



Safety of machinery—Equipment for power driven parking of motor vehicles—Safety and EMC requirements for design, manufacturing, erection and commissioning stages (EN 14010:2003, MOD)

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 - Australian Industry Group
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 - Fire Protection Association Australia
 - Insurance Council of Australia
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-

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Australian Standard®

**Safety of machinery—Equipment for
power driven parking of motor
vehicles—Safety and EMC requirements
for design, manufacturing, erection and
commissioning stages
(EN 14010:2003, MOD)**

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-089, Mechanical Parking Devices.

The objective of this Standard is to provide requirements for the safe design, installation and servicing of car storage devices.

This Standard is an adoption with national modifications and has been reproduced from EN 14010:2003+A1:2009, *Safety of machinery—Equipment for power driven parking of motor vehicles—Safety and EMC requirements for design, manufacturing, erection and commissioning stages*, and has been varied as indicated to take account of Australian conditions. The modifications are listed in Appendix ZZ. Amendment A1 2009 is incorporated in the text of EN 14010, and designated A1. Appendix ZX provides additional guidance for the fire risk of the installation and operation of automatic, semi-automatic and manual operation systems for power-driven parking of motor vehicles (car stackers).

As this Standard is reproduced from a European Standard, the following applies:

- (a) In the source text ‘this European Standard’ should read ‘this Australian Standard’.
- (b) A full point substitutes for a comma when referring to a decimal marker.

None of the normative references in the source document have been adopted as Australian or Australian/New Zealand Standards.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex or appendix to which they apply. A ‘normative’ annex or appendix is an integral part of a Standard, whereas an ‘informative’ annex or appendix is only for information and guidance.

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FOREWORD

This document (EN 14010:2003+A1:2009) has been prepared by Technical Committee CEN /TC 98, "Lifting platforms", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.

This document includes Amendment 1, approved by CEN on 2009-06-19.

This document supersedes EN 14010:2003.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

A1 For relationship with EU Directive(s), see informative Annexes ZA, ZB and ZC, which are integral parts of this document. **A1**

Annexes **A1** A and C **A1** are normative. Annex B is informative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

INTRODUCTION

A1 This European Standard is a type C standard as stated in EN ISO 12100-1:2003. **A1**

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

When producing this standard it was assumed that

- negotiation will take place between the manufacturer and the purchaser of the parking equipment/systems, concerning particular conditions for the use and places of use for the equipment/system, related to health, safety and environmental conditions;
- erection, commissioning and testing will be carried out by suitably trained persons;
- only legal drivers of vehicles will use the equipment/system;
- no vehicles in excess of the rated load or otherwise unsuitable (see clause 1), will use the equipment/system;
- persons will not be lifted or transported by the machinery;
- the machinery and its components will be kept in good repair and working order in accordance with the manufacturers instructions, to retain specified safety characteristics throughout the intended working life of the machinery;
- by design of the load bearing elements, safe operation of the machinery will be assured for loading ranging from zero to 100% of the rated capacities and during the loaded tests (see 6.1f);
- harmful materials, such as asbestos are not used as part of the machine;
- all parts of the equipment/system without specific requirements will be:
 - 1) designed in accordance with the usual engineering practice and design codes, using appropriate safety factors, taking account of all relevant forces, loads and failure modes;
 - 2) of sound mechanical and electrical construction;
 - 3) made from materials of adequate strength and durability and of suitable quality for their intended purpose.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over other standards, for machines that have been designed and built according to the provisions of this type C standard.

