SLOVENSKI STANDARD
SIST EN 692:2000

01-april-2000

Mechanical presses - Safety

Mechanical presses - Safety

Mechanische Pressen - Sicherheit

Presses mécaniques - Sécurité

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Ta slovenski standard je istoveten z: **EN 692:1996**

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ICS:

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

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EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 692

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ICS 25.120.10

Descriptors: presses, safety of machines, dangerous machines, accident prevention, design, hazards, safety measures, safety devices, safety requirements, dangerous area, control devices, specifications, technical notices, utilization, marking

English version

Mechanical presses - Safety

Presses mécaniques - Sécurité

Mechanische Pressen - Sicherheit

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 143 "Machine tools - Safety" the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by December 1996, and conflicting national standards shall be withdrawn at the latest by December 1996.

This European Standard 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).

Annexes A to C to this standard are normative, whereas annexes D to J are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0 Introduction

0.1 This standard is applicable to mechanical presses as defined in 3.17.

0.2 This standard has been prepared to be a harmonized standard to provide one means of conforming with the Essential safety requirements of the Machinery Directive and associated EFTA Regulations.

0.3 The extent to which hazards are covered is indicated in the scope of this standard. In addition, machinery shall comply as appropriate with EN 292 for hazards which are not covered by this standard.

0.4 Complementary guidance is given in the A and B standards to which reference is made in the text (see clause 2). The figures are intended to be examples only and not to give the only interpretation of the text.

1 Scope

1.1 This standard specifies technical safety requirements and measures to be adopted by persons undertaking the design (as defined in 3.11 of EN 292-1:1991), manufacture and supply of mechanical presses which are intended to work cold metal or material partly of cold metal.

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1.2 This standard also covers presses, whose primary intended use is to work cold metal, which are to be used in the same way to work other materials (such as cardboard, plastic, rubber or leather), and metal powder.

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1.3 The requirements in this standard take account of intended use, as defined in 3.12 of EN 292-1:1991. This standard presumes access to the press from all directions, deals with the hazards described in clause 4, and specifies the safety measures for both the operator and other exposed persons.

1.4 This standard also applies to ancillary devices which are an integral part of the press. For the safeguarding of integrated manufacturing systems using presses, see also ISO 11161.

1.5 This standard does not cover machines whose principal designed purpose is:

a) sheet metal cutting by guillotine;

b) attaching a fastener, e.g. riveting, stapling or stitching;

c) bending or folding;

d) straightening;

e) turret punch pressing;

f) extruding;

g) drop forging or drop stamping;

h) compaction of metal powder;

i) single purpose punching machines designed exclusively for profiles, e.g. for the construction industry.

1.6 This standard applies to machines built after its date of issue.

2 Normative references

This European standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 292-1:1991	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
EN 292-2:1991	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications (and Amendment A1:1995)
EN 294:1992	Safety of machinery - Safety distances 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 563:1994	Safety of machinery - Temperatures of touchable surfaces - Ergonomics data to establish temperature limit values for hot surfaces
EN 574:1996	Safety of machinery - Two-hand control device
EN 614-1:1995	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 626-1:1994	Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery - Part 1: Principles and specifications for machinery manufacturers
EN 842:1996	Safety of machinery - Visual danger signals - General requirements, design and testing
EN 1037:1995	Safety of machinery - Prevention of unexpected start-up

