger zone of a peripheral equipment, such protection shall meet the safety requirements applicable to the equipment.

Figure 1
Schematic drawing of horizontal injection machine showing the main danger zones without fixed or moveable protections.



Key:

1 closing mechanism
2 hydraulic puller
3 parts discharge area
4 moveable plate and fixed plate of the nozzle (mold area)
5 injection nozzle
6 plasticizing cylinder (cannon)
7 feeding funnel

Source: Fundacentro

ANNEX XI

MACHINERY AND IMPLEMENTS FOR AGRICULTURAL AND FORESTRY USE

1. This Annex applies to the design, manufacture, importation, trading, exhibition and cession in any way of stationary or non-stationary machinery and implements for agriculture and forestry use, and also to the machinery and equipment for storage and drying and their conveyors such as silos and dryers.

2. The protections, devices and safety systems provided in this Annex shall integrate the machinery from its manufacture, and cannot be considered optional items for any purposes.

3. The starting, actuation and stop devices of stationary machinery and equipment shall be designed, selected and installed so that they:

a) are not localized in their hazardous areas;

b) prevent inadvertent actuation or shutdown by the operator or by any other accidental way;

c) do not provide additional risks;

d) cannot be juggled; and

e) can be activated or shut off in case of emergency by a person other than the operator.

4. The starting or actuation commands of the stationary machinery shall have devices to prevent their automatic operation when energized.

5. The machinery whose actuation by unauthorized persons may show a risk to health or safety integrity of any person shall have a system or, in the case of self-propelled machinery, ignition switch, that allows the lock of their actuation devices.

6. Danger zones of machinery and implements shall have safety systems, characterized by fixed protections, moveable protections and interconnected or non-interconnected safety devices to ensure protection to health and physical integrity of workers.

6.1. The adoption of safety systems, particularly in the areas of operation that shows danger, shall consider the technical characteristics of the machine and the working process and the existing measures and technical choices in order to achieve the necessary safety level provided in this Standard.

6.1.1. The functional components of process and work areas of self-propelled machinery and implements, which need to be exposed for correct operation, shall be properly protected to the maximum possible extent, in order to allow the operational functionality as intended, meeting the current technical standards and the exceptions listed in Table II of this Annex.

6.2. For the purposes of applying this Annex, is considered protection the element used specifically to provide safety through a physical barrier, where can be:

a) fixed protection, which shall be kept in its permanent position or by means of fixing elements which allow their removal or opening with the use of specific tools only; and

b) moveable protection, which can be opened without the use of tools, usually by mechanical elements connected to the machine structure or a near fixed element, and shall be joined with the interlocking devices.

6.3. For the purposes of applying this Annex, are considered safety devices the components, alone or connected or related to protections, that reduce risks of accidents and other health injuries being classified as:

a) electrical controls and safety interfaces: devices responsible to perform the monitoring, that verifies the connection, position and operation of other system devices and prevent the occurrence of a failure that causes the loss of safety function, such as safety relays, safety configurable controllers and safety programmable logic controller - PLC;

b) interlocking devices: electromechanical safety switches, with positive and break action, magnetic and electronic coded, optoelectronics, safety inductive sensors and other safety devices that have the purpose of preventing the operation of machine elements under specific conditions;

c) safety sensors: mechanical and no-mechanical presence detectors devices, that act when a person or part of your body penetrate the danger zone of a machine or equipment, sending a signal to stop or prevent the start of hazardous actions such as light curtains, optoelectronics presence detectors, laser of multiple beams, optical barriers, area monitors or scanners, stops, carpets and position sensors;

d) valves and safety blocks or pneumatic and hydraulic systems with the same effectiveness;

e) mechanical devices, such as: restraint devices, limiters, separators, pushers, inhibitors, baffles and retractable; and

f) validation devices: supplementary hand-operated control devices, that when applied on a permanent mode, enable the actuation device, such as lockable switches and lockable devices.