1 Scope

- 1.1** This European Standard deals with the technical requirements to minimise the risks due to the hazards listed in clause 4, which can arise during installation¹, operation and maintenance of permanently installed equipment and systems for the power driven parking of motor vehicles, as defined in 3.1 to 3.4 below. Requirements are also given on the provision of information for use, which includes requirements for the drafting of the instructions. Electromagnetic compatibility requirements are also covered.
- 1.2** This European Standard applies to equipment and systems for the power driven parking of motor vehicles which have four wheels, are within a maximum size envelope of 5,30 m long, by 2,30 m wide, by 2,20 m high and have a mass less than 2500 kg. The equipment can be manually or automatically controlled.
- 1.3** This standard does not cover:
- a) vehicle lifts (see EN 1493);
 - b) peripheral devices, which do not handle motor vehicles, e.g. parking meters, ticket machines;
 - c) requirements related to the building even if they support directly stored vehicles;
 - d) goods only lifts in accordance with EN 81-31;
 - e) power driven parking equipment intended for lifting and/or transporting any person;
 - f) transmission and interface of remote controls;
 - g) automatic parking equipment with transfer areas which move;
 - h) the use of power driven parking equipment by wheelchair users and deaf persons;
 - i) the workplace of any attendant.
- 1.4** This standard does not deal with the following:
- a) hazards arising if loads, or other items fall from vehicles;
 - b) hazards arising if fuel or oil leaks from vehicles;
 - c) hazards caused by operating the equipment/system in electromagnetic fields outside the range of EN 61000-6-2;
 - d) hazards caused by operating the equipment/system in areas subject to special regulations (e.g. explosive atmospheres, fire risks);
 - e) hazards caused by the use of dangerous/toxic materials, e.g. special hydraulic oil;
 - f) hazards caused by noise;
 - g) hazards arising from inadequate lighting of the surrounding of automatic parking systems and/or the place of installation of non-automatic parking equipment;
 - h) hazards caused by earthquakes;
 - i) hazards caused by vandalism;
 - j) hazards due to the use of programmable electronic systems related to safety functions;

¹ When carried out by or on behalf of the purchaser

- k) hazards due to the use of cableless control devices;
- l) hazards arising due to collision caused by the driver of the vehicle.

This document is not applicable to power driven parking equipment and systems manufactured before the date of publication of this document by CEN.

2 Normative references

[A1] The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. **[A1]**

[A1] *deleted text* **[A1]**

EN 294:1992, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 418:1992, *Safety of machinery — Emergency stop equipment, functional aspects; principles for design*

EN 457, *Safety of machinery — Auditory danger signals — General requirements, design and testing (ISO 7731:1986, modified)*

EN 811, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*

EN 842, *Safety of machinery — Visual danger signals — General requirements, design and testing*

EN 894-2, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

EN 982:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 1005-2, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 1005-3, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up*

EN 1050:1996, *Safety of machinery — Principles for risk assessment*

[A1] *deleted text* **[A1]**

EN 1088, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1760-2, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars*

EN 1837, *Safety of machinery — Integral lighting of machines*

EN 12150-1, *Glass in building — Thermally toughened soda lime silicate safety glass — Part 1: Definition and description*

EN 12385-4, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

EN 12385-5, *Steel wire ropes — Safety — Part 5: Stranded ropes for lifts*

EN 12433-1, *Industrial, commercial and garage doors and gates — Terminology — Part 1: Types of doors*

EN 12453, *Industrial commercial and garage doors and gates — Safety in use of power operated doors — Requirements*

EN 12604, *Industrial, commercial and garage doors and gates — Mechanical aspects — Requirements*

prEN 12624, *Industrial, commercial and garage doors and gates — Operational noise — Requirements and test methods*

EN 12635, *Industrial, commercial and garage doors and gates — Installation and use*

EN 12978, *Industrial, commercial and garage doors and gates — Safety devices for power operated doors and gates — Requirements and test methods*

prEN 13241, *Industrial, commercial and garage doors and gates — Product standard*

EN 13411-2, *Terminations for steel wire ropes — Safety — Part 2: Splicing of eyes for wire rope slings*

prEN 13411-3, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule-securing*

prEN 13411-6, *Terminations for steel wire ropes — Safety — Part 6: Asymmetric wedge socket*

