



SLOVENSKI STANDARD

SIST EN 12622:2010+A1:2014

01-januar-2014

Nadomešča:
SIST EN 12622:2010

Varnost obdelovalnih strojev - Stiskalnice za upogibanje pločevine

Safety of machine tools - Hydraulic press brakes

Sicherheit von Werkzeugmaschinen - Hydraulische Gesenkbiegepressen

Sécurité des machines-outils - Presses plieuses hydrauliques

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: EN 12622:2009+A1:2013

<https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4e1/sist-en-12622-2010a1-2014>

ICS:

25.120.10	Kovaški stroji. Stiskalnice. Škarje	Forging equipment. Presses. Shears
-----------	--	---------------------------------------

SIST EN 12622:2010+A1:2014

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 12622:2010+A1:2014](https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014)

<https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12622:2009+A1

October 2013

ICS 25.120.10

Supersedes EN 12622:2009

English Version

Safety of machine tools - Hydraulic press brakes

Sécurité des machines-outils - Presses plieuses
hydrauliques

Sicherheit von Werkzeugmaschinen - Hydraulische
Gesenkbiegepressen

This European Standard was approved by CEN on 17 October 2009 and includes Amendment 1 approved by CEN on 26 August 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

[SIST EN 12622:2010+A1:2014](https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014)

<https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms, definitions and abbreviations	9
3.1 Terms and definitions	9
3.2 Abbreviations	12
4 List of significant hazards	12
5 Safety requirements and/or measures	15
5.1 Protection of mechanical hazards	15
5.1.1 Description of the safeguarding of access to moving parts	15
5.1.1.1 General	15
5.1.1.2 Fixed enclosing guards	15
5.1.1.3 Interlocking guards with or without guard locking	15
5.1.1.4 ESPE using AOPD.....	16
5.1.1.5 Laser actuated AOPD	20
5.1.1.6 Hold to run control	22
5.1.1.7 Scanner systems	22
5.1.1.8 ESPE using AOPD when used in automatic cycle as a trip device	23
5.1.2 Location of the safeguarding of access to moving parts	24
5.1.2.1 Prevention of access from the front.....	24
5.1.2.2 Prevention of access from the sides	25
5.1.2.3 Prevention of access from the rear	25
5.2 Control systems.....	26
5.2.1 General.....	26
5.2.2 Manual control devices	26
5.2.3 Failure of power supply	26
5.2.4 Protection against external influences.....	26
5.2.5 Safety functions	26
5.2.5.1 General	26
5.2.5.2 Behaviour of the control system in case of failure.....	33
5.2.5.3 Stop or hold to stop closing stroke of the beam	34
5.2.5.4 Stop back gauges.....	34
5.2.5.5 Back gauges movement limitation	34
5.2.5.6 Stop work-piece support movement	35
5.2.5.7 Slow speed.....	35
5.2.5.8 Muting.....	35
5.2.5.9 Blanking	36
5.2.5.10 Emergency stop	36
5.2.5.11 Mode selection	36
5.2.5.12 Single stroke function	37
5.2.6 Other functions	37
5.2.6.1 Start	37
5.2.6.2 Restart	37
5.2.6.3 Reset.....	38
5.2.6.4 Normal stop	38
5.2.7 Use of electronic components	38
5.2.7.1 Access to the NC program	38
5.2.7.2 Use of PES for safety functions.....	38
5.3 Mode of operation.....	39
5.3.1 Description of the various modes of operation	39
5.3.2 Setting mode	39
5.3.3 Production modes	39
5.3.3.1 Single cycle manual load and/or unload	39