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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 983:1996	Safety of machinery - Safety requirements for fluid power systems and their components - Pneumatics
EN 999:1996	Safety of machinery - Approach speed of parts of the body for the positioning of safety devices
EN 1037:1995	Safety of machinery - Prevention of unexpected start-up
EN 1088:1995	Safety of machinery - Interlocking devices with and without guard locking - General principles and provisions for design
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 11202:1995	Acoustics - Noise emitted by machinery and equipment - Measurement of emission sound pressure levels at the work station and at other specified positions - Survey method in situ (ISO 11202:1995)
EN 60204-1:1992	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 204-1:1992, modified)
EN 61310-2:1995	Safety of machinery - Indication, marking and actuation - Part 2: Requirements for marking (IEC 1310-2:1995)
prEN 894-2:1992	Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 2: Displays
prEN 894-3:1992	Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators
prEN 953:1992	Safety of machinery - General requirements for the design and construction of guards (fixed, movable)
prEN 1005-2:1993	Safety of machinery - Human physical performance - Part 2: Manual handling of objects associated to machinery
prEN 1050:1993	Safety of machinery - Principles for risk assessment
prEN 1127-1:1993	Safety of machinery - Fire and explosions - Part 1: Explosion prevention and protection
prEN 1299:1994	Vibration isolation of machines - Information for the application or source isolation
prEN 50100-1:1995	Safety of machinery - Electrosensitive protective equipment - Part 1: General requirements and tests (IEC 1496-1:1995)
prEN 50100-2:1994	Safety of machinery - Electrosensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices (IEC 1496-2:1995)
ISO 8540:1993	Open front mechanical power presses - Vocabulary

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ISO 11161:1994	Industrial automation systems - Safety of integrated manufacturing systems - Basic requirements
ISO/TR 11688-1:1995	Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning.

3 Definitions

For the purposes of this standard, the following definitions apply. Further definitions are provided in relevant type A and type B standards and in annex A of EN 292-2:1991/A1:1995.

3.1 band brake: Brake (see 3.2) where a flexible band lined with friction material is arranged around the circumference of a drum.

3.2 brake: Mechanism (usually friction) intended to stop and hold the slide when the clutch, if provided, is disengaged.

3.3 clutch: Mechanism used to impart the movement of the flywheel to the slide.

3.4 clutch - full revolution: Type of clutch that, when tripped or actuated, cannot be disengaged until the slide has completed a complete stroke, e.g. most positive key clutches. It also includes clutches which can only be disengaged at certain positions in the operating cycle.

3.5 clutch - part revolution: Type of clutch that can be engaged or disengaged at any point in the stroke of the slide, e.g. most friction clutches.

3.6 cycle - automatic: Operating mode where the slide repeats continuously or intermittently, all functions achieved without manual intervention after initiation.

3.7 cycle - operating: Movement of the slide from the cycle start position (normally the top dead centre) to the bottom dead centre and back to the cycle stop position (normally the top dead centre). The operating cycle includes all operations carried out during this movement.

3.8 cycle - single: Operating mode where each operating cycle of the slide has to be positively actuated by the operator.

3.9 dead centres: Points at which the tool, during its stroke, is

- either nearest/closest to the die (generally it corresponds to the end of the closing stroke), known as the bottom dead centre (BDC),
- or furthest from the die (generally it corresponds to the end of the opening stroke), known as the top dead centre (TDC).

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3.10 die: In general, the fixed part of the tools used in a press.

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3.11 die cushion: Accessory for a die which accumulates and releases, or absorbs, force as required in some press operations.

3.12 direct drive: Type of driving arrangement wherein no clutch is used: movement of the slide is accomplished by energising and de-energising the motor, possibly in conjunction with a brake.

3.13 early opening interlocking guard: Guard associated with an interlocking device which, if opened when any dangerous movement in the tools area has ceased, does not interrupt the operating cycle.

3.14 **extractor; latch**: Device for disengaging a full revolution clutch.

3.15 **guard locking device**: Mechanical device to maintain an interlocking guard gate in the closed and locked position until the risk of injury from the hazardous machine functions has passed.

3.16 **limited movement control device; inching device**: Control device, the actuation of which permits only a limited amount of travel of a machine element, thus minimizing risk as much as possible; further movement is precluded until there is a subsequent and separate actuation of the control. [3.23.8 of EN 292-1:1991]

3.17 **mechanical press**: Machine designed or intended to transmit energy from a prime mover to a tool by mechanical means for the purpose of the working (e.g. forming or shaping) of cold metal or material partly of cold metal between the tools. Such energy may be transmitted by a flywheel and clutch or by means of a direct drive mechanism (see figure 1).

3.18 **monitoring**: Safety function which ensures that a safety measure is initiated if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed in such a way that hazards are generated.