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60947-5-1:1997, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices (IEC 60947-5-1:1997)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:1999, modified)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3:1996, modified)*

EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)*

EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310-2:1995)*

EN 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496:1997)*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)* ^(A1)

EN ISO 12543-2, *Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass (ISO 12543-2:1998)*

EN ISO 14122-1, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels (ISO 14122-1:2001)*

EN ISO 14122-2, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2001)*

EN ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

prEN ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO/FDIS 14122-4:2002)*

ISO 3864, *Graphical symbols — Safety colours and safety signs*

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis*

ISO 13050:1999, *Curvilinear toothed synchronous belt drive systems*

IEC 61496-2, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

3 Terms and definitions

[A₁] For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply. **[A₁]**

3.1

automatic parking system

automatic parking equipment together with its linked ancillary equipment, e.g. main door, working area door, side door, emergency door

3.2

automatic parking equipment

power driven parking equipment for motor vehicles, which stores and retrieves motor vehicles in an automatically sequenced mode (see 5.11 and annex B). The equipment, which may include structural elements, is permanently installed

3.3

non-automatic horizontally moving parking equipment

power driven parking equipment for motor vehicles, which has a load carrier which is moved in a non-automatically sequenced mode only in the horizontal plane. The horizontal movement is either under permanent control of the user or partially automatic. The equipment is permanently installed

3.4

non-automatic vertical parking equipment

power driven parking equipment for motor vehicles, which is moved vertically exclusively or with separate horizontal movement in a non-automatically sequenced mode and has only one defined fixed access point for the load carrier. Each movement is under permanent control of the user or partially automatic. The equipment is permanently installed

3.5

ancillary equipment

3.5.1

main door

door between the access area outside an automatic parking equipment and the parking equipment itself, which is used by motor vehicles and users and passengers, to enter and exit the transfer area (see annex B)

3.5.2**working area door**

door between the transfer area and the working area (see annex B)

3.5.3**side door**

pedestrian door which is intended to be used by users and passengers to give access to the transfer area (see annex B)

3.5.4**service door**

pedestrian door which is intended to be used by trained personnel to give access to the working area (see annex B)

3.5.5**emergency door**

pedestrian door which is intended to be used solely for persons leaving the respective area in emergencies, e.g. fire (see annex B)

3.5.6**pass door**

part of a door leaf for pedestrians only (see EN 12433-1 and annex B)

3.6**other definitions****3.6.1****safety switch**

control switch having one or more break-contact elements coupled to the switch actuator via non-resilient members so that full contact opening of the break contact element(s) is obtained when the actuator is moved through the positive opening travel by applying the force stated by the switch manufacturer

NOTE See annex K of EN 60947-5-1:1997.

3.6.2**rated load (carrying capacity)**

maximum load per parking space that power driven parking equipment has been designed to carry

3.6.3**transfer area**

area within automatic parking equipment in which vehicles are transferred to, or taken from, to reach the working area. The transfer area is intended to allow for at least the driver to leave or to enter the vehicle (see annex B)

3.6.4**working area**

area in which the vehicle is handled. Within automatic parking equipment this area is not intended to be accessed by the user(s) (see annex B)

3.6.5**user**

person who parks and/or retrieves a vehicle, using power driven parking equipment

3.6.6**type test**

testing of a representative sample of a new design or of one which incorporates deviations from an existing design, which is conducted by or on behalf of the manufacturer or his authorised representative

3.6.7**load carrier**

part of power driven parking equipment on which a single motor vehicle is located

3.6.8**transmission element**

component through which force is transmitted from the power source to the load carrier. Transmission elements include e.g. gear boxes, hydraulic cylinders, lead screws and nuts, steel wire ropes, toothed belts and chains

3.6.9**lifting element**

transmission element through which force is transmitted to raise or lower the load carrier