6.3.1. The components related to safety systems and actuation and stop controls of the stationary machines, including the emergency, shall ensure the safe state of the machinery or equipment when there are fluctuations in energy level beyond the limits considered in the design, including the power outage and reestablishing of energy supply.

6.4. The protections shall be designed and built to meet the following safety requirements:

a) perform their functions appropriately during the useful life of the machine or permit the replacement of damaged or deteriorated parts;

b) be built of resistant and suitable materials to contain the projection of parts, materials and particles;

c) firm fixation and guarantee of stability and mechanical strength compatible with the required stresses;

d) not create gripping or crushing points with machine parts or other protections;

e) cannot have ends and sharp edges or other dangerous projections;

f) withstand the environmental conditions of the place where they are installed;

g) prevent from being juggled;

h) provide hygiene and cleanliness conditions;

i) prevent access to the danger zone;

j) have their interlocking devices adequately protected from dirt, dust and corrosion, if necessary;

k) take positive action, i.e. acting in a positive mode; and

l) not entail additional risks;

m) have dimensions as provided on Item A of Annex I of this Standard.

6.4.1. When the protection is made of a discontinued material, shall be noted the safety distances to prevent access to danger zones, as provided in Annex I, Item A of this Standard.

6.5. The protection shall be moveable when the access to a danger zone is required one or more times per shift, noting that:

a) the protection shall be associated with an interlocking device when its opening does not allow access to the danger zone before the elimination of risk; and

b) the protection shall be associated with an interlocking device with lock when its opening allow access to the danger zone before the elimination of risk.

6.5.1. For self-propelled machinery and their implements, the protection shall be moveable when access to a danger zone is required more than once per shift.

6.5.2. The machinery and equipment with a moveable protections associated with interlocking devices shall:

a) operate when the protections are closed only;

b) stop their hazardous functions when the protections are opened during operation; and

c) ensure that the closing of the protections alone cannot initiate the dangerous functions.

6.5.2.1. The self-propelled machinery are exempted from meeting the paragraphs "a" and "b" of sub-item 6.5.2 of this Annex for access in maintenance and inspection operations, provided these operations are performed by trained or qualified worker.

6.5.3. For the self-propelled machinery, it is allowed the use of mechanical interlocking device of single actuation and not-monitored to protect the engine compartment.

6.5.4. The interlocking devices with lock associated to the moveable protections of machinery and equipment shall:

a) allow operation while the protection is closed and locked only;

b) keep the protection closed and locked until the injury risk have been eliminated due to hazardous functions of the machinery or equipment;

c) ensure that the closure and lock of the protection by itself can not initiate the dangerous functions of the machinery or equipment.

6.5.4.1. The self-propelled machinery are exempted from meeting the paragraphs "a" and "b" of sub-item 6.5.3 for access in maintenance and inspection operations, provided these operations are performed by trained or qualified worker.

6.6. The power transmissions and the moveable components connected to them, accessible or exposed, shall be protected by fixed or moveable protections with interlocking devices, which prevents access from all sides, with the exception the provided on sub-item 6.1.1 of this Annex and the exceptions provided on Table II of this Annex.

6.6.1. When used moveable protections to confine the power transmissions that have inertia, shall be used interlocking devices with lock.

6.7. The drive shaft (cardan) shall have adequate protection, in perfect condition in its full length, fixed in the machine power take-off from the cross head to the coupling of the implement or equipment.

6.8. The machinery and equipment that provide a risk of rupture of its parts, projection of parts or materials in processing, shall have protections to ensure health and safety of workers, unless the exceptions shown on Tables I and II of this Annex.

6.8.1. The brush cutters shall have protective devices against the throw of solid materials.

6.9. The machinery to cut, chop, triturate, grind, shred and similar shall have safety systems that prevents the contact of the operator or all other persons with the danger zones.

6.10. On protections away from stationary machinery, where there is a possibility of someone getting into the danger zone, shall be adopted additional safety measures of collective protection to prevent starting the machine while there are persons in that area.

6.11. The openings for supply of machinery or implements that are located at the support point level of the operator or below him, shall have protection to prevent the persons to fall inside.

