

NIST GCR 01-814
A Guide to the EU Machinery Directive

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ABSTRACT

This guide (prepared under contract by Helen Delaney and Rene van de Zande, DVZ Joint Ventures) is an easy-to-use introductory reference for industry and government officials on the requirements of the European Union's (EU) Machinery Directive [Directive 98/37/EC]. It is designed to help business and government officials understand the purpose of the directive, its relationship to other directives, the essential requirements contained in the directive, and the basic steps necessary for compliance. The guide offers explanations of such requirements as: the products covered by the directive, the products excluded by the directives, and differences in the essential requirements for different types of machinery. The guide contains the text of the directive and a list of applicable standards. The guide also references appropriate sections of **NIST Special Publication 951 A Guide to EU Standards and Conformity Assessment** for further information on some of the generic conformity assessment concepts and requirements of the EU's New Approach.

Keywords: CEN; CENELEC; conformity assessment; directives; European Union; New Approach directives; machinery directive; technical construction files; user manuals

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The Machinery Directive¹

Directive 98/37/EC

Applicable since June 22, 1998²

To Be Considered:

Legal Obligations Other Than Those Imposed by the Machinery Directive:

European Directives most likely to involve machinery are Electromagnetic Compatibility (Directive 89/336/EEC, as amended), Electrical Safety (Directive 73/23/EEC, as amended), Simple Pressure Vessels (Directive 87/404/EEC, as amended), Pressure Equipment (Directive 98/23/EC) Equipment Designed For Use In Potentially Explosive Atmospheres (Directive 94/9/EEC) and Gas Appliances (Directive 90/396/EEC, as amended).

Note: *The Manufacturer may determine how his or her machinery relates to other Directives by analyzing hazards. In fact, the Manufacturer is obliged to conduct a risk assessment of the machine. The principles that can be used to evaluate risks can be found in European Standard EN 292 – Parts 1 and 2 (machine safety, basic concepts, general design principles) and in EN 1050 (machine safety, risk assessment principles).*

Relationships to Other Directives:

- 1. Article 1(5) of the Machinery Directive states that “Where... the risks are mainly of electrical origin, such machinery shall be covered exclusively by Directive 73/23/EEC” (The Low Voltage Directive). Examples of machinery whose risks are mainly of electrical origin are household appliances; and it is generally accepted that they are covered exclusively by the Low Voltage Directive. However, it must be obvious that industrial equipment or machinery for professional use must be governed by the Machinery Directive, since there are far more risks associated with the use of such equipment than those with electrical origins. For compliance with the electrical safety provisions of the Machinery Directive, the manufacturer should look for guidance to standardization (i.e., standards developed by CEN, CENELEC or IEC). (See: Machinery Harmonized Standards at the end of this report and the list of Low Voltage Harmonized Standards in NIST GCR 01-812 A Guide to the EU Low Voltage Directive).*

¹ Readers of this report may wish to refer to NIST SP 951 A *Guide to EU Standards and Conformity Assessment*, which is available on NIST’s website at: <http://ts.nist.gov/ca>.

² A recast of the Machinery Directive has been proposed. The proposed recast version does not include any fundamental changes, particularly as regards conformity assessment. Its primary intent is to clarify the text. The proposal, however, does include certain additional products.

It should be noted, however, that the use of standards developed by CEN, CENELEC, ISO or IEC is not mandatory (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 10).

2. *Manufacturers whose machinery is intended for use in a non-explosive (or normal, i.e., an atmosphere that is not created by the machine itself) atmosphere should apply the Machinery Directive exclusively to the equipment in question.*

However, manufacturers whose machinery is intended for use in explosive atmospheres should apply both the Machinery Directive plus the specific and relevant requirements of the Directive on Equipment and Protective Systems in Potentially Explosive Atmospheres (94/9/EC). That is, machinery intended for use in explosive atmospheres must meet the essential requirements of the Machinery Directive and the specific and relevant essential requirements of the Explosive Atmospheres Directive as well. There are exceptions. Machines where the danger of explosion comes exclusively from the presence of explosive materials or unstable chemical materials are covered exclusively by the Machinery Directive. See Essential Requirements, Section g. Explosion, Page 18 of this document.

3. *If equipment satisfies the provisions of the Directive on Electromagnetic Compatibility (89/336/EEC), it may also satisfy the Machinery Directive's provision on Radiation. See Essential Requirements, Section j. Radiation, Page 19 of this document.*
4. *The manufacturer's attention is called to Directive 92/58/EEC, which lays down minimum requirements for signs at the workplace. See Essential Requirements Note on Page 23 of this document. The manufacturer of a machine, however, need only be concerned with signs that have to do with the safety of the equipment and not with social obligations (such as the training of workers). The manufacturer may be guided by this directive to help him or her distinguish between warning signs, alarm signs, mandatory signs, first aid signs, etc. The annexes to the Directive show the graphics of signs and rules for acoustic and luminous signals.*
5. *The manufacturer should also be aware that there is a European law (Directive 89/655/EEC) and there are local (national) regulations that place some of the burden of safety on professional machine users. Employers, for example, must provide certain training and worker information and take some responsibility for providing instructions on the use of machinery. Likewise, the manufacturer is not responsible for modifications to a new machine by the user. The Declaration of Conformity (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 26) only covers the machine in its original state.*

Purpose of the Directive on Machinery

The purpose of the Machinery Directive is to integrate safety into the design, production, adjustment, maintenance, assembly and dismantling of machines, and thereby reduce, as far as possible, the risk of accidents and harm to persons at risk.

I. Basic Steps to Compliance

A. Determining Whether or Not the Product Has To Comply with the Machinery Directive

1. Products Covered by the Directive

This Directive applies to two families of products: machinery and similar equipment, and safety components.

A product is a “machine,” and must comply with this Directive if it is an assembly of linked parts or components, at least one of which moves, with the appropriate actuators, control and power circuits, etc., joined together for a specific application, in particular for the processing, treatment, moving or packaging of a material.

A product is also a “machine” or is “machinery” if it is an *assembly* of machines that are arranged and controlled so that they function as an integral whole.

“Machinery” is also interchangeable equipment modifying the function of a machine which is placed on the market for the purpose of being *assembled* with a machine or a series of different machines or with a tractor by the operator himself insofar as this equipment is not a spare part or a tool.

A “safety component” is a component, provided that it is not interchangeable equipment, which the Manufacturer or his Authorized Representative places on the market to fulfill a safety function when in use, the failure or malfunctioning of which endangers the safety or health of exposed persons.

The following are examples of "safety components:"

- emergency stopping devices;
- non-return valves designed as safety devices for equipment's hydraulic systems;
- safety belts and restraining devices in the event of overturning;

- control or monitoring modules of safety-related parts of control systems, such as the position detectors in a locking mechanism;
- products preventing undesired operation of machinery;
- products preventing repetition of a machine cycle;
- temperature-control products or systems to keep machinery within safe operating limits;
- smoke or dust extraction systems for machinery;
- guards and their locking mechanisms;
- noise reduction enclosures;
- anti-derailment mechanisms for suspended lifting machinery;
- load control devices for lifting equipment; and
- hold-to-run controls.

2. Products Excluded from the Directive

The following products are excluded from the scope of this Directive:

- machinery whose only power source is directly applied manual effort, unless it is a machine used for lifting or lowering loads (*Note: Lifting equipment, even if powered by directly applied human effort, such as jacks, hoists and hand winches, is covered by the Machinery Directive because it presents particular hazards, even if it lifts only to a low height*);
- machinery for medical use used in direct contact with patients;
- special equipment for use in fairgrounds and/or amusement parks;
- steam boilers, tanks and pressure vessels;
- machinery specially designed or put into service for nuclear purposes which, in the event of failure, may result in an emission of radioactivity;
- radioactive sources forming part of a machine;
- firearms;
- storage tanks and pipelines for petrol, diesel fuel, inflammable liquids and dangerous substances;

- means of transport, i.e., vehicles and their trailers intended solely for transporting passengers by air or on road, rail or water networks, as well as means of transport in so far as such means are designed for transporting goods by air, on public road or rail networks or on water. Vehicles used in the mineral extraction industry are included;
- seagoing vessels and mobile offshore units together with equipment on board such vessels or units;
- cableways, including funicular railways, for the public or private transportation of persons;
- agricultural and forestry tractors;
- machines specially designed and constructed for military or police purposes;
- lifts which permanently serve specific levels of buildings and constructions, having a car moving between guides which are rigid and inclined at an angle of more than 15 degrees to the horizontal and designed for the transport of:
 - persons,
 - persons and goods, and
 - goods alone if the car is accessible, that is to say, a person may enter it without difficulty, and fitted with controls situated inside the car or within reach of a person inside.

(Note: "Lifts which permanently serve ..." are excluded. They are covered by the "lifts" Directive 95/16/EC, but lifting platforms moving vertically or obliquely intended for the transport of handicapped persons are covered by the Directive, as are similar devices fitted on staircases.);

- means of transport of persons using rack and pinion rail mounted vehicles;
- mine winding gear;
- theatre elevators; and
- construction site hoists.

B. Essential Requirements

The Essential Requirements, the heart and bulk of the Machinery Directive, are found in their official version in *Annex I* of the text. Compliance with the essential requirements is *mandatory where the hazard exists in the machine*. They are grouped into the following categories:

1. Essential Requirements

- General
- Controls
- Protection Against Mechanical Hazards
- Required Characteristics of Guards and Protection Devices
- Protection Against Other Hazards
- Maintenance
- Indicators

2. Essential Health And Safety Requirements For Certain Categories Of Machinery

- Agri-Foodstuffs Machinery
- Portable Hand-Held And/Or Hand-Guided Machinery
- Machinery For Working Wood And Analogous Materials

3. Essential Health And Safety Requirements To Offset The Particular Hazards Due To The Mobility Of Machinery

4. Essential Health And Safety Requirements To Offset The Particular Hazards Due To A Lifting Operation

5. Essential Health And Safety Requirements For Machinery Intended For Underground Work

6. Essential Health And Safety Requirements To Offset The Particular Hazards Due To The Lifting Or Moving Of Persons

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1. Essential Requirements

General

*The principles outlined in this section are the basic concepts that underlie safety integration and, as such, illustrate the purpose of the Machinery Directive in the most general terms. **The Principles of Safety Integration apply to all machinery covered by the Directive. The manufacturer is responsible for assessing the risks and hazards associated with the machine during the design stage and relating them to the corresponding requirements in this Directive. There is a European standard to guide manufacturers of machinery in the process of risk assessment (EN 1050).***

The Principles of Safety Integration

- Machinery must be, in the words of the Directive, “fitted for its function;” and when used under conditions foreseen by the manufacturer, it must not put persons at risk of injury when it is operated, adjusted, or maintained.

Safety must be integrated at the design stage and considered throughout the foreseeable lifetime of the machinery, from assembly to dismantlement and in foreseeable abnormal situations.

Here, in attempting to apply the “foreseeable lifetime and abnormal situations” concept, the manufacturer must rely not only on his or her risk assessment, but also on experience, feedback from customers, logic, and common sense. The manufacturer is only required to take the foreseeable lifetime of the machinery into account when it has a direct effect on the safety of the equipment. Durability likewise does not fall under the scope of the Directive where it does not concern safety.

- The manufacturer must apply the following principles:
 - Eliminate or reduce risks as far as possible.
 - Take necessary protection measures to address risks that cannot be eliminated.
 - Inform users of residual risks, indicate where training is required, and specify any need for personal protective equipment.

The manufacturer must specify the uses of the machine in the instructions. This includes the processes of assembling and dismantling, when accidents often occur. For example, the manufacturer must specify which assembling and dismantling operations are appropriate for the customer to perform or when assembly may be beyond the technical capacity of the customer and should be performed by a specialist. In any case, the manufacturer is

obliged to provide clear instructions on the assembly, uses, and dismantling of the machine.

Instructions should also indicate the ways in which machinery is not to be used.

- The manufacturer must envisage not only the normal use of the machinery, but also uses that could reasonably be expected.
- The machinery must be designed to prevent abnormal use if such use would engender a risk.
- Discomfort, fatigue and psychological stresses upon the operator must be reduced to the minimum possible. (See *Machinery Harmonized Standards* for ergonomics standards listed at the end of this report)
- The manufacturer must take into account the possible use of personal protective equipment and the constraints they will put upon the operator. *Note: The use of personal protective equipment worn to prevent risks inherent in the machinery must be part of the information supplied by the manufacturer in the instructions.*
- Machinery must be supplied with any special equipment or accessories that will enable it to be maintained and used without risk.

Note: The manufacturer should also be aware that there is a European law (Directive 89/655/EEC) and there are local (national) regulations that place some of the burden of safety on professional machine users. Employers, for example, must provide certain training and worker information and take some responsibility for providing instructions on the use of machinery. Likewise, the manufacturer is not responsible for modifications to a new machine by the user. The Declaration of Conformity (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 26) only covers the machine in its original state.

- Material that is used to construct the machinery or products used and created during its use must not put people at risk or endanger their safety or health. Where fluids are used, for example, machines must be designed for use without risks during filling, use, recovery, or draining.
- The manufacturer must supply suitable lighting where its lack is likely to cause a risk, even when there is normal ambient lighting. There should be no shadows, dazzles, and no dangerous stroboscopic effects due to the lighting provided by the manufacturer. Internal parts requiring frequent inspection and adjustment and maintenance areas, must also be provided with appropriate lighting.

In other words, the lighting that the manufacturer is responsible for is in the work area of the machine and, if necessary, in the internal parts of the machine. The manufacturer is not responsible for the lighting of the workplaces of the users.

- Machinery must be designed so that it can be handled safely, be packaged or designed so that it can be stored safely and without damage.

If the machinery cannot be moved by hand due to weight, size, or other constraints, it (or each component part) must have attachments for lifting gear, or be designed so that it can be fitted with such attachments, or be shaped so that standard lifting gear can easily be attached.

Machinery that is to be moved by hand must either be easily movable or have equipment such as handgrips so that it can be picked up and moved safely.

Special arrangements must be made for the handling of tools and/or machinery parts (even if lightweight) that could be dangerous.

Moving and lifting requirements are also applicable to the risks involved in the handling of fixtures and interchangeable equipment when using, servicing, or adjusting the machine.

Controls

a. Control Systems

- Control systems must be safe and reliable. They must be able to withstand the rigors of normal use and external factors, and errors in logic must not lead to dangerous situations.

It is important not to confuse a control system with a control device. The device (see next section) is the external part of the control system.

b. Control Devices

Control devices must be:

- Clearly visible, identifiable, and marked. The manufacturer should attempt to use standard symbols, colors, and pictograms whenever possible. ISO Standard 7000 for graphic symbols, for example, can assist, especially in identifying control devices in the language of the user.
- Positioned for safe operation; i.e., they should be easily seen and reached by the operator. They can also be placed in subassemblies.

- Designed so that movements are consistent with effect.
- Located outside danger zones (except where necessary, as in the case of consoles for training robots).
- Positioned to not cause additional risk.
- Designed or protected so that they may not operate without intent, and
- Able to withstand foreseeable strain (particularly emergency stop devices).
- Where designed and constructed to perform more than one action, the action that is going to be performed must be clearly displayed and confirmed.
- Layout, travel, and resistance to operation must be compatible with the action to be performed. Ergonomic principles and personal protection equipment must be taken into account.
- Dials and signals required for safe operation must be fitted to the machinery and they must be readable from the control position.
- From the control position, the operator shall be able to make sure there are no persons in the danger zones.
- If this is impossible, the control system must provide an acoustic and/or visual warning signal when the machine is about to start. Blind spots must be reduced as much as possible. The signal must give a person the time to prevent the machinery from starting up.

c. Starting

- Starting a machine must be the result of intentional action. The same principle applies to *restarting* machinery after a stoppage, (whatever the cause), and when a *change* takes place, such as in speed or pressure, unless the restarting involves no risk.
- This requirement does not apply to restarts or changes if they are part of a normal automatic cycle.

d. Stopping Device

1. Normal Stopping

- Each machine must have a control that will bring the machine to a complete stop. Each workstation (for example, in automated production where operations are connected) must have a control that will stop some or all moving parts of the machinery, depending on the type of hazard. The stop controls will have priority over start controls.
- Once the machinery (or its dangerous parts) has stopped, the energy supply to the actuators must be cut off if there is a source of risk.

2. Emergency Stopping

- Each machine must have an emergency stop device, *except*
 - where an emergency stop will not lessen the risk, or

- for hand-held portable machines and hand-guided machines.
- The emergency stop device must:
 - have controls that are identifiable, clearly visible, and quickly accessible;
 - stop the dangerous process as quickly as possible (without creating additional hazards); and
 - where necessary, trigger safeguard movements.
- Once the emergency stop control has been actuated, the emergency stop order must be maintained until it is specifically overridden, or reactivated. It must be impossible to engage the device without triggering a stop command. Disengaging the device must not restart the machinery.
- When machinery or parts of machinery work together in complex installations, the stop controls and the emergency stop must stop the machinery and all equipment upstream and/or downstream if continued operation can be dangerous.

e. Mode Selection

- The control mode selected must have priority over all the others, except the emergency stop device.
- Where there are several control or operating modes, there should be a mode selector which can be locked into each position. The operator should be able to make a choice based on unequivocal action on the control device.
- If the machine must operate with neutralized protection devices (such as when one must work inside the machine), then the mode selector must simultaneously
 - disable the automatic control mode,
 - permit movements only by controls requiring sustained action,
 - permit the operation of dangerous moving parts in enhanced safety conditions (such as reduced speed) while preventing hazards from linked sequences, i.e., machinery should only be operable on a step-by-step basis, and
 - prevent any dangerous movement by acting voluntarily or involuntarily on the machine's internal sensors.
- A person adjusting the machinery must be able to control operation of the parts he is working on and have a clear view of the mechanisms he is controlling.

f. Failure of the Power Supply

Note: The manufacturer of machinery is not responsible for defects in the electrical system of the site or establishment that will house the machine. The manufacturer should, however, provide for protection against electrical failures that will cause sudden start-up by making the machine's control circuit electrically separate from the one of the place of use. The manufacturer is cautioned as well to take preventive measures against all risks associated with failure in the power supply system.

Likewise, the manufacturer is not responsible for voltage failures (“dips” or drops in voltage that can cause short-term power failures) or surges (caused by storms, for example). The manufacturer may, however, have to provide protection relays at “threshold voltage” or at the electronic equivalent.

Electromagnetic disturbances are covered by Directive 89/336/EEC on Electromagnetic Compatibility.

The interruption, re-establishment after an interruption, or fluctuation in the power supply must not lead to a dangerous situation. Although electricity is the form of energy most often used to operate machinery, other forms of energy, especially hydraulic and pneumatic energy, may cause fluctuations as well. In any case, an interruption must not:

- cause the machinery to start unexpectedly;
- prevent the machinery from stopping if the command has already been given;
- cause a moving part of the machinery to fall or be ejected;
- impede the automatic or manual stopping of the moving parts; or
- compromise the protection devices.

g. Failure of the Control Circuit

A fault in the control circuit logic, or failure or damage to the control circuit must not lead to dangerous situations. In particular,

- the machinery must not start unexpectedly;
- must not be prevented from stopping if the command has already been given;
- there must be no falling or ejection of moving parts of the machinery;
- automatic or manual stopping of the moving parts must not be impeded;
- protection devices must not be compromised; and
- there must be incorporation of safety in the concept of control logic.

Note: The manufacturer is cautioned to pay particular attention to inter-connected components. Hardwired logic circuits may be susceptible to electromagnetic disturbances and fluctuations in supply voltage. In the case of programmed logic circuits, the manufacturer is cautioned to consider sequential failures in instructions set by microprocessors.

h. Software

Interactive software between the operator and the command or control system of a machine must be user-friendly, i.e., easily usable by people who are not specialists.

Note: It may also mean that on-screen instructions need to be in a language understood by the user. Whether or not software needs to be translated will depend on the machine

and the level of operator training planned by the manufacturer. The most important thing is that the operator understands the software.

Protection Against Mechanical Hazards

a. Stability

Machines must be stable. They must be balanced and should not overturn, fall, or make any unexpected movements. If a machine is not stable, then it must be anchored, and the instructions for installation must include appropriate means of anchorage.

Environmental conditions must be taken into consideration. For example, a manufacturer should take into account the effects of wind and/or snow on the operators and the stability of exposed machinery. The machine should remain stable during use and dismantling.

b. Risk of Break-up During Operation

- Machines must be able to withstand all stresses to which they are subject when used and as foreseen by the manufacturer. The manufacturer should take into account such aspects as resistance, linkage, the quality of the assembly components, such as screws and bolts, and methods of permanent assembly, such as welding and gluing.
- Durability of the materials used in the manufacture of the machine must be adequate. Material durability might take into account such factors as tensile strength, fatigue, aging, corrosion, hardness, abrasion, and shock, water, fire or heat resistance.
- The manufacturer must provide (in the instructions) the type and frequency of inspection and maintenance required for safety. Parts subject to wear and criteria for replacement must also be indicated.
- Where a risk of rupture or disintegration remains despite the measures taken (e.g., as with grinding wheels), moving parts must be mounted and positioned in such a way that in case of rupture their fragments will be contained.
- Rigid and flexible pipes carrying fluids (particularly those under high pressure) must withstand foreseeable internal and external stresses and must be firmly attached and/or protected against external stresses and strains. Precautions must be taken to ensure that a rupture poses no risk.
- Where material to be processed is automatically fed to the tool, the tool must have attained its normal working conditions when the work piece comes into contact with it.
- When the tool starts and/or stops (intentionally or accidentally), the feed movement and the tool movement must be coordinated.

c. Falling or Ejected Objects

- Precautions (such as installing a protective shield) must be taken to prevent risks from falling or ejected objects (such as work pieces, tools, cuttings, fragments, waste, etc.).

d. Risks due to Surfaces, Edges or Angles

- In so far as their purpose allows, accessible parts of the machinery must have no sharp edges, no sharp angles, and no rough surfaces likely to cause injury. A special risk assessment should be made of parts next to passageways, workstations and handling areas.

e. Risks Related to Combined Machinery

- When machinery is intended to carry out several different operations with manual removal of the piece between successive operations, each element must be able to be used separately without the other elements constituting a danger or risk for the exposed person. It must be possible to start and stop separately any elements that are not protected.

f. Risks Related to Variations in the Rotational Speed of Tools

- When the machine is designed to perform operations under different conditions (different speeds or energy supply), the user must be able to regulate the operating conditions (such as speed) without risk or danger.

g. Prevention of Risks Related to Moving Parts

- The moving parts of machinery must be designed, built, and laid out so as to avoid hazards. Where hazards persist, machinery must be fixed with guards or protective devices in such a way as to prevent all risk of contact that could lead to accidents. This provision applies to moving parts that convey movement (shafts, cylinders, rods, slides, belts, chains, sprockets, etc.) and to work elements (tools, moulds, matrices, rolls, mixing arms).
- All necessary steps must be taken to prevent accidental blockage of moving parts. Where blockages are likely to occur in spite of precautions, the manufacturer should provide specific protection devices or tools, the instruction handbook, and possibly a sign on the machinery to enable the equipment to be safely unblocked. In other words, the manufacturer should, through instructions, provide for a hazard-free unblocking process.

h. Choice of Protection Against Risks Related to Moving Parts

- Guards or protection devices for moving parts *must be related to the type of risk.*

Note: The following points are guidelines and should be taken as such rather than absolute legal requirements.

