



APPENDIX 1

to Order of November 8, 2021  
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# STANDARD ON FENCING OF MACHINES AND MECHANISMS IN JSC ILIM GROUP

*It's about LIFE element*  
Protection of Machines and Mechanisms/Zero Energy  
Of Ilim Group Manufacturing System (GMS)

Saint Petersburg  
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## 1. SCOPE

- 1.1 Standard on *Fencing Of Machines And Mechanisms* (hereinafter Standard) is to be used at facilities of JSC Ilim Group branches.
- 1.2 This Standard sets out requirements for protective fencing and safety devices, excluding impact of moving parts of equipment and machinery on personnel. *Protection of Machines and Mechanisms/Zero Energy* is a part of *It's about LIFE* program, Ilim GMS.
- 1.3 Standard includes general requirements to be implemented together with other current regulatory documents.
- 1.4 Standard requirements are obligatory for personnel of all Ilim Group branches and contractors.
- 1.5 This Standard is recommended to be applied by JSC Ilim Group subsidiaries and associates. This Standard application in subsidiary and associate companies is achieved through approval and introduction of corresponding internal acts by authorized control bodies of subsidiary and associate companies.

## 2. TERMS AND DEFINITIONS

**Safe Distance** is a minimal distance from the hazardous source, at which a protective fencing and/or safety device shall be installed.

**Machines And Mechanisms** in terms of this Standard are a complex of connected parts and devices where minimum one of them moves and has a drive, control systems and power units (agitators belt drives; couplings and cardan drives for KLB and PM; couplings of motor shafts, KLB rope drives, technical devices with hydraulic drive, etc.).

**Protective device** is a protective fencing or a safety device.

**Protective fencing** is a device physically preventing unintentional access of personnel to the area of rotating and moving parts of machines. Fencing is also used for protection from outgoing particles and aggressive liquids. Depending on the design, as protective fencing can be understood a housing, cover, guard shield, door, locking fencing, etc. The examples of protective fencing are in Appendix 1.

**Fixed protective fencing** is a fencing fixed in such a way that its opening or relocation is possible only with the tools.

**Movable protective fencing** is a fencing that can be opened and relocated without special tools.

**Adjustable protective fencing** is a fixed or movable fencing, which dimensions and position can be adjusted either as the whole unit or by separate parts for operations.

**Interlocking protective fencing** is a fencing with an interlocking device connected to machine control system that ensures the following protection functions:

- prevents machine movement while fencing is open;
- activates STOP command if fence opening may cause a hazard;
- machine performs hazardous functions only when fence is closed (closing of fence shall not cause the start of hazardous functions).

**Interlocking protective fencing with guard locking** is a fencing with mechanical locking device in closed position. It ensures the following safety functions:

- prevents machine from performing hazardous functions if fencing is not closed and fixed;
- maintains fencing in closed position until there is no risk of machine's hazardous functions;
- machine performs hazardous functions only when fence is closed and fixed (closing

and fixation of the fence shall not cause an automatic start-up of hazardous functions).

**Safety device** is a protection device, except for fencing. Examples of safety devices are in Appendix 1.

**Interlocking device** is a mechanically, electrically, etc. operated device that prevents switch-on of hazardous functions of the machine under certain conditions (while protective fencing is open).

**Unlocking device** is a manually operated auxiliary device, which in conjunction with start-up control panel provides machine operation only with manual control over the device.

**Holding control device** is a control device, which starts and maintains machine operation only when manual control mechanism (actuator) is activated.

**Two-hand control device** is a control device, which requires simultaneous two-hand operation to activate and maintain hazardous functions of the machine. This device protects operator's hands. Control interruption with at least one hand automatically stops these functions of the machine.

**Sensor safety device** is a device to detect a person or their body parts in hazardous area. It transmits a special signal to the control system in order to mitigate the risks for persons in this area. The signal is generated if a person or their body part crosses set borders, for example, accidentally enters a hazardous area (e.g. because of stumbling) or is in there (presence detection).

**Active optoelectronic protective device** is a device, which reading function is performed by optoelectronic emitting and receiving units. They are used for revealing an opaque object in a specified area (detection zone) through interruption of optical emission by the object.

**Mechanical restraint device** is a firm mechanical barrier (e.g. wedge, pin, stopper, track shoe) able to prevent any hazardous movement of the machine or its part.

**Limiting device** is a device that prevents machine or its hazardous operation modes to exceed limit values of parameters provided by the machine design (for example, space limits, limit values for pressure and load).

**Limited movement control device** is a controlling device, which activated once together with the machine control system allows only limited movement of some machine element.

**Impeding device** is any physical obstacle (dwarf partition, rail, etc.) that impedes access to the hazardous area and reduces the probability to enter it, but does not exclude it completely.

### 3. RISK ASSESSMENT

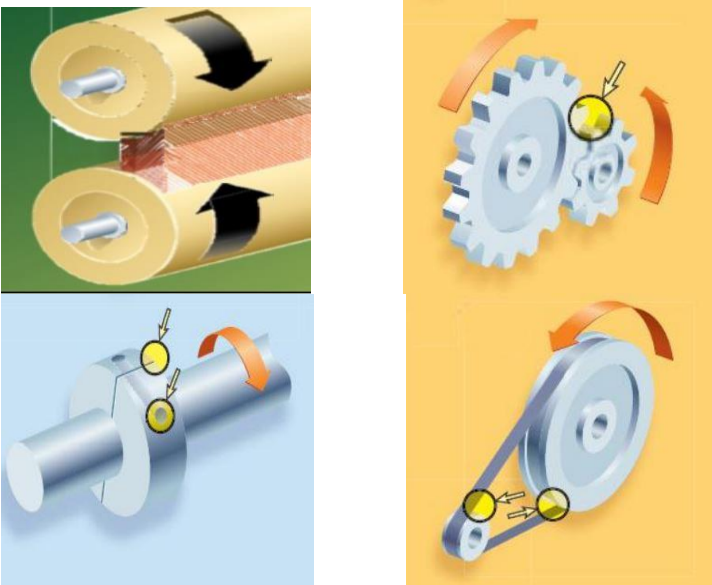
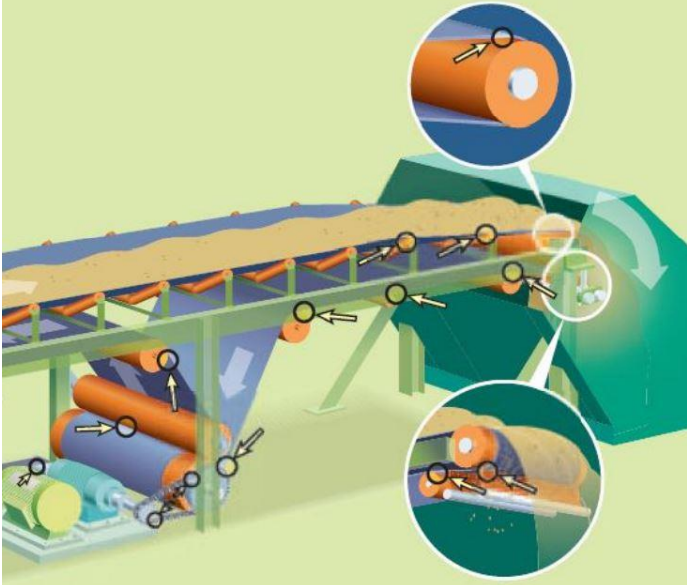
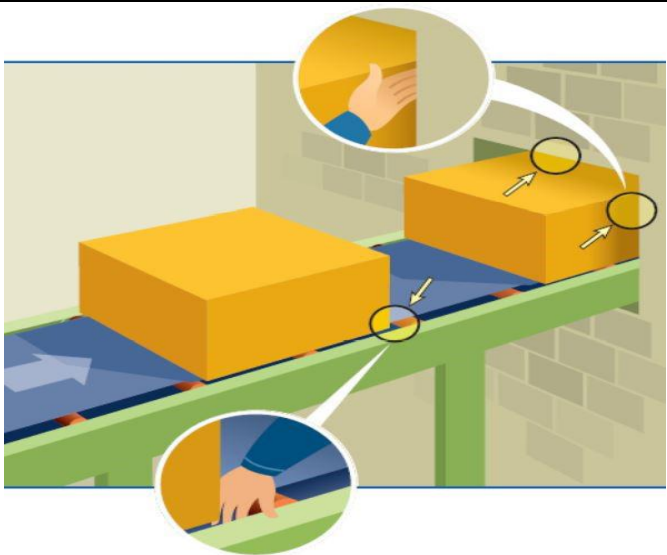
3.1 Moving parts of equipment and machinery shall be isolated from personnel with protective fencing and safety devices that provide a safe distance between the hazardous area and employees.