6.12. When the machinery or implement characteristics require that the protections are also used as a means of access, they shall meet the strength and safety requirements appropriate for both purposes.

6.12.1. The bottom of the steps or the stair shall have protection - riser, whenever a protruding part of the foot or hand of the worker can contact a hazardous zone.

7. The batteries shall meet the following minimum safety requirements:

a) located so that their maintenance and replacement can be performed easily from the ground or from a support platform;

b) setting up and fixing in order to have no accidental displacement; and

c) positive terminal protection in order to prevent accidental contact and short circuit.

8. The self-propelled machinery manufactured from May 2008 under the auspices of NR 31 Regulatory Standard given by the Governmental Decree No. 86, March 3rd, 2005, shall have headlights, rear position lamps, horn, rear view mirror and automatic backup alarm coupled to the transmission system, unless the exceptions listed in Table I of this Annex.

9. The self-propelled machinery shall have Rollover Protective Structure - ROPS and seat belts, except those listed in Table II of this Annex, which shall be used in accordance with the specifications and recommendations given in the manufacturer manuals.

10. The self-propelled machinery during the operation that shows risks of falling objects on the workstation shall have Falling Object Protective Structure - FOPS.

11. In power take-off - PTO of agricultural tractors, shall be installed a protection that covers the top and the sides, as shown in Figure 1 of this Annex.

12. The tractive machinery and equipment shall have coupling systems for towing by the drive system, in order to ensure the easy and safe coupling and decoupling, as well as to prevent the accidental decoupling during use.

12.1. The indication for use of coupling systems cited on item 12 shall be in place for easy visualization and fixed in a place near the connection.

12.2. The tractive implement, if the weight of the tow bar so requires, shall have support device that enables the reduction of efforts and the safe connection to the drive system.

13. The conveyor belts shall have:

a) braking system along the spaces where there are access to workers;

b) device that stops its actuation when necessary;

c) start preceded by audible signal in the entire operation area which indicate its actuation;

d) falling material protection system, when a risk of accidents to workers during operation or movement in its vicinity;

e) systems and walkways allowing that maintenance works are developed in a safe manner;

f) walkways with falling protection system along the full high length where may be circulation of workers; and

g) locking system to be used in maintenance.

13.1. Are excepted from the requirement of item 13 the conveyor belts installed on self-propelled machinery, implements and in conveyor belts for loading and unloading.

14. The machinery and equipment shall have instruction manuals supplied by the manufacturer or importer with information relating to safety at all stages of transport, assembly, installation, adjustment, operation, cleaning, maintenance, inspection, deactivation, dismantling.

14.1. The manuals shall:

a) be written in Portuguese Language - Brazil, with characters of type and size to allow the better readability possible, followed by explanatory illustrations;

b) be objective, clear, unambiguous and easy understanding language;

c) have signs or warnings regarding to safety; and

d) remain available to all users in the workplaces.

14.2. The manuals of machinery and equipment manufactured in Brazil or imported shall contain, at least, the following information:

a) legal name, corporate identity number (CNPJ) and address of manufacturer or importer, if any;

b) type and model;

c) serial number or identification number and year of manufacture;

d) detailed description of the machinery or equipment and their accessories;

e) diagrams, including electrical circuits, especially the schematic representation of the safety functions, as appropriate, for stationary machinery.

f) definition of the intended use of the machinery or equipment;

g) risks where the users are exposed;

h) definition of existing safety measures and those to be adopted by the users;

i) technical specifications and limitations for its use with safety, including the criteria for slope work for machinery and implements, as appropriate;

j) risks that can result from tampering or removal of protections and safety devices;

k) risks that can result from uses other than those prescribed in the design;

l) procedures for the use of machinery or equipment safely;

m) procedures and schedule for inspections and maintenance;

n) basic procedures to be adopted in emergencies.

15. Machinery, equipment and implements shall have accesses permanently fixed and secured at all their points of operation, supply, raw materials insertion and removal of products worked, preparation, maintenance and constant intervention.