For example,

- **Moving Transmission Parts:** Guards that protect against risks associated with moving transmission parts (pulleys, belt, gears, rack and pinions, shafts, etc.) must be either fixed or movable (See next section on Guards and Protection Devices).
- **Moving Parts Directly Involved in the Process:** Guards or protection devices against risks associated with moving parts contributing to the work (cutting tools, moving parts of presses, cylinders, etc.) must be wherever possible fixed, or otherwise movable or protection devices such as sensing devices, remote-hold protection devices, or protection devices intended automatically to prevent all or part of the operator's device from encroaching on the danger zone (See next section on Required Guards and Protection Devices).

When moving parts directly involved in the process cannot be made inaccessible during operation, such parts must be fitted with (wherever technically possible):

- Fixed guards preventing access to those sections of the parts that are not used in the work or adjustable guards restricting access to those sections of the moving parts that are strictly for the work (See next section on Guards and Protection Devices).

Required Characteristics of Guards and Protection Devices

Note: A guard is part of a machine used to provide protection by means of a physical obstacle. The guard can be a casing, a lid, a door, an enclosure, etc. The choice of guard is up to the manufacturer and should be made relative to foreseeable risk. However, the manufacturer must make sure that guards or protection devices do not create other risks.

a. General Requirements

Guards and protection devices must

- Be of robust construction;
- Not give rise to any additional risk;
- Not be easy to by-pass or render non-operational;

- Be located at an adequate distance from the danger zone;
- Cause minimum obstruction to the view of the production process; and
- Enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by restricting access only to the area where the work has to be done, if possible without the guard or protection device having to be dismantled.

b. Special Requirements for Guards

- Fixed Guards: must be securely held in place, fixed by systems that can be opened only with tools, and wherever possible, they must be unable to remain in place without their fixings.
- Movable Guards:
 - Type A (Interlocking): Must as far as possible remain fixed to the machinery when open, be associated with a locking device to prevent moving parts starting up as long as they are accessible and to give a stop command whenever they are no longer closed.
 - Type B (Interlocking with Guard Locking): Must be designed and incorporated into the control system so that moving parts cannot start up while they are within the operator's reach, an exposed person cannot reach moving parts once they have started up, they can be adjusted only by means of an intentional action (such as the use of a tool), the absence or failure of one of their components prevents starting or stops the moving parts, and protection against any risk of ejection is provided by means of an appropriate barrier.
- Adjustable Guards Restricting Access: Adjustable Guards restricting access to those areas of the moving parts strictly necessary for the work must:
 - be adjustable manually or automatically according to the type of work involved;
 - be readily adjustable without the use of tools; and
 - reduce as far as possible the risk of ejection.

c. Special Requirements for Protection Devices

Protection devices must be designed and incorporated into the control system so that:

- Moving parts cannot start up while they are within the operator's reach.
- The exposed person cannot reach moving parts once they have started up.
- They can be adjusted only by means of an intentional action such as the use of a tool.

- The absence or failure of one of their components prevents starting or stops the moving parts.

Protection Against Other Hazards

a. Electricity Supply

Where machinery has an electricity supply it must be designed, constructed and equipped so that all hazards of an electrical nature are or can be prevented. In other words, machines must be equipped to avoid direct contact between a person and an active conductor or a normally live conductive component.

The specific rules in force relating to electrical equipment designed for use within certain voltage limits must apply to machinery, which is subject to those limits.

Note: The “specific rules in force relating to electrical equipment” refer to the Low Voltage Directive (73/23/EEC). However, Article 1(5) of the Machinery Directive states that “Where... the risks are mainly of electrical origin, such machinery shall be covered exclusively by Directive 73/23/EEC” (The Low Voltage Directive). Examples of machinery whose risks are mainly of electrical origin are household appliances; and it is generally accepted that they are covered exclusively by the Low Voltage Directive. However, it must be obvious that industrial equipment or machinery for professional use must be governed by the Machinery Directive, since there are far more risks associated with the use of such equipment than those with electrical origins. For compliance with the electrical safety provisions of the Machinery Directive, the manufacturer should look for guidance to standardization in the electro-technical sector (i.e., standards developed by CENELEC or IEC). See also the list of Machinery Harmonized Standards at the end of this report and the list of Low Voltage Harmonized Standards in NIST GCR 01-812 A Guide of the EU Low Voltage Directive.

It should be noted, however, that the use of standards developed by CEN, CENELEC, ISO or IEC is not mandatory. (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 10.)

b. Static Electricity

Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system.

c. Energy Supply Other Than Electricity

Where machinery is powered by an energy other than electricity (e.g. hydraulic pneumatic or thermal energy, etc.), it must be so designed, constructed and equipped as to avoid all potential hazards associated with these types of energy.

Example: Energy build-up of pressurized fluids may present risks to maintenance personnel. When this is a possibility, the manufacturer should provide procedures and instructions for safe handling.

d. Errors of fitting

When fitting or refitting certain parts, errors, which could be a source of risk, must be made impossible by the design of such parts. For example, the manufacturer might avoid symmetrical parts. If this is not possible, pertinent information must be given on the parts themselves and/or the housings. The same information must be given on moving parts and/or their housings where the direction of movement must be known. Any further information that may be necessary must be given in the instructions.

Where a faulty connection can be the source of risk, incorrect fluid connections, including electrical conductors, must be made impossible by the design or, failing this, by information given on the pipes, cables, etc. and/or connector blocks.

e. Extreme temperatures

There should be no risk of injury caused by contact with or proximity to machinery parts or materials at high or very low temperatures. The risk of hot or very cold material being ejected should be assessed. Where this risk exists, the necessary steps must be taken to prevent it or, if this is not technically possible, to render it non-dangerous.

f. Fire

Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dust, vapors or other substances produced or used by the machinery.

Note: The manufacturer should rely on codes of good practice and/or the regulations in force on electrical safety. On some machines, there should be fire extinguishers and perhaps even an integrated extinguishing system.

g. Explosion

Machinery must be designed and constructed to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dust, vapors or other substances produced or used by the machinery. To that end the manufacturer must take steps to:

- avoid a dangerous concentration of products;
- prevent combustion of the potentially explosive atmosphere; and
- minimize any explosion, which may occur so that it does not endanger the surroundings.

Note: The above provisions refer to intrinsic risks of explosion that may arise either from the substances worked or produced by the machine or from the operating parameters of the machine itself. However, a machine can contain an explosive atmosphere in one or more of its components (such as a ventilating system). Such internal components that function in an explosive atmosphere must adhere to the provision below.

The same precautions must be taken if the manufacturer foresees the use of the machinery in a potentially explosive atmosphere. Electrical equipment that is part of the machinery must conform, as far as the risk from explosion is concerned, to the relevant provisions of Directive 94/9/EEC on Equipment and Protective Systems in Potentially Explosive Atmospheres.

Note: Manufacturers whose machinery is intended for use in a non-explosive (or normal, i.e., an atmosphere that is not created by the machine itself) atmosphere should apply the Machinery Directive exclusively to the equipment in question.

Manufacturers whose machinery is intended for use in explosive atmospheres should apply both the Machinery Directive plus the specific and relevant requirements of the Directive on Equipment and Protective Systems in Potentially Explosive Atmospheres. That is, machinery intended for use in explosive atmospheres must meet the essential requirements of the Machinery Directive and the specific and relevant essential requirements of the Explosive Atmospheres Directive as well. There are exceptions. Machines where the danger of explosion comes exclusively from the presence of explosive materials or unstable chemical materials are covered exclusively by the Machinery Directive.

h. Noise

Risks resulting from the emission of airborne noise must be reduced to the lowest level, taking account of technical progress and the availability of means of reducing noise, in particular at source.

i. Vibration

Risks resulting from vibrations produced by the machinery must be reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source.

j. Radiation

Emission of radiation must be limited to the extent necessary for its operation. It must have no effect on exposed persons or it must be reduced to non-dangerous proportions.

Some machinery has to emit radiation to operate (X-rays, gamma rays, electromagnetic fields, etc.). Radiation must be limited to what is necessary for the machine to operate.

The aim of the provision is that radiation not cause harmful effects on people (and pets and property). Distance can reduce the hazard of radiation (as well as noise, nuclear radiation or electromagnetic radiation), as well as a physical obstacle between the radiation and exposed persons.

Note: If the equipment satisfies the provisions of the Directive on Electromagnetic Compatibility (89/336/EEC), it may also satisfy the Machinery Directive's provision on Radiation, since in the current state of the art, levels of exposure to electromagnetic radiation that will affect human health are above levels that cause interference to equipment. The manufacturer is warned, however, to be aware of limit values for operator exposure for some types of radiation and of his or her obligation to provide appropriate protection (such as distance or a physical obstacle).

- External radiation

Machinery should be designed and constructed so that external radiation does not interfere with its operation.

- Laser equipment
 - Laser equipment on machinery must be designed and constructed so as to prevent any accidental radiation.
 - Laser equipment on machinery must be protected so that effective radiation, radiation produced by reflection or diffusion and secondary radiation do not damage health.
 - Optical equipment for the observation or adjustment of laser equipment on machinery must be such that the laser rays create no health risk.

Note: Manufacturers are advised to consult the numerous standards that exist on laser and other forms of radiation.

k. Emissions of dust, gases, etc.

Machinery must be so designed, constructed and/or equipped that risks due to gases, liquids, dust, vapors and other waste materials that it produces can be avoided.

Where a hazard exists, the machinery must be so equipped that the said substances can be contained and/or evacuated.

Where machinery is not enclosed during normal operation, the devices for containment and/or evacuation must be situated as close as possible to the source emission.

Note: Manufacturers are advised to be aware of other Community (or national) Directives that regulate emission limits (such as for diesel engines), and discharges into water or the atmosphere.

l. Risk of being trapped in a machine

Machinery must be designed, constructed or fitted with a means of preventing an exposed person from being enclosed within it or, if that is impossible, with a means of summoning help.

m. Risk of slipping, tripping or falling

Parts of the machinery where persons are liable to move about or stand must be designed and constructed to prevent persons slipping, tripping or falling on or off these parts.

Maintenance

a. Machinery maintenance

- Adjustment, lubrication and maintenance points must be located outside danger zones. It should be possible to carry out adjustment, maintenance, repair, cleaning and servicing operations while machinery is at a standstill.
- If one or more of the above conditions cannot be satisfied for technical reasons, these operations must be possible without risk. (See 2. Controls, Section e. Mode Selection on Page 11.)
- In the case of automated machinery and, where necessary, other machinery, the manufacturer must make provision for a connecting device for mounting diagnostic fault-finding equipment.
- Automated machine components which have to be changed frequently, in particular for a change in manufacture or where they are liable to wear or likely to deteriorate following an accident, must be capable of being removed and replaced easily and in safety. Access to the components must permit these tasks to be carried out with the necessary technical means (tools, measuring instruments, etc.) in accordance with an operating method specified by the manufacturer.

b. Access to operating position and servicing points

The manufacturer must provide means of access (stairs, ladders, catwalks, etc.) to allow access in safety to all areas used for production, adjustment and maintenance operations.

c. Isolation of energy sources

- All machinery must be fitted with means to isolate it from all energy sources. Such isolators must be clearly identified. They must be capable of being locked if reconnection could endanger exposed persons. In the case of machinery supplied

with electricity through a plug capable of being plugged into a circuit, separation of the plug is sufficient.

- The isolator must also be capable of being locked if an operator is unable to check that the energy is still cut off from any of the points to which he has access.
- After the energy is cut off, it must be possible to dissipate normally any energy remaining or stored in the circuits of the machinery without risk to exposed persons.
- As an exception to the above requirements, certain circuits may remain connected to their energy sources in order, for example, to hold parts, protect information, light interiors, etc. In this case, special steps must be taken to ensure operator safety.

d. Operator intervention

- Machinery must be so designed, constructed and equipped that the need for operator intervention is limited.
- If operator intervention cannot be avoided, it must be possible to carry it out easily and in safety.

Note: Intervention procedures should be clearly detailed in the instructions so that operators do not improvise solutions that could be dangerous.

e. Cleaning of internal parts

The machinery must be designed and constructed in such a way that it is possible to clean internal parts that have contained dangerous substances or preparations without entering them. Any necessary unblocking must also be possible from the outside. If it is absolutely impossible to avoid entering the machinery, the manufacturer must take steps to allow cleaning to take place with the minimum of danger.

Indicators

a. Information devices

- The information needed to control machinery must be unambiguous and easily understood.
- It must not be excessive to the extent of overloading the operator.

- Where the health and safety of exposed persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning.

The concept of this provision is that exposed persons must be informed of risks.

b. Warning devices

- Where machinery is equipped with warning devices (such as signals, etc.), these must be unambiguous and easily perceived.
- The operator must have facilities to check the operation of such warning devices at all times.
- The requirements of the specific Directives concerning colors and safety signals must be complied with.

Note: The manufacturer's attention is called to Directive 92/58/EEC, which lays down minimum requirements for signs at the workplace. However, the manufacturer of a machine need only be concerned with signs that have to do with the safety of the equipment and not social obligations (such as the training of workers). The manufacturer may be guided by this directive to help him or her distinguish between warning signs, alarm signs, mandatory signs, first aid signs, etc. The annexes to the Directive show the graphics of signs and rules for acoustic and luminous signals.

c. Warning of residual risks

- Where risks remain despite all the measures adopted or in the case of potential risks that are not evident (e.g., electrical cabinets, radioactive sources, bleeding of a hydraulic circuit, hazard in an unseen area, etc.), the manufacturer must provide warnings. Residual risks are risks that remain after all design-integrated safety measures have been exhausted.
- Such warnings should preferably use readily understandable pictograms and/or be drawn up in one of the languages of the country in which the machinery is to be used, accompanied, on request, by the languages understood by the operators.

d. Marking

1. All machinery must be marked legibly and indelibly (i.e., resistant to normal erasure) with the following minimum particulars:

- name and address of the manufacturer;
- the CE marking (see *Annex III of the Directive*);
- designation of series or type;

- serial number, if any; and
- the year of construction.

2. Furthermore, where the manufacturer constructs machinery intended for use in a potentially explosive atmosphere, this must be indicated on the machinery.

Note: The manufacturer should refer here to Directive 94/9/EEC, Equipment and Protective Systems in Potentially Explosive Atmosphere, for specific markings.

3. Machinery must also bear full information relevant to its type and essential to its safe use (e.g., maximum speed of certain rotating parts, maximum diameter of tools to be fitted, mass, etc.).

4. Where a machine part must be handled during use with lifting equipment, its mass must be indicated legibly, indelibly and unambiguously.

5. The interchangeable equipment referred to in the third indent of Article 1(2)(a), “*an assembly of machines which, in order to achieve the same end, are arranged and controlled so that they function as an integral whole,*” must bear the same information.

e. Instructions

Manufacturers have a legal obligation to provide information that affects the safety of the user. The manufacturer is likewise obligated to obtain relevant information from suppliers (of components for example) and incorporate that information into his or her own instructions.

The Directive’s requirements on instructions are specific and detailed, and the intent is not only to inform on matters of safety, but also to help clarify responsibilities of the manufacturer and the user.

Note: Information supplied in catalogs will not satisfy this requirement. An instructions document must be physically transmitted to each buyer of the machine.

1. All machinery must be accompanied by instructions that include at least the following:

- a repeat of the information with which the machinery is marked, except the serial number, together with any appropriate additional information to facilitate maintenance (e.g. addresses of the importer, repairers, etc.);
- foreseen use of the machinery within the meaning of the *Principles of Safety Integration*;
- workstation(s) likely to be occupied by operators;
- instructions for safe:
 - putting into service,
 - use,

- handling, giving the mass of the machinery and its various parts where they are regularly to be transported separately,
- assembly, dismantling,
- adjustment,
- maintenance (servicing and repair);
- where necessary, training instructions; and
- where necessary, the essential characteristics of tools which may be fitted to the machinery.

Where necessary, the instructions should draw attention to ways in which the machinery should not be used.

2. The instructions must be drawn up in one of the Community languages by the manufacturer or his authorized representative established in the Community. *English is, of course, one of the official languages of the European Union.*

On being put into service, all machinery must be accompanied by a translation of the instructions in the language or languages of the country in which the machinery is to be used and by the instructions in the original language.

Note: The “original” instructions are the instructions for which the manufacturer accepts liability.

This translation must be done either by the manufacturer or his authorized representative established in the Community or by the person introducing the machinery into the language area in question. By way of derogation from this requirement, the maintenance instructions for use by specialized personnel employed by the Manufacturer or his Authorized Representative established in the Community may be drawn up in only one of the Community languages understood by that personnel.

3. The instructions must contain the drawings and diagrams necessary for putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the machinery, and all useful instructions in particular with regard to safety.

Note: For machinery that may be dangerous to repair, the manufacturer may reserve the right to maintain and repair the machine. This condition must be written into the instructions and contracts.

4. Any literature describing the machinery (*such as advertising*) must not contradict the instructions as regards safety aspects. The technical documentation describing the machinery must give information regarding the airborne noise emissions (referred to in Section 6 below) and, in the case of hand-held and/or hand-guided machinery, information regarding vibration as referred to in the section on portable hand-held and/or hand-guided machinery.

5. Where necessary, the instructions must give the requirements relating to installation and assembly for reducing noise or vibration (e.g., use of dampers, type and mass of foundation block, etc.).
6. The instructions must give the following information concerning airborne noise emissions by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery:
 - equivalent continuous A-weighted sound pressure level at workstations, where this exceeds 70 dB(A); where this level does not exceed 70 dB(A), this fact must be indicated;
 - peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 mPa); and
 - sound power level emitted by the machinery where the equivalent continuous A-weighted sound pressure level at workstations exceeds 85 dB(A).

In the case of very large machinery, instead of the sound power level, the equivalent continuous sound pressure levels at specified positions around the machinery may be indicated.

Where the harmonized standards are not applied, sound levels must be measured using the most appropriate method for the machinery.

The manufacturer must indicate the operating conditions of the machinery during measurement and what methods have been used for the measurement.

Where the workstation(s) are undefined or cannot be defined, sound pressure levels must be measured at a distance of 1 meter from the surface of the machinery and at a height of 1,60 meters from the floor or access platform. The position and value of the maximum sound pressure must be indicated.

Note: Certain types of construction machinery are subject to noise levels that are laid down in other Directives:

*84/533/EEC for compressors,
 84/534/EEC for tower cranes,
 84/535/EEC for welding generators,
 84/536/EEC for power generators,
 84/537/EEC for concrete breakers and picks,
 84/538/EEC for lawnmowers, and
 86/662/EEC for excavators, bulldozers, loaders and excavator-loaders.*

These Directives require the maximum sound power level “guaranteed” by the manufacturer to be marked on the machinery. These Directives are currently the

subject of a draft revision that is designed to generalize their application to all machinery used outdoors.

86/594/EEC is the Directive that specifies the method of measurement for domestic appliances.

7. If the manufacturer foresees that the machinery will be used in a potentially explosive atmosphere, the instructions must give all the necessary information.
(See Directive 94/9/EC, Equipment and Protective Systems in Potentially Explosive Atmospheres.)

8. In the case of machinery which may also be intended for use by non-professional operators, the wording and layout of the instructions for use, while respecting the other essential requirements mentioned above, must take into account the level of general education and acumen that can reasonably be expected from such operators.

2. Essential Health And Safety Requirements For Certain Categories Of Machinery

Agri-Foodstuffs Machinery

Machinery that prepares and processes foodstuffs (e.g., cooking, refrigeration, thawing, washing, handling, packaging, storage, transport or distribution), must be so designed and constructed as to avoid any risk of infection, sickness or contagion. In other words, this part of the Machinery Directive refers to any machine that is liable to come into contact with products intended for consumption. Manufacturers of machines that produce pet food should be reminded that the Directive states that machines must not compromise the safety and health of individuals or of *pets* (and goods) where they are used correctly. Therefore, machines that produce pet food must comply with this Directive.

The following hygiene rules must be observed:

- Materials in contact, or intended to come into contact, with the foodstuffs must satisfy the conditions set down in relevant Directives.

Note: The manufacturer should consult Directive 89/109/EEC on Materials And Articles Intended To Come Into Contact With Foodstuffs and 90/128/EEC concerning Plastic Materials And Articles Intended To Come Into Contact With Food.

The machinery must be so designed and constructed that these materials can be clean before each use.

- All surfaces, including their joinings, must be smooth, and must have neither ridges nor crevices which could harbor organic materials.
- Assemblies must be designed in such a way as to reduce projections, edges and recesses to a minimum. They should preferably be made by welding or continuous bonding. Screws, screwheads and rivets may not be used except where technically unavoidable.
- All surfaces in contact with the foodstuffs must be easily cleaned and disinfected, where possible after removing easily dismantled parts. The inside surfaces must have curves of a radius sufficient to allow thorough cleaning.
- Liquid deriving from foodstuffs, as well as cleaning, disinfecting and rinsing fluids, should be able to be discharged from the machine without impediment (possible in a 'clean' position).
- Machinery must be so designed and constructed as to prevent any liquids or living creatures, in particular insects, entering, or any organic matter accumulating in areas that cannot be cleaned (e.g., for machinery not mounted on feet or casters, by placing a seal between the machinery and its base, by the use of sealed units, etc.).
- Machinery must be so designed and constructed that no ancillary substances (e.g., lubricants, etc.) can come into contact with foodstuffs.
- Where necessary, machinery must be designed and constructed so that continuing compliance with this requirement can be checked.

Instructions

In addition to the information required in *Indicators, Section e . Instructions, on Page 24 of this document*, the instructions must indicate recommended products and methods for cleaning, disinfecting and rinsing (not only for easily accessible areas but also where areas to which access is impossible or unadvisable, such as piping, have to be cleaned in situ).

Note: the manufacturer must not merely mention a product brand of recommended cleaning products, but must define the products by their physical-chemical characteristics so that the person using the machine can obtain them easily and in all circumstances.

Portable Hand-Held And/Or Hand-Guided Machinery

Note: This requirement refers both to portable machines and non-portable machines whose use requires manual guiding of the work tool.

Portable hand-held and/or hand-guided machinery must conform to the following essential health and safety requirements:

- According to the type of machinery, it must have a supporting surface of sufficient size and have a sufficient number of handles and supports of an appropriate size and arranged to ensure the stability of the machinery under the operating conditions foreseen by the manufacturer.
- Except where technically impossible or where there is an independent control, in the case of handles which cannot be released in complete safety, it must be fitted with start and stop controls arranged in such a way that the operator can operate them without releasing the handles.
- It must be designed, constructed or equipped to eliminate the risks of accidental starting and/or continued operation after the operator has released the handles. Equivalent steps must be taken if this requirement is not technically feasible.
- Portable hand-held machinery must be designed and constructed to allow, where necessary, a visual check of the contact of the tool with the material being processed.

Instructions

The instructions must give the following information concerning vibrations transmitted by hand-held and hand-guided machinery:

- the weighted root mean square acceleration value to which the arms are subjected, if it exceeds 2.5 m/s^2 as determined by the appropriate test code. Where the acceleration does not exceed 2.5 m/s^2 , this must be mentioned. If there is no applicable test code, the manufacturer must indicate the measurement methods and conditions under which measurements were made.