3.19 **muting**: Temporary automatic suspension of a safety function(s) by safety related parts of the control system during normal operation of a machine. [3.5 of EN 954-1:1996]

3.20 **overall system stopping performance; overall response time**: Time occuring from actuating the protective device to the cessation of hazardous motion, or to the machine assuming a safe condition.

3.21 **overrun**: Movement of the crankshaft past a defined stopping point, e.g. TDC.

3.22 **overrun monitoring device**: Device which provides a signal to inhibit further machine initiation when the overrun exceeds the pre-set limit(s).

3.23 **position switch**: Switch which is operated by a moving part of the machine when this part reaches or leaves a predetermined position.

3.24 **redundancy**: Application of more than one device or system, or part of a device or a system, with the objective of ensuring that, in the event of one failing to perform its function, another is available to perform that function. [3.47 of EN 60204-1:1992]

3.25 **shut height**: Distance from the bedplate surface to the slide surface measured with the maximum variable stroke, stroke down and slide adjustment up. [3.12 of ISO 8540:1993]

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3.26 **single stroke function**: Feature used to limit the motion of the tool to one operating cycle at each engagement of the clutch even if the stroke initiating means (e.g. a pedal) is held in the operating position.

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3.27 **slide**: Main reciprocating press member which holds the tool.

3.28 **tool**: In general, moving part of the tools.

3.29 **tools**: Term for the combination of tool and die.

3.30 **tools - closed**: Tools designed and constructed to be inherently safe (see figure D.1).