3.6.10**suspension element**

vertical transmission elements consisting of ropes, toothed belts and chains

3.6.11**wheel track width**

distance between the centre lines of the wheels on one axle

3.6.12**wheel base**

distance between the centres of wheels on the front and rear axle

3.6.13**locking device**

device which prevents the load carrier from leaving a defined position

3.6.14**safety gear**

mechanical device which is designed to stop and to hold the load carrier if the load carrier is overspeeding

3.6.15**parking unit**

one or several load carriers connected together mechanically and move at a whole

3.6.16**parking equipment attendant**

person(s) given the task of operating and/or cleaning and/or supervising power driven parking equipment

3.6.17**public use**

where the power driven parking equipment is intended to be used by untrained users

4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for this type of equipment and which require action to eliminate or reduce the risk.

The list of significant hazards is based on EN 1050 and is using the numbering of annex A of EN 1050:1996. Also shown are the sub-clause references to the safety requirements and/or protective measures in the present standard.

Before using this standard it is important to carry out a risk assessment of the equipment to check that its significant hazards are identified in this clause.

Table 1 - List of hazards

No	Hazards	Relevant clauses of this standard
1	Mechanical hazards	
	Mechanical hazards due to machine parts or work pieces caused, for example, by:	
	— Relative location	5.8.4, 5.8.5
	— Mass and stability (potential energy of elements which may move under the effect of gravity)	5.6, 5.7.5
	— Mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)	5.5.2, 5.7.5, 5.8.1, 5.8.8, 5.9.1, 5.9.2, 5.9.4, 5.11.1, 5.11.10
	— Inadequacy of mechanical strength	5.1.1, 5.5.3, 5.6, 5.11.10.2, annex 'A'
	Mechanical hazards due to accumulation of energy inside the machinery, caused for example, by:	
	— Liquids under pressure	5.4
1.1	Crushing hazard	5.2.3.1.1, 5.2.3.1.2, 5.2.3.1.4, 5.8.4, 5.8.5, 5.9.1, 5.9.3, 5.10.1, 5.11.3, 5.11.4, 5.11.5, 5.11.8, 5.11.10, 5.11.11, 5.11.12
1.2	Shearing hazard	5.7.6, 5.8.2, 5.11.3, 5.11.4, 5.11.5, 5.11.8, 5.11.10, 5.11.11, 5.11.12
1.3	Cutting or severing hazard	5.8.2, 5.11.3, 5.11.4, 5.11.5, 5.11.8, 5.11.10, 5.11.11, 5.11.12
1.4	Entanglement hazard	5.7.6, 5.11.3, 5.11.4, 5.11.5, 5.11.8, 5.11.10, 5.11.11, 5.11.12
1.5	Drawing-in or trapping hazard	5.2.3.6, 5.5.4, 5.7.6, 5.8.2, 5.8.3, 5.10.4, 5.10.6, 5.10.7, 5.11.3, 5.11.4, 5.11.5, 5.11.8, 5.11.10, 5.11.11, 5.11.12
1.6	Impact hazard	5.2.3.1.2, 5.8.1, 5.9.1, 5.11.3, 5.11.4, 5.11.5, 5.11.10, 5.11.11, 5.11.12
1.7	Stabbing or puncture hazard	5.11.10.1

continued

Table 1 (continued)

No	Hazards	Relevant clauses of this standard
1.9	High pressure fluid injection or ejection hazard	5.4
2	Electrical hazards due to:	
2.1	Contact of persons with live parts (direct contact)	5.3.1, 5.3.2, 5.3.3, 5.3.4
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	5.3.1, 5.3.3, 5.3.4
2.3	Access to live parts under high voltage	5.3.1, 5.3.2, 5.3.3, 5.3.4
2.4	Electrostatic phenomena	5.3.1, 5.3.5
3	Thermal hazards, resulting in:	
3.1	Burns and scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	Not Dealt With See 1.4d)
4	Hazards generated by noise, resulting in:	
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	Not Dealt With See 1.3f) & 1.4f)
4.2	Interference with speech communication, acoustic signals, etc.	Not Dealt With See 1.3f) & 1.4f)

continued

Table 1 (continued)

