not permitted; special requirements can be given for inflatable barriers. The sill shall be strong enough to withstand the impact of the cars at maximum speed.

5.2.6.2 Passenger units

Mini motorbikes shall be designed in such a way that the risk of overturning is reduced to a minimum.

Mini-motorbikes shall be provided with adequate bumpers, which shall project at least 10 cm beyond the most extreme parts of the vehicle. The bumpers fitted to vehicles which are used on the same ride shall be set at the same height for all vehicles and at the same height as the edge of the sill or barrier.

Careful attention shall be paid to ensure that the motorbike is stable, during riding and in case of impacts.

Special precautions shall be taken in order to ensure safe accommodation and protection of passengers. An integrated footrest, shall be provided to protect passengers' legs against impact and to prevent passengers from falling.

5.2.6.3 Restraints

No special requirements.

5.2.6.4 Miscellaneous

The speed of mini-motorbikes shall not exceed 8 km/h, if the risk assessment demonstrates safe use.

5.2.7 Boat rides

5.2.7.1 General

Water sports and public transportation are not dealt with in this standard.

5.2.7.2 Area separation system and access and egress

On the sides of the waterway there shall be an access area at least 0,5 m wide at places where the boat is intended to stop.

The landing position shall be clearly marked and shall provide safe and easy access to and egress from the boats by using as a minimum J1 requirements. The gate “K” requirements shall be defined by the risk assessment.

5.2.7.3 Passenger units

See general requirements in 5.1.7.

5.2.7.4 Restraints

See general requirements in 5.1.7.2.

NOTE In water rides the hazards in case the passenger unit capsizes need to be considered.

5.2.7.5 Miscellaneous

Water depths shall not be greater than technologically necessary. Where water depths exceed 0,7 m adequate safety measures shall be taken to prevent users from drowning if the boat takes on water or capsizes.

Where power driven boats operate in a channel permitting one way operation only, the speed shall not exceed 15 km/h. Where free ranging boats operate on an enclosed lake, the number of boats allowed to operate at any one time shall be restricted in accordance with the available water area, in order to ensure safe operation. The following water areas shall be provided as a minimum:

15 m^2/boat with a maximum speed up to 8 km/h;

30 m^2/boat with a maximum speed of no more than 15 km/h.

Boats driven by internal combustion engines shall be fitted with a tray beneath the engine and the fuel lines. The engine shall be positioned so that passengers are not endangered by an engine fire. A suitable fire suppression system shall be fitted in the engine compartment.

Facilities shall be provided to recover all boats in case of emergency.

5.2.8 Flume rides

5.2.8.1 Area separating system and access and egress openings

During loading and unloading of passengers, the relative velocity between the boat and the access platform shall not exceed 0,5 m/s.

The minimum distance between the wall of the boat and the wall of the channel shall be 0,12 m (see Figure 35), in normal floating conditions. In the station area the distance between the wall of the boat and access- respectively egress-platform shall be reduced to approximately 0,05 m. Special consideration shall be given to the change of clearance. The separation system shall meet a minimum of J1 requirements. The K requirements shall be defined by the risk assessment.

Dimensions in millimetres

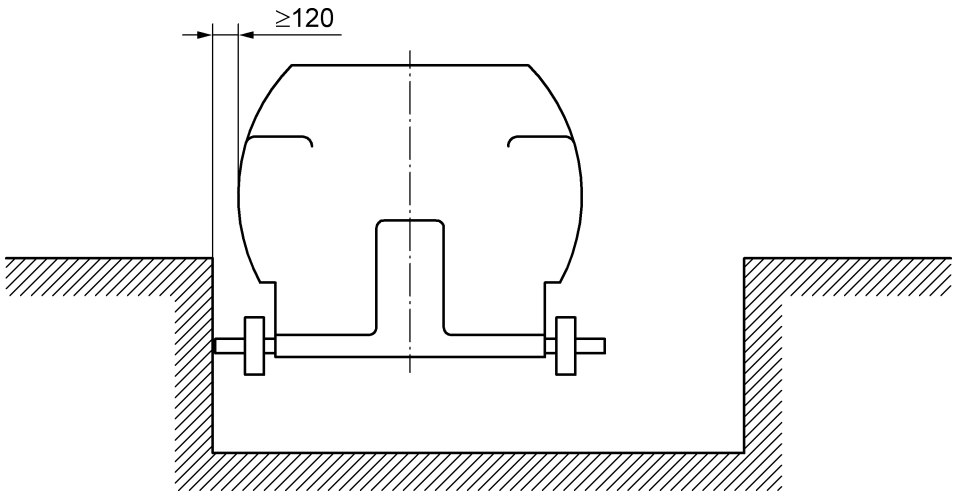

Figure 35 — Minimum distance to channel walls

5.2.8.2 Passenger units

The boat shall be provided with adequate handrails and footrests in order to allow passengers to brace themselves against forces occurring during boat acceleration and deceleration.