15.1. Are considered means of access lifts, ramps, walkways, platforms or stairs.

15.1.1. In the technical impossibility of applying the means provided on sub-item 15.1, may be used a ship-type ladder.

15.1.2. The self-propelled machinery and implements with technical impossibility to adopt the means of access provided on sub-item 15.1, where the presence of the worker is required for inspection and maintenance and that are not accessible from the ground shall have support means such as handles or handrails, bars, footrest or steps with slip-resistant surface, ensuring the operator to maintain support contact at three points throughout the access time in order to make it safe, as set forth on item 15.21 of this Annex.

15.1.2.1. Shall be used a safe mean of access indicated in the operation manual, in situations that do not apply the means provided on sub-item 15.1.2.

15.2. The places or worksites above ground level where there is access for workers for interventions shall have stable and safe working platforms.

15.3. Shall be provided means of access if the height from the ground or from the floor to the operator station of machinery is greater than 0.55 m (fifty-five centimeters).

15.4. In self-propelled machinery used in the construction industry with agroforestry application, the means of access shall be provided if the height from the ground to the operator station is greater than 0.60 m (sixty centimeters).

15.5. In rice harvesters, harvesters equipped with conveyor belts and other harvesters equipped with self-leveling system, means of access shall be provided if the height from the ground to the operator station is greater than 0.70 m (seventy centimeters).

15.6. In machinery, equipment and implements, the permanent means of access shall be located and installed in order to prevent risks of accidents and facilitate their use by workers.

15.7. The means of access of stationary machinery, except elevator and ship-type ladder, shall have falling protection system with the following characteristics:

a) be sized, built and secured in a safe and resistant manner, in order to withstand the stresses;

b) be made of material resistant to weathering and corrosion;

c) having upper cross member from 1.10 m (one meter and ten centimeters) to 1.20 m (one meter and twenty centimeters) in height from the floor along the entire length on both sides;

d) the upper cross member shall not have flat surface, in order to prevent the placement of objects; and

e) have skirting-board of at least 0.20 m (twenty centimeters) in height and intermediate cross member to 0.70 m (seventy centimeters) in height from the floor, located between the skirting-board and the upper cross member.

15.7.1. If there is danger of falling objects and materials, the clearance between the skirting-board and the upper cross member of the railing shall receive fixed, full and resistant protection.

15.7.1.1. The protection cited on item 15.7.1 may be formed of resistant screen, provided its mesh does not allow the passage of any object or material that can cause injuries to the workers.

15.7.2. For the falling protection system in platforms used in supply operations or that accumulate dirty is allowed the adoption of the dimensions of Figure 5 of Annex III.

15.8. The use of the means of access for stationary machinery shall consider the pitch angle as shown in Figure 1 of Annex III.

15.9. The catwalks, platforms, ramps and stairs shall provide safe working conditions, circulation, movement and handling of materials and:

a) be sized, built and secured in a safe and resistant manner, in order to withstand the stresses and safe movement of workers;

b) have floors and steps made of slip-resistant materials or coatings;

c) be kept clear; and

d) be located and installed as to prevent risk of falling, slipping, tripping and excessive physical efforts by workers to use them.

15.10. The ramps with slopes between 10º (ten) and 20º (twenty) degrees from the horizontal plane shall have horizontal cross parts securely attached to prevent slipping, spaced with each other 0.40 m (forty centimeters) in all its entire length when the floor is not slip-resistant.

15.11. It is prohibited to build ramps with slopes greater than 20º (twenty) degrees from the floor.

15.12. The catwalks, platforms and ramps shall have the following characteristics:

a) minimum useful width of 0.60 m (sixty centimeters) for machinery, except for self-propelled machinery and implements which have to meet the minimum width determined according to specific technical standard;

b) means of drainage, if necessary; and

c) cannot have skirting-board in the access clearance.

