M5-EN.2. MECHANICAL RISK FACTORS

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M5-EN.2.5.3. Safety measures to prevent exposure to rolling, sliding, falling, loosened, scattered or spread around objects

M5-EN.2.6. Falls on flat surfaces slips and trips, instable step

M5-EN.2.6.1. Risk factors

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M5-EN.2.7. Falls

M5-EN.2.7.1. Risk factors, impact on human health

M5-EN.2.7.2. Safety measures

M5-EN.2.8. Self-study assignment

Short description of the section:

In this section examples of typical **mechanical risk factors** **##G13##** that a driver employed in a land transportation company (working in a typical workplace of this sector) is subject to are presented and analyzed.

The **goal** of this section is:

– Identify the most characteristic types of risk factors that vehicle drivers are subject to;

– Present examples and descriptions of these risk factors;

– Identify negative impact of risk factors on human health; and

– Give recommendations for work safety measures.

The material presented in this section will assist the employee, the employer and the company owner to adjusting recommendations for identifying risk factors, ways of prevention and safety measures in his workplace and his company.

M5-EN.2.1. Mechanical risk factors in land transportation sector

Drivers working in land transportation companies (in a typical workplace) encounter a number of mechanical risk factors. **(M5.2.1.jpg)** These risk factors may be divided into the following groups:

– Unguarded moving parts of machinery;

– Parts with hazardous surface;

– Moving vehicles and work equipment;

– Objects moving without control;

– Falls on flat surfaces, slips and trips, instable step;

– Falls

Accidents caused by mechanical risk factors usually occur when inexperienced, unauthorized and incompetent drivers do mechanical repair work by infringing work safety requirements; when vehicles are not properly prepared for work; when vehicle technical inspection terms are not complied with; when load distribution plan is ignored while loading the cargo; when unsafe steps or ladders are used or access to them is encumbered; when safe distance is not maintained; when the driver suddenly changes the driving direction or applies the brakes abruptly; when personal protective equipment is not used; when driving or access roads are narrow, obstructed and unsafe for walking; when walkways are polluted with oil or lubricants, slippery, unstable, sloping etc.; when jumping on or off elevated surfaces is not prevented.

M5-EN.2.2. Unguarded moving parts of machinery

M5-EN.2.2.1. Risk factors

Unguarded moving parts of machinery present one type of mechanical risk factors that a driver of a land transportation company may be subject to.

In the assessment of the manifestation of this risk factor the following shall be **inspected and identified**:

– Are moving parts of mechanisms in the vehicle or in close proximity of the vehicle (e.g., winches, including drives, mechanisms of V-belt and fan including drives, electric window winder) guarded to prevent the risk of entanglement?

– Are safety guard (e.g. covers) installed at wheels, hub covers, boot cap (spur geared pinion, belt mechanisms, spindles), main propeller shaft and axels, and are they in proper condition?

– Are warning signs that mark hazardous areas clear and visible?

A properly operating company usually ensures that safety guards and lock-out systems are in place. However the **risk of hazard still exists**:

– With the increase of movement distance,

– In the event of failure (e.g., malfunctioning of lock-out or breaking device),

– When safety guards are removed, overridden, damaged etc.

Most often safety guards are not used or not operated because they are insufficient, damaged, inconvenient or simply removed for time saving reasons.

M5-EN.2.2.2. Impact on human health

Body traumas of vehicle drivers caused by unguarded moving parts of machinery may be very different**,** from not severe injuries and cuts to fatal injuries. The scope of injuries first of all depends on the energy of action. The following factors may also have influence:

– The surface of moving parts (corners, edges, sharp bulges, blades, roughness);

– Unsafe distance;

– Direction or zone of action of the moving part;

– Injured part of the body and its resistance to external impact.

All parts of the body may be injured, most often hands, feet, legs, head, chest, arms (listed according to the incidence of traumas).

M5-EN.2.2.3. Safety measures

There are always two possibilities of protection from hazardous spots:

– Limit the hazard down to not hazardous parameters;

– Eliminate the influence of a hazardous spot by applying preventive measures, especially safety guards.