No	Hazards	Relevant clauses of this standard
7	Hazards generated by materials and substances (and their constituent elements) processed or used by the machinery	
7.2	Fire or explosion hazard	Not Dealt With See 1.4d)
8	Hazards generated by neglecting ergonomic principles in machinery design as, e.g. hazards from:	
8.1	Unhealthy postures or excessive effort	Not Dealt With See Clause '1.3i)' & See Clause 'Introduction' - Negotiations
8.4	Inadequate local lighting	5.11.2, 7.1.2.2 & See Clause '1.4g)'
8.6	Human error, human behaviour	5.2.2, 5.2.3, 5.4.4, 5.8.8, 5.10.2, 5.10.5, 5.11.3, 5.11.4, 5.11.5, 5.11.7, 5.11.10, 5.11.11, 5.11.12, 5.11.13, 7.1.1, 7.1.3, 7.1.5, 7.2
8.7	Inadequate design, location or identification of manual controls	5.2.3, 5.11.13
8.8	Inadequate design or location of visual display units	5.2.3.1.2
9	Combinations of hazards	5.1.2

continued

Table 1 (continued)

No	Hazards	Relevant clauses of this standard
10	Unexpected start-up, unexpected overrun/ overspeed (or any similar malfunction) from:	
10.1	Failure/disorder of the control system	5.2.2, 5.2.4, 5.11.6, 5.11.14
10.2	Restoration of energy supply after an interruption	5.2.3.2, 5.2.4
10.3	External influences on electrical equipment	5.2.5.2
10.5	Errors in the software	Not Dealt With See Clause '1.4j)
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6 above)	5.2.2, 5.2.3, 5.4.4, 5.8.8, 5.10.2, 5.10.5, 5.11.3, 5.11.4, 5.11.5, 5.11.6, 5.11.7, 5.11.10, 5.11.11, 5.11.12, 5.11.13, 5.11.14, 7.1.1, 7.1.3, 7.1.5
11	Impossibility of stopping the machine in the best possible conditions	5.2.3.3, 5.2.3.4, 5.11.7
13	Failure of the power supply	5.2.3.6, 5.2.4.1
14	Failure of the control circuit	5.2.2.1, 5.2.2.2, 5.2.2.3, 5.2.4, 5.11.6, 5.11.7, 5.11.14
15	Errors of fitting	5.3.4, 5.4.4, 7.1.1, 7.1.2.3, 7.1.4
16	Break-up during operation	5.1.1, 5.4.3.6, 5.4.3.7, 5.5.3, 5.6, 7.1.2.1, 7.1.3, 7.1.4, annex 'A'
17	Ejected fluids	5.4
18	Loss of stability/overtipping of machinery	5.5.2, 5.6.1.4, 7.1.1, 7.1.2.1, 7.1.2.3, 7.1.3
19	Slip, trip and fall of persons (related to machinery)	5.5.3, 5.5.6, 5.5.7, 5.6.1.8, 5.8.9, 5.10.8, 5.11.9

continued

Table 1 (concluded)