Machinery For Working Wood And Analogous Materials

Machinery for working wood and machinery for working materials with physical and technological characteristics similar to those of wood (such as cork, bone, hardened rubber, hardened plastic material and other similar stiff material) must conform to the following essential health and safety requirements:

- The machinery must be designed, constructed or equipped so that the piece being machined can be placed and guided in safety. Where the piece is hand-held on a work-bench the latter must be sufficiently stable during the work and must not impede the movement of the piece.
- Where the machinery is likely to involve the risk of ejection of pieces of wood, it must be designed, constructed, or equipped to eliminate this ejection. In any case, the ejection must not engender risks for the operator and/or exposed persons.
- If there is a risk of contact with the tool whilst it runs down, the machinery must be equipped with an automatic brake that stops the tool in a sufficiently short time.
- If the tool is incorporated into a non-fully automated machine, the latter must be so designed and constructed as to eliminate or reduce the risk of serious accidental injury (by using cylindrical cutter blocks, restricting depth of cut, etc.).

Note: A note from the European Commission: "Apart from the German, all the language versions of the (last point above) are incorrect: mention is made of "limiting the depth of pass" although it should have said "limiting the thickness of the chipping;" it is in fact possible to work with a very great depth of pass if the feed of the tool is sufficiently low, while too great a chipping thickness leads either to the tool being blocked or, even more dangerously, the worked workpiece being rejected."

3. Essential Health And Safety Requirements To Offset The Particular Hazards Due To The Mobility Of Machinery

Note: The following requirements are to be considered (1) when the machine is moving while it is working, and (2) when the machine is being moved between phases of the work or between two work sites.

Risks due to mobility always exist when the machinery is self-propelled, towed or pushed or carried by other machinery or tractors, is operated in working areas and whose operation requires either mobility while working (be it continuous or semi-continuous movement), or between a succession of fixed working positions.

Risks due to mobility may also exist when machinery is operated without being moved, but is equipped in such a way that allows it to be moved from one place to another (machinery fitted with wheels, rollers, runners, etc. or placed on gantries, trolleys, etc.).

Rotary cultivators and power harrows are mentioned specifically. They are required to undergo testing. The Manufacturer or his Authorized Representative (See *NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 23*) must perform the appropriate tests or have such tests performed.

Note: The Directive formally lays down the requirement of carrying out tests only for a very limited number of machines: rotary cultivators and power hoes and self-propelled trucks.

General

Definition

“Driver” means an operator responsible for the movement of machinery. The driver may be transported by the machinery or may be on foot, accompanying the machinery, or may be guiding the machinery by remote control (cables, radio, etc.).

Lighting

If self-propelled machinery is to be used in dark places, it must be fitted with a lighting device appropriate to the work to be carried out, without prejudice to any other regulations applicable (road traffic regulations, navigation rules, etc.). (Machinery used for working underground is covered under 5, below.)

Design Of Machinery To Facilitate Its Handling

During the handling of the machine and/or its parts, there must be no sudden movements and/or no instability while the machine and/or its parts are being handled (in accordance with the manufacturer's instructions).

Work Stations

1. Driving position

- The driving position must be designed in accordance with ergonomic principles. Where there are two or more driving positions, each driving position must be provided with all the requisite controls. Where there is more than one driving position, the use of one must preclude the use of the others, except in emergency stops. Visibility from the driving position must be such that the driver can operate the machinery in complete safety and the safety of other exposed persons. Where necessary, appropriate devices must be provided to remedy inadequate direct vision.
- There must be no risk to the driver and operators on board from inadvertent contact with wheels or tracks.

- The driving position must not present any health risk due to exhaust gases and/or lack of oxygen.
- A cab must be provided for the driver if the environment of the machine is dangerous, unhealthy or uncomfortable. If there is room, the cab must have a place for the instructions needed for the driver and/or operators.
- If there is a cab, it should have good operating conditions and be protected against hazards (for instance: inadequate heating and ventilation, inadequate visibility, excessive noise and vibration, falling objects, penetration by objects, rolling over, etc.). The exit must permit rapid evacuation. An emergency exit must be provided in a direction which is different from the usual exit. The materials used for the cab and its fittings must be fire-resistant.

2. Seating

- The driving seat of any machinery must be stable and be designed with due regard to ergonomic principles. The seat must be designed so that vibrations transmitted to the driver are at the lowest level that can reasonably be achieved. The seat mountings must withstand all stresses to which they are subjected (such as a rollover). Where there is no floor beneath the driver's feet, the driver must have footrests covered with a slip-resistant material.
- Where the machinery has a rollover protection structure, the seat must be equipped with a safety belt or equivalent device that keeps the driver in his seat in the event of a rollover. No device, however, must restrict driving.

3. Other places

If operators other than the driver are occasionally or regularly transported by the machinery, or work on it, appropriate places must be provided which enable them to be transported or to work on it without risk, particularly the risk of falling. Where the working conditions so permit, these work places must be equipped with seats. If a dangerous environment dictates the use of a cab for the driver, there must be room in this cab, or in another cab having the same characteristics, for the operators being transported.

Controls

1. Control devices

- The driver must be able to reach all control devices from the driving position, except those that can only be safely activated elsewhere. These may be working positions other than the driving position, for which operators other than the driver are

responsible or for which the driver has to leave his driving position in order to carry out the maneuver in safety.

- Pedals must allow the driver to operate without confusion. They must have a slip-resistant surface and be easy to clean.
- The machinery's controls, except for those with preset positions, must return to the neutral position as soon as the operator releases them.
- In the case of wheeled machinery, the steering system must reduce the force of sudden movements of the steering wheel or steering lever caused by shocks to the guide wheels.
- Any control that locks the differential must allow the differential to be unlocked when the machinery is moving.

2. Starting/moving

- Self-propelled machinery with a ride-on driver must be equipped (*with a key or a programmable access code, for example*) to deter unauthorized persons from starting the engine.
- Movement of self-propelled machinery with a ride-on driver must be possible only if the driver is at the controls.
- If machinery must be fitted with devices which exceed its normal clearance zone (e.g. stabilizers, jib, etc.), the driver must be able to check (before moving the machinery) that such devices will not cause the machine to move in an unsafe manner. This also applies to all other parts which, to allow safe movement, have to be in particular positions, locked if necessary.
- It must not be possible for the machine to move while the engine is being started.

3. Traveling Function

- Self-propelled machinery and its trailers must be able to meet highway code requirements for slowing down, stopping, braking and immobilization and must remain safe under all operating, loading, speed, ground and gradient conditions.
- The driver must be able to slow down and stop self-propelled machinery by means of a main device. In the event of a failure of the main device, or in the absence of the energy supply to actuate the main device, an emergency device with fully independent and easily accessible controls must be provided for slowing down and stopping.

- A parking device must be provided to keep stationary machinery immobile. This device may be combined with one of the devices referred to in the paragraph above, provided that it is purely mechanical. Remote-controlled machinery must be able to stop automatically if the driver loses control.

4. Movement of Pedestrian-Controlled Machinery

- Self-propelled pedestrian-controlled machinery must remain under the control of the driver. It must not be able to be started and moved without sustained action by the driver.
- It must not be able to be moved while the engine is being started.
- The control systems for pedestrian-controlled machinery must not allow inadvertent movement of the machine towards the driver which may result in injury, in particular
 - Crushing, and/or
 - injury from rotating tools.
- The speed of normal travel of the machine must be compatible with the pace of a person walking.
- A rotary tool must not be able to be actuated when in reverse, except where movement of the machinery results from movement of the tool. In the latter case, the reversing speed must be such that it does not endanger the driver.

5. Control Circuit Failure

- A failure in the power supply to power-assisted steering must not prevent machinery from being steered during the time required to stop it.

Protection Against Mechanical Hazards

1. Uncontrolled Movements

- When a part of a machine has been stopped, any drift away from the stopping position, for whatever reason other than action at the controls, must be such that it is not a hazard to exposed persons.
- Machinery must be placed on a mobile support so that when moved the uncontrolled oscillations of its center of gravity do not affect its stability or exert excessive strain on its structure.

2. Risk Of Break-Up During Operation

- Parts of machinery rotating at high speed which can break up or disintegrate must be mounted and guarded in such a way that their fragments will be contained or, if that is not possible, that they cannot be projected towards the driver and/or operator.

3. Rollover

- Where there is a risk of rolling over, the machinery must be fitted with anchorage points allowing it to be equipped with a rollover protective structure (ROPS).

Note: When ROPSs are sold as individual units, they must comply with the appropriate Harmonized Standard (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 11) or be subject to an "EC" type examination (See Annex IV).

This structure must be such that it affords the ride-on driver and where appropriate the ride-on operators an adequate deflection-limiting volume (DLV). In order to verify that the structure complies with this requirement, the Manufacturer or his Authorized Representative *must*, for each type of structure concerned, *perform appropriate tests or have such tests performed*.

In addition, the earth-moving machinery listed below with a capacity exceeding 15 kW must be fitted with a rollover protective structure:

- crawler loaders or wheel loaders,
- backhoe loaders,
- crawler tractors or wheel tractors,
- scrapers, self-loading or not,
- graders, and
- articulated steer dumpers.

4. Falling Objects

Where there is a risk of falling objects or material, machinery with a ride-on driver and/or ride-on operators should be designed for, and fitted with, if its size allows, anchorage points allowing it to be equipped with a falling-object protective structure (FOPS).

This structure must guarantee the ride-on operators an adequate deflection-limiting volume (DLV).

The manufacturer is required to test or have tests performed on each type of FOPS concerned (See Annex IV of the text On Page 55).

5. Means Of Access

Handholds and steps must be designed, constructed and arranged in such a way that the operators use them instinctively and do not use the controls for that purpose.

6. Towing Devices

All machinery used to tow or to be towed must be fitted with towing or coupling devices that will ensure easy and safe connection and disconnection, and will prevent accidental disconnection during use. If the towbar is heavy, a support must be provided (Example: a support leg with a surface for bearing on the ground). A recommendation for putting the towbar down should appear in the instructions.

7. Transmission Of Power Between Self-Propelled Machinery (Or Tractor) And Recipient Machinery

- Transmission shafts with universal joints linking self-propelled machinery (or tractor) to the first fixed bearing of recipient machinery must be guarded on the self-propelled machinery side and the recipient machinery side over the whole length of the shaft and associated universal joints.
- On the side of the self-propelled machinery (or tractor), the power take-off to which the transmission shaft is attached must be guarded either by a screen fixed to the self-propelled machinery (or tractor) or by any other device offering equivalent protection.
- On the towed machinery side, the input shaft must be enclosed in a protective casing fixed to the machinery.
- Torque limiters or freewheels may be fitted to universal joint transmissions only on the side adjoining the driven machine. The universal-joint transmission shaft must be marked accordingly.
- All towed machinery whose operation requires a transmission shaft to connect it to self-propelled machinery or a tractor must have a system for attaching the transmission shaft so that when the machinery is uncoupled the transmission shaft and its guard are not damaged by contact with the ground or part of the machinery.
- The outside parts of the guard must be so that they cannot turn with the transmission shaft. The guard must cover the transmission shaft to the ends of the inner jaws in the case of simple universal joints and at least to the center of the outer joint or joints in the case of 'wide-angle' universal joints.
- Manufacturers providing means of access to working positions near to the universal joint transmission shaft must ensure that shaft guards cannot be used as steps unless designed and constructed for that purpose

8. Moving Transmission Parts

In the case of internal combustion engines,

and by way of derogation from the section on Protection Against Risks Related to Moving Parts, (the requirement that says that guards protecting the moving parts of the drive [belts, pulleys, etc.] must either be fixed guards or movable guards which can only be opened with a key or a tool or which have an opening located inside the cab or movable guards which prevent the moving parts from operating when they are open and which stop the machine when they are no longer closed.

removable guards preventing access to the moving parts in the engine compartment need not have locking devices if they have to be opened either by the use of a tool or key or by a control located in the driving position if the latter is in a fully enclosed cab with a lock to prevent unauthorized access.

Protection Against Other Hazards

1. Batteries

The battery housing must be constructed and located and the battery installed so as to avoid as far as possible the chance of electrolyte being ejected on to the operator in the event of rollover and/or to avoid the accumulation of vapors in places occupied by operators.

The battery must be able to be disconnected with the aid of an easily accessible device provided for that purpose.

2. Fire

Depending on the hazards anticipated by the manufacturer, machinery, when in use, must where its size permits:

- either allow easily accessible fire extinguishers to be fitted, or
- be provided with built-in extinguisher systems.

3. Emissions Of Dust, Gases, Etc.

Where such hazards exist, the containment equipment provided for in the section on Protection Against Other Hazards

which says that machines must be designed so as to avoid the risks due to gas, liquids, dust, vapors and other waste products, and must be equipped with a collection or suction device,

may be replaced by other means, for example precipitation by water spraying.

Moreover, the Directive does not require sprayers to collect the products that they spray!

Indications

1. Signs And Warning

- Machinery must have means of signaling and/or instruction plates concerning use, adjustment and maintenance, wherever necessary, to ensure the health and safety of exposed persons. They must be clearly visible and indelible.
- For traveling on the public highway, machinery with a ride-on driver must have the following equipment:
 - an acoustic warning device to alert exposed persons, and
 - a system of light signals relevant to the intended conditions of use, such as stop lamps, reversing lamps and rotating beacons.

Note: The latter requirement does not apply to machinery intended solely for underground working and having no electrical power.

- Remote-controlled machinery, which exposes persons to the hazards of impact or crushing, must be fitted with appropriate means to signal its movements or with means to protect exposed persons against such hazards. The same applies to machinery that involves, when in use, the constant repetition of a forward and backward movement on a single axis where the back of the machine is not directly visible to the driver.
- Machinery must have warning and signaling devices that cannot all be disabled unintentionally. Where this is essential for safety, such devices must have means to check that they are in good working order and their failure must be made apparent to the operator.
- Where the movement of machinery or its tools is particularly hazardous, signs on the machinery must be provided to warn against approaching the machinery while it is working; the signs must be legible at a sufficient distance to ensure the safety of persons who have to be in the vicinity.

2. Marking

The specific nature of the hazards associated with the mobility of the machinery requires special markings on the frame of the machinery; therefore the minimum requirements set

out in the section on Marking (See Page 23 of this document) must be supplemented by the following:

- nominal power expressed in kW; and
- mass in kg of the most usual configuration, and where appropriate:
 - maximum drawbar pull provided for by the manufacturer at the coupling hook, in N,
 - maximum vertical load provided for by the manufacturer on the coupling hook, in N.

3. Instruction Handbook

Apart from the minimum requirements set out in the section on Indicators (See Page 22 of this document), the instruction handbook must also contain the following information:

- Regarding vibrations emitted by the machinery, either the actual value or a figure calculated from measurements performed on identical machinery:
 - The weighted root mean square acceleration value to which the arms are subjected, if it exceeds 2.5 m/s^2 . Should it not exceed 2.5 m/s^2 , this must be mentioned.
 - The weighted root mean square acceleration value to which the body (feet or posterior) is subjected, if it exceeds 0.5 m/s^2 . Should it not exceed 0.5 m/s^2 , this must be mentioned.
- Where Harmonized Standards (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 11) are not applied, the vibration must be measured using the most appropriate method for the machinery concerned.
- The manufacturer must indicate the operating conditions of the machinery during measurement and which methods were used for taking the measurements.
- Manufacturers of basic machinery to which interchangeable equipment may be attached and manufacturers of the interchangeable equipment must provide the necessary information to enable the equipment to be fitted and used safely.

4. Essential Health And Safety Requirements To Offset The Particular Hazards Due To A Lifting Operation

Machinery presenting hazards due to lifting operations - mainly hazards of load falls and collisions or hazards of tipping caused by a lifting operation - must be designed and constructed to meet the requirements set out below.

Risks due to a lifting operation exist particularly where machinery is designed to move a unit load involving a change in level during the movement. The load may consist of objects, materials or goods.

General Remarks

Definitions

- Lifting accessories means components or equipment not attached to the machine and placed between the machinery and the load or on the load in order to attach it.
- Separate lifting accessories means accessories which help to make up or use a slinging device, such as eyehooks, shackles, rings, eyebolts, etc.
- Guided load means the load where the total movement is made along rigid or flexible guides, whose position is determined by fixed points.
- Working coefficient means the arithmetic ratio between the load guaranteed by the manufacturer up to which a piece of equipment, an accessory or machinery is able to hold it and the maximum working load marked on the equipment, accessory or machinery respectively.
- Test coefficient means the arithmetic ratio between the load used to carry out the static or dynamic tests on a piece of equipment, an accessory or machinery and the maximum working load marked on the piece of equipment, accessory or machinery.
- Static test means the test during which the machinery or the lifting accessory is first inspected and subjected to a force corresponding to the maximum working load multiplied by the appropriate static test coefficient and then re-inspected once the said load has been released to ensure no damage has occurred.
- Dynamic test means the test during which the machinery is operated in all its possible configurations at maximum working load with account being taken of the dynamic behavior of the machinery in order to check that the machinery and safety features are functioning properly.

Protection Against Mechanical Hazards

Risks Due To Lack Of Stability

Machinery must be so designed and constructed that the stability required in the section on *Stability (See 13 of this document)* is maintained both in service and out of service, including all stages of transportation, assembly and dismantling, during foreseeable component failures and also during the tests carried out in accordance with the instruction handbook.

To that end, the manufacturer must use the appropriate verification methods; in particular, for self-propelled industrial trucks with lift exceeding 1.8 m, the manufacturer must, for each type of industrial truck concerned, perform a platform stability test or similar test, or have such tests performed.

Guide Rails And Rail Tracks

Machinery must be provided with devices which act on the guide rails or tracks to prevent derailment. However, if derailment occurs despite such devices, or if there is a failure of a rail or of a running component, devices must be provided which prevent the equipment, component or load from falling or the machine overturning.

Note: The liability of a manufacturer is clearly limited to what he supplies under contract. For example, in the case of a traveling crane, the manufacturer who does not supply the rails must specify the tolerances that the rails are to meet in order for them to be compatible with what he has supplied.

Mechanical Strength

- Machinery, lifting accessories and removable components must be capable of withstanding the stresses to which they are subjected, both in and, where applicable, out of use, under the installation and operating conditions provided for by the manufacturer, and in all relevant configurations, with due regard, where appropriate, to the effects of atmospheric factors and forces exerted by persons. This requirement must also be satisfied during transport, assembly and dismantling.
- Machinery and lifting accessories must be designed and constructed to prevent failure from fatigue or wear, taking due account of their intended use.
- The materials used must be chosen on the basis of the working environments provided for by the manufacturer, with special reference to corrosion, abrasion, impacts, cold brittleness and aging.

Note: To meet these requirements, the designer may use Harmonized Standards or a recognized widely used code.

- The machinery and the lifting accessories must be able to withstand the overload in the static tests without permanent deformation or patent defect. The calculation must take account of the values of the static test coefficient chosen to guarantee an adequate level of safety: that coefficient has, as a general rule, the following values:
 - manually-operated machinery and lifting accessories: 1.5;
 - other machinery: 1.25.
- Machinery must be able to undergo, without failure, the dynamic tests carried out using the maximum working load multiplied by the dynamic test coefficient. This dynamic test coefficient is chosen so as to guarantee an adequate level of safety: the coefficient is, as a general rule, equal to 1.1.
- The dynamic tests must be performed on machinery ready to be put into service under normal conditions of use. As a general rule, the tests will be performed at the nominal speeds laid down by the manufacturer. Should the control circuit of the machinery allow for a number of simultaneous movements (for example, rotation and displacement of the load), the tests must be carried out under the least favorable conditions, i.e., as a general rule, by combining the movements concerned.

Pulleys, Drums, Chains Or Ropes

- Pulleys, drums and wheels must have a diameter commensurate with the size of rope or chains with which they can be fitted.
- Drums and wheels must be so designed, constructed and installed that the ropes or chains with which they are equipped can wind round without falling off.
- Ropes used directly for lifting or supporting the load must not include any splicing other than at their ends (splicings are tolerated in installations which are intended from their design to be modified regularly according to needs of use). Complete ropes and their endings have a working coefficient chosen so as to guarantee an adequate level of safety; as a general rule, this coefficient is equal to five.
- Lifting chains have a working coefficient chosen to guarantee an adequate level of safety; as a general rule, this coefficient is equal to four. In order to verify that an adequate working coefficient has been attained, the Manufacturer must, for each type of chain and rope used directly for lifting the load, and for the rope ends, perform the appropriate tests or have such tests performed.

Separate Lifting Accessories

- Lifting accessories must be sized with due regard to fatigue and aging processes for a number of operating cycles consistent with their expected life-span as specified in the operating conditions for a given application.
- Moreover, the working coefficient of the metallic rope/rope-end combination is chosen to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to five. Ropes must not comprise any splices or loops other than at their ends.
- Where chains with welded links are used, they must be of the short-link type. The working coefficient of chains of any type is chosen to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to four.
- The working coefficient for textile ropes or slings is dependent on the material, method of manufacture, dimensions and use. This coefficient is chosen so as to guarantee an adequate level of safety; it is, as a general rule, equal to seven, provided the materials used are shown to be of very good quality and the method of manufacture is appropriate to the intended use. Should this not be the case, the coefficient is, as a general rule, set at a higher level in order to secure an equivalent level of safety. Textile ropes and slings must not include any knots, connections or splicing other than at the ends of the sling, except in the case of an endless sling.
- All metallic components making up, or used with, a sling must have a working coefficient chosen so as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to four.
- The maximum working capacity of a multilegged sling is determined on the basis of the safety coefficient of the weakest leg, the number of legs and a reduction factor that depends on the slinging configuration.
- To verify that an adequate working coefficient has been attained, the Manufacturer must, for each type of component referred to in the first four bullets, perform the appropriate tests or have such tests performed.

Note: The different coefficients given in the Machinery Directive are only valid in the absence of standards, which, in turn, can, as long as justified, provide for higher values as well as lower values. These values amount to "presumption of conformity."

Control Of Movements

Devices for controlling movements must act so that the machinery on which they are installed is kept safe. In that regard:

- Machinery must be so designed or fitted with devices that the amplitude of movement of its components is kept within the specified limits. The operation of such devices must, where appropriate, be preceded by a warning.
- Where several fixed or rail-mounted machines can be maneuvered simultaneously in the same place, with risks of collision, such machines must be so designed and constructed as to make it possible to fit systems that would cause these risks to be avoided.
- The mechanisms of machinery must be so that the loads cannot creep dangerously or fall freely and unexpectedly, even in the event of partial or total failure of the power supply or when the operator stops operating the machine.
- It must not be possible, under normal operating conditions, to lower the load solely by friction brake, except in the case of machinery whose function requires it to operate in that way.
- Holding devices must be so that inadvertent dropping of the loads is avoided.

Handling Of Loads

- The driving position of machinery must be located in such a way as to ensure the widest possible view of trajectories of the moving parts, in order to avoid possible collisions with persons or equipment or other machinery which might be maneuvering at the same time and liable to constitute a hazard.
- Machinery with guided loads fixed in one place must be designed and constructed to prevent exposed persons from being hit by the load or the counter-weights.

Lightning

- Machinery in need of protection against the effects of lightning while being used must be fitted with a system for conducting the resultant electrical charges to earth.

Special Requirements For Machinery Whose Power Source Is Other Than Manual Effort

1. Controls

Driving position

The requirements laid down above in the Mobility of Machinery/Driving Position, also apply to non-mobile machinery.