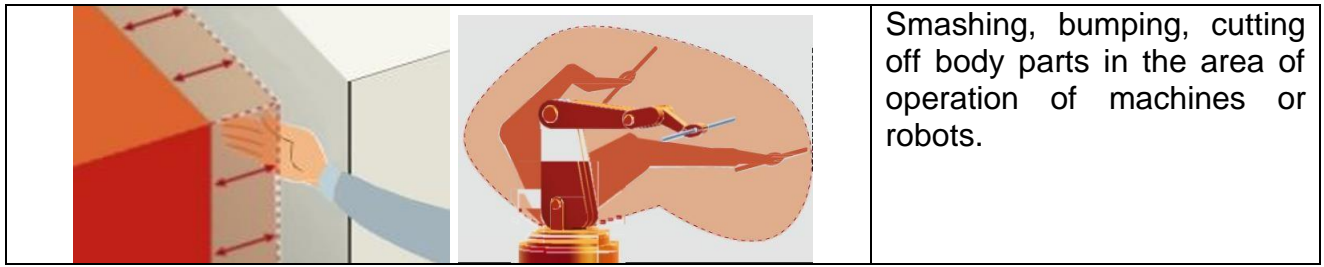
3.2 Risk assessment for the process activities and workplaces connected with the operation of moving parts of equipment and machinery is performed according to the company local regulatory documents.

3.3 When performing risk assessment, it is necessary to pay attention to:

- safe distance to the hazardous area;
- hazardous area dimensions and their position relative to the space and floor or service platforms;
- anthropometric characteristics of different parts of human body;
- frequent hazards mentioned in Table 1.

Hazards of moving equipment and machinery

	<p>Pulling into a moving part, smashing, cutting, cutting off by the roll, coupling, pulley, drive belt, chain, and sprocket.</p>
	<p>Pulling into a moving part, smashing, bumping when contacting with the rollers. Risk of handled material outbreak. Damage from friction or abrasive action.</p>
	<p>Crushing and smashing between the cargo and stationary object or a fallen cargo.</p>

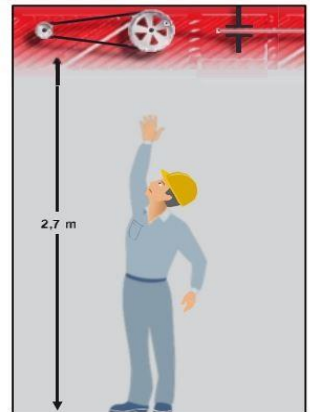


Smashing, bumping, cutting off body parts in the area of operation of machines or robots.

- 3.4 After risk assessment of equipment and machinery moving parts, an action plan to mitigate the risks shall be developed. The actions shall be included into 5-year program *Protection of Machines and Mechanisms/Zero Energy*.
- 3.5 For all actions included into the budget, messages for their implementation shall be created in SAP PM. Messages shall be created by December 31 of the year preceding the year of the action.

#### 4. SAFE DISTANCE

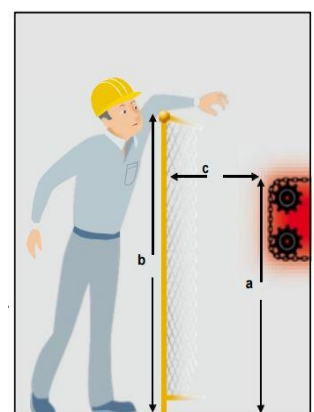
- 4.1 One of the methods to eliminate or mitigate the risks created by machines is to ensure a safe distance to prevent body parts from entering the hazardous area.
- 4.2 For bottom access (Picture 1), a safe distance is the distance between the elevation surface or the stationary work platform and the bottom level of the hazardous area. It also depends on how high and available the hazardous area is.
- 4.3 Any hazardous area located lower than 2.7 m from the elevation surface or the stationary work platform shall be fenced.



Picture 1

- 4.4 Any hazardous area located higher than 2.7 m from the elevation surface or the stationary work platform shall be fenced if this area is regularly maintained from the lifted platforms, mobile service platforms or scaffold structures.
- 4.5 Safe distance while accessing over the fence (Picture 2) is defined according to Table 2.
- 4.6 Protective fencing height shall depend on the hazardous unit elevation and the safe distance between the fencing and the hazardous unit.

- a - hazardous unit height according to the elevation surface or to the stationary work platform, mm;
- b - protective fencing height, mm;
- c - safe distance from hazardous unit to fencing, mm.