Therefore, the following safety measures can be recommended for unguarded moving parts of machinery:

– Use safe equipment in new installations;

– Maintain safe distances (LST EN 294 standard);

– Avoid narrow spaces (Standard LST EN 349, Parts 1-3 of Standard LST EN 547 and Standard LST EN 811);

– Select safety guard properly (subject to the hazardous spot activity zone, possibility to get into this zone and frequency of work in that zone):

  – **Dismantled safety guard**: hazardous crushing, cutting and entanglement spots in the area are safeguarded in such a manner that people could not reach them, e.g., covered with lids, meshes, caps etc.

  - **Obstructing safety guard**: a physical obstacle blocking full reach of the hazardous zone, e.g., finger protection panel at the spindle, bows etc.
  - **Not dismantled (immovable) safety guard**: the guard alone or together with dismantled safety guard eliminates or mitigates the hazard (most often operation function is also applied), e.g. locked equipment, forced position switches, safety equipment that become activated when approached.
- Inspection by a competent person (at least once per year);
- Labelling of hazardous spots.

M5-EN.2.3. Parts with hazardous surface (M5.2.3.1.jpg)

M5-EN.2.3.1. Risk factors, impact on human health

Hazardous surfaces are:

- Corners and edges,
- Pointed bulges, blades,
- Rough surfaces

encountered in fixed equipment, supports or moving parts such as vehicles, instruments, spare parts etc.

In the assessment of the manifestation of this risk factor the following shall be **inspected and identified**:

- Is contact with sharp-edged, pointed or abrasive elements in the vehicle or close to the vehicle (e.g. protruding door handles or tyre treads) prevented?

Impact on human health. The form and dimensions of hazardous surface influence the scope of injury. Hazardous surfaces may:

- jab, prick or cut
- scratch or tear
- stick or seize

Incidents are related to the intensiveness of body movements; injured part of the body and its specific ability to resist; failure to estimate the hazardous surface due to bad visibility; insufficient lighting; not sharp enough contrast; unexpected appearance of hazardous surfaces; inconvenient for movement space; inadequate movement trajectory (possibility of contact with hazardous surfaces); too little space for standing etc.

M5-EN.2.3.2. Safety measures

The most effective way of protection is to avoid hazardous surfaces.

If that is impossible to achieve, the following is recommended:

- To mitigate hazardous impact to not dangerous limits (e.g., round or take away corners, polish the roughness, cover blades and edges with soft material etc.) making the surfaces that have to be contacted as big and/or as soft as possible.
- Organize the work and arrange spaces in such a manner that the possibility for a person moving in all directions of contacting the hazardous surface would be minimized. Use of safeguards serves this purpose.
- Ensure good visibility of hazardous surfaces (lighting).
- Use instruments with hazardous surfaces with great care (e.g., keep them in safe places and boxes).
- Don't carry sharp and pointed instruments and things in pockets; do not keep them inside the vehicle.
- Provide employees with **personal protective equipment** and control that the equipment is used:
  - Head protection (safety helmet),
  - Feet protection (safety footwear with puncture resistant soles),
  - Body protection (gloves, cut and puncture resistant clothing).

M5-EN.2.4. Moving vehicles and work equipment (M5.2.4.1.jpg)

M5-EN.2.4.1. Risk factors, impact on human health

In the assessment of the manifestation of this risk factor the following shall be **inspected and identified**:

- Is casual or unauthorized use of moving vehicles or working equipment prevented?
- Do moving vehicles and working equipment comply with the task (without obvious limitations, e.g. loading of extra size loads when appropriate and sufficient loading safety is required)?
- Are periodic inspections by a competent person ensured?
- Are adequate and sufficient safety measures used while working with moving vehicles and work equipment (e.g. is overloading etc. prevented)?
- Are moving vehicles and work equipment regularly inspected by a competent person?
- Is the vehicle in safe condition for use?
- Is reverse driving avoided as much as possible?
- Is a signaller appointed to guide during reverse driving?
- Are vehicles parked only when the driver has a clear view of the driving zone?
- Is there awareness of specific hazards of coupling trailers and are measures taken to avoid them?

– Are closed heel and toe shoes worn while driving?
– Is protective footwear worn while loading and unloading?
– Is cargo distribution plan prepared for all vehicles?
– Are passenger vehicles not overcrowded?
– Are vehicles prepared for winter in a timely manner?

After the inspection decisions are made if additional actions or measures are required, safety goals are defined, hazard elimination measures are selected and the need for additional consultations of specialists is identified.

The impact of accidents caused by moving vehicles **on human health** may be very painful and result in injuries of different seriousness or even death.