No	Hazards	Relevant clauses of this standard
27.1	Mechanical hazards and hazardous events, from load falls, collisions, machine tipping, caused by:	
27.1.1	Lack of stability	5.5.2, 5.6.1.4, 7.1.1, 7.1.2.1, 7.1.2.3, 7.1.3
27.1.2	Uncontrolled loading - overloading - overturning moments exceeded	Not Dealt With See Clause 'Introduction' - Assumptions
27.1.3	Uncontrolled amplitude of movements	5.4.3.6, 5.4.3.7, 5.10.1, 5.10.2
27.1.4	Unexpected/unintended movement of loads	5.5.5, 5.6.1.7, 5.6.1.8, 5.10.3
27.1.5	Inadequate holding devices/accessories	5.5.5, 5.6.1.7, 5.6.1.8
27.2	From access of persons to load support	5.6.1.8, 7.1.3.2
27.3	From derailment	5.5.2, 5.6.1.5, 5.6.2.6, 5.6.4.8, 5.6.5.3, 5.6.6.3
27.4	From insufficient mechanical strength of parts	5.1.1, 5.4.3.6, 5.4.3.7, 5.6, 5.11.10.2, 7.1.2.1, 7.1.4, annex 'A'
27.5	From inadequate design of pulleys, drums	5.6.2.4, 5.6.2.6, 5.6.4.6, 5.6.4.7, 5.6.5.1, 5.6.5.2, 5.6.5.3, 5.6.5.6, 5.6.5.7
27.6	From inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine	5.6
27.7	From lowering of the load under the control of friction brake	5.7.5
27.8	From abnormal conditions of assembly/testing/ use/ maintenance	5.2.3.7, 5.6.1.9, 5.6.4.9, 5.6.6.5, 5.11.8, 5.11.9, 7.1.4
27.9	From the effect of load on persons (impact by load or counterweight)	Not Applicable
28	Electrical hazard	
28.1	From lightning	5.2.5.2
29	Hazards generated by neglecting ergonomic principles	
29.1	Insufficient visibility from the driving position	5.2.3.1.2, 5.8.4

5 Safety and EMC requirements and/or safety measures

5.1 General

For the application of EN 294, EN 457, EN 842, EN 953, EN 954-1:1996, 5.3, prEN 1005-2, EN 1005-3, EN 1837, EN 60204-1 the manufacturer shall carry out an adequate risk assessment for the requirements thereof where choice is necessary.

NOTE This specific risk assessment is part of the general risk assessment relating to the hazards not covered by this “C” standard.

Power driven parking equipment and systems shall comply with the safety requirements and/or protective measures of this clause. In addition, power driven parking equipment and systems shall be designed according to the principles of **1A1** EN ISO 12100 **1A1** for hazards, which are relevant but not significant, which are not dealt with by this document (e.g. sharp edges).

5.1.1 Design criteria

The design shall be based on the criteria mentioned in annex A. Where less favourable situations occur the actual forces and their position shall be taken into account.

5.1.2 Combinations of hazard

Dealing with each separate hazard is considered to cover their combinations.

5.2 Control devices and equipment used for safety purposes

5.2.1 General

Control devices and equipment used for safety purposes, depending on the design, include all equipment and circuits associated with e.g.:

- ultimate tripping and position tripping functions;
- malfunction and fault detection functions;
- interlocking functions;
- overspeed tripping functions;
- braking functions;
- start functions;
- stop and emergency stop functions.

5.2.2 Devices and equipment

Control devices, safety devices, transmission elements, response elements, control systems used for safety purposes, shall be in accordance with the requirements of EN 954-1 Category 1 (see 6.2.2 in EN 954-1:1996), unless stated otherwise.

Where electronic equipment, or electronic devices including electronic sub-assemblies are used for safety purposes unless otherwise specified such electronic equipment and devices shall be in accordance with the requirements of EN 954-1 Category 2 (see 6.2.3 in EN 954-1:1996).

Electronic control circuitry, software, adjustable safety devices and adjustable safety related equipment shall be protected against access by unauthorised persons (e.g. by the use of access codes, special tools)

Control devices shall be located out of the passage gauge of the vehicles.

