Guide to application of the Machinery Regulation (EU) 2023/1230

Annex III, 3.2.2 - seating

Final version – 18 October 2026

Reminder:

Modifications brought to EHSR 3.2.2 led to rewriting §295 of the current guide and to adding two modifications to §315

Note that references to other paragraphs (§xx) are references to the paragraph numbers in the current guide for the Machinery Directive Edition 2.3 – April 2024

3.2.2. Seating

Where there is a risk that operators or other persons transported by the machinery may be crushed between parts of the machinery and the surroundings should the machinery roll or tip over, in particular for machinery equipped with a protective structure referred to in section 3.4.3 or 3.4.4:

a) *the machinery shall be designed or equipped with a restraint system so as to keep the persons in their seats or in the protective structure, without restricting movements necessary for operations or movements relative to the structure caused by the suspension of the seats;*

where there is a significant risk of roll or tip over and its restraint system is not used it shall not be possible for the machinery to move;

such restraint systems or provision shall take ergonomic principles into account and shall not be fitted if they increase the risk;

b) *a visual and audible signal shall be provided at the driving position alerting the driver when the driver is in the driving position and not using the restraint system.*

§295 Seated persons' restraint system

The requirements set out in section 3.2.2 are complementary to the general requirements on seating set out in section 1.1.8.

Section 3.2.2. deals with the risk of crushing of the seated operators or other seated transported persons between parts of the machinery and its surroundings in case the machinery rolls or tips over (e.g. if the persons try to escape when the machinery is in the process of tipping over or in case of crushing under the machinery after ejection).

Surroundings include the ground and any obstacle, natural or not, other than the machinery itself, against which any person could be crushed following the ejection in case of tip-over or roll-over.

Section 3.2.2 does not deal with the risks created by the ejection of the operator other than the risk of crushing between the surroundings and the machinery following its roll-over or tip-over.

Note that the risk of being thrown around in the cab in the event of roll-over if adequate seatbelts are not provided and the frontal Impact risks must be assessed in the risk assessment, if necessary, additional risk reduction measures must be applied. See Annex III, Bart B General principles and No. 1.1.2.

The roll-over and tip-over protective structures referred to in section 3.4.3 can only fulfil their role if the persons concerned are maintained within an adequate deflection- limiting volume.

For this purpose, machinery shall either be designed so that persons concerned are maintained within the adequate deflection-limiting volume or shall be equipped with an appropriate restraint system, considering the specific characteristics of the machinery as well as the risks of ejection and/or crushing related to tip-over or roll-over, which may vary from one type to another. According to the results of the manufacturer's risk assessment which must take reasonably foreseeable misuse into account, it may be necessary to provide one or more restraint systems.

The manufacturer must take into account strength requirements for the integration of the restraint system in the machinery. Examples of restraint systems are: gates, door-bar systems (with adequate fixtures), safety belts (with adequate anchorage points), or any other equivalent restraint devices (see the list of restraint systems in § 315).

Restraint systems are protective devices and therefore must comply with their specific requirements (see §216: comments on sections 1.4.1 and 1.4.3) but also be designed in accordance with ergonomic principles, as stated in the last paragraph of section 3.2.2 (a) (see § 181: comments on section 1.1.6). In particular, the design shall ensure that:

- No physical discomfort occurs, such as pressure points on the body caused by the restraint.
- Technical features of the seat(s) (e.g. suspensions, swiveling, adjustments, etc.) are taken into account.
- The system does not impose physical strain resulting from a forced or unnatural posture.

The restraint system(s) shall be easy to open and close and shall restrict the necessary movements of the operator as little as possible. This is particularly important for machinery such as, for example, industrial trucks or certain wheel loaders, where the driver may have to frequently leave and return to the driving position.

Any necessary instructions for the use of the restraint system shall be given.

Where there is a significant risk of roll-over or tip-over, as stated in the second paragraph of 3.2.2. (a), it must not be possible for the machinery to move when the restrain system is not used. The term 'to move' refers to the powered travel movement of the machinery itself travelling in any direction. This requirement means that the machinery must not be able to start powered travel movement until the restraint system has been engaged by the driver or other persons concerned. The term 'used' in the requirement also means that the restraint system must stay engaged while the

machinery is travelling. In the situation where the restraint system is removed or disconnected during travelling, the machinery shall be able to stop in a safe way which can require a slowdown in a controlled manner.

The function which prevents the machinery from travelling when restraint systems are not used shall be considered as a safety function as defined in article 3 (4) of the regulation.

It should be noted that restraint systems independently placed on the market are safety components (see n°9 in the indicative list of safety components set out in Annex II).

The term “significant risk” used in point a/ second paragraph has to be distinguished from the ‘risk’ referred to in the first paragraph of the section 3.2.2.

It corresponds to “high risk” and “serious risk” according to the manufacturer’s risk assessment (as described in 'General principles' of Annex III, Part B, §158 and §160 of the present Guide), carried out in accordance with the principles of EN ISO 12100[1].

The determination of the level of risk results from the risk evaluation, combining the severity of harm and the probability of occurrence of the harm, see definition of risk: Annex III, part A, (e). In a concrete way, a significant risk of roll-over or tip-over is related to the stability of the machinery, or more precisely, to its stability limits, which may be influenced by one or more design criteria (e.g. mass, position of the centre of gravity, operating conditions, etc.). This risk is assessed considering intended use and reasonably foreseeable misuse (e.g. speed of the machinery, use of interchangeable equipment, travelling with a raised load, etc.) see §175 and §264.