Seating

The requirements laid down above in the Mobility of Machinery/Seating, and those laid down in Mobility of Machinery/Other Places Section also apply to non-mobile machinery.

Control Devices

The devices controlling movements of the machinery or its equipment must return to their neutral position as soon as the operator releases them. However, for partial or complete movements in which there is no risk of the load or the machinery colliding, the said devices may be replaced by controls authorizing automatic stops at preselected levels without holding a hold-to-run control device.

Loading Control

Machinery with a maximum working load of not less than 1,000 kilograms or an overturning moment of not less than 40,000 Nm must be fitted with devices to warn the driver and prevent dangerous movements of the load in the event of:

- overloading the machinery: either as a result of maximum working loads being exceeded; or
- as a result of the moments due to the loads being exceeded; or
- the moments conducive to overturning being exceeded as a result of the load being lifted.

Note the following comments by the European Commission: “Some machines performing lifting operations have complex operating mechanisms and special working conditions (combination of lifting and mobility, difficult work-site environment due to earth-working and lifting operations performed by the same machine, etc.) which render the devices to prevent dangerous movements ineffective. The current state of the art does not enable this requirement to be met in its entirety.”

However, the Commission goes on to say that attempts must be made to comply, as far as possible, with that which the Directive requires.

Moreover, the Manufacturer is still under the obligation to carry out a risk analysis and to find the solution that comes closest to the requirements of the Directive. If he opts for

derogation from a requirement, he must indicate in the technical file what analyses have been carried out, what conclusions have been drawn and what measures have been taken to come as close as possible to the requirements.

Installation Guided By Cables

Cable carriers, tractors or tractor carriers must be held by counter-weights or by a device allowing permanent control of the tension.

Risks To Exposed Persons: Means Of Access To Driving Position And Intervention Points

- Machinery with guided loads and machinery whose load supports follow a clearly defined path must be equipped with devices to prevent any risks to exposed persons.
- Machinery serving specific levels at which operators can gain access to the load platform in order to stack or secure the load must be designed and constructed to prevent uncontrolled movement of the load platform, in particular while being loaded or unloaded.

Fitness For Purpose

- When machinery is placed on the market or is first put into service, the Manufacturer must ensure, by taking appropriate measures or having them taken, that lifting accessories and machinery which are ready for use - whether manually or power-operated - can fulfill their specified functions safely. The said measures must take into account the static and dynamic aspects of the machinery.
- Where the machinery cannot be assembled in the manufacturer's premises, or in the premises of his Authorized Representative, appropriate measures must be taken at the place of use. Otherwise, the measures may be taken either in the Manufacturer's premises or at the place of use.

Marking

Chains and ropes

Each length of lifting chain, rope or webbing not forming part of an assembly must bear a mark or, where this is not possible, a plate or irremovable ring bearing the name and

address of the Manufacturer or his Authorized Representative established in the Community and the identifying reference of the relevant certificate.

Note: The certificate is not the Declaration Of Conformity referred to in Annex II. The special certificate takes the place of the Declaration Of Conformity.

The certificate should show the information required by the Harmonized Standards or, should those not exist, at least the following information:

- the name of the Manufacturer or his Authorized Representative established within the Community;
- the address within the Community of the Manufacturer or his Authorized Representative, as appropriate;
- a description of the chain or rope which includes:
 - Its nominal size,
 - Its construction,
 - the material from which it is made, and
 - any special metallurgical treatment applied to the material,
 - if tested, the standard used,
 - a maximum load to which the chain or rope should be subjected in service. A range of values may be given for specified applications.

Note: There is no explicit mention that the special certificate for lifting chains, ropes and webbing has to go with the products. The chain manufacturer can keep this certificate. It is not a condition of freedom of movement of the product.

It is worth noting that the details contained in the harmonized standards have to be reproduced in the special certificate.

The Directive therefore makes these standards obligatory. This is the only case in this Directive.

Lifting accessories

All lifting accessories must show the following:

- identification of the manufacturer,
- identification of the material (e.g. international classification) where this information is needed for dimensional compatibility,
- identification of the maximum working load, and
- CE marking.

In the case of accessories including components such as cables or ropes, on which marking is physically impossible, the particulars referred to in the first paragraph must be displayed on a plate or by some other means and securely affixed to the accessory.

The particulars must be legible and located in a place where they are not liable to disappear as a result of machining, wear, etc., or jeopardize the strength of the accessory.

Machinery

In addition to the minimum information provided for in the section on Indicators, each machine must bear, legibly and indelibly, information concerning the nominal load:

- displayed in uncoded form and prominently on the equipment where the machinery has only one possible value; or
- where the nominal load depends on the configuration of the machine, each driving position must be provided with a load plate indicating, preferably in diagrammatic form or by means of tables, the nominal loads for each configuration.

Machinery equipped with a load support that allows access to persons and involves a risk of falling must bear a clear and indelible warning prohibiting the lifting of persons. This warning must be visible at each place where access is possible.

Instruction Handbook

1. Lifting accessories

Each lifting accessory or each commercially indivisible batch of lifting accessories must be accompanied with an instruction handbook setting out at least the following particulars:

- normal conditions of use,
- instructions for use, assembly and maintenance, and
- the limits of use

2. Machinery

In addition to section on Indicators (*See Page 22 of this document*), the instruction handbook must include the following information:

- the technical characteristics of the machinery, and in particular:
 - where appropriate, a copy of the load table described above,

- the reactions at the supports or anchors and characteristics of the tracks,
- where appropriate, the definition and the means of installation of the ballast;
- the contents of the logbook, if the latter is not supplied with the machinery;
- advice for use, particularly to offset the lack of direct sight of the load by the operator; and
- the necessary instructions for performing the tests before first putting into service machinery which is not assembled on the manufacturer's premises in the form in which it is to be used.

5. Essential Health And Safety Requirements For Machinery Intended For Underground Work

Note: This article is directed to equipment used in mines and underground quarries, not in "buildings" located below ground.

Machinery intended for underground work must meet the requirements set out below.

Risks Due To Lack Of Stability

Powered roof supports must maintain a given direction when moving and not slip before and while they come under load and after the load has been removed. They must be equipped with anchorages for the top plates of the individual hydraulic props.

Movement

Powered roof supports must allow for unhindered movement of exposed persons.

Lighting

The requirements laid down in the section on General Requirements/Lighting do not apply. This derogation is based on the fact that for underground work the operator carries his own lighting, generally on his helmet.

Control Devices

- The accelerator and brake controls for the movement of machinery running on rails must be manual. However, the deadman's control may be foot-operated.
- The control devices of powered roof supports must be designed and laid out so that, during displacement operations, operators are sheltered by a support in place. The control devices must be protected against any accidental release.

Stopping

Self-propelled machinery running on rails for use in underground work must be equipped with a deadman's control acting on the circuit controlling the movement of the machinery.

Fire

See Mobility of Machinery, Section 2.Fire (Page 37 of this document).

- The braking system of machinery meant for use in underground working must be designed and constructed so as not to produce sparks or cause fires.
- Machinery with heat engines for use in underground working must be fitted only with internal combustion engines using fuel with a low vaporizing pressure and which exclude any spark of electrical origin.

Emissions Of Dust, Gases, Etc.

Exhaust gases from internal combustion engines must not be discharged upwards.

6. Essential Health And Safety Requirements To Offset The Particular Hazards Due To The Lifting Or Moving Of Persons

Machinery presenting hazards due to the lifting or moving of persons must be designed and constructed to meet the requirements set out below.

6.1 General

Definition

For the purposes of this Chapter, “carrier” means the device by which persons are supported in order to be lifted, lowered or moved.

Mechanical Strength

The working coefficients defined in *Essential Health and Safety Requirements to Offset the Particular Hazards due to a Lifting Operation (See Page 39 of this document)* are inadequate for machinery intended for the lifting or moving of persons and must, as a general rule, be doubled. The floor of the carrier must be designed and constructed to offer the space and strength corresponding to the maximum number of persons and the maximum working load set by the manufacturer.

Loading Control For Types Of Device Moved By Power Other Than Human Strength

The requirements in Particular Hazards due to a Lifting Operation (See above) apply regardless of the maximum working load figure. This requirement does not apply to machinery in respect of which the manufacturer can demonstrate that there is no risk of overloading and/or overturning.

6.2 Controls

Where Safety Requirements Do Not Impose Other Solutions:

- The carrier must, as a general rule, be designed and constructed so that persons inside have means of controlling movements upwards and downwards and, if appropriate, of moving the carrier horizontally in relation to the machinery.
- In operation, those controls must override the other devices controlling the same movement, with the exception of the emergency stop devices.
- The controls for these movements must be of the maintained command type, except in the case of machinery serving specific levels.
- If machinery for the lifting or moving of persons can be moved with the carrier in a position other than the rest position, it must be designed and constructed so that the person or persons in the carrier can prevent any hazards produced by the movement of the machinery.
- Machinery for the lifting or moving of persons must be designed, constructed or equipped so that excess speeds of the carrier do not cause hazards.

Note: Relating to the last bullet above, the Commission suggests that a risk analysis be carried out in order to take all aspects into account, in particular where risks of jamming

or transporting handicapped persons are concerned. These might be, for example, platforms for wheelchairs or stair-lift seats.

6.3 Risks Of Persons Falling From The Carrier

- If other measures referred to elsewhere in this Directive are not adequate, carriers must be fitted with a sufficient number of anchorage points for the number of persons possibly using the carrier, strong enough for the attachment of personal protective equipment against the danger of falling.
- Any trapdoors in floors or ceilings or side doors must open in a direction, which obviates any risk of falling should they open unexpectedly.
- Machinery for lifting or moving must be designed and constructed so that the floor of the carrier does not tilt. In other words, it must not create a risk of the occupants falling when it is moving. The floor of the carrier must be slip-resistant.

6.4 Risks Of The Carrier Falling Or Overturning

- Machinery for the lifting or moving of persons must be designed and constructed to prevent the carrier falling or overturning.
- Acceleration and braking of the carrier or carrying vehicle, under the control of the operator or triggered by a safety device and under the maximum load and speed conditions laid down by the manufacturer, must not cause any danger to exposed persons.

6.5 Markings

Where necessary to ensure safety, the carrier must bear the relevant essential information.

Annex II: Declaration of Conformity

Note 1: The Declaration of Conformity (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 26) must be in the same language as the original instructions. It must be in one of the official languages of the European Union (English is one of the official languages). It must be accompanied by a translation in one of the official languages of the country in which the machinery is to be used.

Note 2: The Declaration of Conformity must accompany each example of Machinery. The Machinery Directive is one of the rare European Directives to require the accompaniment of the DoC with the product.

Note 3: The Manufacturer should also state on the DoC what other Community Directives the machinery complies with (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 26, 27, and Page 28 for a sample DoC). The Manufacturer may use the Declaration Of Conformity with the Machinery Directive as the common Declaration Of Conformity with all the other pertinent Directives applicable to his product.

The Machinery Directive is sufficiently detailed to be helpful to manufacturers in that it gives particulars for the following types of Declarations of Conformity:

1. For Machinery
 - **Not Subject** To "EC" Type Examination.
 - **Subject** To "EC" Type Examination.
2. For a Subassembly
 - A Declaration of Incorporation (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 29).
3. For A Safety Component
 - **Not Subject** To "EC" Type Examination.
 - **Subject** To "EC" Type Examination.

1. The Declaration of Conformity for Machinery Not Subject To "EC" Type Examination and for Machinery Subject To "EC" Type Examination must contain the following:

- name and address of the Manufacturer or his Authorized Representative (See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 23);
- description of the machinery;
- all relevant provisions complied with by the machinery;
- where appropriate, name and address of the Notified Body and number of the EC type-examination certificate;
- where appropriate, the name and address of the Notified Body to which the file has been forwarded;

- where appropriate, the name and address of the Notified Body which has carried out the verification;
- where appropriate, a reference to the Harmonized Standards (See *NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page10*);
- where appropriate, the national technical standards and specifications (See *NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page12*) used; and
- identification of the person empowered to sign on behalf of the Manufacturer or his Authorized Representatives.

2. The Declaration of Incorporation of A Subassembly must contain the following:

Note: The following is a statement from the European Commission: “ This Declaration Of Incorporation has been specially designed for incomplete machinery. "Incomplete" machinery may be ordinary machinery from which the safety devices have been removed for the purpose of integrating them into a complex assembly. Safety is built in by the manufacturer of the complete machinery or by the acquirer, at the site. Subassemblies, motors, etc., may also be the subject of a declaration of incorporation.”

- name and address of the Manufacturer or the Authorized Representative;
- description of the machinery or machinery parts;
- where appropriate, the name and address of the Notified Body and the number of the EC type-examination certificate;
- where appropriate, the name and address of the Notified Body to which the file has been forwarded;
- where appropriate, the name and address of the Notified Body which has carried out the verification;
- where appropriate, a reference to the Harmonized Standards;
- a statement that the machinery must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive; and
- identification of the person signing.

3. The Declaration of Conformity for Safety Components Placed on the Market Separately must contain the following:

- name and address of the Manufacturer or his Authorized Representative established in the Community;
- description of the safety component;
- safety function fulfilled by the safety component, if not obvious from the description;
- where appropriate, the name and address of the Notified Body and the number of the EC type-examination certificate;
- where appropriate, the name and address of the Notified Body to which the file was forwarded;
- where appropriate, the name and address of the Notified Body which carried out the verification;
- where appropriate, a reference to the Harmonized Standards;
- where appropriate, the national technical standards and specifications used; and
- identification of the person empowered to sign on behalf of the Manufacturer or his Authorized Representative established in the Community.

ANNEX III: CE MARKING

Please refer to Annex III of the text of the Machinery Directive and to NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 17.

ANNEX IV: TYPES OF MACHINERY AND SAFETY COMPONENTS FOR WHICH THE PROCEDURE REFERRED TO IN ARTICLE 8(2)(b)

8(2)(b)

If the machinery is referred to in Annex IV and its manufacturer does not comply, or only partly complies, with the standards referred to in Article 5(2) or if there are no such standards, submit an example of the machinery for the EC type-examination referred to in Annex VI

AND (c)

8(2)(c)

If the machinery is referred to in Annex IV and is manufactured in accordance with the standards referred to in Article 5(2):

either draw up the file referred to in Annex VI and forward it to a Notified Body, which will acknowledge receipt of the file as soon as possible and keep it,

submit the file referred to in Annex VI to the Notified Body, which will simply verify that the standards referred to in Article 5(2) have been correctly applied and will draw up a certificate of adequacy for the file,
or submit the example of the machinery for the EC type-examination referred to in Annex VI.

MUST BE APPLIED

Note: Article 5(2) refers to Harmonized Standards (*See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 11*).

In other words, if machinery *complies* with Harmonized Standards, the Manufacturer may:

- submit the Technical File (*See NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 24*) to a Notified Body to keep;
- submit the Technical File to a Notified Body, which will simply verify that the Harmonized Standards have been correctly applied and will draw up a certificate of adequacy for the file; or
- submit an example of the machinery for the EC type-examination.

If machinery does *not comply* with Harmonized Standards or only *partly complies* with Harmonized Standards, or if there *are no* Harmonized Standards, the manufacturer must submit an example of the machinery for the EC type-examination.

A. Machinery

1. Circular saws (single or multi-blade) for working with wood and analogous materials or for working with meat and analogous materials.
 - 1.1. Sawing machines with fixed tool during operation, having a fixed bed with manual feed of the workpiece or with a demountable power feed.
 - 1.2. Sawing machines with fixed tool during operation, having a manually operated reciprocating saw-bench or carriage.
 - 1.3. Sawing machines with fixed tool during operation, having a built-in mechanical feed device for the work-pieces, with manual loading and/or unloading.
 - 1.4. Sawing machines with movable tool during operation, with a mechanical feed device and manual loading and/or unloading.
2. Hand-fed surface planing machines for woodworking.

3. Thicknessers for one-side dressing with manual loading and/or unloading for woodworking.
4. Band-saws with a fixed or mobile bed and band-saws with a mobile carriage, with manual loading and/or unloading, for working with wood and analogous materials or for working with meat and analogous materials.
5. Combined machines of the types referred to in 1 to 4 and 7 for working with wood and analogous materials.
6. Hand-fed tenoning machines with several tool holders for woodworking.
7. Hand-fed vertical spindle moulding machines for working with wood and analogous materials.
8. Portable chainsaws for woodworking.
9. Presses, including press-brakes, for the cold working of metals, with manual loading and/or unloading, whose movable working parts may have a travel exceeding 6 mm and a speed exceeding 30 mm/s.
10. Injection or compression plastics-molding machines with manual loading or unloading.
11. Injection or compression rubber-molding machines with manual loading or unloading.
12. Machinery for underground working of the following types:
 - machinery on rails: locomotives and brake-vans,
 - hydraulic-powered roof supports,
 - internal combustion engines to be fitted to machinery for underground working.
13. Manually-loaded trucks for the collection of household refuse incorporating a compression mechanism.
14. Guards and detachable transmission shafts with universal joints.
15. Vehicles servicing lifts.
16. Devices for the lifting of persons involving a risk of falling from a vertical height of more than three meters.
17. Machines for the manufacture of pyrotechnics.

B. Safety components

1. Electro-sensitive devices designed specifically to detect persons in order to ensure their safety (non-material barriers, sensor mats, electromagnetic detectors, etc.).
2. Logic units which ensure the safety functions of bimanual controls.
3. Automatic movable screens to protect the presses referred to in 9, 10 and 11.
4. Roll-over protection structures (ROPS).
5. Falling-object protective structures (FOPS).

ANNEX V: EC DECLARATION OF CONFORMITY

Please see *NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 26.*

For the purposes of this Annex, “machinery” means either “machinery” or “safety component.” It does not mean subassemblies, or incomplete machinery.

1. The Declaration of Conformity is the procedure by which the Manufacturer, or his Authorized Representative, declares that the machinery being placed on the market complies with all the essential health and safety requirements applying to it.
2. Signature of the Declaration of Conformity authorizes the Manufacturer, or his Authorized Representative, to affix the CE Marking (See *NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 17*) to the machinery.
3. Before drawing up the Declaration Of Conformity, the manufacturer, or his Authorized Representative, shall have ensured and be able to guarantee that the documentation listed in Annex V is and will remain available on his premises for any inspection purposes:

Please refer to *Annex V* of the text for the list of documentation required.

ANNEX VI: EC TYPE-EXAMINATION

Please see *NIST SP 951 A Guide to EU Standards and Conformity Assessment, Page 22.*

For the purposes of this Annex, “machinery” means either “machinery” or “safety component.” It does not mean subassemblies, or incomplete machinery.

1. EC type-examination is the procedure by which a Notified Body ascertains and certifies that an example of machinery satisfies the provisions of this Directive which apply to it.

Please refer to *Annex VI* of the text for a list of what is to be included in the application for the EC type-examination and relevant details.

FOR FURTHER INFORMATION ON ANY OF THESE TOPICS, SEE THE TEXT OF DIRECTIVE, WHICH FOLLOWS.

Text of Directive on Machinery 98/37/EC

The following text of the Directive on Machinery (98/37/EC) has been taken from EUR-Lex, the digital version of the legislation issued in the Official Journal of the European Communities.

Web Site: http://www.europa.eu.int/eur-lex/en/lif/dat/1998/en_398L0037.html

Only European Community's legislation printed in the Official Journal of the European Communities is deemed to be authentic.

DIRECTIVE 98/37/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 22 June 1998 On The Approximation Of The Laws Of The Member States Relating To Machinery

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,
 Having regard to the Treaty establishing the European Community, and in particular Article 100a thereof,
 Having regard to the proposal from the Commission,
 Having regard to the opinion of the Economic and Social Committee (1),
 Acting in accordance with the procedure laid down in Article 189b of the Treaty (2),
 (1) Whereas Council Directive 89/392/EEC of 14 June 1989 on the approximation of the laws of the Member States relating to machinery (3) has been frequently and substantially amended; whereas for reasons of clarity and rationality the said Directive should be consolidated;
 (2) Whereas the internal market consists of an area without internal frontiers within which the free movement of goods, persons, services and capital is guaranteed;
 (3) Whereas the machinery sector is an important part of the engineering industry and is one of the industrial mainstays of the Community economy;
 (4) Whereas the social cost of the large number of accidents caused directly by the

use of machinery can be reduced by inherently safe design and construction of machinery and by proper installations and maintenance;
 (5) Whereas Member States are responsible for ensuring the health and safety on their territory of persons and, where appropriate, of domestic animals and goods and, in particular, of workers, notably in relation to the risks arising out of the use of machinery;
 (6) Whereas, in the Member States, the legislative systems regarding accident prevention are very different; whereas the relevant compulsory provisions, frequently supplemented by de facto mandatory technical specifications and/or voluntary standards, do not necessarily lead to different levels of health and safety, but nevertheless, owing to their disparities, constitute barriers to trade within the Community; whereas, furthermore, conformity certification and national certification systems for machinery differ considerably;
 (7) Whereas existing national health and safety provisions providing protection against the risks caused by machinery must be approximated to ensure free movement on

the market of machinery without lowering existing justified levels of protection in the Member States; whereas the provisions of this Directive concerning the design and construction of machinery, essential for a safer working environment, shall be accompanied by specific provisions concerning the prevention of certain risks to which workers can be exposed at work, as well as by provisions based on the organisation of safety of workers in the working environment;

(8) Whereas Community law, in its present form, provides - by way of derogation from one of the fundamental rules of the Community, namely the free movement of goods - that obstacles to movement within the Community resulting from disparities in national legislation relating to the marketing of products must be accepted in so far as the provisions concerned can be recognised as being necessary to satisfy imperative requirements;

(9) Whereas paragraphs 65 and 68 of the White Paper on the completion of the internal market, approved by the European Council in June 1985, provide for a new approach to legislative harmonisation; whereas, therefore, the harmonisation of laws in this case must be limited to those requirements necessary to satisfy the imperative and essential health and safety requirements relating to machinery; whereas these requirements must replace the relevant national provisions because they are essential;

(10) Whereas the maintenance or improvement of the level of safety attained by the Member States constitutes one of the essential aims of this Directive and of the principle of safety as defined by the essential requirements;

(11) Whereas the field of application of this Directive must be based on a general definition of the term 'machinery' so as to allow the technical development of products;

whereas the development of complex installations and the risks they involve are of an equivalent nature and their express inclusion in the Directive is therefore justified;

(12) Whereas it is also necessary to deal with safety components which are placed on the market separately and the safety function of which is declared by the manufacturer or his authorised representative established in the Community;

(13) Whereas, for trade fairs, exhibitions, etc., it must be possible to exhibit machinery which does not conform to this Directive; whereas, however, interested parties should be properly informed that the machinery does not conform and cannot be purchased in that condition;

(14) Whereas the essential health and safety requirements must be observed in order to ensure that machinery is safe; whereas these requirements must be applied with discernment to take account of the state of the art at the time of construction and of technical and economic requirements;

(15) Whereas the putting into service of machinery within the meaning of this Directive can relate only to the use of the machinery itself as intended by the manufacturer; whereas this does not preclude the laying-down of conditions of use external to the machinery, provided that it is not thereby modified in a way not specified in this Directive;

(16) Whereas it is necessary not only to ensure the free movement and putting into service of machinery bearing the 'CE' marking and having an EC conformity certificate but also to ensure free movement of machinery not bearing the 'CE' marking where it is to be incorporated into other machinery or assembled with other machinery to form a complex installation;

(17) Whereas, therefore, this Directive defines only the essential health and safety requirements of general application, supplemented by a number of more specific

requirements for certain categories of machinery; whereas, in order to help manufacturers to prove conformity to these essential requirements and in order to allow inspection for conformity to the essential requirements, it is desirable to have standards harmonised at European level for the prevention of risks arising out of the design and construction of machinery; whereas these standards harmonised at European level are drawn up by private-law bodies and must retain their non-binding status; whereas for this purpose the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (Cenelec) are the bodies recognised as competent to adopt harmonised standards in accordance with the general guidelines for cooperation between the Commission and these two bodies signed on 13 November 1984; whereas, within the meaning of this Directive, a harmonised standard is a technical specification (European standard or harmonisation document) adopted by either or both of these bodies, on the basis of a remit from the Commission in accordance with the provisions of Directive 83/189/EEC (4) and on the basis of general guidelines referred to above;

(18) Whereas it was found necessary to improve the legislative framework in order to ensure an effective and appropriate contribution by employers and employees to the standardisation process;

(19) Whereas the Member States' responsibility for safety, health and the other aspects covered by the essential requirements on their territory must be recognised in a safeguard clause providing for adequate Community protection procedures;

(20) Whereas, as is currently the practice in Member States, manufacturers should retain the responsibility for certifying the conformity of their machinery to the relevant essential

requirements; whereas conformity to harmonised standards creates a presumption of conformity to the relevant essential requirements; whereas it is left to the sole discretion of the manufacturer, where he feels the need, to have his products examined and certified by a third party;

(21) Whereas, for certain types of machinery having a higher risk factor, a stricter certification procedure is desirable; whereas the EC type-examination procedure adopted may result in an EC declaration being given by the manufacturer without any stricter requirement such as a guarantee of quality, EC verification or EC supervision;

(22) Whereas it is essential that, before issuing an EC declaration of conformity, the manufacturer or his authorised representative established in the Community should provide a technical construction file; whereas it is not, however, essential that all documentation be permanently available in a material manner, but it must be made available on demand; whereas it need not include detailed plans of the sub-assemblies used in manufacturing the machines, unless knowledge of these is indispensable in order to ascertain conformity with essential safety requirements;

(23) Whereas, in its communication of 15 June 1989 on a global approach to certification and testing (5), the Commission proposed that common rules be drawn up concerning a 'CE' conformity marking with a single design; whereas, in its resolution of 21 December 1989 on a global approach to conformity assessment (6), the Council approved as a guiding principle the adoption of a consistent approach such as this with regard to the use of the 'CE' marking; whereas the two basic elements of the new approach which must be applied are therefore the essential requirements and the conformity assessment procedures;

(24) Whereas the addressees of any decision taken under this Directive must be

informed of the reasons for such a decision and the legal remedies open to them;

(25) Whereas this Directive must not affect the obligations of the Member States concerning the deadlines for transposition
CHAPTER I SCOPE, PLACING ON THE MARKET AND FREEDOM OF MOVEMENT

Article 1

1. This Directive applies to machinery and lays down the essential health and safety requirements therefor, as defined in Annex I. It shall also apply to safety components placed on the market separately.