5.2.2.1 Safety device

Safety devices, e.g. trip devices, ultimate-position switches, slack lifting element switches, "door-locked" switches, interlocking switches, emergency stop devices, ultimate-position valves, overspeed governors, shall be located and installed to prevent them being damaged or rendered inoperative during any foreseeable operating conditions. They shall only be adjustable using tools and shall be accessible for inspection purposes from the working area. If a hazardous situation arises and a safety device is actuated, the appropriate safety device shall automatically initiate a category "0" or category "1" stop function as appropriate to be compatible with the design (see EN 60204-1:1997, 9.2.2) and prevent any movement in the relevant plane, unless stated otherwise. The stop function shall comply with EN 954-1, 5.2.

After release of an actuated safety device, it shall only be possible to initiate powered movement by a new start command.

5.2.2.1.1 Electrical safety devices

The switching arrangements of electrical safety devices, shall be of positive opening operation in accordance with Chapter 3 of EN 60947-5-1:1997 (i.e. "safety switches" as defined in 3.6.1 above).

With the exception, on automatic parking equipment, of ultimate switches on movements with a vertical component and those on horizontal movements without mechanical limiting devices other types of switching arrangement may be used, subject to the following conditions:

- i) mechanically actuated electrical switches which are not "safety type" switches, shall be duplicated, shall utilise break contacts and the switches shall be wired in series.
- ii) If sensing devices are used they shall be automatically monitored, which shall at least ensure that an error signal or faulty operation of the sensing device shall be detected prior to the start of the associated movement, i.e. shall meet the requirements of at least EN 61496-1 type 2.
- iii) If the monitoring system (see 5.11.14), shall detect an error signal, or unacceptable signal deviation, the monitoring system shall automatically initiate positive interruption of the associated powered movement and prevent further movement in that direction.

5.2.2.1.2 Hydraulic safety devices

Hydraulic safety devices shall be designed and installed to achieve a safety level comparable to the requirements for electrical safety devices specified above.

5.2.2.1.3 Mechanical safety devices

Mechanical safety devices shall be designed and installed to achieve a safety level comparable to the requirements for electrical safety devices specified above.

5.2.2.2 Transmission elements used for safety purposes

Transmission elements, e.g. safety related wiring, pipework, rods, safety ropes, chains, shall be designed so that failure shall not lead to a dangerous condition. In the event of failure or rupture, a category "0" or category "1" stop function shall be automatically initiated, as appropriate to be compatible with the design (see EN 60204-1:1997, 9.2.2). The stop function shall comply with EN 954-1:1996, 5.2. Mechanical components shall have factors of safety of at least 4 to 1 in relation to maximum intended loading, without permanent deformation or failure.

All flexible piping, flexible hoses and also any rigid pipework or connections used as transmission elements for safety purposes, shall be designed to withstand at least 4 x maximum working pressure without failure or permanent deformation.

The safety factor for the overspeed governor rope shall be at least 8 to 1, computed from the maximum force when the safety gear is initiated in relation to the minimum breaking load in accordance with the rope manufacturer's specifications.

Wiring/pipework used for safety purposes shall be installed and protected to prevent damage due to external influences.

5.2.2.3 Response elements used for safety purposes

Response elements include, e.g. safety related contactors, full-flow directional valves, locking devices, brakes, safety gear.

5.2.2.3.1 Full flow directional valves which are used for safety purposes shall be designed so that in the event of valve control pressure failure the valve shall not move to a dangerous position for the system.

This requirement may be fulfilled by either:

- a) a mechanically and positively actuated full flow directional valve which acts directly on the relevant part of the hydraulic system, or
- b) a pilot operated full flow directional valve controlled by a mechanically and positively actuated hydraulic safety device. The pilot operated full flow directional valve, shall in the event of control pressure failure, positively interrupt the associated movement and prevent further movement in that direction. The full flow directional valve shall also incorporate the following design features to ensure that it shall not be prevented from operating correctly in the event of a spring failure:
 - i) compression springs shall be guided to prevent them buckling and prevent the ends becoming displaced during use ; in combination with ii) or iii)
 - ii) compression springs shall have both ends guided ; or
 - iii) compression springs shall be selected such that the wire diameter is greater than the distance between the coils, hence preventing coils from winding into each other in the event of breakage.