The last sentence of section 3.2.2 letter a, 3rd paragraph also requires that restraint system(s) shall not be fitted if they increase the risk of being crushed in case of roll-over or tip-over. This may be the case, for example, for small mobile machinery, such as light-weight ride-on mowers with seated operator, that are not fitted with a tip-over or roll-over protective structure. It may also be impracticable to fit a restraint system at the driver’s seat on machinery designed for active riding, such as quads, that demand extensive movement of the driver while travelling. Furthermore, this last sentence provides the possibility of not stopping the machinery where such action is likely to increase the risk of crushing as a result of overturning or tipping.

[1] For market surveillance authorities’ risk assessment method, see Annex II, COMMISSION DELEGATED REGULATION (EU) 2024/3173 of 27 August 2024 supplementing Regulation (EU) 2023/988 of the European Parliament and of the Council with regard to rules on access to and operation of the Safety Gate Rapid Alert System, information to be entered in that System, notification requirements and the criteria for assessment of the level of risk.

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Certain machinery (e.g., ride-on mowers, skid-steer loader, small compactors or small dumpers) might be equipped with foldable tip-over or roll-over protective structures. In case it is necessary to temporarily fold down the roll-over or the tip-over protective structure:

- there shall be a deactivation of the devices, if fitted, preventing travelling when restraint system(s) is not used;

- the visual signal may remain active.

Regardless of whether the risk of tip-over or roll-over is significant or not, paragraph 3.2.2. (b) of the requirement sets out that machinery shall be equipped with both a visual and an audible signal that is activated when the restraint system is not properly engaged by the driver or if the restraint system is disengaged by the driver when travelling.

The visual signal must be positioned at a location in the direct vicinity of the driving position so as to be visible to the driver. The volume of the audible signal depends on the machine and the normally intended environmental conditions.

Designing machinery or equipping it with a restraint system to maintain persons within a deflection-limiting volume is not usually required for machinery equipped with a falling-object protective structure (FOPS) only. However, this is necessary with a FOPS, when this FOPS has the intended function of a roll-over protective structure (ROPS) or a tip-over protective structure (TOPS) in the event of roll-over or tip-over.

§315 Roll-over and tip-over

Section 3.4.3 deals with the residual risk of loss of stability of the machinery if, despite the measures taken according to sections 1.3.1 and 3.4.1 to ensure adequate stability, there is a residual risk due to the machinery rolling or tipping over. The term 'roll-over' designates complete overturning involving a rotation of 180°. The term 'tip-over' designates the situation where the machinery falls over but where its shape or an element such as a mast or a boom prevents it from rotating more than 90°. The machinery may be liable to roll-over or tip-over in a lateral or longitudinal direction or both. Roll-over or tip-over always creates a risk for the driver or other persons transported by the machinery of being ejected or crushed.

The first paragraph of section 3.4.3 requires machinery having such a residual risk to be equipped with an appropriate protective structure, that is to say a roll-over protective structure or a tip-over protective structure. These structures must be designed to protect all persons transported by the machinery who are exposed to the risk concerned.

The assessment of the residual risk due to rolling or tipping over should take account of the following parameters:

- the intended and foreseeable operating conditions of the machinery (such as speed, maximum slope and terrain);

- the mass, dimensions and centre of gravity of the machinery, the different loading conditions, the presence of levelling devices;

- the shape of the machinery and the position of the operator(s).

The necessary protection may be ensured by parts of the machinery itself that ensure the necessary protection of the operator(s) in the event of roll-over or tip-over. When a specific protective structure is required, it may be integrated into a cab.

For many categories of mobile machinery, harmonised standards state whether a protective structure is necessary and specify the type of protective structure to be fitted.

The only exception to this requirement is where fitting a protective structure would increase the risk related to rolling or tipping over. For example, it could be the case with certain small machinery, such as ride-on mowers with seated driver, on which, under a certain mass of the machine, adding a protective structure will increase the risk of tip-over or roll-over.

The second paragraph of section 3.4.3 sets out the objective to be achieved by roll-over and tip-over protective structures. The protective structure must provide an adequate deflection-limiting volume, in other words, in the event of roll-over or tip-over, it should not deform to the extent that it contacts the operator while he or she is in the operating position. It should be noted that such protective structures can only fulfil their protective functions if the persons concerned are restrained so that they remain inside the protective volume of the self-propelled machinery in the case of roll-over or tip-over. To fulfil this objective, some restraint systems such as: gates, door-bar systems or seat-belts may need to be mounted on the protective structure or on the seat – see §295: comments on section 3.2.2.

The third paragraph of section 3.4.3 requires roll-over and tip-over protective structures to be subject to the necessary type-tests to verify that they fulfil their protective role.

It should be noted that roll-over and tip-over protective structures independently placed on the market are safety components, while ROPS are included in the indicative list of safety components set out in Annex II (item 14). Such ROPS are also included in the categories of machinery listed in Annex I part B (item 18) subject to the conformity assessment procedures referred to in Article 25 (3).

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