5.3.3.2	Automatic cycle with automatic load and unload	40
5.4	Basic design considerations	40
5.4.1	Stability	40
5.4.1.1	Prevention of unintended gravity fall of the beam (down stroking press brakes).....	40
5.4.1.2	Stability of the press brake	40
5.4.1.3	Stability of the work piece.....	40
5.4.2	Risk of break up during operation	40
5.4.3	Tool holder and tool design	41
5.4.4	Access to raised work stations or platforms.....	41
5.4.5	Slips, trips and falls.....	41
5.4.6	Release of trapped persons	41
5.4.7	Guarding of drives, transmission machinery and ancillary devices.....	41
5.5	Protection against non-mechanical hazard	42
5.5.1	Noise	42
5.5.2	Electrical hazards	43
5.5.3	Ergonomic and handling.....	43
5.5.4	Hydraulic and pneumatic systems	43
5.5.4.1	General	43
5.5.4.2	Valves	44
5.5.4.3	Hydraulic systems	44
5.5.5	Thermal hazards	45
5.5.6	Hazards generated by materials and substances	45
5.5.7	Hazards generated by lasers	45
5.5.8	High pressure fluid ejection hazards.....	45
5.5.9	Isolation and energy dissipation.....	45
5.5.10	Maintenance	45
5.5.11	Errors of fitting.....	45
6	Verification of the safety requirements and/or protective measures.....	46
7	Information for use	48
7.1	Marking	48
7.2	Instruction handbook	49
7.3	Commercial informations	50
Annex A	(normative) Calculation of minimum safety distances.....	51
Annex B	(normative) The overall response time of the press brake stopping performance.....	53
Annex C	(informative) Example of redundant and monitored hydraulic control circuits for a down-stroking press brake	54
Annex D	(normative) Conditions for noise measurement of press brakes	55
Annex E	(informative) Side safeguarding for manually fed press brakes.....	56
Annex F	(informative) Markings.....	57
Annex G	(normative) Laser actuated AOPD system tests.....	58
Annex H	(informative) Bending speed	59
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42	61
Bibliography	62

EN 12622:2009+A1:2013 (E)**Foreword**

This document (EN 12622:2009+A1:2013) has been prepared by Technical Committee CEN/TC 143 "Machine tools - Safety", the secretariat of which is held by SNV.

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 April 2014, and conflicting national standards shall be withdrawn at the latest by April 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes A1 EN 12622:2009 A1.

This document includes Amendment 1 approved by CEN on 2013-08-26.

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).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This European Standard constitutes a revision of EN 12622:2001 for which it has been technically revised. The main modifications are listed below:

- complete reorder of Clause 5 "Safety requirements and/or measures";
- description of safety functions and its safety related part of control systems with categories assigned and /or performance levels required (see Tables 2 and/or 3);
- addition of subclause 5.2.7 on the use of programmable electronic components (PES);
- addition of subclause 5.3.3 concerning production mode;
- addition of new safety functions and new safety devices: a stop work-piece support movement (see 5.2.5.6), monitoring of slow speed (see 5.2.5.7), laser actuated AOPD (see 5.1.1.5), AOPDDR scanner systems (see 5.1.1.7.1) and ESPE using AOPD used in automatic cycle as a trip device (see 5.1.1.8).

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

Introduction

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

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this standard. When provisions of this C type standard are different from those which are stated in A or B standards, the provision of this C type standard take precedence over the provisions of the other standards for machines that have been designed and built according to the provisions of this C type standard.

In addition, press brakes comply as appropriate with EN ISO 12100-1 and EN ISO 12100-2 for hazards which are not covered by this standard.

The requirements of this European Standard concern designers, manufacturers, suppliers and importers of machines described in the scope.

This European Standard also includes information to be provided by the manufacturer to the user.

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 12622:2010+A1:2014

<https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014>

EN 12622:2009+A1:2013 (E)**1 Scope**

This European Standard specifies technical safety requirements and protective measures to be adopted by persons undertaking the design, manufacture and supply of hydraulic press brakes which are designed to work cold metal or material partly of metal and hereafter referred to as machines.

This European Standard also covers hydraulic press brakes, whose primary intended use is the cold working of metal, which are to be used in the same way to work other sheet materials such as cardboard or plastic.

The requirements in this European Standard take account of intended use, including foreseeable misuse as defined in 3.22 of EN ISO 12100-1:2003. This European Standard presumes access to the press brake from all directions, deals with the hazards described in Clause 4, and specifies the safety measures for both the operator and other exposed persons.

This European Standard also applies to:

- ancillary devices which are an integral part of the press brake, e.g. back gauges and adjustable front sheet supports;
- machines which are integrated into an automatic production line where the hazards and risk arising are comparable to those of machine working separately.

The requirements of this European Standard apply to all hydraulic press brakes whatever the technology used in their control system, e.g. electromechanical and/ or electronic.

This European Standard does not apply to machines whose principal designed purpose is:

- a) sheet folding by rotary action;
- b) tube and pipe bending by rotary action;
- c) roll bending.

(standards.iteh.ai)
SIST EN 12622:2010+A1:2014
<https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014>

This European Standard applies to machines built after the date of issue of this European Standard.

This European Standard does not cover the safety aspect of automatic loading and unloading equipment.

Some guidance how to take into account additional automatic loading and unloading equipment can be found in ISO 11161.

2 Normative references

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.