Protection shall be provided, in order to prevent damage to passengers seated in the front, if they can be propelled against the front panel.

The gunwale to the seat height is shown in Figure 36.

See also general requirements in 5.1.7.

Dimensions in millimetres

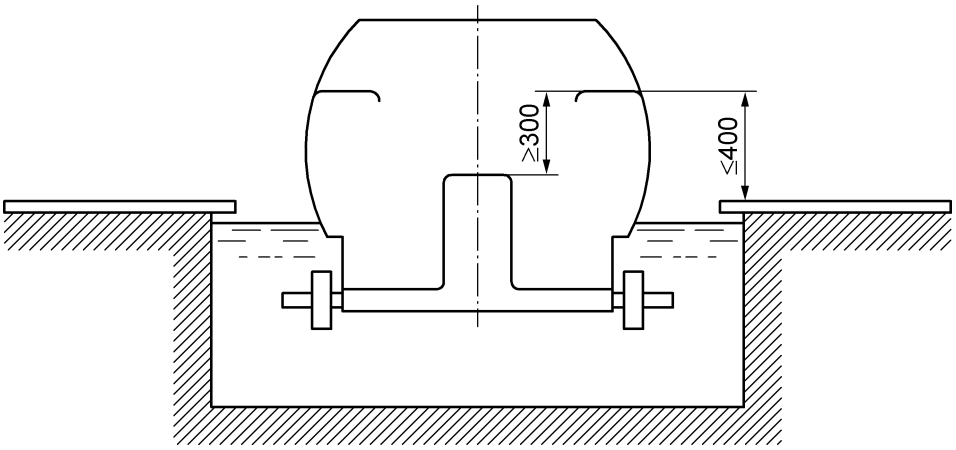

Figure 36 — Minimum and maximum step height and side wall height

5.2.8.3 Restraints

Restraint devices are not allowed on flume ride boats when there is a risk of overturning. If the average longitudinal deceleration during braking does not exceed 0,7 g, the downward slope does not exceed 40° and head-to-foot acceleration is more than +0,2 g in all places, the “restraint rose” (see Figure 22) need not be applied.

5.2.8.4 Miscellaneous

Automatic fail-safe block-zone systems shall be provided in the channel zones where, because of the velocity, collisions between boats could injure passengers.

Means shall be provided to prevent collisions at speeds greater than that which the bumpers were designed to handle on the lifts or in zones preceding the slopes.

Fail-safe means shall be provided to prevent any boat from entering the downward slope block-zone if the minimum water depth necessary for a safe deceleration is not ensured, at the end of the slope.

For general requirements on block-zone systems see also 5.2.3.6. For block-zone control systems see Annex B.

Sufficient water quality shall be achieved and kept.

Compliance to EEC directive 2006/7/EC (32006L0007) is recommended.

5.2.9 Helter skelters, slides, etc

5.2.9.1 General

The requirements below are in addition to or prevail over those contained in the European Standards for playground equipment EN 1176 (all parts). Slides with a height greater than that mentioned in EN 1176-3 are not excluded from being used as amusement devices.

NOTE For Waterslides refer to EN 1069 series.

5.2.9.2 Area separation system and access and egress openings

In areas where passengers can walk onto the slide area or run out zones area demarcation systems for the general public shall comply with J3 requirements as a minimum. Access openings to the loading and

run out zones shall comply with K2 requirements, in order to prevent crushing of users. Egress openings shall comply with K1 requirements.

5.2.9.3 Passenger units

Means (sacks, mats, sleds, etc.) shall be provided for the user to sit on during the ride, where additional protection is required to protect against splinters and burns.

5.2.9.4 Restraints

No special requirements.

5.2.9.5 Miscellaneous

Channels or troughs shall be smooth throughout their entire length. Overlapping is only permitted in the sliding direction. Channel side walls shall for single channels be at least 0,45 m high and well-rounded at the top upper edge.