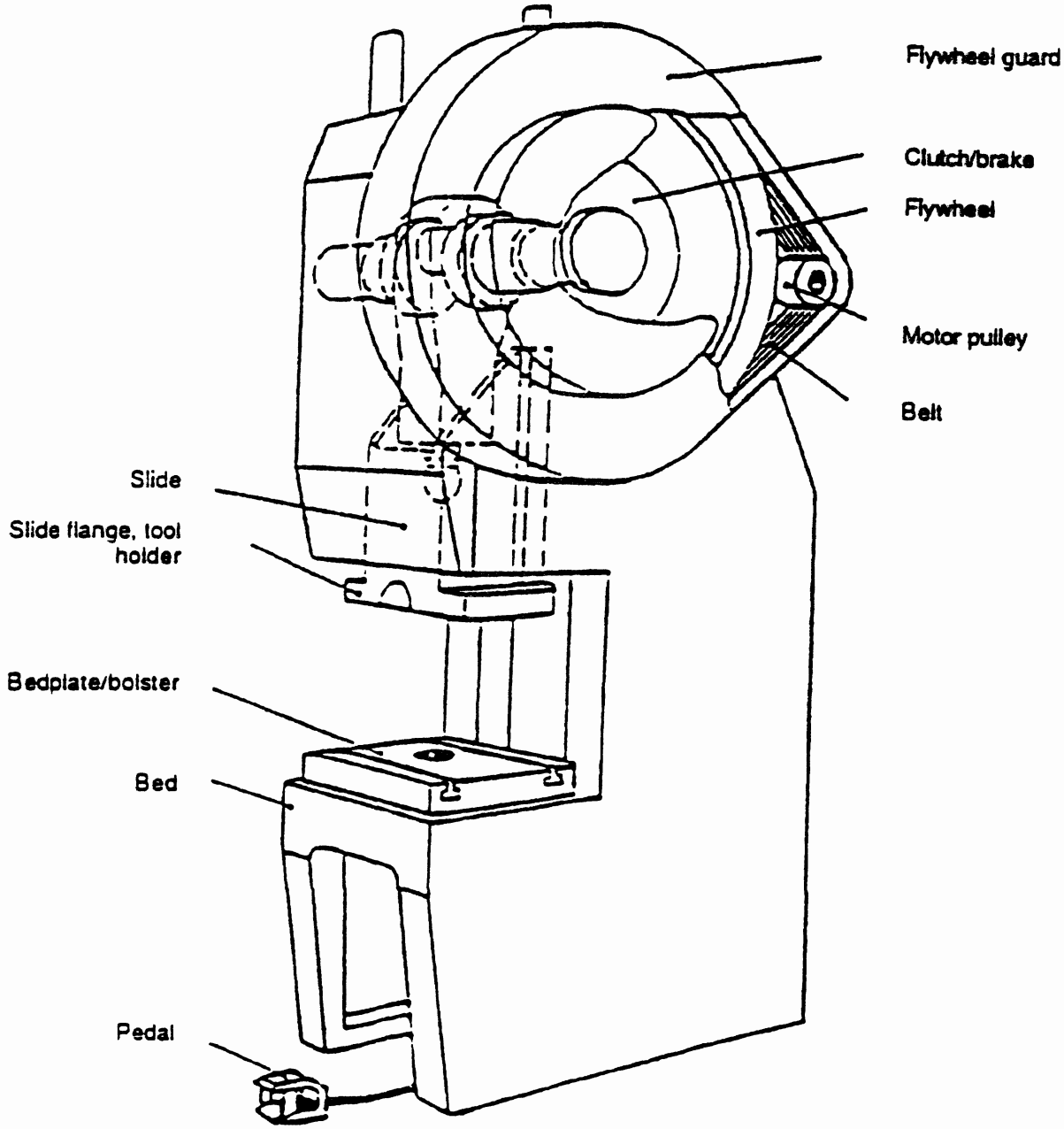

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Figure 1: Example of mechanical power press (tools area safeguards not shown)

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4 List of hazards

4.1 The list of hazards contained in table 1 is the result of a risk assessment, carried out as required by prEN 1050, for all mechanical presses covered by the scope of this standard. The technical measures and information for use contained in clauses 5 and 7 and annexes A, B, C, F and G are based on the risk assessment, and deal with the identified hazards by either eliminating them or reducing the effects of the risks they generate.

4.2 The risk assessment assumes foreseeable access from all directions, as well as overruns, unexpected and unintended strokes or gravity falls. Risks to both the operators and other persons who may have access to the danger zones are identified, taking into account all hazards which may occur during the life of the press. The assessment includes an analysis of the effect of failure in the control system.

4.3 In addition, the user of this standard, i.e. the designer, manufacturer or supplier, shall conduct a risk assessment in accordance with prEN 1050 with particular attention to:

- the intended use of the press including maintenance, toolsetting and cleaning, and its reasonably foreseeable misuse;
- the identification of the significant hazards associated with the press (see 4.4).

4.4 Table 1 of this standard is a list of significant hazards and their related danger zones normally associated with a mechanical power press. As part of the risk assessment, the designer shall verify whether the list of hazards in table 1 is exhaustive and applicable to the press under consideration.

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Table 1: Significant hazards, danger zones, preventive measures

Hazards	Danger zone	Preventive measures: relevant clauses of this standard	Relevant clauses of EN 292-1:1991
Mechanical hazards			
Crushing hazard Shearing hazard Cutting or severing hazard Entanglement hazard Drawing-in or trapping hazard	Tools area: - between moving tools - moving slide - moving die cushions - workpiece ejectors - guards	5.3 to 5.5 Annexes A, B, D and E	4.2.1
Impact hazard	Moving parts of electrical, hydraulic and pneumatic equipment Motor and drive machinery Mechanical handling device	5.6.1 to 5.6.3 5.6.1 to 5.6.4	
Ejection hazard	Machine components Workpieces and tools	5.6.5 7.2.2 i)	
High pressure fluid ejection hazard	Hydraulic systems	5.8.3	4.2.1
Slip, trip and fall hazards	All work at heights Floor area around the press	5.7	4.2.3
Electrical hazards			
Direct contact hazard	Electrical equipment	5.8.1	4.3
Indirect contact hazard Thermal radiation hazard (burns)	Electrical equipment Parts made live by electrical equipment under fault conditions	5.8.1	4.3
Thermal hazards resulting in burns and scalds, by a possible contact of persons	Brakes, clutches, parts of the hydraulic system	5.8.2	4.4
Hazards generated by noise resulting in hearing losses (deafness)	Any area at the press where there is a risk to hearing	5.8.4	4.5
Hazards generated by vibration	Parts of the press where the risk occurs, e.g. the workstation(s)	5.8.5	4.6
Hazards generated by materials and substances processed, used or exhausted by machinery, for example: Hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	Hydraulic systems, pneumatic systems and their controls, toxic work materials	5.8.6.1 to 5.8.6.4	4.8
Fire or explosion hazards	Exhaust ventilation and dust collection equipment	5.8.6.5	4.8
Hazards generated by neglecting ergonomic principles in machine design (mismatch of machinery with human characteristics and abilities) caused, for example, by unhealthy postures or excessive efforts	The working position and controls for operators and maintenance staff handling tools	5.8.7	4.9