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

EN 574:1996, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 894-1, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

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

EN 894-3, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

- EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*
- EN 954-1, *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 983:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*
- EN 999:1998, *Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body*
- EN 1005-1, *Safety of machinery — Human physical performance — Part 1: Terms and definitions*
- EN 1005-2, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and components parts of machinery*
- EN 1005-3, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*
- EN 1005-4, *Safety of machinery — Human physical performance — Part 4: Evaluation of working postures and movements in relation to machinery*
- EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up*
- EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*
- EN 1837, *Safety of machinery — Integral lighting of machines*
- EN 50370-1, *Electromagnetic compatibility (EMC) — Product family standard for machine tools — Part 1: Emission*
- EN 50370-2, *Electromagnetic compatibility (EMC) — Product family standard for machine tools — Part 2: Immunity*
- EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*
- EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989).*
- EN 60825-1:2007, *Safety of laser products — Part 1: Equipment classification and requirements (IEC 60825-1:2007)*
- EN 60947-5-1:2004, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices (IEC 60947-5-1:2003)*
- EN 60947-5-3, *Low-voltage switchgear and controlgear — Part 5-3: Control circuit devices and switching elements — Requirements for proximity devices with defined behaviour under fault conditions (PDF) (IEC 60947-5-3:1999)*
- EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310-2:2007)*
- EN 61496-1:2004, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)*
- EN 62061:2005, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061:2005)*
- EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN 12622:2009+A1:2013 (E)

EN ISO 3746:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane* (ISO 3746:1995)

EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment* (ISO 4871:1996)

EN ISO 9614 (all parts), *Acoustics — Determination of sound power levels of noise sources using sound intensity* (ISO 9614)

EN ISO 11202:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Survey method in situ* (ISO 11202:1995)

EN ISO 11688-1:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning* ((ISO/TR 11688-1:1995)

EN ISO 11688-2, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design* (ISO/TR 11688-2:1998)

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)

EN ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces* (ISO 13732-1:2006)

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design* (ISO 13849-1:2006)

EN ISO 13849-2, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation* ((ISO 13849-2:2003)

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design* (ISO 13850:2006)

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by the upper and lower limbs* (ISO 13857:2008)

EN ISO 14121-1, *Safety of machinery — Risk assessment — Part 1: Principles* (ISO 14121-1:2007)

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)

EN ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders* (ISO 14122-4:2004)

EN ISO 14738, *Safety of machinery — Anthropometric requirements for the design of workstations at machinery* (ISO 14738:2002)

CLC/TS 61496-2:2006, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)* (IEC 61496-2:2006)

CLC/TS 61496-3, *Safety of machinery — Electro-sensitive protective equipment — Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1

beam

main reciprocating press brake member which normally holds the punch on a down-stroking press brake, and which normally holds the die on an up-stroking press brake

3.1.2

blanking

optional function that permits an object of a size greater than the detection capability of the ESPE to be located within the detection zone without causing an OFF-state of the OSSD(s)

[EN 61496-1:2004, definition 3.1]

NOTE 1 Fixed blanking is a technique wherein the locations of the blanked areas of the detection zone do not change during operation. The detection capability of the other parts of the detection zone remains unchanged.

NOTE 2 Floating blanking is a technique wherein the blanked area of the detection zone follows the location of a moving object(s) during operation. The detection capability of the other areas remains unchanged.

3.1.3

automatic cycle

operating mode where the operating cycle is repeated continuously or intermittently, all functions achieved without manual intervention after initiation

3.1.4

operating cycle

movement completed by the moving part of the tools from the cycle start position to the bottom dead centre and back to the cycle stop position

NOTE 1 The operating cycle includes all operations carried out during this movement.

NOTE 2 Normally, the cycle start and stop position is the top dead center.

3.1.5

single cycle

operating mode where each operating cycle of the beam has to be positively actuated by the operator

3.1.6

dead centre(s)

point at which the tool, during its travel, is either nearest/closest to the die (generally it corresponds to the end of the closing stroke), known as the bottom dead centre, or furthest from the die (generally it corresponds to the end of the opening stroke), known as the top dead centre

NOTE On an up stroking press brake, the centres are reversed.