Picture 2

Table 2

Hazardous unit elevation (a), mm	Protective fencing height (b), mm									
	1000	1200	1400	1600	1800	2000	2200	2400	2500	2700
	Safe distance from hazardous unit to fencing (c), mm									
2700	0	0	0	0	0	0	0	0	0	0
2600	900	800	700	600	600	500	400	300	100	0
2400	1100	1000	900	800	700	600	400	300	100	0
2200	1300	1200	1000	900	800	600	400	300	0	0
2000	1400	1300	1100	900	800	600	400	0	0	0
1800	1500	1400	1100	900	800	600	0	0	0	0
1600	1500	1400	1100	900	800	500	0	0	0	0
1400	1500	1400	1100	900	800	0	0	0	0	0
1200	1500	1400	1100	800	700	0	0	0	0	0
1000	1500	1400	1000	600	0	0	0	0	0	0
800	1500	1300	900	0	0	0	0	0	0	0
600	1400	1300	800	0	0	0	0	0	0	0
400	1400	1200	400	0	0	0	0	0	0	0
200	1200	900	0	0	0	0	0	0	0	0
0	1100	500	0	0	0	0	0	0	0	0

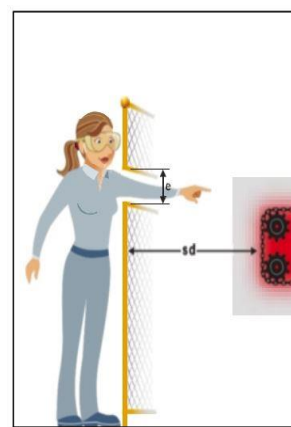
Protective structures lower than 1000 mm are not included as they do not sufficiently restrict body movements.  
Protective structures lower than 1400 mm are not recommended for usage without additional safety measures.  
Requirements for hazardous areas above 2700 mm are in clauses 4.2 – 4.4.

4.7 Safe distance while accessing through the hole in the fencing (Picture 3) is defined according to Table 3.

e - grating (wire) hole dimension, mm;

sd - safe distance from the fence to the hazardous unit, mm.

4.8 The holes match the side of square opening, diameter of round hole, and minimal width of the slot. Safe distances for the holes over 120 mm shall be provided according to Table 3.



Picture 3

Table 3

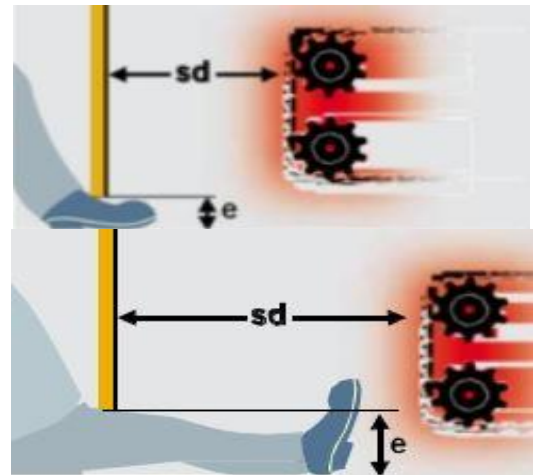
Part of the body	Hole dimension (e), mm	Safe distance (sd), mm according to wire hole shape		
		Slot	Square	Circle
Phalanges	$e \leq 4$	$\geq 2$	$> 2$	$> 2$
	$4 < e \leq 6$	$\geq 10$	$\geq 5$	$\geq 5$
Full length fingers	$6 < e \leq 8$	$\geq 20$	$\geq 15$	$\geq 5$
	$8 < e \leq 10$	$\geq 80$	$\geq 25$	$\geq 20$
	$10 < e \leq 12$	$\geq 100$	$\geq 80$	$\geq 80$
	$12 < e \leq 20$	$\geq 120$	$\geq 120$	$\geq 120$
Hand	$20 < e \leq 30$	$\geq 850^1$	$\geq 120$	$\geq 120$
Straight arm from shoulder	$30 < e \leq 40$	$\geq 850$	$\geq 200$	$\geq 120$
	$40 < e \leq 120$	$\geq 850$	$\geq 850$	$\geq 850$

The bold lines in the table show values for the part of the human body, which is limited by the opening dimensions.

1 - if the slot length is 65 mm, thumb will act as a stopper, and the safe distance can be reduced to 200 mm.

4.9 Requirements of this Standard for the lower limbs apply only when a risk assessment assumes that no upper limbs will enter the area.

4.10 If risk assessment reveals the risk of lower limbs getting into hazardous area under the fence, then chosen safe distance  $sd$  and opening dimensions  $e$  shall eliminate this risk (Picture 4). Dimensions are defined according to Table 4.



Picture 4

Table 4

Part of a lower limb	Dimension of the opening ( $e$ ), mm	Safe distance ( $sd$ ), mm according to wire hole shape	
		Slot	Square or circle
Tiptoe	$e \leq 5$	0	0
	$5 < e \leq 15$	$\geq 10$	0
Toe	$15 < e \leq 35$	$\geq 80^1$	$\geq 25$
Foot	$e \leq 60$	$\geq 180$	$\geq 80$
	$e \leq 80$	$\geq 650^2$	$\geq 180$
Leg (from tiptoes to knee)	$e \leq 95$	$\geq 1100^3$	$\geq 650^2$
Leg (whole length)	$e \leq 180$	$\geq 1100$	$\geq 1100$
	$e \leq 240$	prohibited	$\geq 1100$

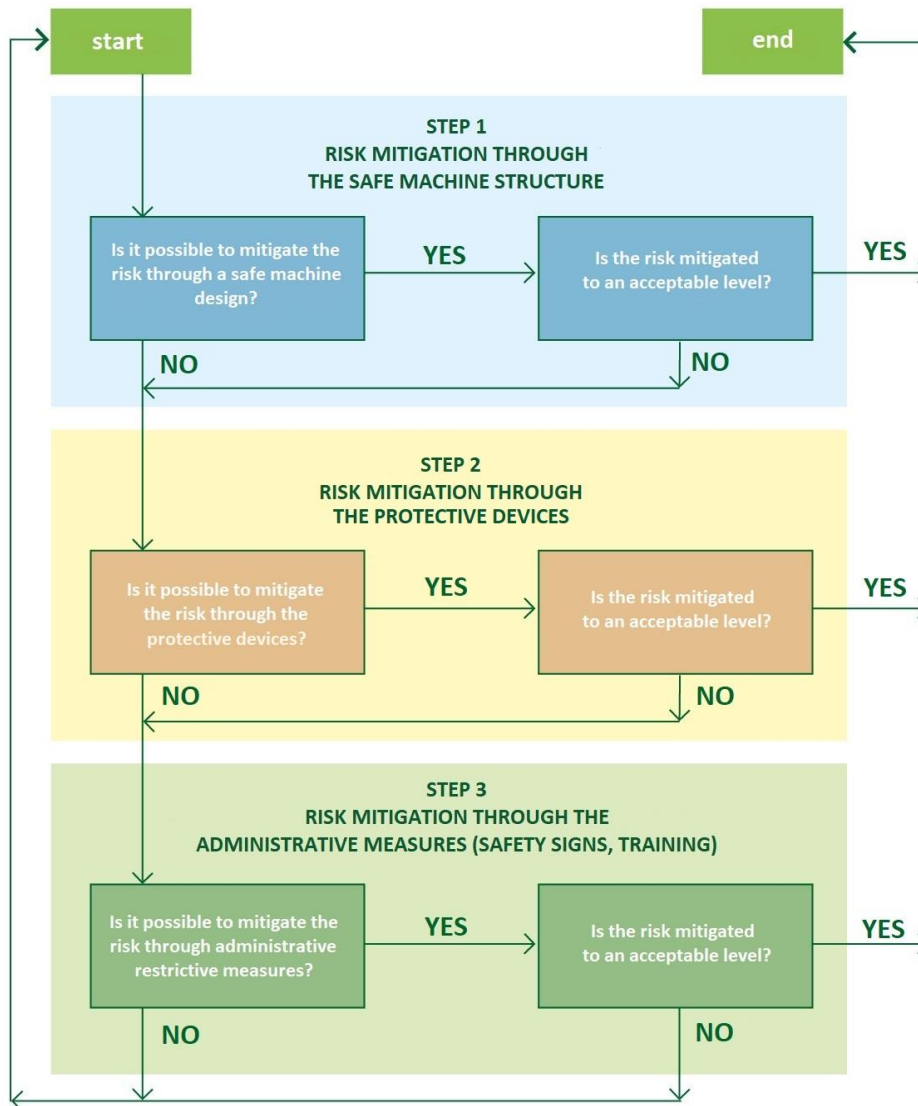
<sup>1</sup> - if the slot length is 75 mm, the distance can be reduced to 50 mm.  
<sup>2</sup> - value for leg (from tiptoes to knee).  
<sup>3</sup> - value for leg (whole length).