15.13. In stationary machinery, the stairs with riser shall have:

a) width of 0.60 m (sixty centimeters);

b) steps with a minimum depth of 0.20 m (twenty centimeters);

c) uniform steps and flights, leveled and without protrusions;

d) height between the steps of 0.20 m (twenty centimeters) to 0.25 m (twenty-five centimeters);

e) rest platform with 0.60 m (sixty centimeters) to 0.80 m (eighty centimeters) of width and length at intervals of not more than 3.00 m (three meters) in height.

15.14. In stationary machinery, the stairs without riser shall have:

a) minimum width of 0.60 m (sixty centimeters);

b) steps with a minimum depth of 0.15 m (fifteen centimeters);

c) uniform steps and flights, leveled and without protrusions;

d) maximum height between steps of 0.25 m (twenty-five centimeters);

e) rest platform with 0.60 m (sixty centimeters) to 0.80 m (eighty centimeters) of width and length at intervals of not more than 3.00 m (three meters) in height;

f) minimum projection of at least 0.01 m (ten millimeters) of one step on the other; and

g) steps with depth that meets the formula: $600 \leq g + 2h \leq 660$ (dimensions in millimeters) as shown in Figure 2 of this Annex.

15.15. In stationary machinery, the fixed ship-type ladders shall have:

a) dimension, construction and secure and resistant mounting, to withstand the applied stresses;

b) provision of materials or coatings resistant to weathering and corrosion, if they are exposed to corrosive or external environment;

c) roll cages, in the event to have a height greater than 3.50 m (three meters and fifty centimeters), installed from 2.0 m (two meters) from the floor, exceeding the rest platform or the top floor in at least 1.10 m (one meter and ten centimeters) to 1.20 m (one meter and twenty centimeters);

d) handrail or continuation of the stair pillars exceeding the rest platform or the top floor of 1.10 m (one meter and ten centimeters) to 1.20 m (one meter and twenty centimeters);

e) width of 0.40 m (forty centimeters) to 0.60 m (sixty centimeters), as shown in Figure 3 of Annex III;

f) maximum total height of 10.00 meters (ten meters), if a single flight;

g) maximum height of 6.00 meters (six meters) between two rest platforms, if multiple flights, built in consecutive flights with parallel axes, spaced by at least 0.70 m (seventy centimeters), as shown in Figure 3 of Annex III;

h) spacing between bars of 0.25 m (twenty-five centimeters) to 0.30 meters (thirty centimeters), as shown in Figure 3 of Annex III;

i) spacing between the floor of the machine or the first bar not exceeding 0.55 m (fifty-five centimeters), as shown in Figure 3 of Annex III;

j) distance from the structure that is attached to at least 0.15 m (fifteen centimeters), as shown in Figure 4 of Annex III;

k) bars of 0.025 m (twenty-five millimeters) to 0.038 m (thirty-eight millimeters) in diameter or thickness; and

l) bars with surfaces, shapes or grooves to prevent slippage.

15.15.1. The roll cages shall have:

a) diameter of 0.65 m (sixty-five centimeters) to 0.80 m (eighty centimeters), as shown in Figure 4 of Annex III; and

b) clearance between guardrails of no more than 0.30 meters (thirty centimeters), as shown in Figure 3 of Annex III.

15.16. The means of access for self-propelled machinery and implements, shall have the following characteristics:

a) be sized, built and secured in a safe and resistant manner, in order to withstand the stresses;

b) be made of material resistant to weathering and corrosion; and

c) the upper cross member shall not have flat surface, in order to prevent the placement of objects.

15.17. The steering wheel cannot be considered support handle.

15.18. The tires, hubs, wheels and fenders are not considered steps for access to the operator stations.

15.19. The fenders can be considered as steps to reach provided they are designed for that purpose.

15.20. In crawler machinery, the track shoes and the supporting surface of the track shoes can be used as access steps provided they are designed for that purpose and if is guaranteed to the operator support in three-points of contact throughout the access time.