The end of the slide shall be built in such a way that the user can complete his ride without assistance.

The access platform to the highest part of the slide can deviate from requirements mentioned in 5.1.3.2, but the slope shall not exceed the slope of the starting section of the slide the slide entry. In this area passengers shall walk in single file only.

The longitudinal configuration of the channel shall prevent excessive speeds and account for accelerations exerted on the passenger and the necessary stopping distances. The risk of lift off from the surface shall be reduced to a minimum.

In case of multi-channel slides the internal division (between channels) shall not be less than 10 cm.

5.2.10 Side shows, booths, win-a-prize and sales stands, mazes, halls of mirrors, fun houses, labyrinths, hammers, ring the bell and similar

5.2.10.1 Fun houses

Amusement devices on which users can climb, shall be positioned so that the surroundings take this risk into account. Where falls are foreseeable, e.g. from climbing frames, climbing nets, adventure equipment, in addition to eliminating parts of the structure likely to cause injury, suitable impact absorbing surfaces, shall be provided over a sufficient area.

Where the likelihood of falls is built into the concept, e.g. with inclined rope ladders, especially with swivel retaining devices, then high efficiency absorption material, e.g. deep foam, rubber or inflated mattresses shall be provided.

Smooth and splinter free surfaces (sanded where necessary if wooden) shall be provided to minimize risk of injury. The most favourable materials shall be selected to avoid hostile surfaces, e.g. to avoid material liable to splinter, especially where the body may be in close contact with the surface, such as for slides or divisions of slides.

All nails, screws, sharp angled fixtures and fittings shall be recessed, sunken or otherwise protected. Staples holding punchbags, climbing ropes and nets at floor level shall be covered.

Neither hazardous protruding items nor pinch points are allowed. Wherever possible, smooth surfaces shall be provided.

Certain rotating amusement devices, whether power or non-power driven, shall be regulated so as not to exceed the maximum permitted speed. They shall also be provided with a smooth sliding surface and adequate impact absorbing material at the limiting point of travel e.g. on rotating horizontal wheels and cages as well as inclined axis wheels. Any impact absorbing material and the dimensions of the run-out area shall be defined by risk assessment.

Where users transfer from a standing to a sitting position to prepare to descend a slide or inclined tube, adequate safe hand holds shall be fixed at suitable positions and in such a way that they themselves do not cause injury. Loading platforms shall be installed in such places (if the amusement device is only for the use of children up to 10 years of age, minimum dimensions can be found in the European Standard for playground equipment (EN 1176-1)).

All power driven parts of an amusement device shall be analysed for possible trapping or crushing. Emergency stop devices and close operator supervision shall be provided as required. Risks at transitions from moving to stationary surfaces shall be minimized, e.g. by using comb techniques.

Devices not driven by mechanical power, such as roller walkways, horizontal multiple tier rolls, pyramid rolls and rise and fall sections of floor often spring loaded for return, shall have supplementary supports, such as parallel bars for the participants to support themselves. They shall also be provided with additional safeguards so that a fallen person cannot fall through openings in the floor, down stairwells or under rails protecting a gallery. Any foot or toe traps shall be eliminated, especially at any device which is moving under user load.

Amusement devices like swinging platforms, seesaws etc. shall be safeguarded (i.e. fences, area separation) preventing access to their extreme points of travel. Foreseeable abuse of such measures shall be taken into account. Limitation of the arc of travel may be required as well as padding of the extreme ends.

Trampolines and other bouncing devices shall be sited at locations where the surroundings are not likely to cause injuries.

NOTE Supplementary information can be found for Trampolines in ASTM F 381 and for Inflatables in EN 14960.

Devices with hinged floors, including those operating by the moving weight of participants require special attention to clearances between their moving edges and the side walls, taking into account the safety of a fallen person, and in particular, children.

Warning notices shall clearly indicate the need to wear footwear on devices such as boardwalks, rocking bridge, stepping stones and steel rollers so as to avoid injuries from splinters, etc.

Warning notices shall clearly indicate “no footwear” for amusement devices such as slides, tubes, rotating barrels, rotating dishes, etc. where hard footwear is undesirable as fellow participants may be struck by flailing footwear.

The following legible notice shall be displayed outside such amusement devices: “This amusement device is only for the use of users in good physical condition and requires sportive actions”.