## 5. PROTECTIVE DEVICES

- 5.1 Protective fencing and safety devices shall be designed in accordance with conditions of equipment operation, maintenance and nearby sidewalks for personnel.
- 5.2 Fencing structures and safety devices shall protect personnel from hazards that cannot be avoided or sufficiently limited by the machine design for risk mitigation.
- 5.3 In order to mitigate the risks of equipment and machinery moving parts' impact on personnel, safety measures shall be applied in sequence of *Three Steps to Mitigate the Risks*, Diagram 1.



## THREE STEPS TO MITIGATE THE RISKS



5.4 If there is no need for personnel to enter a hazardous area during normal operation of the machine, it is necessary to choose the following protective fencing and safety devices:

- fixed protective fencing;
- movable protective fencing with interlocking, guard locking or without it;
- movable protective fencing with automatic closing;
- sensor safety devices (for example, electro-sensitive detectors or pressure sensors, including pressure mats).

5.5 If personnel needs to enter a hazardous area during normal operation of the

machine, it is necessary to choose the following protective fencing and safety devices:

- movable protective fencing with interlocking, guard locking or without it;
  - sensor safety devices, for example, electro-sensitive detectors;
  - adjustable protective fencing;
  - movable protective fencing with automatic closing;
  - two-hand control devices.
- 5.6 Protective fencing and safety devices shall guard personnel from injuries by rotating and moving parts of the equipment. Their design shall not provide possibility for bypassing.
- 5.7 Fencing and safety devices shall:
- have strong design;
  - not cause any hazard;
  - not make possible to break or bypass them;
  - be placed on a safe distance from the hazardous area;
  - create minimal obstacle for monitoring production process;
  - not impede maintenance, providing access only to the intended area, if possible, without removing the protective fence or switching off safety devices.
- 5.8 Fixed fencing shall be securely fastened with:
- dead connections (for example, welding);
  - detachable connections with fasteners (screws, bolts, etc.), which impede their dismantling or opening without tools. Such fencing shall not remain closed without appropriate fastening.
- 5.9 Movable fencing used to prevent hazard from moving parts of the equipment drive shall meet the following requirements:
- remain fixed on the equipment or other unit (usually with hinge straps or guides) in open position;
  - have interlocking device for open position (with guard locking if needed).
- 5.10 Movable fencing structure used to prevent hazards from non-drive moving parts of the equipment, together with the control system shall ensure:
- impossibility of drive moving parts to start when fencing is open in order to prevent operator from contacting the moving parts of equipment. It can be achieved by using fences with interlocks or a guard locking if needed;
  - adjusting of fencing only by intentional actions of operator with appropriate tools;
  - shutdown of moving parts or impossibility of their start-up when one of the fencing elements is absent or damaged.
- 5.11 Manually adjustable fencing is allowed only if it is impossible to fence a hazardous area completely because of operational conditions.  
Design of manually adjustable fencing shall meet the following requirements:
- fencing position after adjustment shall be fixed when performing a certain operation;
  - fencing can be easily adjusted without any additional tools.
- 5.12 Safety devices shall be installed and connected to the control system with no possibility to bypass them during operation.
- 5.13 If machine (as a result of risk assessment) is to be equipped with components and elements used for emergency shutdown to prevent real or supposed emergencies, the following requirements shall be met:
- actuators for emergency shutdown are to be clearly identifiable, visible, and easily accessible;
  - after activation of emergency shutdown, hazardous process shall stop immediately with no additional hazards;

- emergency shutdown control unit shall start or stop certain movements of protective fencing if necessary.
- 5.14 Safety devices (sensor units, interlocks, pressure-sensitive mats, floors) shall detect the contact of operator with the hazardous border and stop potentially hazardous machine movement if any part of the body is in the hazardous area.
- 5.15 Safety devices shall be installed so that machine is stopped before operator can fall, touch or step over the moving machine unit.
- 5.16 Solid fences are preferred. Fencing made of wire shall have a structure that ensures consistent shape and specified rigidity.
- 5.17 All mechanisms shall have a strong metal fencing provided by the design. It shall be solid, wire, and rail. It shall securely close an all-around access to the moving parts.
- 5.18 Fencing shall provide comfortable cleaning, tuning, lubrication, and operation of the equipment. It shall not trouble operator movements and shall not reduce labor productivity.
- 5.19 Fencing shall be designed and installed to provide a good visibility of the machine and production process. Such design reduces the necessity to dismantle/remove the fence while checking the operation or revealing faults.
- 5.20 Fencing structure and fastening shall exclude an accidental contact between operator and a fence with the fenced elements.
- 5.21 Fencing shall not create additional risks (cutting off, entangling, stumbling, smashing, etc.) or make personnel to remove them due to inconvenience. Portable fencing components shall have dimensions and weight suitable for easy relocation.
- 5.22 Fences of all types or their components, dismantled and installed manually only during repairs of the fenced equipment, shall not exceed 50 kg.
- 5.23 Fences or their components, dismantled and installed manually during equipment maintenance (inspection, cleaning, lubrication, etc.) shall not exceed 15 kg.
- 5.24 Fences or their components manually dismantled once and more per shift for technical needs shall not exceed 6 kg. They shall have handles. Handles shall be placed so that to exclude mechanical shock and smashing of fingers and hands while removing/installing and opening/closing.
- 5.25 Folding, sliding, and removable fences in a protective position shall be kept from self-movement. Upwardly opened fences shall be fixed in open position.
- 5.26 Signal painting of fences, floor marking, safety signs shall correspond to JSC Ilim Group Standard for *Visualization Tools and Safety Signs*. Safety signs shall warn of hazards, availability of safety devices. Clear signs or tags shall be applied to all operator buttons and indicator lights.
- 5.27 All the work, including repairs, close to hazardous source or equipment moving parts shall be stopped before fencing is removed. Standard on *Insulation and Control of Hazardous Energy Sources in JSC Ilim Group (Zero Energy System)* shall be met except for the cases mentioned in this Standard.
- 5.28 It is forbidden to remove and disable protective devices while machines and mechanisms are in operation. The operation of machines and mechanisms without appropriate protective devices is prohibited.