3.1.7

hydraulic press brake

machine designed or intended to transmit energy to the moving part of the tools by hydraulic means principally for the purpose of bending between narrow forming tools along straight lines

NOTE See Figure 1.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 12622:2010+A1:2014

<https://standards.iteh.ai/catalog/standards/sist/c75abd59-0936-420e-a2eb-246002e3a4c4/sist-en-12622-2010a1-2014>

EN 12622:2009+A1:2013 (E)**3.1.8****overall system stopping performance**

overall response time

overall stopping distance

time/distance occurring from actuating the protective device to the cessation of hazardous motion, or to the machine assuming a safe condition

3.1.9**position switch**

switch which is operated by a moving part of the machine when this part reaches or leaves a predetermined position

3.1.10**restraint valve**

device which protects against a gravity fall of the beam

3.1.11**single stroke function**

feature used to limit the motion of the tool to one operating cycle even if the stroke initiating means (e.g. a pedal) is held in the operating position

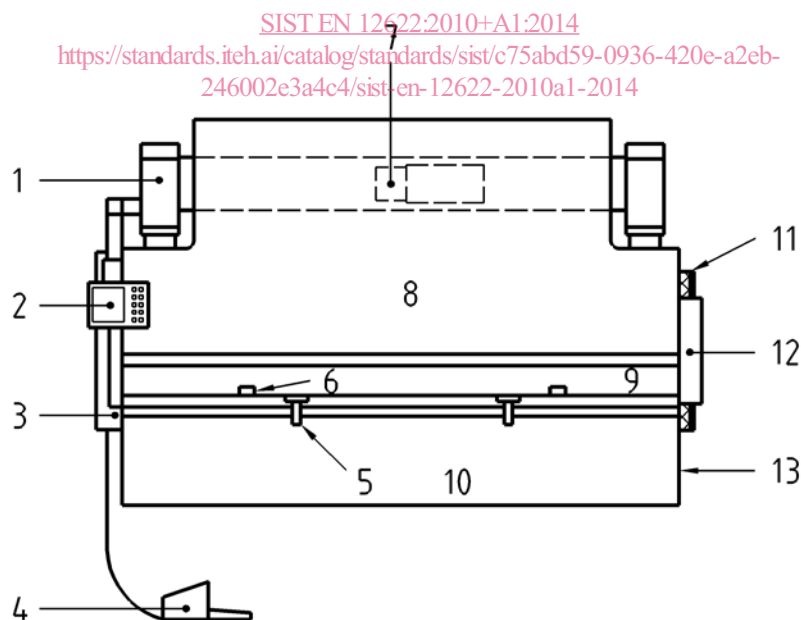
3.1.12**tools**

combination of punch and die

3.1.13**up-stroking press brake**

press brake in which the lower tool moves upwards during the closing stroke

NOTE The movement is reciprocal to a down-stroking press, see Figure 1.

**Key**

1 Press cylinder	6 Backgauge	11 Side safeguard
2 Control panel	7 Hydraulic system	12 Light Curtain
3 Electrical Switch Gear Cabinet	8 Beam	13 Frame
4 Foot pedal	9 Tools	
5 Work-piece support	10 Bed	

Figure 1 — Example of a down-stroking hydraulic press brake

3.1.14**down-stroking press brake**

press brake in which the upper tool moves downwards during the closing stroke

3.1.15**programmable electronic system****PES**

system for control, protection or monitoring based on one or more programmable electronic devices, including all elements of the system such as power supplies, sensors and other input devices, data highways and other communication paths, and actuators and other output devices

[EN 61508-4:2001, definition 3.3.2]

3.1.16**electro-sensitive protective equipment****ESPE**

assembly of devices and/or components working together for protective tripping or presence-sensing purposes comprising

- a sensing device;
- controlling monitoring devices;
- output devices and all interconnecting wiring.

[EN 61496-1:2004, definition 3.5]

NOTE For the purposes of this European Standard, ESPE covers AOPD, AOPDDR, laser actuated AOPD.

3.1.17**light curtain**

active opto-electronic protective device (AOPD) comprising an integrated assembly of one or more emitting element(s) and one or more receiving element(s) forming a detection zone with a detection capability specified by the supplier

[CLC/TS 61496-2:2006, definition 3.205]

3.1.18**output signal switching device****OSSD**

component of the electro-sensitive protective device (ESPE) connected to the machine control system which, when the sensing device is actuated during normal operation, responds by going to the OFF-state

[EN 61496-1:2004, definition 3.19]

3.1.19**safety-related parts of the control system**

parts (mechanical, hydraulic, electrical, pneumatic) of a control system whose failure can result in a hazard

3.1.20**single break cycle initiation**

initiation of the single operating cycle of the beam by actuating the light curtain by an object (e.g. work material, hand) and subsequently withdrawing the object from the detection zone of the curtain

3.1.21**double break cycle initiation**

initiation of the single operating cycle of the beam by twice in succession disturbing (actuating) the light curtain by an object (e.g. work material, hand) and subsequently withdrawing the object from the detection zone of the curtain