An essential element of the safe enjoyment of the Fun House environment is an adequate alert supervision. Supervisors shall take immediate action to avoid injury e.g. by stopping a device. He shall control unruly behaviour and warn participants of their unsafe acts. Supervision may be supplemented by remote controls such as closed circuit TV, visual display units or mirrors. Observation points shall be positioned at suitable places which give an overall view of the activities within the funhouse.

5.2.10.2 Hall of mirrors

No steps are permitted in halls of mirrors.

Glass panels shall be made of safety glass.

Neither hazardous protruding items nor pinch points are allowed. Wherever possible, smooth surfaces shall be provided. For additional requirements see also 5.2.10.1.

5.2.10.3 Win-a-prize and sales stands

All installations with a ground area of more than 50 m^2 shall have a minimum of two distinct exits each being at least 1,0 m wide. For more than 100 m^2 there shall be a minimum of two opposite exits.

Throw a Ball and similar installations shall be equipped with safety nets or walls of sufficient strength, so as to protect the general public from injury during operations. The operator's position shall be safeguarded in a similar manner.

5.2.10.4 The hammer, ring the bell and similar installations

The installation shall be stable or otherwise securely anchored to the ground (see 4.5).

The anvil or striking plate shall be fixed in such a way that it cannot become detached.

The whole attraction shall be fenced off by means of a perimeter fence. Safety distances from the anvil shall be in accordance with 5.1.4.2.2 (general safety distances).

Where percussion caps or similar explosive devices are used adequate protection against splinters and fragments shall be provided around the striking points.

5.2.10.5 Temporary grandstands

Where on an open air temporary grandstand a row of seats has an aisle at one end of the row only, the number of seats shall not exceed 16. Where there is an aisle at both ends of the row, it shall not exceed 32 seats. When the difference in height of the rows is more than 32 cm, then only 11 and 22 places are permitted respectively.

Escape routes shall have a width of at least 1 m per 450 persons in the open air and 1 m per 150 persons in tents. The minimum width of escape routes is 1 m in either case. The walkway of each row shall be at the same level as the corresponding step.

Where there is standing only, the minimum width per person shall be 50 cm and the maximum depth of the row 45 cm. Where there is standing room only, the number of persons (e.g. for the width of exits) shall be calculated according to the available area.

The floor slab of grandstands shall be firmly attached to the supporting structure, so as to prevent sliding (see 4.5).

Where access is possible beneath the grandstand, protection from falling objects shall be provided.

The design of the structure shall prevent the accumulation of rubbish.

Seats shall be at least 44 cm wide and fixed to the supporting structure. Seats within a row shall be fixed to each other or the ground. The minimum distance between seating rows shall be 45 cm.

NOTE Supplementary information can be found in EN 13200 (all parts).

5.2.10.6 Maneges

The ring in circus tents shall be separated from the seating area by a substantially solid barrier at least 40 cm high. For circus tents contrary to 5.1.6.1.3, the admissible number of persons shall be based on the number of seats (e.g. on grandstands).

5.2.11 Shooting stands and trailers, shooting devices

5.2.11.1 Area separation system and access and egress openings

Shooting stands shall be completely closed off at the sides and overhead as well as in the direction of shooting. Care shall be taken, by way of structural measures, to ensure that nobody is injured as a result of a shot going astray.

The rear wall of the shooting gallery shall be vertical and of sheet steel at least of 1,5 mm thick.

The side walls and overheads of shooting galleries shall be made from material which can retain the bullets within the gallery.

Steel sheeting shall be firmly fixed to the base on which it is set, and shall show no evidence of being able to move backwards or forwards; screws or nails with domed heads shall not be used. The heads of nails or screws used for fixing the coverings of steel sheet shall be of the countersunk type. Where steel angle is being used, it shall not be inserted in the side turned towards those who are shooting.

For each shooter, a width of at least 80 cm shall be provided. Further area separation systems are not required if the booths or trailers are enclosed as mentioned in the above clauses.

Any access and egress doors in the side walls shall be designed as lockable doors with the same requirements as for the side walls. The maximum angle of opening shall be 90°.

5.2.11.2 Miscellaneous

The lighting shall be adequately protected against erratic or ricochet bullets.

If there are devices for fixing targets in front of the rear wall, means shall be provided to prevent the projectiles from ricocheting (e.g. freely suspended layers of woollen material, tenting material (twill or jute)).