## **6. WINDER PROTECTIVE DEVICES**

- 6.1 All moving components of winders shall be fenced.
- 6.2 Winder shall be fenced from every side. Dimensions allow holding the pushed out rolls and restricting access to this area.
- 6.3 While putting rolls on winder, there shall be a distance from fencing to unwinding stand. It impedes personnel to enter the area between rolls and guides, as there is a

- risk of pulling into the equipment or getting into the nip. Fencing may be a part of unwinding stand framework.
- 6.4 Minimal distance between two full rolls on the stand is to be kept. It is achieved due to binding of rolls to the stopping units. Besides, distance between stopping units shall provide placing of two rolls with maximum diameter and keeping a 500 mm distance between them. If stand rail is equal or higher than 2 m over the floor, then the distance may be reduced to 300 mm.
  - 6.5 Sometimes operator needs to go behind fencing for web threading into the winder.
  - 6.6 A swing gate with interlock system, photoelectric protection or other protective device shall fence access to the winder. Their activation shall at least slow down the winder to a threading speed.
  - 6.7 Arrangement of access monitoring and control system is to ensure clear observation of equipment process area for winder operator (or other equipment operator) and let them see any person intending to enter the feeding area.
  - 6.8 Any hazardous unit of equipment, for example, drive chain left unprotected after arranging access point, shall be protected by installation of a fixed local fencing.
  - 6.9 Trainings and existing control systems of safe work execution are to guarantee that personnel with appropriate permits go through the fencing only for a short time needed (e.g. threading in manual mode). Personnel do not work within the area protected with fencing and access control system when winder runs at full speed.
  - 6.10 Scanners or safety contact mats inside the fenced unwinding section are used as the additional safety measures to prevent operators from working in the fenced area at speed that exceeds the threading one.
  - 6.11 Emergency protection loop and these protective devices shall be properly connected, programmed and set up, as their incorrect operation poses a significant risk of injury.
  - 6.12 Slitter section of the winder is to be equipped with enclosures to prevent contact with the slitter cutting edge, as well as prevent ejection of the slitter or its parts.
  - 6.13 Since the slitter diameter will decrease during operation due to wear and sharpening, the following shall be considered:
    - enclosures are to be installed on both sides of the slitter, only a minimum part of the blade remains open for cutting.
    - side part surface of the enclosure shall be large enough to overlap the blade considering the reduction of its diameter during normal operation.
    - based on information from the slitter manufacturer, it is necessary to consider at what blade diameter the enclosure becomes ineffective.
  - 6.14 It is allowed to install one-side housing only if the gap between slitter and upper side of the housing does not exceed 6 mm. In this case, checks are to be carried out according to the maintenance schedule. Locking nuts shall be used to prevent knife loosening.
  - 6.15 It is necessary to consider the installation of quick-release housings on the side where regular access to the blades is required for material removal in case of winding.
  - 6.16 To mitigate the risk of unbalancing the blades, ensure that the blade is compatible with the holder and it is maintained according to the manufacturer's instructions.
  - 6.17 To impede access to winder rotating mechanisms, a front-side entrance with photoelectric protection shall be equipped. Fencing and photoelectric protection shall be installed so that time spent to get to machine hazardous elements after photoelectric activation exceeds the time needed for shutdown of these elements.
  - 6.18 Infeed table in raised position may serve as a fence preventing access to hazardous units of the winder. To restrict access to the equipment, it is also necessary to install an upper fencing (hereinafter front fencing), which can be lowered into the running

position.

- 6.19 Front fencing shall prevent access to hazardous moving units when the winder operates at speed exceeding the threading one. Fencing prevents roll ejection as well. (If winder is not equipped with an infeed table, other fencing shall be installed).
- 6.20 Front fencing shall be equipped with an interlock system and set up in such a way that speed in excess of the threading one cannot be reached until fencing is in a running position. For a long-term downtime of the winder, there shall be a device to ensure immobility of hazardous units before they can be accessed.
- 6.21 If lifting tables are used as a front fencing, access to the roll shall be prevented through the lifted table or through the gaps between the table and fixed winder units. If there are side fences at both ends of the lifting table, any gaps between moving table and fixed fences that can trap a person shall be eliminated. To provide it, side fencing shall be properly designed and exceed the maximum extended winder table. If a pass between side fencing and table is needed, fencing or any access gates are to have interlock system that allows their opening at a threading speed or lower. Interlock system shall have a high-level reliability.
- 6.22 Unintended roll ejection poses the risk of serious injury. Front fencing, its guides or fastenings shall be strong enough to hold the ejected roll.
- 6.23 Risk of roll ejection increases if there are height restrictions that make unreasonable the use of standard firm fences to prevent the rolls from lifting and falling. In this case, it is necessary to install alternative protective devices or to place personnel and control panels far away from hazardous area.
- 6.24 When such reliable protection is impossible, an interlock system for core clamp holder/spindle position shall be installed. It ensures correct position and retention of the roll until the equipment start-up and prevents the core or spindle from being released during equipment operation.
- 6.25 Winders with rotating pressure rolls that affect reel horizontally shall be equipped with interlock systems for the core clamp holder/spindle position, since in this case the roll may rotate until the front fencing is lowered into the operation position. It must be taken into account that in terms of providing protection clamping bars are not as effective as installing a front fencing.
- 6.26 When winding narrow rolls (paper web is not wounded over the full core width), to reduce the risk of core breakage and ejection of the roll, core shall be supported, for example, by installing an inner metal sleeve.
- 6.27 To prevent unintentional lowering of the rolls, it is necessary to provide a mechanical locking device or a locking device and a hydraulic counterweight.
- 6.28 If there is a mechanical locking device, it shall automatically switch on when the roll is raised before a protective fencing is lifted up. Any incorrect operation of the locking device shall trigger an alarm and prevent opening of the protective fencing.
- 6.29 Access to the hazardous area and units shall be prevented by installing a fixed fencing and photoelectric curtain around the hazardous area.
- 6.30 All access gates in fencing shall be latched and remain locked until the roll stops rotating and the front edge of the lifting table (if available) is lowered to 150 mm above the floor.
- 6.31 If winder has a lifting table, the lowering speed shall not exceed 0.5 m/min when it travels the remaining distance to the floor.
- 6.32 If there are photoelectric curtains in roll unloading area, it is necessary to install fixed fences and interlocking devices such as photocells, safety contact mats or safety edge bumpers to prevent a person from being pressed by the table.
- 6.33 All manual controls for equipment shall be located outside the fenced area.
- 6.34 In cases when physical control is impossible, lifting table shall be started with hold-to-