2. For the purposes of this Directive:

(a) 'machinery' means:

- an assembly of linked parts or components, at least one of which moves, with the appropriate actuators, control and power circuits, etc., joined together for a specific application, in particular for the processing, treatment, moving or packaging of a material,
- an assembly of machines which, in order to achieve the same end, are arranged and controlled so that they function as an integral whole,
- interchangeable equipment modifying the function of a machine, which is placed on the market for the purpose of being assembled with a machine or a series of different machines or with a tractor by the operator himself in so far as this equipment is not a spare part or a tool;

(b) 'safety components' means a component, provided that it is not interchangeable equipment, which the manufacturer or his authorised representative established in the Community places on the market to fulfil a safety function when in use and the failure or malfunctioning of which endangers the safety or health of exposed persons.

3. The following are excluded from the scope of this Directive:

- machinery whose only power source is directly applied manual effort, unless it is a machine used for lifting or lowering loads,

and application of the Directives set out in Annex VIII, part B,

HAVE ADOPTED THIS DIRECTIVE:

- machinery for medical use used in direct contact with patients,
- special equipment for use in fairgrounds and/or amusement parks,
- steam boilers, tanks and pressure vessels,
- machinery specially designed or put into service for nuclear purposes which, in the event of failure, may result in an emission of radioactivity,
- radioactive sources forming part of a machine,
- firearms,
- storage tanks and pipelines for petrol, diesel fuel, inflammable liquids and dangerous substances, - means of transport, i.e. vehicles and their trailers intended solely for transporting passengers by air or on road, rail or water networks, as well as means of transport in so far as such means are designed for transporting goods by air, on public road or rail networks or on water. Vehicles used in the mineral extraction industry shall not be excluded,
- seagoing vessels and mobile offshore units together with equipment on board such vessels or units,
- cableways, including funicular railways, for the public or private transportation of persons,
- agricultural and forestry tractors, as defined in Article 1(1) of Directive 74/150/EEC (7),
- machines specially designed and constructed for military or police purposes,
- lifts which permanently serve specific levels of buildings and constructions, having a car moving between guides which are rigid and inclined at an angle of more than 15 degrees to the horizontal and designed for the transport of:
 - (i) persons;
 - (ii) persons and goods;

(iii) goods alone if the car is accessible, that is to say, a person may enter it without difficulty, and fitted with controls situated inside the car or within reach of a person inside,

- means of transport of persons using rack and pinion rail mounted vehicles,
- mine winding gear,
- theatre elevators,
- construction site hoists intended for lifting persons or persons and goods.

4. Where, for machinery or safety components, the risks referred to in this Directive are wholly or partly covered by specific Community Directives, this Directive shall not apply, or shall cease to apply, in the case of such machinery or safety components and of such risks on the implementation of these specific Directives.

5. Where, for machinery, the risks are mainly of electrical origin, such machinery shall be covered exclusively by Directive 73/23/EEC (8).

Article 2

1. Member States shall take all appropriate measures to ensure that machinery or safety components covered by this Directive may be placed on the market and put into service only if they do not endanger the health or safety of persons and, where appropriate, domestic animals or property, when properly installed and maintained and used for their intended purpose.

2. This Directive shall not affect Member States' entitlement to lay down, in due observance of the Treaty, such requirements as they may deem necessary to ensure that persons and in particular workers are protected when using the machinery or safety components in question, provided that this does not mean that the machinery or safety components are modified in a way not specified in the Directive.

3. At trade fairs, exhibitions, demonstrations, etc., Member States shall not prevent the

showing of machinery or safety components which do not conform to the provisions of this Directive, provided that a visible sign clearly indicates that such machinery or safety components do not conform and that they are not for sale until they have been brought into conformity by the manufacturer or his authorised representative established in the Community. During demonstrations, adequate safety measures shall be taken to ensure the protection of persons.

Article 3

Machinery and safety components covered by this Directive shall satisfy the essential health and safety requirements set out in Annex I.

Article 4

1. Member States shall not prohibit, restrict or impede the placing on the market and putting into service in their territory of machinery and safety components which comply with this Directive.

2. Member States shall not prohibit, restrict or impede the placing on the market of machinery where the manufacturer or his authorised representative established in the Community declares in accordance with point B of Annex II that it is intended to be incorporated into machinery or assembled with other machinery to constitute machinery covered by this Directive, except where it can function independently.

'Interchangeable equipment', as referred to in the third indent of Article 1(2)(a), must in all cases bear the CE marking and be accompanied by the EC declaration of conformity referred to in Annex II, point A.

3. Member States may not prohibit, restrict or impede the placing on the market of safety components as defined in Article 1(2) where they are accompanied by an EC declaration of conformity by the manufacturer or his authorised representative established in the Community as referred to in Annex II, point

C.

Article 5

1. Member States shall regard the following as conforming to all the provisions of this Directive, including the procedures for checking the conformity provided for in Chapter II:

- machinery bearing the CE marking and accompanied by the EC declaration of conformity referred to in Annex II, point A,
- safety components accompanied by the EC declaration of conformity referred to in Annex II, point C.

In the absence of harmonised standards, Member States shall take any steps they deem necessary to bring to the attention of the parties concerned the existing national technical standards and specifications which are regarded as important or relevant to the Article 6

1. Where a Member State or the Commission considers that the harmonised standards referred to in Article 5(2) do not entirely satisfy the essential requirements referred to in Article 3, the Commission or the Member State concerned shall bring the matter before the committee set up under Directive 83/189/EEC, giving the reasons therefor. The committee shall deliver an opinion without delay.

Upon receipt of the committee's opinion, the Commission shall inform the Member States whether or not it is necessary to withdraw those standards from the published information referred to in Article 5(2).

2. A standing committee shall be set up, consisting of representatives appointed by the Member States and chaired by a representative of the Commission. The standing committee shall draw up its own rules of procedure.

Any matter relating to the implementation and practical application of this Directive may be brought before the standing committee, in accordance with the following procedure:

proper implementation of the essential safety and health requirements in Annex I.

2. Where a national standard transposing a harmonised standard, the reference for which has been published in the Official Journal of the European Communities, covers one or more of the essential safety requirements, machinery or safety components constructed in accordance with this standard shall be presumed to comply with the relevant essential requirements. Member States shall publish the references of national standards transposing harmonised standards.

3. Member States shall ensure that appropriate measures are taken to enable the social partners to have an influence at national level on the process of preparing and monitoring the harmonised standards.

The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft, within a time limit which the chairman may lay down according to the urgency of the matter, if necessary by taking a vote.

The opinion shall be recorded in the minutes; in addition, each Member State shall have the right to ask to have its position recorded in the minutes.

The Commission shall take the utmost account of the opinion delivered by the committee. It shall inform the committee of the manner in which its opinion has been taken into account.

Article 7

1. Where a Member State ascertains that:

- machinery bearing the CE marking, or
- safety components accompanied by the EC declaration of conformity,

used in accordance with their intended purpose are liable to endanger the safety of persons, and, where appropriate, domestic animals or property, it shall take all

appropriate measures to withdraw such machinery or safety components from the market, to prohibit the placing on the market, putting into service or use thereof, or to restrict free movement thereof.

Member States shall immediately inform the Commission of any such measure, indicating the reason for its decision and, in particular, whether non-conformity is due to:

- (a) failure to satisfy the essential requirements referred to in Article 3;
- (b) incorrect application of the standards referred to in Article 5(2);
- (c) shortcomings in the standards themselves referred to in Article 5(2).

2. The Commission shall enter into consultation with the parties concerned without delay. Where the Commission considers, after this consultation, that the measure is justified, it shall immediately so inform the Member State which took the initiative and the other Member States.

Where the Commission considers, after this consultation, that the action is unjustified, it shall immediately so inform the Member

State which took the initiative and the manufacturer or his authorised representative established within the Community. Where the decision referred to in paragraph 1 is based on a shortcoming in the standards, and where the Member State at the origin of the decision maintains its position, the Commission shall immediately inform the committee in order to initiate the procedures referred to in Article 6(1).

3. Where:

- machinery which does not comply bears the CE marking,
- a safety component which does not comply is accompanied by an EC declaration of conformity,

the competent Member State shall take appropriate action against whom so ever has affixed the marking or drawn up the declaration and shall so inform the Commission and other Member States.

4. The Commission shall ensure that Member States are kept informed of the progress and outcome of this procedure.

CHAPTER II CONFORMITY ASSESSMENT PROCEDURES

Article 8

1. The manufacturer or his authorised representative established in the Community must, in order to certify that machinery and safety components are in conformity with this Directive, draw up for all machinery or safety components manufactured an EC declaration of conformity based on the model given in Annex II, point A or C as appropriate.

In addition, for machinery alone, the manufacturer or his authorised representatives established in the Community must affix to the machine the CE marking.

2. Before placing on the market, the

manufacturer, or his authorised representative established in the Community, shall:

- (a) if the machinery is not referred to in Annex IV, draw up the file provided for in Annex V;
- (b) if the machinery is referred to in Annex IV and its manufacturer does not comply, or only partly complies, with the standards referred to in Article 5(2) or if there are no such standards, submit an example of the machinery for the EC type-examination referred to in Annex VI;
- (c) if the machinery is referred to in Annex IV and is manufactured in accordance with the standards referred to in Article 5(2):
 - either draw up the file referred to in Annex

VI and forward it to a notified body, which will acknowledge receipt of the file as soon as possible and keep it,

- submit the file referred to in Annex VI to the notified body, which will simply verify that the standards referred to in Article 5(2) have been correctly applied and will draw up a certificate of adequacy for the file,
- or submit the example of the machinery for the EC type-examination referred to in Annex VI.

3. Where the first indent of paragraph 2(c) of this Article applies, the provisions of the first sentence of paragraphs 5 and 7 of Annex VI shall also apply.

Where the second indent of paragraph 2(c) of this Article applies, the provisions of paragraphs 5, 6 and 7 of Annex VI shall also apply.

4. Where paragraph 2(a) and the first and second indents of paragraph 2(c) apply, the EC declaration of conformity shall solely state conformity with the essential requirements of the Directive.

Where paragraph 2(b) and the third indent of paragraph 2(c) apply, the EC declaration of conformity shall state conformity with the example that underwent EC type-examination.

5. Safety components shall be subject to the certification procedures applicable to machinery pursuant to paragraphs 2, 3 and 4. Furthermore, during EC type-examination, the notified body shall verify the suitability of the safety component for fulfilling the safety functions declared by the manufacturer.

6. (a) Where the machinery is subject to other Directives concerning other aspects and which also provide for the affixing of the CE marking, the latter shall indicate that the machinery is also presumed to conform to the provisions of those other Directives.

(b) However, where one or more of those Directives allow the manufacturer, during a transitional period, to choose which arrangements to apply, the CE marking shall

indicate conformity only to the Directives applied by the manufacturer. In this case, particulars of the Directives applied, as published in the Official Journal of the European Communities, must be given in the documents, notices or instructions required by the directives and accompanying such machinery.

7. Where neither the manufacturer nor his authorised representative established in the Community fulfils the obligations of paragraphs 1 to 6, these obligations shall fall to any person placing the machinery or safety component on the market in the Community. The same obligations shall apply to any person assembling machinery or parts thereof or safety components of various origins or constructing machinery or safety components for his own use.

8. The obligations referred to in paragraph 7 shall not apply to persons who assemble with a machine or tractor interchangeable equipment as provided for in Article 1, provided that the parts are compatible and each of the constituent parts of the assembled machine bears the CE marking and is accompanied by the EC declaration of conformity.

Article 9

1. Member States shall notify the Commission and the other Member States of the approved bodies which they have appointed to carry out the procedures referred to in Article 8 together with the specific tasks which these bodies have been appointed to carry out and the identification numbers assigned to them beforehand by the Commission.

The Commission shall publish in the Official Journal of the European Communities a list of the notified bodies and their identification numbers and the tasks for which they have been notified. The Commission shall ensure that this list is kept up to date.

2. Member States shall apply the criteria laid down in Annex VII in assessing the bodies to

be indicated in such notification. Bodies meeting the assessment criteria laid down in the relevant harmonised standards shall be presumed to fulfil those criteria.

3. A Member State which has approved a body must withdraw its notification if it finds

that the body no longer meets the criteria referred to in Annex VII. It shall immediately inform the Commission and the other Member States accordingly.

CHAPTER III CE MARKING

Article 10

1. The CE conformity marking shall consist of the initials 'CE'. The form of the marking to be used is shown in Annex III.

2. The CE marking shall be affixed to machinery distinctly and visibly in accordance with point 1.7.3 of Annex I.

3. The affixing of markings on the machinery which are likely to deceive third parties as to the meaning and form of the CE marking shall be prohibited. Any other marking may be affixed to the machinery provided that the visibility and legibility of the CE marking is not thereby reduced.

4. Without prejudice to Article 7:

(a) where a Member State establishes that the CE marking has been affixed unduly, the manufacturer or his authorised representative established within the Community shall be obliged to make the product conform as regards the provisions concerning the CE marking and to end the infringement under the conditions imposed by the Member State;

(b) where non-conformity continues, the Member State must take all appropriate measures to restrict or prohibit the placing on the market of the product in question or to ensure that it is withdrawn from the market in accordance with the procedure laid down in Article 7.

which restricts the placing on the market and putting into service of machinery or a safety component shall state the exact grounds on which it is based. Such a decision shall be notified as soon as possible to the party concerned, who shall at the same time be informed of the legal remedies available to him under the laws in force in the Member State concerned and of the time limits to which such remedies are subject.

Article 12

The Commission will take the necessary steps to have information on all the relevant decisions relating to the management of this Directive made available.

Article 13

1. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the field governed by this Directive.

2. The Commission shall, before 1 January 1994, examine the progress made in the standardisation work relating to this Directive and propose any appropriate measures.

Article 14

1. The Directives listed in Annex VIII, Part A, are hereby repealed, without prejudice to the obligations of the Member States concerning the deadlines for transposition and application of the said Directives, as set out in Annex VIII, Part B.

2. References to the repealed Directives shall be construed as references to this Directive and be read in accordance with the correlation table set out in Annex IX.

CHAPTER IV FINAL PROVISIONS

Article 11

Any decision taken pursuant to this Directive

Article 15

This Directive shall enter into force on the 20th day following that of its publication in the Official Journal of the European Communities.

Article 16

This Directive is addressed to the Member States.

Done at Luxembourg, 22 June 1998.

For the European Parliament

The President

J. M. GIL-ROBLES

For the Council

The President

J. CUNNINGHAM

(1) OJ C 133, 28.4.1997, p. 6.

(2) Opinion of the European Parliament of 17 September 1997 (OJ C 304, 6.10.1997, p. 79), Council common position of 24 March 1998 (OJ C 161, 27.5.1998, p. 54) and Decision of the European Parliament of 30 April 1998 (OJ C 152, 18.5.1998). Council Decision of 25 May 1998.

(3) OJ L 183, 29.6.1989, p. 9. Directive as last amended by Directive 93/68/EEC (OJ L 220, 30.8.1993, p. 1).

(4) Council Directive 83/189/EEC of 28 March 1983 laying down a procedure for the provision of information in the field of technical standards and regulations (OJ L 109, 26.4.1983, p. 8). Directive as last amended by Commission Decision 96/139/EC (OJ L 32, 10.2.1996, p. 31).

(5) OJ C 231, 8.9.1989, p. 3, and OJ C 267, 19.10.1989, p. 3.

(6) OJ C 10, 16.1.1990, p. 1.

(7) Council Directive 74/150/EEC of 4 March 1974 on the approximation of the laws of the Member States relating to the type-approval of wheeled agricultural or forestry tractors (OJ L 84, 28.3.1974, p. 10). Directive as last amended by Decision 95/1/EC, Euratom, ECSC (OJ L 1.1.1995, p. 1).

(8) Council Directive 73/23/EEC of 19 February 1973 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (OJ L 77, 26.3.1973, p. 29). Directive as last amended by Directive 93/68/EEC (OJ L 220, 30.8.1993, p. 1).

ANNEX I

ESSENTIAL HEALTH AND SAFETY REQUIREMENTS RELATING TO THE DESIGN AND CONSTRUCTION OF MACHINERY AND SAFETY COMPONENTS
For the purposes of this Annex 'machinery' means either 'machinery' or 'safety component' as defined in Article 1(2).

PRELIMINARY OBSERVATIONS

1. The obligations laid down by the essential health and safety requirements apply only when the corresponding hazard exists for the machinery in question when it is used under the conditions foreseen by the manufacturer. In any event, requirements 1.1.2, 1.7.3 and 1.7.4 apply to all machinery covered by this Directive.

2. The essential health and safety requirements laid down in this Directive are mandatory. However, taking into account the state of the art, it may not be possible to meet the objectives set by them. In this case, the machinery must as far as possible be designed and constructed with the purpose of approaching those objectives.

3. The essential health and safety requirements have been grouped according to the hazards which they cover. Machinery presents a series of hazards which may be indicated under more than one heading in this Annex.

The manufacturer is under an obligation to assess the hazards in order to identify all of those which apply to his machine; he must

then design and construct it taking account of his assessment.

1. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS

1.1. General remarks

1.1.1. Definitions

For the purpose of this Directive:

1. 'danger zone' means any zone within and/or around machinery in which an exposed person is subject to a risk to his health or safety;
2. 'exposed person' means any person wholly or partially in a danger zone;
3. 'operator' means the person or persons given the task of installing, operating, adjusting, maintaining, cleaning, repairing or transporting machinery.

1.2.2. Principles of safety integration

(a) Machinery must be so constructed that it is fitted for its function, and can be adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen by the manufacturer.

The aim of measures taken must be to eliminate any risk of accident throughout the foreseeable lifetime of the machinery, including the phases of assembly and dismantling, even where risks of accident arise from foreseeable abnormal situations.

- (b) In selecting the most appropriate methods, the manufacturer must apply the following principles, in the order given:
- eliminate or reduce risks as far as possible (inherently safe machinery design and construction),
 - take the necessary protection measures in relation to risks that cannot be eliminated,
 - inform users of the residual risks due to any shortcomings of the protection measures adopted, indicate whether any particular

training is required and specify any need to provide personal protection equipment.

(c) When designing and constructing machinery, and when drafting the instructions, the manufacturer must envisage not only the normal use of the machinery but also uses which could reasonably be expected.

The machinery must be designed to prevent abnormal use if such use would engender a risk. In other cases the instructions must draw the user's attention to ways - which experience has shown might occur - in which the machinery should not be used.

(d) Under the intended conditions of use, the discomfort, fatigue and psychological stress faced by the operator must be reduced to the minimum possible taking ergonomic principles into account.

(e) When designing and constructing machinery, the manufacturer must take account of the constraints to which the operator is subject as a result of the necessary or foreseeable use of personal protection equipment (such as footwear, gloves, etc.).

(f) Machinery must be supplied with all the essential special equipment and accessories to enable it to be adjusted, maintained and used without risk.

1.1.3. Materials and products

The materials used to construct machinery or products used and created during its use must not endanger exposed persons' safety or health.

In particular, where fluids are used, machinery must be designed and constructed for use without risks due to filling, use, recovery or draining.

1.1.4. Lighting

The manufacturer must supply integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity.

The manufacturer must ensure that there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects due to the lighting provided by the manufacturer. Internal parts requiring frequent inspection, and adjustment and maintenance areas, must be provided with appropriate lighting.

1.1.5. Design of machinery to facilitate its handling

Machinery or each component part thereof must:

- be capable of being handled safely,
 - be packaged or designed so that it can be stored safely and without damage (e.g. adequate stability, special supports, etc.).
- Where the weight, size or shape of machinery or its various component parts prevents them from being moved by hand, the machinery or each component part must:
- either be fitted with attachments for lifting gear, or
 - be designed so that it can be fitted with such attachments (e.g. threaded holes), or
 - be shaped in such a way that standard lifting gear can easily be attached.

Where machinery or one of its component parts is to be moved by hand, it must:

- either be easily movable, or
- be equipped for picking up (e.g. hand-grips, etc.) and moving in complete safety.

Special arrangements must be made for the handling of tools and/or machinery parts, even if lightweight, which could be dangerous (shape, material, etc.).