If, however, the target objects are fixed directly onto the rear wall, or there is some other reason why loose layers of material cannot be suspended between the target objects and the rear wall, then the rear wall shall be constructed in such a manner, (e.g. using thick steel sheeting, padding at the rear) that dangerous ricochets cannot occur.

Any objects which are suspended, for decorative purposes between the shooting rest and the target, shall be designed or deployed in such a manner that they cannot lead to ricochets; they shall be at a distance of at least 2,5 m from the side of the shooting rest which is turned towards the person who is shooting.

5.2.11.3 Weapons

Only the following types of weapons, which are neither semi-automatic nor fully automatic, shall be used:

Weapons with a calibre of up to 5,5 mm for which the muzzle energy shall not be more than 7,5 Nm. The trigger shall not be fitted with a hair spring and shall be designed in such a way that the weapon will not be discharged as a result of an impact on the barrel or the spring mechanism, or through a relatively small vibration. In the case of those weapons where the gun does not have to be cocked and loaded by hand before further shots can be discharged, the operating personnel shall be able to interrupt the shooting by means of some suitable device.

Rifles designed for indoor use using rim-firing cartridges of up to 4,5 mm.

Pistols and other weapons with a length of up to 60 cm may only be used where they are restricted to some fixed field of fire.

Crossbows for which the kinetic energy of the bolt is not more than 2 Nm.

NOTE Weapons can be subject to prevailing national laws.

5.2.11.4 Ammunition

Only the following type of ammunition may be used:

— commercially available soft lead shot, round shot, or diablo shot;

— a 4,5 mm shot rim-fire cartridge with a medium charge as a maximum;

— air rifle ammunition;

— feathered bolts for cross bows.

NOTE Ammunition can be subject to prevailing national laws.

5.2.11.5 Targets

Where camera covers and flash bulbs are used in “photo shooting” stands, these shall be designed and fitted in such a way that they cannot burst and so that the shooting pieces cannot ricochet.

The rear wall shall be at least 2,8 m from the shooting rests when using weapons of the compressed air type. The front of the targets shall be at least 2,4 m from the fixed shooting rests.

For live ammunition, the rear wall shall be at least 5,5 m from the fixed shooting rests.

Fittings in shooting galleries onto which tubes for the insertion of flowers and the like are affixed, shall be mounted so that their upper horizontal surfaces are either horizontal or sloped to the rear side. The vertical front side shall be tilted at an angle of at least 20° to the vertical towards the rear, and, where the fitting is not made of steel, it shall be covered with steel sheeting of at least 2 mm in thickness. The distance between the brackets which support them, shall be such that if they are hit by a shot, no vibration will occur.

Fittings in shooting galleries for the purpose of holding targets and the “hit” indicator shall be designed and fitted in such a manner that they can only be brought into action from the shooting rest. The brackets holding the figures used as targets and the devices for supporting these shall be protected from “hits” by suitable constructional measures. The funnel shall be fashioned in such a way that shots which strike it cannot ricochet, even when they strike at an angle. Disc targets and moving targets shall be designed and manufactured in such a manner that shots are not able to ricochet from them, even when they strike at an angle. The targets for feathered bolts shall be of knot free white wood or of a material of equivalent effectiveness.

Shooting stands in which feathered bolts as well as weapons firing soft shots are used, shall be separated into different firing areas by dividing walls.

5.3 Mechanical systems

5.3.1 Hydraulic and pneumatic devices

5.3.1.1 General requirements

The adequate safety of the hydraulic and pneumatic equipment shall be demonstrated by means of construction drawings, calculations, the relevant circuit diagrams and a functional description of the plant.

In case of failure, the devices shall maintain a safe state when required by Risk Assessment (DRA). A first failure of the system shall be detected. In this case a subsequent failure need not be considered (see EN ISO 4413, EN ISO 4414).

5.3.1.2 Design

All rams, cylinders and associated pipework and fittings which are subjected to pressure shall be designed to withstand twice the maximum working pressure for hydraulic equipment and 1,5 times for pneumatic equipment without sustaining permanent distortion or failure. Brittle material shall not be used for cylinders or connecting links. Rams and cylinders shall be mounted so that they are subjected to axial loads only.

Purchased parts off the shelf (e.g. valves) shall be designed in accordance with EN ISO 4413, EN ISO 4414.

5.3.1.3 Travelling limits

Effective means shall be provided to prevent rams from travelling beyond the limits of the cylinder. A separate mechanical stop is not necessarily required.