- run control devices where removal of hands from the control device during the process results in table lifting or stopping. Control devices shall be located to provide unobstructed view of the roll unloading area. Still the winder operator is responsible for cleaning of the process area from the foreign objects.
- 6.35 There are additional safety measures to be used together with the listed above, not instead of them:
- installation of audible/visual indicators to warn that lifting table is moving.
  - installation of a tough rubber (or similar material) bumper along the edge to prevent the risk of pressing/catching body parts; it shall be wide enough to function as a pushing device.
  - using of stoppers or sloping panels to prevent roll movement during gluing or packing. If this operation poses a high risk of injury in manual mode, automatic systems shall be used.
- 6.36 Floor conveyors shall be fenced at the locations of drives, rolls-positioning/transferring mechanisms by installing the fixed fencing and emergency pull cords/stop devices.
- 6.37 For the winder or its units that are to function as part of roll positioning, turning and transferring units, the whole unit shall be assessed before start-up to ensure that the safety system operates properly and that emergency stop and isolation devices can stop the winder and all associated equipment. Safety interlocks shall not be used for isolation of the unit.
- 6.38 Conveyor belts or sections shall be flush mounted with the floor surface. To hide most of the moving elements, conveyor color shall be clearly visible, especially when moving.
- 6.39 Automatic conveyors shall be equipped with a sound alarm system that trips before the start. Decisions on the installation of sound alarms are made as part of a general assessment of the safety of pedestrian routes/access to hazardous areas on the site, while equally effective measures, such as visual alarms, are allowed.
- 6.40 For manually operated conveyor systems, the controls shall be positioned so that the operator can see the entire conveyor path.
- 6.41 When checking the conveyors, cleaning and inspection of the under conveyor space shall be carried out.
- 6.42 The window for discharging reels from the winder shall be equipped with photocell protective devices.
- 6.43 To prevent entry into the hazardous area through the non-photocell discharge window, a chain overlap or similar fence shall be provided to impede accidental access and act as an additional visual warning.
- 6.44 To maintain and repair the winder, next to each equipment, in an easily accessible place, there shall be devices and tools to shut down and lock out the sources of hazardous energy (power supply, compressed air, etc.) as per ZES.
- 6.45 Safety interlocks (or emergency stop buttons) shall not be used to shut down and lock out the equipment.
- 6.46 A manual for the winder safe operation is to be developed; it shall include:
- information on who is responsible for the work;
  - detailed information on the required protective devices;
  - information on the required training, briefing and supervision;
  - information on the identified hazards and the correct method of performing the work;
  - official regulated system of work performance in the written form aimed at minimizing the impact of potential hazards;

- information on actions in emergencies.
- 6.47 Where system may malfunction or a third party may restart the winder, consider removing the key from the control panel or using a non-removable key lockout system. Keys can be configured to follow a predefined sequence of actions to ensure safety (i.e., for example, the key on the control panel puts the equipment into threading mode before it can be removed).
- 6.48 When inspecting the equipment for defects that affect quality (such as holes, folding, etc.), consider implementing preventive measures to mitigate the risks associated with frequent access to hazardous areas and the severity of possible injuries, such as:
- elimination of the need to enter the hazardous area by installing high-speed cameras;
  - installation of access gates equipped with safety interlocks that remain active until the equipment slows down to the speed specified for each of the quality control procedures during the risk assessment;
  - installation of an automatic web break detection system, which stops the machine when tripped – the effectiveness of such system depends on the type of processed paper;
  - configuration and layout of the machine, for example, broke chest availability.
- 6.49 Working on any equipment, even those operating in threading mode, is a dangerous task. A person can be injured at both slow and higher operating speeds. Such work on operating equipment shall be performed only if absolutely necessary after a risk assessment and implementation of a safe work procedure.
- 6.50 Web shall be threaded in the threading mode. The speed shall be reduced to the practicable minimum. The maximum threading speed does not exceed 10 m/min.
- 6.51 The workplaces of the winder operators shall be analyzed in terms of risks and places where people can get stuck/pulled into the equipment or get injured; emergency stop devices (cord, button) shall be installed where anyone working in this area can quickly reach them. Emergency stop devices shall stop the machine and all associated equipment if continued operation is dangerous.

## **7. CONVEYOR PROTECTIVE DEVICES**

- 7.1 Conveyors with traveling loading and unloading devices shall be equipped with the limit switches and stoppers, which are limiting their traveling area.
- 7.2 Conveyors used to transfer the packaged goods shall be equipped with side guards along their whole length, the height of the guards shall be at least the half of the height limit of the handled goods.
- 7.3 In order to prevent the cargo from falling when it is transferred from the conveyor to the lift, the ends of the discharge gates shall be tightly adjacent to the side guard of the conveyor and the lift.
- 7.4 Conveyors for handling of bulk materials shall provide for the motorized cleaning of spillage in accessible places of the route (conveyor line) without stopping the conveyor. The spilled material shall not be jammed between the fencing and conveyor moving parts.
- 7.5 To be fenced:
- conveyors along the whole length;
  - ropes and tensioning devices, weights of tensioning devices along the height of their movement and the floor area under them;
  - discharge devices for bulk materials;
  - collecting devices (bins, chutes of machines), installed in the places of material

- discharge from conveyors;
  - lower outstanding parts of the conveyor, which is crossing the personnel walkways or driveways of vehicles (by installation of the shed going at least 1 meter over the dimensions of the conveyor). Walkways shall be marked with a WALKWAY warning sign;
  - paths of conveyors (except overhead ones), where personnel is not allowed to pass;
  - supporting rollers of carrying and return belt runs in working places, walkway and cleaning areas.
- 7.6 Both sound and light automatic alarm shall be installed and tripped before the drive of the conveyor switches on. The signal shall be audible and visible along the whole length of the conveyor.
- 7.7 The process lines, consisting of several subsequently connected and simultaneously operating conveyors or conveyors with other machines, shall have their drives interlocked in a way, that if one of the conveyors or machines suddenly stops, the upstream machines and conveyors shall automatically shut down, and downstream ones shall continue operating until they are free of handled material. During the emergency shutdown of conveyor the light-and-sound alarm shall switch on automatically.
- 7.8 Conveyors shall be equipped with emergency STOP buttons in the tail and leading ends.
- 7.9 Conveyors shall be equipped with pull cords along the whole length of conveyor to be able to stop the conveyor during the emergency at any place.
- 7.10 Conveyors with multiple drives shall have brake arrangement at each drive.
- 7.11 Belt conveyors shall be equipped with:
- devices, which prevent the handled material from falling;
  - scraping or brushing devices for belt cleaning when handling the bulk materials;
  - devices for automatic return run belt cleaning from stuck material. Manual cleaning of conveyor is allowed when conveyor is not in operation and stopped;
  - motorized devices to clean the spillages (industrial vacuum cleaners and/or vacuum collection devices).
- 7.12 Conveyors for handling of dust-, steam-, gas-yielding materials and other hazardous substances shall have covers with local exhaust ventilation for connection of dust suction or sprinkler systems.
- 7.13 Belt conveyors, which are operated at open-air sites, shall be equipped with protective devices, preventing the belt or material from falling due to the wind. This requirement does not apply to conveyor paths with traveling loading and unloading devices.
- 7.14 When feeding the materials with dropping devices to the bins, which are located under the belt conveyor, the openings of bins shall be fenced with standard hand railing and floor edging and covered with grating with properly sized slots to allow for the material flow only.
- 7.15 Places of loading of belt conveyors, which are handling packaged cargoes, shall be equipped with baffles, preventing the cargoes from falling down.
- 7.16 Ends of conveyors (drive, tensioning devices), belt cleaning devices shall be equipped with removable fencing, interlocked with conveyor drive.
- 7.17 In order to be capable of inspecting the conveyor units during handling of cargoes, fencing is made of wire.
- 7.18 Drive, tensioning, bend pulleys, tensioning devices of belt conveyors shall be covered with fences, preventing from access to them.
- 7.19 Conveyor belt areas, which are running over the drive, tensioning, bend pulleys, shall