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5 Safety requirements and/or measures

5.1 Introduction

The mechanical presses covered by this standard range in size from small high speed machines with a single operator producing small workpieces to large relatively slow speed machines with several operators and large complex workpieces. They are here classified by their design, i.e. presses with part revolution clutches and full revolution clutches.

The methods or measures to be implemented to eliminate the significant hazards or reduce their associated risks are detailed in this clause in the following manner:

- basic design considerations for major press components or systems (see 5.2);
- safeguarding against mechanical hazards in the tools area under different modes of production (see 5.3 and tables 2, 3 and 4);
- protection against hazards due to control system or control component failures (see 5.4);
- safeguarding against hazards which can occur during toolsetting, trial strokes, maintenance and lubrication (see 5.5);
- safeguarding against other hazards (see 5.6 to 5.8).

5.2 Basic design considerations

5.2.1 Brakes and clutches

5.2.1.1 Fluid or air pressure shall not be used to apply a brake unless means are provided to ensure that, in the event of loss of fluid or air pressure, the integrity of the brake is maintained and the clutch is disengaged. Diaphragms shall not be used to apply a brake.

5.2.1.2 The designer shall ensure that:

a) the springs used for applying the brake or disengaging the clutch are of compression type;

b) multiple spring assemblies are used;

c) all the springs are closely uniform in dimension, quality and rating;

d) the means of loading the springs are such that, when adjusted, the spring anchorages can be locked to prevent slackening back;

e) the arrangements for spring housing and guiding, and of guide pins, are such as to minimize binding;

f) the brake can function even if 50% of the spring assembly has failed.

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5.2.1.3 The engagement and disengagement of the clutch and brake shall not affect their safe function.

NOTE: Combined clutch and brake units are recommended so as to reduce the possibility of the overlapping of their engagement.

5.2.1.4 The brake and the clutch shall be designed so that failure of any component does not stress other components in such a way that rapid consequential dangerous failure is possible.

5.2.1.5 Any heat generated which can cause a hazardous situation shall be dissipated.

5.2.1.6 Effective arrangements shall be made to prevent penetration of lubricants to the brake friction surfaces, when this is not intended by the brake design.

5.2.1.7 The clutch and brake shall be designed in such a way that any moisture, dust or lubricating oil, which breaks or corrodes packing material (e.g. gaskets and seals), cannot influence the required function adversely, e.g. by obstructing an air channel or otherwise affecting their efficiency.

5.2.1.8 The design shall be such that the accumulation of dust, fluid or debris is minimized in areas likely to give rise to inefficient brake performance. Broken or loose components shall not cause brake failure.

5.2.1.9 Band brakes shall not be used on mechanical presses for the purpose of stopping the slide.

5.2.2 Presses with part revolution clutches (friction clutches)

5.2.2.1 Clutches shall be of a capacity capable of engaging and disengaging the stroke, in the correct position, without excessive temperature rise, under conditions of maximum use of the clutch.

5.2.2.2 Sufficient working clearances shall be provided so as to ensure that, under the severest conditions of operation, friction drag leading to undesired movement of the driven members will not take place.

5.2.2.3 Arrangements shall be made to prevent the accumulation of debris evolved from frictional surfaces in places where it can give rise to inefficient clutch performance, and for its effective dispersal.