15.21. The self-propelled machinery and implements shall be provided with handrails or handles - handgrips, in one or both sides of the means of access that provides a risk of falling or access to danger areas, which shall have:

a) design so that the operator can keep support contact at three points throughout the access time;

b) cross section width of 0.025 m (twenty-five millimeters) and 0.038 m (thirty-eight millimeters);

c) lower end in at least one handrail or handle located up to 1600 mm (one thousand six hundred millimeters) from the ground surface;

d) minimum clearance of 0.050 m (fifty millimeters) between the handrail or handle and the adjacent parts for hand access, except in the attachment points;

e) a handle installed from the last top step of the mean of access to a height of 0.85 m (eighty-five centimeters to 1.10 meters (one meter and ten centimeters); and

f) handle with minimum length of 0.15 m (fifteen centimeters).

15.21.1. The support points for hands shall be at least 0.30 meters (thirty centimeters) from any articulation element.

15.22. The stairs used to access the operator station of self-propelled machinery and implements shall meet one of the following requirements:

a) the slope α shall be between 70º (seventy degrees) and 90º (ninety degrees) from the horizontal as shown in Figure 2 of this Standard, or

b) if the slope α is less than 70º (seventy degrees), the step dimensions shall meet the equation $(2B + G) \leq 700$ mm, where B is the vertical distance, in mm, and G is the horizontal distance, in mm, between steps, maintaining the remaining dimensions according to Figure 2 of Annex III of this standard.

15.22.1. The steps shall have:

a) slip-resistant surface;

b) vertical stops on both sides;

c) projection to minimize the water and dirt accumulation, in normal working conditions;

d) height of the first step reached with the largest tires suitable for the machine;

e) appropriate clearance on the rear, when used without riser, so as to provide a reliable support for the feet;

f) dimensions according to Figure 2 of Annex III of this Standard;

g) height of the first one from the ground up to 700 mm (seven millimeters) for rice harvesters or harvesters equipped with tracks and other harvesters equipped with self-leveling system; and

h) height of the first one from the ground up to 600 mm (six hundred mm) for self-propelled machinery use in construction industry with agroforestry application.

15.22.2. The connection between the first step and the second step can be articulated.

15.22.3. There shall be no risk of cutting, crushing or uncontrollable movement for the operator in the movement of moveable means of access.

15.23. The self-propelled machinery platforms and implements that shows risk of falling for the workers shall be accessed by steps and have falling protection system according to the dimensions of Figure 5 of Annex III of this Standard.

15.24. The operation platform or work floor of self-propelled machinery and implements shall:

a) be flat, level and secured in a safe and resistant manner;

b) have slip-resistant surface;

c) having means of drainage, if necessary;

d) be continuous, except for tractors called "superimposed," and that could be of two levels; and

e) not have skirting board in the platform clearance.

15.24.1. The moveable or retractable means of access of platforms and cabs, for transportation purposes, shall have restraint system of access clearance.

15.25. The filler neck of fuel tank and other materials shall be located no more than 1.5 m (one meter and fifty centimeters) above support point of the operator.

15.25.1. If the provisions of sub-item 15.25 cannot be met for the fueling operations and other materials, in self-propelled machinery shall be fitted access step with handles to ensure three points of contact throughout the task.

15.25.2. If the provisions of sub-item 15.25 cannot be met for the fueling operations of self-propelled machinery that have the tank located on the rear or side, can be used platform or external stair wichh will serve as a support for safe performance of the task.