- be covered with fences from above and on both sides at least at a 2.5 m distance from the line of contact of the belt with pulleys in order to prevent the access to these spaces during manual cleaning of spillage.
- 7.20 Support rollers of carrying and return belt runs in working places, belt transmissions and others, pulleys, couplings and other moving parts of conveyors, which are located at the height less than 2.7 m from the floor and can be approached by the personnel, shall be fenced.
- 7.21 Fencing of tensioning unit, which is located at the leading end of belt conveyor, shall be installed on both sides along the whole length.
- 7.22 In case of a sudden power loss, the starters of motors and belt conveyor control devices shall be immediately switched to STOP position.
- 7.23 Alongside the drag chain conveyor for logs handling, the walkway for personnel shall be arranged out of the trough way.
- 7.24 Sections of chain conveyors with inclination angle more than 10° shall be equipped with catchers for chains, in case if it breaks.
- 7.25 The main means of protection against the risk of injury from falling into the screw conveyor is a fence made of reliably closed solid covers. The covers shall have an interlock that shuts the screw shaft down when the covers are opened. The operation of stationary screw conveyors with open chutes or covers is not allowed.
- 7.26 The drive elements of the rollers of roller conveyors shall be guarded.
- 7.27 To prevent a cargo from falling from a roller non-driven conveyor, its working track on the outer side of the path at turns and on both sides, when the path is located at a height of more than 1.5 m from the floor level, shall be equipped with guide rails or handrails.
- 7.28 When a hinged section for the passage of workers is installed at a roller non-driven conveyor, the section shall be lifted on hinges in the direction opposite to the movement of material in order to prevent the material from falling into the formed opening.
- 7.29 If the length of the conveyor is more than 20.0 m, and the height from the floor level to the bottom of the most protruding parts of the conveyor is not more than 1.2 m, transition gangways with a width of at least 1.0 m and handrails with a height of at least 1.1 m with bottom side lining with a height of at least 0.15 m and an additional guard rail at a height of 0.5 m are installed. Gangways shall be installed in 50 m from each other maximum in industrial buildings, at pipe bridges – 100 m maximum.
- 7.30 During the operation of the conveyor, it is prohibited:
- to repair components and elements of the conveyor, clean support rollers, drive, tension and end pulleys, remove spillage under the conveyor manually by going under the conveyor;
  - to eliminate slipping of the belt on the pulley by throwing sand, clay, rosin, bitumen and other materials into the area between the belt and the pulley;
  - to fix the skew of the conveyor belt using a metal rod, pipe, stick, and adjust the position of pulleys and roller supports;
  - to rearrange the supporting rollers, pull and set the conveyor belt manually;
  - to work with faulty speed relays, protection against slipping, derailment of the belt, with faulty signaling devices and emergency stop devices of the conveyor;
  - to repair the electrical equipment under voltage.
- 7.31 Transfer baling lines, reels, and bale presses shall be equipped with protective devices.

## **8. TESTING OF PROTECTIVE DEVICES**

- 8.1 In each structural unit, a list of interlocking protective fences and safety electrical devices shall be drawn up.
- 8.2 Commission, headed by the manager of the structural unit, shall check the protective devices according to the list every six months. Commission is appointed by the order of the head of the structural unit. Commission includes the head of the structural unit, a representative of the maintenance service, and a representative of the labor protection service. If necessary, participants from other structural units are involved.
- 8.3 The result of the check shall be entered into the logbook of protective fences and safety devices in accordance with Appendix 3. If an issue is found, it is entered in the appropriate column. It is necessary to conduct a risk assessment and develop an action plan to eliminate the risks.
- 8.4 During the check it is necessary to:
- carry out a visual inspection of the equipment, machine or system;
  - ensure that protective fence or safety device is in place, properly operable, securely fastened and in line with the design and the Standard;
  - ensure that calculation of the safe distance is correct;
  - ensure that protective fence or safety device prevents injury;
  - ensure that protective fence or safety device does not create new risks and is safe;
  - test each mechanical safety/interlocking device;
  - test each electronic safety/interlocking device;
  - test all emergency shutdown devices.
- 8.5 Fences and non-electrical safety devices are checked as part of routine maintenance.

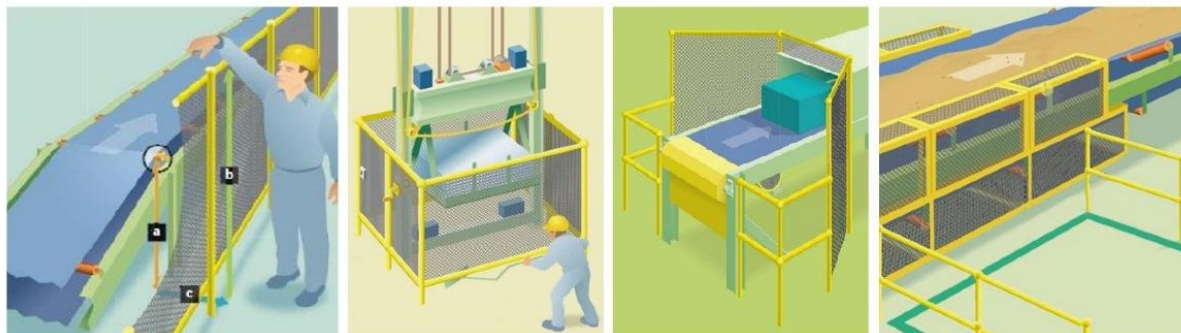
## **9. RESPONSIBILITY AND CONTROL**

- 9.1 Mill/Forest Managers shall be responsible for:
- compliance with the requirements of this Standard at Ilim Group's locations;
  - procurement of resources required for the Standard implementation.
- 9.2 Heads of the structural units and construction project managers shall be responsible for:
- communication of the Standard to the employees and other persons permitted to access the Company's facilities;
  - ensuring compliance with the Standard requirements in their structural units;
  - when putting the equipment into operation, after the implementation of investment projects, project manager shall provide a list of preventive work necessary for its completeness and correct operation, to enter into SAP PM.
- 9.3 Persons in charge in the structural unit (who issue work permits) are responsible for:
- removal and disabling of protective devices;
  - correct installation of protective devices prior to putting the equipment into operation.
- 9.4 Heads of labor protection services of the Branches shall conduct self-examination of compliance with the requirements of this Standard at least once a year in the structural units according to the checklist given in Appendix 2 with identification of areas of concern and drawing up improvement plans.
- 9.5 Health and Safety Directorate will exercise control over the Standard implementation.
- 9.6 Persons who have violated the requirements of this Standard shall be subject to disciplinary action in accordance with the local regulations of JSC Ilim Group.