5.2.2.4 The clutch and its control system shall be designed so that, in the event of failure of pneumatic, hydraulic or electrical supply, the clutch is disengaged and the brake is immediately applied.

5.2.2.5 If diaphragms are used in a clutch system, measures shall be taken to avoid damage by the cutting effect of sharp edges or wearing by rough surfaces. Evacuation of air shall not be prevented due to slackening of the diaphragm, e.g. due to material fatigue.

5.2.3 Presses with full revolution clutches

For presses with full revolution clutches, the further requirements of annex A shall be met. These requirements relate to the design of the extractor and the prevention of overrun and fall-back to prevent an involuntary descent of the slide.

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5.2.4 Hydraulic and pneumatic systems - Common features

5.2.4.1 The requirements in EN 982 and EN 983 shall be taken into consideration in designing hydraulic and pneumatic systems, which shall comply with the particular requirements in 5.2.4, 5.2.5 and 5.2.6.

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5.2.4.2 Filters, pressure regulators and low pressure cut-off arrangements shall be provided.

5.2.4.3 Devices shall be provided to ensure that the permitted range of working pressure is maintained.

5.2.4.4 Bowls of glass and plastic (unless resistant to solvents) shall be guarded to prevent flying particles of broken glass or plastic.

5.2.4.5 All piping, pipe fittings, passages, surge or storage tanks and cored or drilled holes, shall be free from burrs or foreign matter which can cause damage to valves or clutch and brake operating parts. See 5.3.4.2 of EN 982:1996 and 5.3.4.2 of EN 983:1996.

5.2.4.6 Each run of piping shall, where practicable, be continuous from one piece of apparatus to another. Precautions shall be taken to prevent damage by thermal expansion. Rigid piping shall be securely supported at frequent intervals to avoid vibration or movement. Care shall be taken to avoid kinking of flexible pipes used to carry fluids. Such kinking can cause traps which prevent the fluid exhausting. This applies particularly to piping feeding the running joint of the clutch and brake.

5.2.4.7 Where a drop in pressure can lead to unintended dangerous motion of the slide, pipes and pipe connections shall be chosen to prevent such a loss of pressure. Such pipe connections shall not be made with compression fittings, glued rings or similar devices.

5.2.4.8 Operating valves shall not depend on connected piping for support. This is to avoid undesirable effects from vibration which can affect both valves and piping.

5.2.4.9 Operating valves shall be so designed as to ensure that, when in the non-operating position, leakage past the inlet valve will escape sufficiently freely to prevent build-up of pressure in the clutch operating cylinder.

5.2.4.10 Operating valves shall be so designed that it is not possible for both the inlet port and the exhaust ports to remain closed at the same time.

5.2.4.11 Exhaust ports and piping between clutch operating cylinders and valves shall be of sufficient capacity to ensure prompt release of fluid from clutch operating cylinders. Precautions shall be taken to ensure that the exhaust ports of operating valves are of adequate size to prevent residual pressure in the cylinder. The valve shall be selected so that the pressure ratio between clutch and brake is such that the residual pressure in the cylinder will not become excessive in the event of a valve fault.

NOTE: Normally, a ratio of at least 3,5 to 1 between spring pressure in the brake and residual pressure in the cylinder is satisfactory.

5.2.4.12 Control valves shall be mounted in positions which provide adequate accessibility and avoid damage.

5.2.4.13 Where valves are manually or mechanically (as distinct from electrically) operated, the arrangements for restoring the valves to the position of clutch disengagement at the end of the cycle shall be positive in character. See also 5.4.9.

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5.2.5 Pneumatic systems

5.2.5.1 Where valves or other parts of the press control system require lubrication, visible automatic means of lubrication shall be provided to introduce the oil into the air line in suitable form.

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5.2.5.2 Where silencing systems are fitted, they shall be provided and installed in accordance with the valve manufacturer's instructions for use in safety systems and their effect on braking performance shall be taken into account. Only non-clogging direct to atmosphere silencers are permissible to brake/clutch manufacturers' specifications.

5.2.5.3 Water separators shall be provided.