1.2. Controls

1.2.1. Safety and reliability of control systems

Control systems must be designed and constructed so that they are safe and reliable, in a way that will prevent a dangerous situation arising. Above all they must be designed and constructed in such a way that:

- they can withstand the rigours of normal use and external factors,

- errors in logic do not lead to dangerous situations.

1.2.2. Control devices

Control devices must be:

- clearly visible and identifiable and appropriately marked where necessary,
- positioned for safe operation without hesitation or loss of time, and without ambiguity,
- designed so that the movement of the control is consistent with its effect,
- located outside the danger zones, except for certain controls where necessary, such as emergency stop, console for training of robots,
- positioned so that their operation cannot cause additional risk,
- designed or protected so that the desired effect, where a risk is involved, cannot occur without an intentional operation,
- made so as to withstand foreseeable strain; particular attention must be paid to emergency stop devices liable to be subjected to considerable strain.

Where a control is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence (e.g. keyboards, etc.), the action to be performed must be clearly displayed and subject to confirmation where necessary.

Controls must be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles. Constraints due to the necessary or foreseeable use of personal protection equipment (such as footwear, gloves, etc.) must be taken into account.

Machinery must be fitted with indicators (dials, signals, etc.) as required for safe operation. The operator must be able to read them from the control position.

From the main control position the operator must be able to ensure that there are no

exposed persons in the danger zones. If this is impossible, the control system must be designed and constructed so that an acoustic and/ or visual warning signal is given whenever the machinery is about to start. The exposed person must have the time and the means to take rapid action to prevent the machinery starting up.

1.2.3. Starting

It must be possible to start machinery only by voluntary actuation of a control provided for the purpose.

The same requirement applies:

- when restarting the machinery after a stoppage, whatever the cause,
- when effecting a significant change in the operating conditions (e.g. speed, pressure, etc.),

unless such restarting or change in operating conditions is without risk to exposed persons.

This essential requirement does not apply to the restarting of the machinery or to the change in operating conditions resulting from the normal sequence of an automatic cycle.

Where machinery has several starting controls and the operators can therefore put each other in danger, additional devices (e.g. enabling devices or selectors allowing only one part of the starting mechanism to be actuated at any one time) must be fitted to rule out such risks.

It must be possible for automated plant functioning in automatic mode to be restarted easily after a stoppage once the safety conditions have been fulfilled.

1.2.4. Stopping device

Normal stopping

Each machine must be fitted with a control whereby the machine can be brought safely to a complete stop.

Each workstation must be fitted with a control to stop some or all of the moving parts of the machinery, depending on the type of hazard,

so that the machinery is rendered safe. The machinery's stop control must have priority over the start controls.

Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off.

Emergency stop

Each machine must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted.

The following exceptions apply:

- machines in which an emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken,
- hand-held portable machines and hand-guided machines.

This device must:

- have clearly identifiable, clearly visible and quickly accessible controls,
- stop the dangerous process as quickly as possible, without creating additional hazards,
- where necessary, trigger or permit the triggering of certain safeguard movements.

Once active operation of the emergency stop control has ceased following a stop command, that command must be sustained by engagement of the emergency stop device until that engagement is specifically overridden; it must not be possible to engage the device without triggering a stop command; it must be possible to disengage the device only by an appropriate operation, and disengaging the device must not restart the machinery but only permit restarting.

Complex installations

In the case of machinery or parts of machinery designed to work together, the manufacturer must so design and construct the machinery that the stop controls, including the emergency stop, can stop not only the machinery itself but also all

equipment upstream and/or downstream if its continued operation can be dangerous.

1.2.5. Mode selection

The control mode selected must override all other control systems with the exception of the emergency stop.

If machinery has been designed and built to allow for its use in several control or operating modes presenting different safety levels (e.g. to allow for adjustment, maintenance, inspection, etc.), it must be fitted with a mode selector which can be locked in each position. Each position of the selector must correspond to a single operating or control mode.

The selector may be replaced by another selection method which restricts the use of certain functions of the machinery to certain categories of operator (e.g. access codes for certain numerically controlled functions, etc.). If, for certain operations, the machinery must be able to operate with its protection devices neutralised, the mode selector must simultaneously:

- disable the automatic control mode,
- permit movements only by controls requiring sustained action,
- permit the operation of dangerous moving parts only in enhanced safety conditions (e.g. reduced speed, reduced power, step-by-step, or other adequate provision) while preventing hazards from linked sequences,
- prevent any movement liable to pose a danger by acting voluntarily or involuntarily on the machine's internal sensors.

In addition, the operator must be able to control operation of the parts he is working on at the adjustment point.

1.2.6. Failure of the power supply

The interruption, re-establishment after an interruption or fluctuation in whatever manner of the power supply to the machinery must not lead to a dangerous situation.

In particular:

- the machinery must not start unexpectedly,
- the machinery must not be prevented from stopping if the command has already been given,
- no moving part of the machinery or piece held by the machinery must fall or be ejected,
- automatic or manual stopping of the moving parts whatever they may be must be unimpeded,
- the protection devices must remain fully effective.

1.2.7. Failure of the control circuit

A fault in the control circuit logic, or failure of or damage to the control circuit must not lead to dangerous situations.

In particular:

- the machinery must not start unexpectedly,
- the machinery must not be prevented from stopping if the command has already been given,
- no moving part of the machinery or piece held by the machinery must fall or be ejected,
- automatic or manual stopping of the moving parts whatever they may be must be unimpeded,
- the protection devices must remain fully effective.

1.2.8. Software

Interactive software between the operator and the command or control system of a machine must be user-friendly.

1.3. Protection against mechanical hazards

1.3.1. Stability

Machinery, components and fittings thereof must be so designed and constructed that they are stable enough, under the foreseen operating conditions (if necessary taking climatic conditions into account) for use without risk of overturning, falling or unexpected movement.

If the shape of the machinery itself or its intended installation does not offer sufficient stability, appropriate means of anchorage must be incorporated and indicated in the instructions.

1.3.2. Risk of break-up during operation

The various parts of machinery and their linkages must be able to withstand the stresses to which they are subject when used as foreseen by the manufacturer. The durability of the materials used must be adequate for the nature of the work place foreseen by the manufacturer, in particular as regards the phenomena of fatigue, ageing, corrosion and abrasion.

The manufacturer must indicate in the instructions the type and frequency of inspection and maintenance required for safety reasons. He must, where appropriate, indicate the parts subject to wear and the criteria for replacement.

Where a risk of rupture or disintegration remains despite the measures taken (e.g. as with grinding wheels) the moving parts must be mounted and positioned in such a way that in case of rupture their fragments will be contained.

Both rigid and flexible pipes carrying fluids, particularly those under high pressure, must be able to withstand the foreseen internal and external stresses and must be firmly attached and/or protected against all manner of external stresses and strains; precautions must be taken to ensure that no risk is posed by a rupture (sudden movement, high-pressure jets, etc.).

Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to the persons exposed (e.g. tool breakage):

- when the workpiece comes into contact with the tool the latter must have attained its normal working conditions,
- when the tool starts and/or stops (intentionally or accidentally) the feed

movement and the tool movement must be coordinated.

1.3.3. Risks due to falling or ejected objects
Precautions must be taken to prevent risks from falling or ejected objects (e.g. workpieces, tools, cuttings, fragments, waste, etc.).

1.3.4. Risks due to surfaces, edges or angles
In so far as their purpose allows, accessible parts of the machinery must have no sharp edges, no sharp angles, and no rough surfaces likely to cause injury.

1.3.5. Risks related to combined machinery
Where the machinery is intended to carry out several different operations with the manual removal of the piece between each operation (combined machinery), it must be designed and constructed in such a way as to enable each element to be used separately without the other elements constituting a danger or risk for the exposed person.

For this purpose, it must be possible to start and stop separately any elements that are not protected.

1.3.6. Risks relating to variations in the rotational speed of tools

When the machine is designed to perform operations under different conditions of use (e.g. different speeds or energy supply), it must be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably.

1.3.7. Prevention of risks related to moving parts

The moving parts of machinery must be designed, built and laid out to avoid hazards or, where hazards persist, fixed with guards or protective devices in such a way as to prevent all risk of contact which could lead to accidents.

All necessary steps must be taken to prevent accidental blockage of moving parts involved in the work. In cases where, despite the precautions taken, a blockage is likely to occur, specific protection devices or tools, the instruction handbook and possibly a sign on the machinery should be provided by the manufacturer to enable the equipment to be safely unblocked.

1.3.8. Choice of protection against risks related to moving parts

Guards or protection devices used to protect against the risks related to moving parts must be selected on the basis of the type of risk. The following guidelines must be used to help make the choice.

A. Moving transmission parts

Guards designed to protect exposed persons against the risks associated with moving transmission parts (such as pulleys, belts, gears, rack and pinions, shafts, etc.) must be:

- either fixed, complying with requirements 1.4.1 and 1.4.2.1, or
- movable, complying with requirements 1.4.1 and 1.4.2.2.A.

Movable guards should be used where frequent access is foreseen.

B. Moving parts directly involved in the process

Guards or protection devices designed to protect exposed persons against the risks associated with moving parts contributing to the work (such as cutting tools, moving parts of presses, cylinders, parts in the process of being machined, etc.) must be:

- wherever possible fixed guards complying with requirements 1.4.1 and 1.4.2.1,
- otherwise, movable guards complying with requirements 1.4.1 and 1.4.2.2.B or protection devices such as sensing devices (e.g. non-material barriers, sensor mats), remote-hold protection devices (e.g. two-

hand controls), or protection devices intended automatically to prevent all or part of the operator's body from encroaching on the danger zone in accordance with requirements 1.4.1 and 1.4.3.

However, when certain moving parts directly involved in the process cannot be made completely or partially inaccessible during operation owing to operations requiring nearby operator intervention, where technically possible such parts must be fitted with:

- fixed guards, complying with requirements 1.4.1 and 1.4.2.1 preventing access to those sections of the parts that are not used in the work,
- adjustable guards, complying with requirements 1.4.1 and 1.4.2.3 restricting access to those sections of the moving parts that are strictly for the work.

1.4. Required characteristics of guards and protection devices

1.4.1. General requirements

Guards and protection devices must:

- be of robust construction,
- not give rise to any additional risk,
- not be easy to by-pass or render non-operational,
- be located at an adequate distance from the danger zone,
- cause minimum obstruction to the view of the production process,
- enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by restricting access only to the area where the work has to be done, if possible without the guard or protection device having to be dismantled.

1.4.2. Special requirements for guards

1.4.2.1. Fixed guards Fixed guards must be securely held in place. They must be fixed by systems that can be opened only with tools.

Where possible, guards must be unable to remain in place without their fixings.

1.4.2.2. Movable guards

A. Type A movable guards must:

- as far as possible remain fixed to the machinery when open,
- be associated with a locking device to prevent moving parts starting up as long as these parts can be accessed and to give a stop command whenever they are no longer closed.

B. Type B movable guards must be designed and incorporated into the control system so that:

- moving parts cannot start up while they are within the operator's reach,
- the exposed person cannot reach moving parts once they have started up,
- they can be adjusted only by means of an intentional action, such as the use of a tool, key, etc.,
- the absence or failure of one of their components prevents starting or stops the moving parts,
- protection against any risk of ejection is proved by means of an appropriate barrier.

1.4.2.3. Adjustable guards restricting access
Adjustable guards restricting access to those areas of the moving parts strictly necessary for the work must:

- be adjustable manually or automatically according to the type of work involved,
- be readily adjustable without the use of tools,
- reduce as far as possible the risk of ejection.

1.4.3. Special requirements for protection devices

Protection devices must be designed and incorporated into the control system so that:

- moving parts cannot start up while they are within the operator's reach,
- the exposed person cannot reach moving

- parts once they have started up,
- they can be adjusted only by means of an intentional action, such as the use of a tool, key, etc.,
- the absence or failure of one of their components prevents starting or stops the moving parts.

1.5. Protection against other hazards

1.5.1. Electricity supply

Where machinery has an electricity supply it must be designed, constructed and equipped so that all hazards of an electrical nature are or can be prevented.

The specific rules in force relating to electrical equipment designed for use within certain voltage limits must apply to machinery which is subject to those limits.

1.5.2. Static electricity

Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system.

1.5.3. Energy supply other than electricity

Where machinery is powered by an energy other than electricity (e.g. hydraulic, pneumatic or thermal energy, etc.), it must be so designed, constructed and equipped as to avoid all potential hazards associated with these types of energy.

1.5.4. Errors of fitting

Errors, likely to be made when fitting or refitting certain parts which could be a source of risk must be made impossible by the design of such parts or, failing this, by information given on the parts themselves and/or the housings. The same information must be given on moving parts and/or their housings where the direction of movement must be known to avoid a risk. Any further information that may be necessary must be given in the instructions.

Where a faulty connection can be the source of risk, incorrect fluid connections, including electrical conductors, must be made impossible by the design or, failing this, by information given on the pipes, cables, etc. and/or connector blocks.

1.5.5. Extreme temperatures

Steps must be taken to eliminate any risk of injury caused by contact with or proximity to machinery parts or materials at high or very low temperatures.

The risk of hot or very cold material being ejected should be assessed. Where this risk exists, the necessary steps must be taken to prevent it or, if this is not technically possible, to render it non-dangerous.

1.5.6. Fire

Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery.

1.5.7. Explosion

Machinery must be designed and constructed to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery.

To that end the manufacturer must take steps to:

- avoid a dangerous concentration of products,
- prevent combustion of the potentially explosive atmosphere,
- minimise any explosion which may occur so that it does not endanger the surroundings.

The same precautions must be taken if the manufacturer foresees the use of the machinery in a potentially explosive atmosphere.

Electrical equipment forming part of the machinery must conform, as far as the risk

from explosion is concerned, to the provision of the specific Directives in force.

1.5.8. Noise

Machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking account of technical progress and the availability of means of reducing noise, in particular at source.

1.5.9. Vibration

Machinery must be so designed and constructed that risks resulting from vibrations produced by the machinery are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source.

1.5.10. Radiation

Machinery must be so designed and constructed that any emission of radiation is limited to the extent necessary for its operation and that the effects on exposed persons are non-existent or reduced to non-dangerous proportions.

1.5.11. External radiation

Machinery must be so designed and constructed that external radiation does not interfere with its operation.

1.5.12. Laser equipment

Where laser equipment is used, the following provisions should be taken into account:

- laser equipment on machinery must be designed and constructed so as to prevent any accidental radiation,
- laser equipment on machinery must be protected so that effective radiation, radiation produced by reflection or diffusion and secondary radiation do not damage health,
- optical equipment for the observation or adjustment of laser equipment on machinery must be such that no health risk is created by

the laser rays.

1.5.13. Emissions of dust, gases, etc.

Machinery must be so designed, constructed and/or equipped that risks due to gases, liquids, dust, vapours and other waste materials which it produces can be avoided. Where a hazard exists, the machinery must be so equipped that the said substances can be contained and/or evacuated.

Where machinery is not enclosed during normal operation, the devices for containment and/or evacuation must be situated as close as possible to the source emission.

1.5.14. Risk of being trapped in a machine

Machinery must be designed, constructed or fitted with a means of preventing an exposed person from being enclosed within it or, if that is impossible, with a means of summoning help.

1.5.15. Risk of slipping, tripping or falling

Parts of the machinery where persons are liable to move about or stand must be designed and constructed to prevent persons slipping, tripping or falling on or off these parts.

1.6. Maintenance

1.6.1. Machinery maintenance

Adjustment, lubrication and maintenance points must be located outside danger zones. It must be possible to carry out adjustment, maintenance, repair, cleaning and servicing operations while machinery is at a standstill.

If one or more of the above conditions cannot be satisfied for technical reasons, these operations must be possible without risk (see 1.2.5).

In the case of automated machinery and, where necessary, other machinery, the manufacturer must make provision for a

connecting device for mounting diagnostic fault-finding equipment.

Automated machine components which have to be changed frequently, in particular for a change in manufacture or where they are liable to wear or likely to deteriorate following an accident, must be capable of being removed and replaced easily and in safety. Access to the components must enable these tasks to be carried out with the necessary technical means (tools, measuring instruments, etc.) in accordance with an operating method specified by the manufacturer.

1.6.2. Access to operating position and servicing points

The manufacturer must provide means of access (stairs, ladders, catwalks, etc.) to allow access in safety to all areas used for production, adjustment and maintenance operations.

1.6.3. Isolation of energy sources

All machinery must be fitted with means to isolate it from all energy sources. Such isolators must be clearly identified. They must be capable of being locked if reconnection could endanger exposed persons. In the case of machinery supplied with electricity through a plug capable of being plugged into a circuit, separation of the plug is sufficient.

The isolator must be capable of being locked also where an operator is unable, from any of the points to which he has access, to check that the energy is still cut off.

After the energy is cut off, it must be possible to dissipate normally any energy remaining or stored in the circuits of the machinery without risk to exposed persons.

As an exception to the above requirements, certain circuits may remain connected to their energy sources in order, for example, to hold parts, protect information, light interiors, etc. In this case, special steps must be taken

to ensure operator safety.

1.6.4. Operator intervention

Machinery must be so designed, constructed and equipped that the need for operator intervention is limited.

If operator intervention cannot be avoided, it must be possible to carry it out easily and in safety.

1.6.5. Cleaning of internal parts

The machinery must be designed and constructed in such a way that it is possible to clean internal parts which have contained dangerous substances or preparations without entering them; any necessary unblocking must also be possible from the outside. If it is absolutely impossible to avoid entering the machinery, the manufacturer must take steps during its construction to allow cleaning to take place with the minimum of danger.

1.7. Indicators

1.7.0. Information devices

The information needed to control machinery must be unambiguous and easily understood.

It must not be excessive to the extent of overloading the operator.

Where the health and safety of exposed persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning.

1.7.1. Warning devices

Where machinery is equipped with warning devices (such as signals, etc.), these must be unambiguous and easily perceived.

The operator must have facilities to check the operation of such warning devices at all times.

The requirements of the specific Directives

concerning colours and safety signals must be complied with.

1.7.2. Warning of residual risks

Where risks remain despite all the measures adopted or in the case of potential risks which are not evident (e.g. electrical cabinets, radioactive sources, bleeding of a hydraulic circuit, hazard in an unseen area, etc.), the manufacturer must provide warnings.

Such warnings should preferably use readily understandable pictograms and/or be drawn up in one of the languages of the country in which the machinery is to be used, accompanied, on request, by the languages understood by the operators.

1.7.3. Marking

All machinery must be marked legibly and indelibly with the following minimum particulars:

- name and address of the manufacturer,
- the CE marking (see Annex III),
- designation of series or type,
- serial number, if any,
- the year of construction.

Furthermore, where the manufacturer constructs machinery intended for use in a potentially explosive atmosphere, this must be indicated on the machinery.

Machinery must also bear full information relevant to its type and essential to its safe use (e.g. maximum speed of certain rotating parts, maximum diameter of tools to be fitted, mass, etc.).

Where a machine part must be handled during use with lifting equipment, its mass must be indicated legibly, indelibly and unambiguously.

The interchangeable equipment referred to in the third indent of Article 1(2)(a), must bear the same information.

1.7.4. Instructions

(a) All machinery must be accompanied by

instructions including at least the following:

- a repeat of the information with which the machinery is marked, except the serial number (see 1.7.3) together with any appropriate additional information to facilitate maintenance (e.g. addresses of the importer, repairers, etc.),
- foreseen use of the machinery within the meaning of 1.1.2(c),
- workstation(s) likely to be occupied by operators,
- instructions for safe:
 - putting into service,
 - use,
 - handling, giving the mass of the machinery and its various parts where they are regularly to be transported separately,
 - assembly, dismantling,
 - adjustment,
 - maintenance (servicing and repair),
 - where necessary, training instructions,
 - where necessary, the essential characteristics of tools which may be fitted to the machinery.

Where necessary, the instructions should draw attention to ways in which the machinery should not be used.

(b) The instructions must be drawn up in one of the Community languages by the manufacturer or his authorised representative established in the Community. On being put into service, all machinery must be accompanied by a translation of the instructions in the language or languages of the country in which the machinery is to be used and by the instructions in the original language. This translation must be done either by the manufacturer or his authorised representative established in the Community or by the person introducing the machinery into the language area in question. By way of derogation from this requirement, the maintenance instructions for use by specialised personnel employed by the manufacturer or his authorised representative established in the Community

may be drawn up in only one of the Community languages understood by that personnel.

(c) The instructions must contain the drawings and diagrams necessary for putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the machinery, and all useful instructions in particular with regard to safety.

(d) Any literature describing the machinery must not contradict the instructions as regards safety aspects. The technical documentation describing the machinery must give information regarding the airborne noise emissions referred to in (f) and, in the case of hand-held and/or hand-guided machinery, information regarding vibration as referred to in 2.2.

(e) Where necessary, the instructions must give the requirements relating to installation and assembly for reducing noise or vibration (e.g. use of dampers, type and mass of foundation block, etc.).

(f) The instructions must give the following information concerning airborne noise emissions by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery:

- equivalent continuous A-weighted sound pressure level at workstations, where this exceeds 70 dB(A); where this level does not exceed 70 dB(A), this fact must be indicated,
- peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 µPa),
- sound power level emitted by the machinery where the equivalent continuous A-weighted sound pressure level at workstations exceeds 85 dB(A).

In the case of very large machinery, instead of the sound power level, the equivalent continuous sound pressure levels at specified positions around the machinery may be indicated.

Where the harmonised standards are not

applied, sound levels must be measured using the most appropriate method for the machinery.

The manufacturer must indicate the operating conditions of the machinery during measurement and what methods have been used for the measurement.

Where the workstation(s) are undefined or cannot be defined, sound pressure levels must be measured at a distance of 1 metre from the surface of the machinery and at a height of 1,60 metres from the floor or access platform. The position and value of the maximum sound pressure must be indicated.

(g) If the manufacturer foresees that the machinery will be used in a potentially explosive atmosphere, the instructions must give all the necessary information.

(h) In the case of machinery which may also be intended for use by non-professional operators, the wording and layout of the instructions for use, whilst respecting the other essential requirements mentioned above, must take into account the level of general education and acumen that can reasonably be expected from such operators.

2. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR CERTAIN CATEGORIES OF MACHINERY

2.1. Agri-foodstuffs machinery

Where machinery is intended to prepare and process foodstuffs (e.g. cooking, refrigeration, thawing, washing, handling, packaging, storage, transport or distribution), it must be so designed and constructed as to avoid any risk of infection, sickness or contagion and the following hygiene rules must be observed:

(a) materials in contact, or intended to come into contact, with the foodstuffs must satisfy the conditions set down in the relevant Directives. The machinery must be so

designed and constructed that these materials can be clean before each use;

(b) all surfaces including their joinings must be smooth, and must have neither ridges nor crevices which could harbour organic materials;

(c) assemblies must be designed in such a way as to reduce projections, edges and recesses to a minimum. They should preferably be made by welding or continuous bonding. Screws, screwheads and rivets may not be used except where technically unavoidable;

(d) all surfaces in contact with the foodstuffs must be easily cleaned and disinfected, where possible after removing easily dismantled parts. The inside surfaces must have curves of a radius sufficient to allow thorough cleaning;

(e) liquid deriving from foodstuffs as well as cleaning, disinfecting and rinsing fluids should be able to be discharged from the machine without impediment (possible in a 'clean' position);

(f) machinery must be so designed and constructed as to prevent any liquids or living creatures, in particular insects, entering, or any organic matter accumulating in areas that cannot be cleaned (e.g. for machinery not mounted on feet or casters, by placing a seal between the machinery and its base, by the use of sealed units, etc.);

(g) machinery must be so designed and constructed that no ancillary substances (e.g. lubricants, etc.) can come into contact with foodstuffs. Where necessary, machinery must be designed and constructed so that continuing compliance with this requirement can be checked.