5.3.1.4 Piping

Piping shall be supported so that undue stresses are eliminated. Particular attention shall be paid to joints, bends and fittings, and at any section of the system subject to vibration.

Piping shall be mounted in such a way as to allow as much as possible the inspection of the pipe and particularly the joints.

5.3.1.5 Hoses

The nominal pressure of the hoses shall be greater than the maximum operating pressure of the system. The burst pressure of the hose shall be five times higher than the nominal pressure. Particular attention shall be paid to joints, bends and fittings, and at any section of the system subject to vibration. The type of hose shall be selected according to the requirements of the system (compatibility with hydraulic fluid used, etc.). Hoses shall be installed so as to prevent sharp bends and chafing or trapping due to moving parts of the machine. The manufacturer shall specify the intervals at which the hoses should be replaced.

5.3.1.6 Reservoir

Reservoirs for hydraulic fluid shall be of rigid construction, having adequate and effective venting to the atmosphere. The inner covering of the reservoir shall withstand the chemical characteristics and temperature range of the fluid.

An air filter, a fluid strainer and a level indicator shall be provided. The reservoir for normal operation shall have at least 10 % more capacity than that necessary to guarantee an uninterrupted flow of the fluid to the pump. A label showing the correct type of hydraulic fluid shall be clearly displayed on the installation.

5.3.1.7 Venting

The hydraulic circuits shall permit the release of air and as such may require a purging system.

5.3.1.8 Pressure limits

The hydraulic or pneumatic system shall incorporate a pressure relief valve fitted between the pump and the non-return valve. The relief valve shall be set to a pressure of not more than 10 % (pneumatic) or 20 % (hydraulic) higher than the highest normal working pressure but at a pressure higher than that required to prevent the relief valve blowing off during normal working conditions. The strength of the cylinders shall be calculated using 1,4 times the working load. There shall be a fatigue calculation for cylinders.

5.3.1.9 Fail to safe

If due to the failure of piping or hoses a dangerous situation can occur, a non-return valve, a flow control valve or a pipe break valve shall be fitted directly to the cylinder.

5.3.1.10 Checking

Provisions shall be made in the hydraulic system for the fitting of a pressure gauge to facilitate checking of the working pressure and the setting of the pressure release valve.

5.3.1.11 Lowering

In the event of failure or malfunction of the hydraulic or pneumatic system the maximum lowering speed shall not exceed 0,5 m/s for any part of the passenger carrying equipment, unless shock absorbing devices or other equivalent systems are installed to prevent undue shocks to passengers.

5.3.1.12 Protection

All safety-related valves shall be protected against unauthorized resetting.

5.3.1.13 Emergency

Where necessary a manually operated emergency system shall be fitted, in order to facilitate the recovery of passengers from a dangerous position in the case of system power supply failure.

5.3.1.14 Cleanliness

All filters shall have a sufficient degree of filtration and shall be mounted on the pressure side of the pump. The mounting of a filter in the piping returning to the reservoir shall be avoided, when a safe position of the system is dependent on an unrestricted flow of the medium back into the reservoir. All fluids shall be filtered, when put into the system. Each system put into operation, shall be of a cleanliness commensurate with the components.

5.3.2 Lifting and elevating units being integral part of a ride

5.3.2.1 General

These lifts are an integral part of the amusement devices. If they are required for general lifting purposes, they shall be designed accordingly.

5.3.2.2 Hoist unit brake

Hoist units (rope and chain hoists) shall be equipped with effective brakes or other equivalent devices, capable of stopping the movements of the equipment and its loads safely at its rated speed and maintaining it in its stopped position.

In case of power loss all brakes shall maintain a safe state. This could be closed or open, depending on risk assessment.

The hoist unit shall be designed in order to ensure that a single point failure cannot dissociate the brake and the drum or sprocket.

5.3.2.3 Limitation of the lifting and lowering movement

To guard against malfunction of the control system, devices according to EN 60204-32 shall be provided, and shall include:

— preliminary switches for initiating a controlled stop towards the upper and lower hoist limits;

— operational limit switches which prohibit incorrect hoist drive direction at the hoist travel limits;

— ultimate limit switches of the safety type with direct mechanical actuation, which disconnect the main electrical supply from the hoist. The actuators of these switches shall be independent of other switches;

— mechanical top and bottom limit stops.