## **10.LIST OF REGULATORY DOCUMENTS USED FOR DEVELOPMENT OF THIS STANDARD**

- 10.1 Occupational Safety Rules in Pulp & Paper and Wood Chemical Industry approved by Order of the Ministry of Labor and Social Protection of the Russian Federation No. 859n dd. December 04, 2020.
- 10.2 Occupational Safety Rules during Operation of Industrial Transport approved by Order of the Ministry of Labor and Social Protection of the Russian Federation No. 814n dd. November 18, 2020.
- 10.3 GOST ISO 12100-2013 Safety of machinery. General principles for design. Risk assessment and risk reduction, 2015.
- 10.4 GOST ISO 13857-2012 Safety of machinery. Safe distances to prevent hazard zones being reached by upper and lower limbs, dd. August 20, 2013.
- 10.5 GOST ISO 13855-2006 Safety of equipment. Positioning of protective devices with respect to the approach speeds of parts of the human body, 2007.

**EXAMPLES OF SAFETY FENCES  
PROTECTION AGAINST MULTIPLE HAZARDOUS AREAS**



**EXAMPLES OF SAFETY FENCES  
PROTECTION AGAINST ONE HAZARDOUS AREA**



**EXAMPLE OF A SAFETY  
MAINTENANCE GANGWAY**



**EXAMPLES OF SAFETY DEVICES  
PULL CORDS, SENSORS, INTERLOCKS,  
PRESSURE MATS**



<b>Checklist of the Standard on Guarding of machines and mechanisms in JSC Ilim Group</b>		<b>Document No.</b>		
<p>The Standard requirements that shall be implemented and continuously followed by all structural units, subsidiaries and contractors are listed below.</p> <p>Proceed with the following drop down list assigning a score (from 1 to 5 points) to each item of the list. 1 - unsatisfactory situation, 2 - low level of compliance/implementation, 3 - satisfactory level of compliance/implementation, 4 - good level of compliance/implementation, 5 - excellent level of compliance/implementation. If an item was evaluated with 1 or 2 points, it is required to fill in the Remarks/Actions box.</p> <p>A team of competent employees, who have complete and comprehensive information at their disposal and who can professionally and impartially evaluate the situation, as well as to guarantee continuous compliance with the Standard requirements, shall conduct evaluation.</p> <p>Scoring criteria:</p> <p>1 - total non-compliance with the requirements that needs immediate corrective actions.</p> <p>2 - partial non-compliance with the requirements that needs significant improvement.</p> <p>3 - compliance with the requirements that needs insignificant improvements.</p> <p>4 - full compliance with the requirements.</p> <p>5 - full compliance with the requirements, such case that can be used as a benchmark to be implemented in other divisions and Branches of JSC Ilim Group.</p>				
Mill/department/project:			Filled by (Name):	
Basis for assessment:			date:	
No.	The Standard requirements that shall be implemented/applicable criteria:	Assessment: (drop down list)	Remarks/ actions:	
1	All moving parts of machines and mechanisms are isolated from personnel by means of protective fences and safety devices that exclude access from all sides			
2	Assessment of risks relative to manufacturing process and permanent workplaces associated with the operation of moving parts of machines and mechanisms was performed. Action plan was developed			
3	Fences and safety devices prevent themselves from being inoperative or from being bypassed			
4	Safe distance is calculated correctly with respect to the requirements of the Standard, Section 4			
5	Signal painting and safety signs comply with the requirements of Ilim Group. Clear and readable signs or tags apply to all operator buttons and indicator lights			
6	Access to the winder is guarded by installing gates equipped with an interlock system, photocell or other protective device			
7	Scanners or safety pressure mats inside the fenced unwinding section or other emergency stop devices are in use			
8	In the winder cutting section, enclosures are installed on the slitters			
9	To prevent unintended lowering of the rolls, a mechanical locking device or a locking device and a hydraulic counterweight are provided			
10	All elements of manual control over equipment are located outside the fenced area			
11	Manual for the winder safe operation is developed			
12	Conveyors are fenced along their whole length			
13	Support rollers of carrying and return belt runs in working places, walkways, and cleaning areas are fenced			
14	A two-way sound and light alarm is installed; it turns on automatically before the conveyor drive starts. The signal is audible and visible along the whole length			

15	Conveyors are equipped with emergency STOP buttons in the tail and leading ends		
16	Conveyors are equipped with pull cords along the whole length of conveyor to stop the conveyor during emergency at any place		
17	Conveyors are equipped with: <ul style="list-style-type: none"> <li>• devices, which prevent the handled material from falling;</li> <li>• scraping or brushing devices for belt cleaning when handling the bulk materials;</li> <li>• devices for automatic cleaning of return run belt from stuck material;</li> <li>• motorized devices to clean the spillages (industrial vacuum cleaners and/or vacuum collection devices)</li> </ul>		
18	Conveyors for handling of dust-, steam-, gas-yielding materials and other hazardous substances have covers with local exhaust ventilation for connection of dust suction or sprinkler systems		
19	With the conveyor length, gangways are installed if necessary		
20	Commission checks protective devices according to the list every six months		
	<b>General Assessment Summary:</b>		<b>Number of checked items that give 2 points and less:</b>
<b>General Assessment Summary criteria:</b>			
<b>The Standard has been fully implemented and is maintained at the appropriate level:</b>			(≥ 80 and a maximum of two items got 1 and 2 points)
<b>In order to implement the Standard it is required to develop an action plan:</b>			(60-79 and/or a maximum of two items got 1 and 2 points)
<b>The Standard has not been implemented, <u>urgent action</u> is required:</b>			(≤ 59 and/or two or more items got 1 and 2 points)
<b>General comments/confirmation of the assessment results:</b>			
<b>I hereby confirm the performance of the assessment and the accuracy and reliability of the data:</b>			
<b>Full name/position:</b>		<b>Signature/date:</b>	
<b>Full name/position:</b>		<b>Signature/date:</b>	
<b>Full name/position:</b>		<b>Signature/date:</b>	
<b>Approved by (name/position)</b>		<b>Signature/date:</b>	