Instructions

In addition to the information required in section 1, the instructions must indicate recommended products and methods for cleaning, disinfecting and rinsing (not only for easily accessible areas but also where areas

to which access is impossible or undesirable, such as piping, have to be cleaned in situ).

2.2. Portable hand-held and/or hand-guided machinery

Portable hand-held and/or hand-guided machinery must conform to the following essential health and safety requirements:

- according to the type of machinery, it must have a supporting surface of sufficient size and have a sufficient number of handles and supports of an appropriate size and arranged to ensure the stability of the machinery under the operating conditions foreseen by the manufacturer,
- except where technically impossible or where there is an independent control, in the case of handles which cannot be released in complete safety, it must be fitted with start and stop controls arranged in such a way that the operator can operate them without releasing the handles,
- it must be designed, constructed or equipped to eliminate the risks of accidental starting and/or continued operation after the operator has released the handles. Equivalent steps must be taken if this requirement is not technically feasible,
- portable hand-held machinery must be designed and constructed to allow, where necessary, a visual check of the contact of the tool with the material being processed.

Instructions

The instructions must give the following information concerning vibrations transmitted by hand-held and hand-guided machinery:

- the weighted root mean square acceleration value to which the arms are subjected, if it exceeds $2,5 \text{ m/s}^2$ as determined by the appropriate test code. Where the acceleration does not exceed $2,5 \text{ m/s}^2$, this must be mentioned.

If there is no applicable test code, the manufacturer must indicate the

measurement methods and conditions under which measurements were made.

2.3. Machinery for working wood and analogous materials

Machinery for working wood and machinery for working materials with physical and technological characteristics similar to those of wood, such as cork, bone, hardened rubber, hardened plastic material and other similar stiff material must conform to the following essential health and safety requirements:

- (a) the machinery must be designed, constructed or equipped so that the piece being machined can be placed and guided in safety; where the piece is hand-held on a work-bench the latter must be sufficiently stable during the work and must not impede the movement of the piece;
- (b) where the machinery is likely to be used in conditions involving the risk of ejection of pieces of wood, it must be designed, constructed, or equipped to eliminate this ejection, or, if this is not the case, so that the ejection does not engender risks for the operator and/or exposed persons;
- (c) the machinery must be equipped with an automatic brake that stops the tool in a sufficiently short time if there is a risk of contact with the tool whilst it runs down;
- (d) where the tool is incorporated into a non-fully automated machine, the latter must be so designed and constructed as to eliminate or reduce the risk of serious accidental injury, for example by using cylindrical cutter blocks, restricting depth of cut, etc.

3. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET THE PARTICULAR HAZARDS DUE TO THE MOBILITY OF MACHINERY

Machinery presenting hazards due to mobility must be designed and constructed to meet the requirements set out below.

Risks due to mobility always exist in the case of machinery which is self-propelled, towed or pushed or carried by other machinery or tractors, is operated in working areas and whose operation requires either mobility while working, be it continuous or semi-continuous movement, between a succession of fixed working positions.

Risks due to mobility may also exist in the case of machinery operated without being moved, but equipped in such a way as to enable it to be moved more easily from one place to another (machinery fitted with wheels, rollers, runners, etc. or placed on gantries, trolleys, etc.).

In order to verify that rotary cultivators and power harrows do not present unacceptable risks to the exposed persons, the manufacturer or his authorised representative established within the Community must, for each type of machinery concerned, perform the appropriate tests or have such tests performed.

3.1. General

3.1.1. Definition

'Driver' means an operator responsible for the movement of machinery. The driver may be transported by the machinery or may be on foot, accompanying the machinery, or may be guiding the machinery by remote control (cables, radio, etc.).

3.1.2. Lighting

If intended by the manufacturer to be used in dark places, self-propelled machinery must be fitted with a lighting device appropriate to the work to be carried out, without prejudice to any other regulations applicable (road traffic regulations, navigation rules, etc.).

3.1.3. Design of machinery to facilitate its handling

During the handling of the machine and/or its parts, there must be no possibility of sudden

movements or of hazards due to instability as long as the machine and/or its parts are handled in accordance with the manufacturer's instructions.

3.2. Work stations

3.2.1. Driving position

The driving position must be designed with due regard to ergonomic principles. There may be two or more driving positions and, in such cases, each driving position must be provided with all the requisite controls. Where there is more than one driving position, the machinery must be designed so that the use of one of them precludes the use of the others, except in emergency stops. Visibility from the driving position must be such that the driver can in complete safety for himself and the exposed persons, operate the machinery and its tools in their intended conditions of use. Where necessary, appropriate devices must be provided to remedy hazards due to inadequate direct vision.

Machinery must be so designed and constructed that, from the driving position, there can be no risk to the driver and operators on board from inadvertent contact with the wheels or tracks.

The driving position must be designed and constructed so as to avoid any health risk due to exhaust gases and/or lack of oxygen. The driving position of ride-on drivers must be so designed and constructed that a driver's cab may be fitted as long as there is room. In that case, the cab must incorporate a place for the instructions needed for the driver and/or operators. The driving position must be fitted with an adequate cab where there is a hazard due to a dangerous environment.

Where the machinery is fitted with a cab, this must be designed, constructed and/or equipped to ensure that the driver has good operating conditions and is protected against

any hazards that might exist (for instance: inadequate heating and ventilation, inadequate visibility, excessive noise and vibration, falling objects, penetration by objects, rolling over, etc.). The exit must allow rapid evacuation. Moreover, an emergency exit must be provided in a direction which is different from the usual exit.

The materials used for the cab and its fittings must be fire-resistant.

3.2.2. Seating

The driving seat of any machinery must enable the driver to maintain a stable position and be designed with due regard to ergonomic principles.

The seat must be designed to reduce vibrations transmitted to the driver to the lowest level that can be reasonably achieved. The seat mountings must withstand all stresses to which they can be subjected, notably in the event of rollover. Where there is no floor beneath the driver's feet, the driver must have footrests covered with a slip-resistant material.

Where machinery is fitted with provision for a rollover protection structure, the seat must be equipped with a safety belt or equivalent device which keeps the driver in his seat without restricting any movements necessary for driving or any movements caused by the suspension.

3.2.3. Other places

If the conditions of use provide that operators other than the driver are occasionally or regularly transported by the machinery, or work on it, appropriate places must be provided which enable them to be transported or to work on it without risk, particularly the risk of falling.

Where the working conditions so permit, these work places must be equipped with seats.

Should the driving position have to be fitted

with a cab, the other places must also be protected against the hazards which justified the protection of the driving position.

3.3. Controls

3.3.1. Control devices

The driver must be able to actuate all control devices required to operate the machinery from the driving position, except for functions which can be safely activated only by using control devices located away from the driving position. This refers in particular to working positions other than the driving position, for which operators other than the driver are responsible or for which the driver has to leave his driving position in order to carry out the manoeuvre in safety.

Where there are pedals they must be so designed, constructed and fitted to allow operation by the driver in safety with the minimum risk of confusion; they must have a slip-resistant surface and be easy to clean. Where their operation can lead to hazards, notably dangerous movements, the machinery's controls, except for those with preset positions, must return to the neutral position as soon as they are released by the operator.

In the case of wheeled machinery, the steering system must be designed and constructed to reduce the force of sudden movements of the steering wheel or steering lever caused by shocks to the guide wheels. Any control that locks the differential must be so designed and arranged that it allows the differential to be unlocked when the machinery is moving.

The last sentence of section 1.2.2 does not apply to the mobility function.

3.3.2. Starting/moving

Self-propelled machinery with a ride-on driver must be so equipped as to deter unauthorised persons from starting the engine.

Travel movements of self-propelled machinery with a ride-on driver must be possible only if the driver is at the controls. Where, for operating purposes, machinery must be fitted with devices which exceed its normal clearance zone (e.g. stabilisers, jib, etc.), the driver must be provided with the means of checking easily, before moving the machinery, that such devices are in a particular position which allows safe movement.

This also applies to all other parts which, to allow safe movement, have to be in particular positions, locked if necessary.

Where it is technically and economically feasible, movement of the machinery must depend on safe positioning of the aforementioned parts.

It must not be possible for movement of the machinery to occur while the engine is being started.

3.3.3. Travelling function

Without prejudice to the provisions of road traffic regulations, self-propelled machinery and its trailers must meet the requirements for slowing down, stopping, braking and immobilisation so as to ensure safety under all the operating, loading, speed, ground and gradient conditions allowed for by the manufacturer and corresponding to conditions encountered in normal use.

The driver must be able to slow down and stop self-propelled machinery by means of a main device. Where safety so requires in the event of a failure of the main device, or in the absence of the energy supply to actuate the main device, an emergency device with fully independent and easily accessible controls must be provided for slowing down and stopping.

Where safety so requires, a parking device must be provided to render stationary machinery immobile. This device may be combined with one of the devices referred to in the second paragraph, provided that it is

purely mechanical.

Remote-controlled machinery must be designed and constructed to stop automatically if the driver loses control. Section 1.2.4 does not apply to the travelling function.

3.3.4. Movement of pedestrian-controlled machinery

Movement of pedestrian-controlled self-propelled machinery must be possible only through sustained action on the relevant control by the driver. In particular, it must not be possible for movement to occur while the engine is being started.

The control systems for pedestrian-controlled machinery must be designed to minimise the hazards arising from inadvertent movement of the machine towards the driver. In particular:

- (a) crushing;
- (b) injury from rotating tools.

Also, the speed of normal travel of the machine must be compatible with the pace of a driver on foot.

In the case of machinery on which a rotary tool may be fitted, it must not be possible to actuate that tool when the reversing control is engaged, except where movement of the machinery results from movement of the tool. In the latter case, the reversing speed must be such that it does not endanger the driver.

3.3.5. Control circuit failure

A failure in the power supply to the power-assisted steering, where fitted, must not prevent machinery from being steered during the time required to stop it.

3.4. Protection against mechanical hazards

3.4.1. Uncontrolled movements

When a part of a machine has been stopped, any drift away from the stopping position, for whatever reason other than action at the controls, must be such that it is not a hazard

to exposed persons.

Machinery must be so designed, constructed and where appropriate placed on its mobile support so as to ensure that when moved the uncontrolled oscillations of its centre of gravity do not affect its stability or exert excessive strain on its structure.

3.4.2. Risk of break-up during operation

Parts of machinery rotating at high speed which, despite the measures taken, may break up or disintegrate, must be mounted and guarded in such a way that, in case of breakage, their fragments will be contained or, if that is not possible, cannot be projected towards the driving and/or operation positions.

3.4.3. Rollover

Where, in the case of self-propelled machinery with a ride-on driver and possibly ride-on operators, there is a risk of rolling over, the machinery must be designed for and be fitted with anchorage points allowing it to be equipped with a rollover protective structure (ROPS).

This structure must be such that in case of rolling over it affords the ride-on driver and where appropriate the ride-on operators an adequate deflection-limiting volume (DLV). In order to verify that the structure complies with the requirement laid down in the second paragraph, the manufacturer or his authorised representative established within the Community must, for each type of structure concerned, perform appropriate tests or have such tests performed. In addition, the earth-moving machinery listed below with a capacity exceeding 15 kW must be fitted with a rollover protective structure:

- crawler loaders or wheel loaders,
- backhoe loaders,
- crawler tractors or wheel tractors,
- scrapers, self-loading or not,
- graders,

- articulated steer dumpers.

3.4.4. Falling objects

Where, in the case of machinery with a ride-on driver and possibly ride-on operators, there is a risk due to falling objects or material, the machinery should be designed for, and fitted with, if its size allows, anchorage points allowing it to be equipped with a falling-object protective structure (FOPS).

This structure must be such that in the case of falling objects or material, it guarantees the ride-on operators an adequate deflection-limiting volume (DLV).

In order to verify that the structure complies with the requirement laid down in the second paragraph, the manufacturer or his authorised representative established within the Community must, for each type of structure concerned, perform appropriate tests or have such tests performed.

3.4.5. Means of access

Handholds and steps must be designed, constructed and arranged in such a way that the operators use them instinctively and do not use the controls for that purpose.

3.4.6. Towing devices

All machinery used to tow or to be towed must be fitted with towing or coupling devices designed, constructed and arranged to ensure easy and safe connection and disconnection, and to prevent accidental disconnection during use.

In so far as the towbar load requires, such machinery must be equipped with a support with a bearing surface suited to the load and the ground.

3.4.7. Transmission of power between self-propelled machinery (or tractor) and recipient machinery

Transmission shafts with universal joints linking self-propelled machinery (or tractor) to

the first fixed bearing of recipient machinery must be guarded on the self-propelled machinery side and the recipient machinery side over the whole length of the shaft and associated universal joints.

On the side of the self-propelled machinery (or tractor), the power take-off to which the transmission shaft is attached must be guarded either by a screen fixed to the self-propelled machinery (or tractor) or by any other device offering equivalent protection. On the towed machinery side, the input shaft must be enclosed in a protective casing fixed to the machinery.

Torque limiters or freewheels may be fitted to universal joint transmissions only on the side adjoining the driven machine. The universal-joint transmission shaft must be marked accordingly.

All towed machinery whose operation requires a transmission shaft to connect it to self-propelled machinery or a tractor must have a system for attaching the transmission shaft so that when the machinery is uncoupled the transmission shaft and its guard are not damaged by contact with the ground or part of the machinery.

The outside parts of the guard must be so designed, constructed and arranged that they cannot turn with the transmission shaft. The guard must cover the transmission shaft to the ends of the inner jaws in the case of simple universal joints and at least to the centre of the outer joint or joints in the case of 'wide-angle' universal joints.

Manufacturers providing means of access to working positions near to the universal joint transmission shaft must ensure that shaft guards as described in the sixth paragraph cannot be used as steps unless designed and constructed for that purpose

3.4.8. Moving transmission parts

By way of derogation from section 1.3.8.A, in the case of internal combustion engines, removable guards preventing access to the

moving parts in the engine compartment need not have locking devices if they have to be opened either by the use of a tool or key or by a control located in the driving position if the latter is in a fully enclosed cab with a lock to prevent unauthorised access.

3.5. Protection against other hazards

3.5.1. Batteries

The battery housing must be constructed and located and the battery installed so as to avoid as far as possible the chance of electrolyte being ejected on to the operator in the event of rollover and/or to avoid the accumulation of vapours in places occupied by operators.

Machinery must be so designed and constructed that the battery can be disconnected with the aid of an easily accessible device provided for that purpose.

3.5.2. Fire

Depending on the hazards anticipated by the manufacturer when in use, machinery must, where its size permits:

- either allow easily accessible fire extinguishers to be fitted,
- or be provided with built-in extinguisher systems.

3.5.3. Emissions of dust, gases, etc.

Where such hazards exist, the containment equipment provided for in section 1.5.13 may be replaced by other means, for example precipitation by water spraying.

The second and third paragraphs of section 1.5.13 do not apply where the main function of the machinery is the spraying of products.

3.6. Indications

3.6.1. Signs and warning

Machinery must have means of signalling and/or instruction plates concerning use, adjustment and maintenance, wherever

necessary, to ensure the health and safety of exposed persons. They must be chosen, designed and constructed in such a way as to be clearly visible and indelible.

Without prejudice to the requirements to be observed for travelling on the public highway, machinery with a ride-on driver must have the following equipment:

- an acoustic warning device to alert exposed persons,
- a system of light signals relevant to the intended conditions of use such as stop lamps, reversing lamps and rotating beacons. The latter requirement does not apply to machinery intended solely for underground working and having no electrical power.

Remote-controlled machinery which under normal conditions of use exposes persons to the hazards of impact or crushing must be fitted with appropriate means to signal its movements or with means to protect exposed persons against such hazards. The same applies to machinery which involves, when in use, the constant repetition of a forward and backward movement on a single axis where the back of the machine is not directly visible to the driver.

Machinery must be so constructed that the warning and signalling devices cannot all be disabled unintentionally. Where this is essential for safety, such devices must be provided with the means to check that they are in good working order and their failure must be made apparent to the operator.

Where the movement of machinery or its tools is particularly hazardous, signs on the machinery must be provided to warn against approaching the machinery while it is working; the signs must be legible at a sufficient distance to ensure the safety of persons who have to be in the vicinity.

3.6.2. Marking

The minimum requirements set out in 1.7.3 must be supplemented by the following:

- nominal power expressed in kW,
- mass in kg of the most usual configuration and, where appropriate:
- maximum drawbar pull provided for by the manufacturer at the coupling hook, in N,
- maximum vertical load provided for by the manufacturer on the coupling hook, in N.

3.6.3. Instruction handbook

Apart from the minimum requirements set out in 1.7.4, the instruction handbook must contain the following information:

(a) regarding the vibrations emitted by the machinery, either the actual value or a figure calculated from measurements performed on identical machinery:

- the weighted root mean square acceleration value to which the arms are subjected, if it exceeds 2,5 m/s², should it not exceed 2,5 m/s², this must be mentioned,
 - the weighted root mean square acceleration value to which the body (feet or posterior) is subjected, if it exceeds 0,5 m/s², should it not exceed 0,5 m/s², this must be mentioned.
- Where the harmonised standards are not applied, the vibration must be measured using the most appropriate method for the machinery concerned.

The manufacturer must indicate the operating conditions of the machinery during measurement and which methods were used for taking the measurements;

(b) in the case of machinery allowing several uses depending on the equipment used, manufacturers of basic machinery to which interchangeable equipment may be attached and manufacturers of the interchangeable equipment must provide the necessary information to enable the equipment to be fitted and used safely.

4. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET THE PARTICULAR HAZARDS DUE TO A LIFTING OPERATION

Machinery presenting hazards due to lifting operations - mainly hazards of load falls and collisions or hazards of tipping caused by a lifting operation - must be designed and constructed to meet the requirements set out below.

Risks due to a lifting operation exist particularly in the case of machinery designed to move a unit load involving a change in level during the movement. The load may consist of objects, materials or goods.

4.1. General remarks

4.1.1. Definitions

(a) 'lifting accessories' means components or equipment not attached to the machine and placed between the machinery and the load or on the load in order to attach it;

(b) 'separate lifting accessories' means accessories which help to make up or use a slinging device, such as eyehooks, shackles, rings, eyebolts, etc.;

(c) 'guided load' means the load where the total movement is made along rigid or flexible guides, whose position is determined by fixed points;

(d) 'working coefficient' means the arithmetic ratio between the load guaranteed by the manufacturer up to which a piece of equipment, an accessory or machinery is able to hold it and the maximum working load marked on the equipment, accessory or machinery respectively;

(e) 'test coefficient' means the arithmetic ratio between the load used to carry out the static or dynamic tests on a piece of equipment, an accessory or machinery and the maximum working load marked on the piece of equipment, accessory or machinery;

(f) 'static test' means the test during which the machinery or the lifting accessory is first inspected and subjected to a force corresponding to the maximum working load multiplied by the appropriate static test

coefficient and then re-inspected once the said load has been released to ensure no damage has occurred;

(g) 'dynamic test' means the test during which the machinery is operated in all its possible configurations at maximum working load with account being taken of the dynamic behaviour of the machinery in order to check that the machinery and safety features are functioning properly.

4.1.2. Protection against mechanical hazards

4.1.2.1. Risks due to lack of stability

Machinery must be so designed and constructed that the stability required in 1.3.1 is maintained both in service and out of service, including all stages of transportation, assembly and dismantling, during foreseeable component failures and also during the tests carried out in accordance with the instruction handbook.

To that end, the manufacturer or his authorised representative established within the Community must use the appropriate verification methods; in particular, for self-propelled industrial trucks with lift exceeding 1,80 m, the manufacturer or his authorised representative established within the Community must, for each type of industrial truck concerned, perform a platform stability test or similar test, or have such tests performed.

4.1.2.2. Guide rails and rail tracks

Machinery must be provided with devices which act on the guide rails or tracks to prevent derailment.

However, if derailment occurs despite such devices, or if there is a failure of a rail or of a running component, devices must be provided which prevent the equipment, component or load from falling or the machine overturning.

4.1.2.3. Mechanical strength

Machinery, lifting accessories and removable components must be capable of withstanding the stresses to which they are subjected, both in and, where applicable, out of use, under the installation and operating conditions provided for by the manufacturer, and in all relevant configurations, with due regard, where appropriate, to the effects of atmospheric factors and forces exerted by persons. This requirement must also be satisfied during transport, assembly and dismantling.

Machinery and lifting accessories must be designed and constructed so as to prevent failure from fatigue or wear, taking due account of their intended use.

The materials used must be chosen on the basis of the working environments provided for by the manufacturer, with special reference to corrosion, abrasion, impacts, cold brittleness and ageing.

The machinery and the lifting accessories must be designed and constructed to withstand the overload in the static tests without permanent deformation or patent defect. The calculation must take account of the values of the static test coefficient chosen to guarantee an adequate level of safety: that coefficient has, as a general rule, the following values:

(a) manually-operated machinery and lifting accessories: 1,5;

(b) other machinery: 1,25.

Machinery must be designed and constructed to undergo, without failure, the dynamic tests carried out using the maximum working load multiplied by the dynamic test coefficient. This dynamic test coefficient is chosen so as to guarantee an adequate level of safety: the coefficient is, as a general rule, equal to 1,1.

The dynamic tests must be performed on machinery ready to be put into service under normal conditions of use. As a general rule, the tests will be performed at the nominal speeds laid down by the manufacturer.

Should the control circuit of the machinery allow for a number of simultaneous movements (for example, rotation and displacement of the load), the tests must be carried out under the least favourable conditions, i.e. as a general rule, by combining the movements concerned.

4.1.2.4. Pulleys, drums, chains or ropes

Pulleys, drums and wheels must have a diameter commensurate with the size of rope or chains with which they can be fitted.

Drums and wheels must be so designed, constructed and installed that the ropes or chains with which they are equipped can wind round without falling off.

Ropes used directly for lifting or supporting the load must not include any splicing other than at their ends (splicings are tolerated in installations which are intended from their design to be modified regularly according to needs of use). Complete ropes and their endings have a working coefficient chosen so as to guarantee an adequate level of safety; as a general rule, this coefficient is equal to five.

Lifting chains have a working coefficient chosen so as to guarantee an adequate level of safety; as a general rule, this coefficient is equal to four.

In order to verify that an adequate working coefficient has been attained, the manufacturer or his authorised representative established within the Community must, for each type of chain and rope used directly for lifting the load, and for the rope ends, perform the appropriate tests or have such tests performed.