M5-EN.2.4.2. Safety measures

The following work safety measures are recommended for protection from the risk caused by moving vehicles and working equipment:

– Use **safe vehicles** and **auxiliary working equipment** (vehicle superstructures; load securing devices; tanks; local movement restriction (loading restriction, emergency braking etc.) equipment; warning and signalling equipment; equipment to protect space behind the vehicle; alarm systems restricting the leaning angle of the vehicle, loading momentum or driving speed etc.);
– Prevent unauthorized use of vehicles and equipment;
– Periodically inspect the safety of vehicle use;
– Comply with vehicle maintenance terms;
– Have vehicles and working equipment inspected by a competent person;
– Prepare a cargo distribution plan;
– Specify the allowable number of passengers in the vehicle;
– Prepare the vehicle for winter use in time;
– Steps and ladders must be safe and within easy reach.

M5-EN.2.5. Objects moving without control (M5.2.5.1.jpg)

M5-EN.2.5.1. Risk factors, impact on human health

Objects moving out of control are those that may:

– fall or sway
– roll or slide
– fall
– loosen, scatter or spread around

In the assessment of the manifestation of this risk factor the following shall be **inspected and identified**:

- Are things in the vehicle loaded in such a manner that they would not fall or tumble (e.g., cargo, suitcases, bags, and bottles)?
- Is rolling down avoided?
- Is air and power supply to the trailer in proper order (applicable to cargo vehicles)?
- Are loading sites (platforms), vehicle's body (trunk, covers, and tent) and loading equipment in proper order (applicable to cargo vehicles)?
- Do side boards and loading door open on the same and safe side (for stepping off or loading) (applicable to cargo vehicles)?

Impact on human health. Depending on the size, weight and form of the object moving out of control and the body part hit by the object people may suffer from different injuries, including fatal.

M5-EN.2.5.2. Safety measures to prevent exposure to falling or swaying objects

The following work safety measures are recommended **to protect from objects that may fall or sway**:

- Avoid forces generated by acceleration, i.e. sudden change of direction, sudden braking or start-up, towing sideways if the cargo may sway;
- Avoid load force acting in one direction, i.e. sinking into soil, holes, cavities, driving uphill etc.;
- Arrange, load and unload cargo in a safe manner (comply with load distribution plan, allowable height of stacks etc.);
- Distribute the load evenly;
- Keep things carried in the cabin or passenger vehicle (packages, bottles, cans etc.) in a safe and specially arranged place;
- Ensure safe distance from moving objects is maintained (Standard LST EN 294:1997);
- Use head and feet **protective equipment**.
- When these measures are not effective, stability can be ensured by **additional fall protection measures** (e.g., side fastening equipment, stretch equipment, blocking equipment; vertical fastening equipment, support anchors; floor fixed platforms increasing the support surface etc.).

M5-EN.2.5.3. Safety measures to prevent exposure to rolling, sliding, falling, loosened, scattered or spread around objects

The following work safety measures are recommended to protect from **rolling and sliding objects** (that due to small weight or weak adhesion with the base or potential

impact of external forces are characterized as objects of insufficient state or position stability):

- Additional roll protection measures:
  - Cones and barriers;
  - Props, supports, poles, frames, side walls;
  - Tension cables and belts; safely strapped stacks, pyramid type of loading, in-between trays, stoppers are used;
- When these measures are not effective, objects that may roll or slide should be levelled or intercepted. This can be done using:
  - Levelling supports, deflecting grooves;
  - Interception nets, canvas, baskets, fences;
  - Lids, covers, enclosures.
- **Safe distance** to vehicles shall be maintained (Standard LST EN 294:1997);

The following work safety measures are recommended **to prevent the exposure to falling objects**

- Things in the cabin or passenger vehicles must be safely fastened using detaining bands etc.
- The form and dimensions of shelves shall prevent objects from falling.
- Supporting parts of warehouse equipment shall be installed in a safe manner and allowable loads shall be indicated.
- Avoid standing under suspended loads, mark and fence dangerous zones.

The following work safety measures are recommended **to prevent the exposure to loosened, scattered or spread around objects:**

- Avoid external dynamic forces (e.g., impact, pressing);
- Control fasteners and holders etc.;
- Limit pressure in hydraulic or air driven equipment in the event of danger that broken hoses may produce knocks, sprinkle or spray liquids;
- Use retention equipment (e.g., protective walls);
- In all the aforementioned cases when objects move out of control the following safety measures shall be used:
- Head and feet **protective equipment**.
- Regular control whether the loading platform and the vehicle are in proper condition.