3.1.22**overrun**

movement (distance) of the beam past a defined stopping point

EN 12622:2009+A1:2013 (E)**3.1.23****overflow monitoring device**

device which provides a signal to inhibit further complete stroke when the overrun exceeds the pre-set limit(s)

3.1.24**bending plane**

vertical plane passing through the first contact line with the material from the upper tool nearest to the operator

3.2 Abbreviations

TDC	Top Dead Centre
AOPD	Active Opto-electronic Protective Device
NC	Numerical Control
AOPDDR	Active Opto-electronic Protective Device responsive to Diffuse Reflection (Scanner)
PLC	Programmable logic controller
PES	Programmable electronic system
ESPE	Electro-sensitive protective equipment
OSSD	Output signal switching device

4 List of significant hazards

This clause contains the significant and other relevant hazards, hazardous situations and events (see EN ISO 14121-1) as far as they are dealt with in this European Standard, identified by risk assessment as significant for the machines as defined in the scope and which require action to eliminate or reduce the risk. This European Standard deals with:

- significant hazards by defining safety requirements and/ or measures or by reference to relevant type B standards;
- hazards which are present but not significant e.g. general, minor or secondary hazards by reference to EN ISO 12100-1:2003 and EN ISO 12100-2:2003.

These hazards are listed in Table 1 in accordance with EN ISO 14121-1.

Particular attention is given to hazards dealing with:

- crushing and shearing between moving tools, beam, back gauges, work-piece supports (see Table 1);
- entanglement on or drawing into moving parts of the machine, guards, motor and drive machinery, mechanical handling device (see Table 1);
- ejection of machine components of hydraulic system (see Table 1).

Main danger zones are:

- tools area with moving beam, back gauges, work-piece supports;
- mechanical handling device;
- motor and drive machinery.

Table 1 — Overview of hazards and reference to B-Type Standards

Annex A of EN ISO 14121-1	Hazards, hazardous situations and hazardous events	Situations on hydraulic press breaks	EN ISO 12100-		Relevant type B standard	Relevant clause in this International Standard			
			Part 1: 2003	Part 2: 2003					
1 Mechanical hazards						5			
A.1	Acceleration, deceleration (kinetic energy)		4.2	4.2.1 4.2.2 4.3 a) 4.3 b) 4.6 4.10 5.1 5.2 5.3 5.5.2 5.5.4 5.5.5 5.5.6 6.1 6.3 6.4 6.5	ISO 13851 ISO 13854 ISO 13855 ISO 13856-2 ISO 13856-3 EN ISO 13857 ISO 14118 ISO 14119 ISO 14120 EN ISO 14122-1 EN ISO 14122-2 EN ISO 14122-3 EN ISO 14122-4 ISO 16156 EN 60204-1 EN 614-1	5.1.1 5.2.6.4 5.2.5.11 5.4.1 5.4.2 5.4.3 5.4.5 5.4.7 5.5.4 5.5.5 5.5.6 5.5.8			
A.1	Approach of a moving element to a fixed part								
A.1	Cutting parts, sharp edges: crushing and shearing								
A.1	Elastic elements High pressure: fluid injection or ejection Vacuum, Gravity (stored energy)	Dissipation of accumulated energy inside the machine							
A.1	Falling of objects	Falling of work-piece							
A.1	Moving elements: Entanglement								
A.1	Rotating elements: Entanglement								
A.1	Rough, slippery surface: slipping, tripping and falling of persons (related to machinery)	Ejection or spillage of hydraulic fluid. Fall of persons during access to/or at/from the work position machines during setting and operation mode.							
A.1	Stability Height from the ground	Loss of stability							
A.3	Assembly and installation Error of fitting	During tool/workpiece clamping change				5.3 a) 5.3 b) 2)	6.1.2 6.5.1 4.11.4 4.11.5	ISO 14118 EN 60204-1 EN 982 EN 983	5.2.6.2 5.5.3 7
A.3	Operation	Restarting the machine after stopping/interruption							
A.3	Fault finding and troubleshooting	Isolation and energy dissipation							
2 Electrical hazards									
A.1	Live parts (direct contact)	At electrical equipment during maintenance.	4.3	4.9 5.2 5.3.2 5.5.4 6.4 6.5	EN 60204-1	5.2.3 5.4.2 5.5.2 5.5.9			
A.1	Parts which have become live under fault conditions (indirect contact)	At electrical equipment during setting, machining and maintenance.							
A.1	Short-circuit, break up during operation	At any mode of operation, in case of penetration of conducting substances.							