Figure 1
Protective cover of the PTO for agricultural tractors

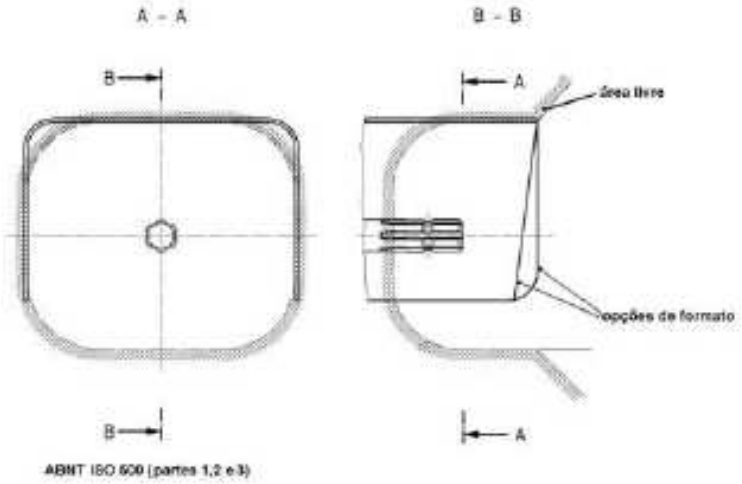
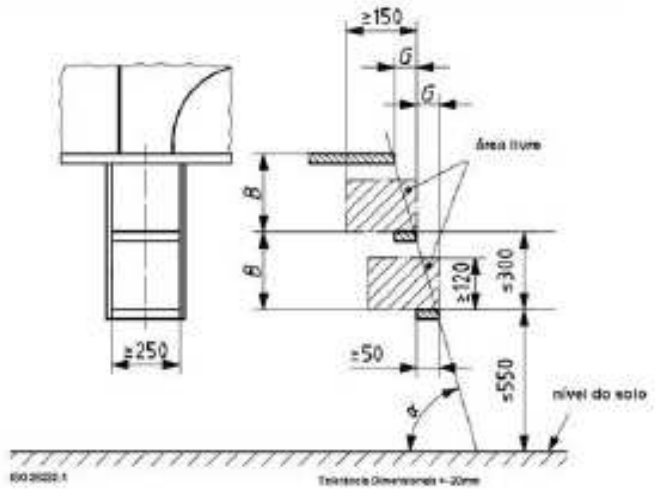


Figure 2
Dimensions in millimeters of means of access for self-propelled machinery



Key:

B vertical distance between successive steps
G horizontal distance between successive steps
α angle of inclination from the horizontal

Table I - Machinery excluded

Machinery Type	Item 9 ROPS	Item 9 Seat belt	Sub-item 6.8 Guard against projection of material processing	Item 8 Backup alarm coupled to the transmission system and rear-view mirror	Item 8 Headlights, horn and rear position lamps
Power cultivators	X	X	X	X	X
Other microtractor and self-propelled lawnmowers (total gross weight below 600 kg)	X	X	X	X	X
Self-propelled sprayers	X				
Self-propelled and tractive fertilizer	X		X		
Grain, cereal, forage, coffee, sugar cane, cotton and orange harvesters among others.	X		X		
Hydraulic excavators	X				
Tractive planters	X	X	X	X	X
Implement holder platform (coupled to power cultivator)	X	X	X	X	X

Table II - Exclusions to the protection in moveable parts (sub-items 6.1.1 and 6.6)

Machinery-implement	Description of exclusion
Power cultivators	Area of the active part of the implement coupled according to the application.
Other microtractor and self-propelled lawnmowers (total gross weight below 600 kg)	Area of the lawnmower, underneath the machine, protected by side protections.
Self-propelled and tractive fertilizer	Distribution area - Distributor area (disk or tube); Area of transportation and helical tracks.
Grain or cereal harvesters	Cutting and feeding or capture area (cut/gathering platform); Area of expulsion and projection of waste (straw spreader); Area of unloading (grain unloader pipe).
Sugar cane harvesters	Cutting or gathering area of sugar cane to be processed (cut/gathering units); Area of material projection/unloading (chopper and material conveyor).
Cotton harvesters	Area of gathering the cotton fiber; Area of unloading of bale of cotton.
Coffee harvesters	Area of vibrating rods assembly, retractable blades, conveyors and unloading.
Orange harvesters	Area of vibrating rods assembly, retractable blades, conveyors and unloading.
Hydraulic excavators, feller bunchers and harvesters	Area of cutting, delimbing, processing or loading logs.
Tractive and self-propelled foragers	Area of cutting or gathering of the plant to be processed (cut or gathering platform); Area of unloading/projection of the triturated material.
Tractive planters	Cutting lines of straw and its components; Planting lines and their components; Area of distribution of seeds and fertilizers.