M5-EN.2.6. Falls on flat surfaces, slips and trips, unstable step (M5.2.6.1.jpg)

M5-EN.2.6.1. Risk factors

Hazards of fall:

- slipping
- tripping
- stumbling
- unstable step on a slippery surface

In the assessment of the manifestation of this risk factor the following shall be **inspected and identified**:

- Are roads and walkways safe for walking, not narrow and unobstructed?

Risk of slipping is caused by:

- Oily surfaces;
- Wet supporting surfaces;
- Polished supporting surfaces;
- Icy or frosted surfaces;
- Unstable supporting surfaces (leaves, powdery material), unfixed surfaces (carpets, slabs);
- Supporting surfaces lined with materials of different slipping resistance;
- Sloping supporting surfaces (ramps etc.).

Risk of tripping, stumbling and unstable step is caused by:

- Uneven surface (steps, slopes, holes, dents);
- Chipped or protruding edges of the lining;
- Hold-ups where the toe or the whole shoe is entrapped (e.g., extended wire);
- Scattered things;
- Supporting surfaces of inadequate form, size and stability.

M5-EN.2.6.2. Safety measures

The following safety measures are recommended to **protect from falling on flat surfaces, slipping, tripping, stumbling, and unstable step**:

- Build roads and walkways so that safe traffic (walking) is ensured.
- Keep roads and walkways clean in all weather conditions to avoid slipping.

- Avoid supporting surfaces made of materials with different slipping resistance.
- Ensure that steps are of even height (prepare the surface respectively).
- Ensure that supporting surfaces are easily cleaned; prevent oil getting onto supporting surfaces by erecting adequate barriers.
- Apply additional chemical or mechanical treatment to give extra roughness to supporting surfaces.
- When flat surfaces become slippery, immediately apply measures to reduce the skidding (e.g., sawdust, ice melting mixes, sand);
- Install handrails, handles or other supports on flat surfaces inconvenient for walking;
- Wear adequate footwear.
- Protect places posing the hazard of falling into (e.g., by using dismantled fencing).

M5-EN.2.7. Falls (M5.2.7.1.jpg)

M5-EN.2.7.1. Risk factors, impact on human health, safety measures

Fall hazard arises while working on high or elevated surfaces.

In the assessment of the manifestation of this risk factor the following shall be **inspected and identified**

- Is safe reaching of the workplace (driver's cabin, loading surface) by steps, stairs or ladders ensured?
- Is unauthorized jumping on and off prevented?
- Is safety while cleaning the windshield ensured?
- Is safe walking and loading site exiting, safe position while putting on or taking off the tent or covering the cargo in other manner ensured?

Effect of falls on human health depends on the fall height and the surface hit when falling. For instance, even falls from low height may cause severe or fatal injuries if the surface hit while falling is hard or sharp edged.

M5-EN.2.7.2. Safety measures

The following safety measures are recommended for **fall protection:**

- Acquire proper vehicles and auxiliary equipment and control their condition;
- Instruct employees about correct boarding and landing as well as safe driving;
- Perform work, if possible, from the floor or other safe standing position;
- Use working equipment (ladders, pallets) correctly;
- Park the vehicle safely at the ramp during loading and unloading.

M5-EN.2.8. Self-study assignment

On the basis of information presented in this section draw a list of **mechanical risk factors** present in a typical driver's workplace in your company.

If the risk factor is defined by standard parameters, name the **regulations** related with the risk factor and **instructions** that have to be complied with.

Choose appropriate **measures (technical, organizational, personal) for elimination of risk factors** and determine whether **additional consultation of specialists** is required. If statutory acts provide for such (e.g., pursuant to legal acts on accident prevention), point that out.

Specify **who is responsible** for implementation of selected measures and when they must be implemented.

Fill in Table 3. You may use the template **##D3##**.

Table 3

Company:

Person in charge:

Job:

Date:

Type of work, work equipment, workplace	Risk factors/ shortcomings/ loads (factor)	Factor related explanations and references	Regulations and working instructions	Measures: Technical, Organizational, Personal	Implementation (who) (when)