5.2.2.3.2 Full flow solenoid directional valves shall not be used alone for safety purposes.

5.2.3 Control devices

5.2.3.1 General

The purpose/function of all control devices shall be clearly and indelibly marked by using symbols (see EN 894-2, ISO 3864 and ISO 7000), or the purpose/function shall be given in the languages of the country of use. Where intended for public use the purpose/function shall be given at least in the languages of the country of use. The way in which control devices are actuated and their relative position shall be logical and where practicable shall correspond to the resulting movement.

5.2.3.1.1 In the case of non-automatic parking equipment, control devices shall be of the hold-to-run type and shall be clearly and indelibly marked with the parking unit to which they belong.

5.2.3.1.2 "Hold-to-run" control devices on non-automatic parking equipment shall be located where the user or parking equipment attendant has an unrestricted view (direct or indirect view e.g. using viewing aids) of the area where the load carrier moves. All control devices and viewing aids shall be located on the control station.

5.2.3.1.3 In the case of non-automatic parking equipment, each parking unit shall be controlled separately.

5.2.3.1.4 For automatic parking equipment the control devices in general shall be out of reach of the users. Only the control devices needed for the use of the parking equipment shall be in reach of the user.

5.2.3.1.5 For all types of parking equipment, if powered operation of parking units can be initiated from several control stations, these shall be mutually interlocked, so that it is only possible to initiate movement from the selected control station.

5.2.3.1.6 Control device(s) shall not be accessible from inside the vehicle with the exception of devices for opening the main door of automatic parking equipment.

5.2.3.2 Start function

Start control devices shall be clearly identifiable and visible. They shall also be constructed, mounted and secured so as to minimise the risk of unintended or unauthorised operation as follows.

5.2.3.2.1 A start control device shall be provided for automatic parking equipment and shall be located outside the reach of users.

5.2.3.2.2 Actuating the hold-to-run control of non-automatic parking equipment may be considered as actuating the start function.

5.2.3.3 Stop function

The stop function shall be a category "0" or category "1" in accordance with EN 60204-1:1997, 9.2.2 as appropriate to be compatible to the design. When a stop control device has been actuated, powered motion shall cease. The parking equipment shall then remain in a stationary condition until the start control device has subsequently been actuated.

Stop control devices shall be provided at all control stations and shall be clearly identifiable and visible. Stop actuators shall have positive operation and shall have a projecting headed operator.

In the case of non-automatic parking equipment under the permanent control of the user a hold to run control device may be used for the stop function. Being in the released position shall actuate the stop function. When a "hold to run" control device is released, a category "0" or category "1" stop function shall be automatically initiated, as appropriate to be compatible with the design (see EN 60204-1:1997, 9.2.2) irrespective of the movement.

5.2.3.4 Emergency stop function

The emergency stop function shall be in accordance with EN 418 and shall be a category "0" stop (see EN 418:1992, 4.1.5).

NOTE The provision of an emergency stop device is not an alternative to the installation of suitable guarding, see EN 418:1992, 4.1.3.

5.2.3.4.1 When an emergency stop control device has been actuated, powered motion shall come to a halt. The parking equipment shall then remain in a stationary condition until the device has been reset and the start control device has subsequently been actuated.

5.2.3.4.2 In the case of non-automatic parking equipment; as an alternative to an emergency stop control at each control station, in accordance with EN 60204-1:1997, 10.7.5, a supply disconnecting device may be used if all the following preconditions are satisfied:

- it is readily accessible to the user, i.e. the distance from the supply disconnecting device to any related control station is not more than 20 m;
- it is positioned at a height between 1,6 m to 1,9 m;
- it is of the type described in EN 60204-1:1997, 5.3.2 a), b), or c);
- it meets the colour requirements of EN 60204-1:1997, 10.7.4.