4.1.2.5. Separate lifting accessories

Lifting accessories must be sized with due regard to fatigue and ageing processes for a number of operating cycles consistent with their expected life-span as specified in the operating conditions for a given application. Moreover:

(a) the working coefficient of the metallic rope/rope-end combination is chosen so as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to five. Ropes must not comprise any splices or loops other than at their ends;

(b) where chains with welded links are used, they must be of the short-link type. The working coefficient of chains of any type is chosen so as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to four;

(c) the working coefficient for textile ropes or slings is dependent on the material, method of manufacture, dimensions and use. This coefficient is chosen so as to guarantee an adequate level of safety; it is, as a general rule, equal to seven, provided the materials used are shown to be of very good quality and the method of manufacture is appropriate to the intended use. Should this not be the case, the coefficient is, as a general rule, set at a higher level in order to secure an equivalent level of safety. Textile ropes and slings must not include any knots, connections or splicing other than at the ends of the sling, except in the case of an endless sling;

(d) all metallic components making up, or used with, a sling must have a working coefficient chosen so as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to four;

(e) the maximum working capacity of a multilegged sling is determined on the basis of the safety coefficient of the weakest leg, the number of legs and a reduction factor which depends on the slinging configuration;

(f) in order to verify that an adequate working coefficient has been attained, the manufacturer or his authorised representative established within the Community must, for each type of component referred to in (a), (b), (c) and (d) perform the appropriate tests or have such tests performed.

4.1.2.6. Control of movements

Devices for controlling movements must act in such a way that the machinery on which they are installed is kept safe:

- (a) machinery must be so designed or fitted with devices that the amplitude of movement of its components is kept within the specified limits. The operation of such devices must, where appropriate, be preceded by a warning;
- (b) where several fixed or rail-mounted machines can be manoeuvred simultaneously in the same place, with risks of collision, such machines must be so designed and constructed as to make it possible to fit systems enabling these risks to be avoided;
- (c) the mechanisms of machinery must be so designed and constructed that the loads cannot creep dangerously or fall freely and unexpectedly, even in the event of partial or total failure of the power supply or when the operator stops operating the machine;
- (d) it must not be possible, under normal operating conditions, to lower the load solely by friction brake, except in the case of machinery whose function requires it to operate in that way;
- (e) holding devices must be so designed and constructed that inadvertent dropping of the loads is avoided.

4.1.2.7. Handling of loads

The driving position of machinery must be located in such a way as to ensure the widest possible view of trajectories of the moving parts, in order to avoid possible collisions with persons or equipment or other machinery which might be manoeuvring at the same time and liable to constitute a hazard.

Machinery with guided loads fixed in one place must be designed and constructed so as to prevent exposed persons from being hit by the load or the counter-weights.

4.1.2.8. Lightning

Machinery in need of protection against the effects of lightning while being used must be fitted with a system for conducting the resultant electrical charges to earth.

4.2. Special requirements for machinery whose power source is other than manual effort

4.2.1. Controls

4.2.1.1. Driving position

The requirements laid down in section 3.2.1 also apply to non-mobile machinery.

4.2.1.2. Seating

The requirements laid down in section 3.2.2, first and second paragraphs, and those laid down in section 3.2.3 also apply to non-mobile machinery.

4.2.1.3. Control devices

The devices controlling movements of the machinery or its equipment must return to their neutral position as soon as they are released by the operator. However, for partial or complete movements in which there is no risk of the load or the machinery colliding, the said devices may be replaced by controls authorising automatic stops at preselected levels without holding a hold-to-run control device.

4.2.1.4. Loading control

Machinery with a maximum working load of not less than 1 000 kilograms or an overturning moment of not less than 40 000 Nm must be fitted with devices to warn the driver and prevent dangerous movements of the load in the event of:

- overloading the machinery:
- either as a result of maximum working loads being exceeded, or
- as a result of the moments due to the loads

being exceeded,
- the moments conducive to overturning being exceeded as a result of the load being lifted.

4.2.2. Installation guided by cables

Cable carriers, tractors or tractor carriers must be held by counter-weights or by a device allowing permanent control of the tension.

4.2.3. Risks to exposed persons. Means of access to driving position and intervention points

Machinery with guided loads and machinery whose load supports follow a clearly defined path must be equipped with devices to prevent any risks to exposed persons. Machinery serving specific levels at which operators can gain access to the load platform in order to stack or secure the load must be designed and constructed to prevent uncontrolled movement of the load platform, in particular while being loaded or unloaded.

4.2.4. Fitness for purpose

When machinery is placed on the market or is first put into service, the manufacturer or his authorised representative established within the Community must ensure, by taking appropriate measures or having them taken, that lifting accessories and machinery which are ready for use - whether manually or power-operated - can fulfil their specified functions safely. The said measures must take into account the static and dynamic aspects of the machinery.

Where the machinery cannot be assembled in the manufacturer's premises, or in the premises of his authorised representative established within the Community, appropriate measures must be taken at the place of use. Otherwise, the measures may be taken either in the manufacturer's premises or at the place of use.

4.3. Marking

4.3.1. Chains and ropes

Each length of lifting chain, rope or webbing not forming part of an assembly must bear a mark or, where this is not possible, a plate or irremovable ring bearing the name and address of the manufacturer or his authorised representative established in the Community and the identifying reference of the relevant certificate.

The certificate should show the information required by the harmonised standards or, should those not exist, at least the following information:

- the name of the manufacturer or his authorised representative established within the Community,
- the address within the Community of the manufacturer or his authorised representative, as appropriate,
- a description of the chain or rope which includes:
 - its nominal size,
 - its construction,
 - the material from which it is made, and
 - any special metallurgical treatment applied to the material,
 - if tested, the standard used,
 - a maximum load to which the chain or rope should be subjected in service. A range of values may be given for specified applications.

4.3.2. Lifting accessories

All lifting accessories must show the following particulars:

- identification of the manufacturer,
- identification of the material (e.g. international classification) where this information is needed for dimensional compatibility,
- identification of the maximum working load,
- CE marking.

In the case of accessories including components such as cables or ropes, on

which marking is physically impossible, the particulars referred to in the first paragraph must be displayed on a plate or by some other means and securely affixed to the accessory.

The particulars must be legible and located in a place where they are not liable to disappear as a result of machining, wear, etc., or jeopardise the strength of the accessory.

4.3.3. Machinery

In addition to the minimum information provided for in 1.7.3, each machine must bear, legibly and indelibly, information concerning the nominal load:

- (i) displayed in uncoded form and prominently on the equipment in the case of machinery which has only one possible value;
- (ii) where the nominal load depends on the configuration of the machine, each driving position must be provided with a load plate indicating, preferably in diagrammatic form or by means of tables, the nominal loads for each configuration.

Machinery equipped with a load support which allows access to persons and involves a risk of falling must bear a clear and indelible warning prohibiting the lifting of persons. This warning must be visible at each place where access is possible.

4.4. Instruction handbook

4.4.1. Lifting accessories

Each lifting accessory or each commercially indivisible batch of lifting accessories must be accompanied with an instruction handbook setting out at least the following particulars:

- normal conditions of use,
- instructions for use, assembly and maintenance,
- the limits of use (particularly for the accessories which cannot comply with

4.1.2.6(e)).

4.4.2. Machinery

In addition to section 1.7.4, the instruction handbook must include the following information:

- (a) the technical characteristics of the machinery, and in particular:
 - where appropriate, a copy of the load table described in section 4.3.3(ii),
 - the reactions at the supports or anchors and characteristics of the tracks,
 - where appropriate, the definition and the means of installation of the ballast;
- (b) the contents of the logbook, if the latter is not supplied with the machinery;
- (c) advice for use, particularly to offset the lack of direct sight of the load by the operator;
- (d) the necessary instructions for performing the tests before first putting into service machinery which is not assembled on the manufacturer's premises in the form in which it is to be used.

5. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY INTENDED FOR UNDERGROUND WORK

Machinery intended for underground work must be designed and constructed to meet the requirements set out below.

5.1. Risks due to lack of stability

Powered roof supports must be so designed and constructed as to maintain a given direction when moving and not slip before and while they come under load and after the load has been removed. They must be equipped with anchorages for the top plates of the individual hydraulic props.

5.2. Movement

Powered roof supports must allow for unhindered movement of exposed persons.

5.3. Lighting

The requirements laid down in the third paragraph of section 1.1.4 do not apply.

5.4. Control devices

The accelerator and brake controls for the movement of machinery running on rails must be manual. The deadman's control may be foot-operated, however.

The control devices of powered roof supports must be designed and laid out so that, during displacement operations, operators are sheltered by a support in place. The control devices must be protected against any accidental release.

5.5. Stopping

Self-propelled machinery running on rails for use in underground work must be equipped with a deadman's control acting on the circuit controlling the movement of the machinery.

5.6. Fire

The second indent of 3.5.2 is mandatory in respect of machinery which comprises highly flammable parts.

The braking system of machinery meant for use in underground working must be designed and constructed so as not to produce sparks or cause fires.

Machinery with heat engines for use in underground working must be fitted only with internal combustion engines using fuel with a low vaporising pressure and which exclude any spark of electrical origin.

5.7. Emissions of dust, gases, etc.

Exhaust gases from internal combustion engines must not be discharged upwards.

6. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET THE PARTICULAR HAZARDS DUE TO THE LIFTING OR MOVING OF PERSONS

Machinery presenting hazards due to the

lifting or moving of persons must be designed and constructed to meet the requirements set out below.

6.1. General

6.1.1. Definition

For the purposes of this Chapter, 'carrier' means the device by which persons are supported in order to be lifted, lowered or moved.

6.1.2. Mechanical strength

The working coefficients defined in heading 4 are inadequate for machinery intended for the lifting or moving of persons and must, as a general rule, be doubled. The floor of the carrier must be designed and constructed to offer the space and strength corresponding to the maximum number of persons and the maximum working load set by the manufacturer.

6.1.3. Loading control for types of device

moved by power other than human strength
The requirements of 4.2.1.4 apply regardless of the maximum working load figure. This requirement does not apply to machinery in respect of which the manufacturer can demonstrate that there is no risk of overloading and/or overturning.

6.2. Controls

6.2.1. Where safety requirements do not impose other solutions:

The carrier must, as a general rule, be designed and constructed so that persons inside have means of controlling movements upwards and downwards and, if appropriate, of moving the carrier horizontally in relation to the machinery.

In operation, those controls must override the other devices controlling the same movement, with the exception of the emergency stop devices.

The controls for these movements must be of

the maintained command type, except in the case of machinery serving specific levels.

6.2.2. If machinery for the lifting or moving of persons can be moved with the carrier in a position other than the rest position, it must be designed and constructed so that the person or persons in the carrier have the means of preventing hazards produced by the movement of the machinery.

6.2.3. Machinery for the lifting or moving of persons must be designed, constructed or equipped so that excess speeds of the carrier do not cause hazards.

6.3. Risks of persons falling from the carrier

6.3.1. If the measures referred to in 1.1.15 are not adequate, carriers must be fitted with a sufficient number of anchorage points for the number of persons possibly using the carrier, strong enough for the attachment of personal protective equipment against the danger of falling.

6.3.2. Any trapdoors in floors or ceilings or side doors must open in a direction which obviates any risk of falling should they open unexpectedly.

6.3.3. Machinery for lifting or moving must be designed and constructed to ensure that the floor of the carrier does not tilt to an extent which creates a risk of the occupants falling, including when moving.

The floor of the carrier must be slip-resistant.

6.4. Risks of the carrier falling or overturning

6.4.1. Machinery for the lifting or moving of persons must be designed and constructed to prevent the carrier falling or overturning.

6.4.2. Acceleration and braking of the carrier or carrying vehicle, under the control of the operator or triggered by a safety device and under the maximum load and speed conditions laid down by the manufacturer, must not cause any danger to exposed persons.

6.5. Markings

Where necessary to ensure safety, the carrier must bear the relevant essential information.

ANNEX II

A. Contents of the EC declaration of conformity for machinery (1)

The EC declaration of conformity must contain the following particulars:

- name and address of the manufacturer or his authorised representative established in the Community (2),
- description of the machinery (3),
- all relevant provisions complied with by the machinery,
- where appropriate, name and address of the notified body and number of the EC type-examination certificate,
- where appropriate, the name and address of the notified body to which the file has been forwarded in accordance with the first indent of Article 8(2)(c),
- where appropriate, the name and address of the notified body which has carried out the verification referred to in the second indent of Article 8(2)(c),
- where appropriate, a reference to the harmonised standards,
- where appropriate, the national technical standards and specifications used,
- identification of the person empowered to sign on behalf of the manufacturer or his authorised representatives.

B. Contents of the declaration by the manufacturer or his authorised representatives established in the Community (Article 4(2))

The manufacturer's declaration referred to in Article 4(2) must contain the following particulars:

- name and address of the manufacturer or the authorised representative,
- description of the machinery or machinery parts,
- where appropriate, the name and address of the notified body and the number of the EC type-examination certificate,
- where appropriate, the name and address of the notified body to which the file has been forwarded in accordance with the first indent of Article 8(2)(c),
- where appropriate, the name and address of the notified body which has carried out the verification referred to in the second indent of Article 8(2)(c),
- where appropriate, a reference to the harmonised standards,
- a statement that the machinery must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive,
- identification of the person signing.

C. Contents of the EC declaration of conformity for safety components placed on the market separately (4)

The EC declaration of conformity must contain the following particulars:

- name and address of the manufacturer or his authorised representative established in the Community (5),
- description of the safety component (6),
- safety function fulfilled by the safety component, if not obvious from the description,
- where appropriate, the name and address of the notified body and the number of the EC type-examination certificate,
- where appropriate, the name and address of the notified body to which the file was forwarded in accordance with the first indent of Article 8(2)(c),
- where appropriate, the name and address of the notified body which carried out the

verification referred to in the second indent of Article 8(2)(c),

- where appropriate, a reference to the harmonised standards,
- where appropriate, the national technical standards and specifications used,
- identification of the person empowered to sign on behalf of the manufacturer or his authorised representative established in the Community.

(1) This declaration must be drawn up in the same language as the original instructions (see Annex I, section 1.7.4(b)) and must be either typewritten or handwritten in block capitals. It must be accompanied by a translation in one of the official languages of the country in which the machinery is to be used. This translation must be done in accordance with the same conditions as for the translation of the instructions.

(2) Business name and full address; authorised representatives must also give the business name and address of the manufacturer.

(3) Description of the machinery (make, type, serial number, etc.).

(4) Description of the safety component (make, type, serial number, if any, etc.).

ANNEX III

CE CONFORMITY MARKING

- The CE conformity marking shall consist of the initials 'CE' taking the following form:

>REFERENCE TO A GRAPHIC<

- if the CE marking is reduced or enlarged the proportions given in the above drawing must be respected,

- the various components of the CE marking must have substantially the same vertical dimension, which may not be less than 5 mm. This minimum dimension may be

waived for small-scale machinery.

ANNEX IV

TYPES OF MACHINERY AND SAFETY COMPONENTS FOR WHICH THE PROCEDURE REFERRED TO IN ARTICLE 8(2)(b) AND (c) MUST BE APPLIED

A. Machinery

1. Circular saws (single or multi-blade) for working with wood and analogous materials or for working with meat and analogous materials.

1.1. Sawing machines with fixed tool during operation, having a fixed bed with manual feed of the workpiece or with a demountable power feed.

1.2. Sawing machines with fixed tool during operation, having a manually operated reciprocating saw-bench or carriage.

1.3. Sawing machines with fixed tool during operation, having a built-in mechanical feed device for the work-pieces, with manual loading and/or unloading.

1.4. Sawing machines with movable tool during operation, with a mechanical feed device and manual loading and/or unloading.

2. Hand-fed surface planing machines for woodworking.

3. Thicknessers for one-side dressing with manual loading and/or unloading for woodworking.

4. Band-saws with a fixed or mobile bed and band-saws with a mobile carriage, with manual loading and/or unloading, for working with wood and analogous materials or for working with meat and analogous materials.

5. Combined machines of the types referred to in 1 to 4 and 7 for working with wood and analogous materials.

6. Hand-fed tenoning machines with several tool holders for woodworking.

7. Hand-fed vertical spindle moulding

machines for working with wood and analogous materials.

8. Portable chainsaws for woodworking.

9. Presses, including press-brakes, for the cold working of metals, with manual loading and/or unloading, whose movable working parts may have a travel exceeding 6 mm and a speed exceeding 30 mm/s.

10. Injection or compression plastics-moulding machines with manual loading or unloading.

11. Injection or compression rubber-moulding machines with manual loading or unloading.

12. Machinery for underground working of the following types:

- machinery on rails: locomotives and brake-vans,
- hydraulic-powered roof supports,
- internal combustion engines to be fitted to machinery for underground working.

13. Manually-loaded trucks for the collection of household refuse incorporating a compression mechanism.

14. Guards and detachable transmission shafts with universal joints as described in section 3.4.7.

15. Vehicles servicing lifts.

16. Devices for the lifting of persons involving a risk of falling from a vertical height of more than three metres.

17. Machines for the manufacture of pyrotechnics.

B. Safety components

1. Electro-sensitive devices designed specifically to detect persons in order to ensure their safety (non-material barriers, sensor mats, electromagnetic detectors, etc.).

2. Logic units which ensure the safety functions of bimanual controls.

3. Automatic movable screens to protect the presses referred to in 9, 10 and 11.

4. Roll-over protection structures (ROPS).

5. Falling-object protective structures

(FOPS).

ANNEX V

EC DECLARATION OF CONFORMITY

For the purposes of this Annex, 'machinery' means either 'machinery' or 'safety component' as defined in Article 1(2).

1. The EC declaration of conformity is the procedure by which the manufacturer, or his authorised representative established in the Community declares that the machinery being placed on the market complies with all the essential health and safety requirements applying to it.

2. Signature of the EC declaration of conformity authorises the manufacturer, or his authorised representative in the Community, to affix the CE marking to the machinery.

3. Before drawing up the EC declaration of conformity, the manufacturer, or his authorised representative in the Community, shall have ensured and be able to guarantee that the documentation listed below is and will remain available on his premises for any inspection purposes:

(a) a technical construction file comprising:

- an overall drawing of the machinery together with drawings of the control circuits,
- full detailed drawings, accompanied by any calculation notes, test results, etc., required to check the conformity of the machinery with the essential health and safety requirements,
- a list of:
 - the essential requirements of this Directive,
 - standards, and
 - other technical specifications, which were used when the machinery was designed,
 - a description of methods adopted to eliminate hazards presented by the machinery,
 - if he so desires, any technical report or

certificate obtained from a competent body or laboratory (1),

- if he declares conformity with a harmonised standard which provides therefor, any technical report giving the results of tests carried out at his choice either by himself or by a competent body or laboratory (2),
 - a copy of the instructions for the machinery;
 (b) for series manufacture, the internal measures that will be implemented to ensure that the machinery remains in conformity with the provisions of the Directive.

The manufacturer must carry out necessary research or tests on components, fittings or the completed machine to determine whether by its design or construction, the machine is capable of being erected and put into service safely.

Failure to present the documentation in response to a duly substantiated request by the competent national authorities may constitute sufficient grounds for doubting the presumption of conformity with the requirements of the Directive.

4. (a) The documentation referred to in 3 above need not permanently exist in a material manner but it must be possible to assemble it and make it available within a period of time commensurate with its importance.

It does not have to include detailed plans or any other specific information as regards the sub-assemblies used for the manufacture of the machinery unless a knowledge of them is essential for verification of conformity with the basic safety requirements.

(b) The documentation referred to in 3 above shall be retained and kept available for the competent national authorities for at least 10 years following the date of manufacture of the machinery or of the last unit produced, in the case of series manufacture.

(c) The documentation referred to in 3 above shall be drawn up in one of the official languages of the Communities, with the exception of the instructions for the

machinery.

(1) A body or laboratory is presumed competent if it meets the assessment criteria laid down in the relevant harmonised standards.

ANNEX VI

EC TYPE-EXAMINATION

For the purposes of this Annex, 'machinery' means either 'machinery' or 'safety component' as defined in Article 1(2).

1. EC type-examination is the procedure by which a notified body ascertains and certifies that an example of machinery satisfies the provisions of this Directive which apply to it.

2. The application for EC type-examination shall be lodged by the manufacturer or by his authorised representative established in the Community, with a single notified body in respect of an example of the machinery.

The application shall include:

- the name and address of the manufacturer or his authorised representative established in the Community and the place of manufacture of the machinery,
- a technical file comprising at least:
 - an overall drawing of the machinery together with drawings of the control circuits,
 - full detailed drawings, accompanied by any calculation notes, test results, etc., required to check the conformity of the machinery with the essential health and safety requirements,
 - a description of methods adopted to eliminate hazards presented by the machinery and a list of standards used,
 - a copy of the instructions for the machinery,
 - for series manufacture, the internal measures that will be implemented to ensure that the machinery remains in conformity with the provisions of the Directive.

It shall be accompanied by a machine representative of the production planned or,

where appropriate, a statement of where the machine may be examined.

The documentation referred to above does not have to include detailed plans or any other specific information as regards the sub-assemblies used for the manufacture of the machinery unless a knowledge of them is essential for verification of conformity with the basic safety requirements.

3. The notified body shall carry out the EC type-examination in the manner described below:

- it shall examine the technical construction file to verify its appropriateness and the machine supplied or made available to it,
- during the examination of the machine, the body shall:

- (a) ensure that it has been manufactured in conformity with the technical construction file and may safely be used under its intended working conditions;

- (b) check that standards, if used, have been properly applied;

- (c) perform appropriate examinations and tests to check that the machine complies with the essential health and safety requirements applicable to it.

4. If the example complies with the provisions applicable to it the body shall draw up an EC type-examination certificate which shall be forwarded to the applicant. That certificate shall state the conclusions of the examination, indicate any conditions to which its issue may be subject and be accompanied by the descriptions and drawings necessary for identification of the approved example.

The Commission, the Member States and the other approved bodies may obtain a copy of the certificate and, on a reasoned request, a copy of the technical construction file and of the reports on the examinations and tests carried out.

5. The manufacturer or his authorised representative established in the Community shall inform the notified body of any

modifications, even of a minor nature, which he has made or plans to make to the machine to which the example relates. The notified body shall examine those modifications and inform the manufacturer or his authorised representative established in the Community whether the EC type-examination certificate remains valid.

6. A body which refuses to issue an EC type-examination certificate shall so inform the other notified bodies. A body which withdraws an EC type-examination certificate shall so inform the Member State which notified it. The latter shall inform the other Member States and the Commission thereof, giving the reasons for the decision.

7. The files and correspondence referring to the EC type-examination procedures shall be drawn up in an official language of the Member State where the notified body is established or in a language acceptable to it.

ANNEX VII

MINIMUM CRITERIA TO BE TAKEN INTO ACCOUNT BY MEMBER STATES FOR THE NOTIFICATION OF BODIES

For the purposes of this Annex, 'machinery' means either 'machinery' or 'safety component' as defined in Article 1(2).

1. The body, its director and the staff responsible for carrying out the verification tests shall not be the designer, manufacturer, supplier or installer of machinery which they inspect, nor the authorised representative of any of these parties. They shall not become either involved directly or as authorised representatives in the design, construction, marketing or maintenance of the machinery. This does not preclude the possibility of exchanges of technical information between the manufacturer and the body.

2. The body and its staff shall carry out the verification tests with the highest degree of

professional integrity and technical competence and shall be free from all pressures and inducements, particularly financial, which might influence their judgement or the results of the inspection, especially from persons or groups of persons with an interest in the result of verifications.

3. The body shall have at its disposal the necessary staff and possess the necessary facilities to enable it to perform properly the administrative and technical tasks connected with verification; it shall also have access to the equipment required for special verification.

4. The staff responsible for inspection shall have:

- sound technical and professional training,
- satisfactory knowledge of the requirements of the tests they carry out and adequate experience of such tests,
- the ability to draw up the certificates, records and reports required to authenticate the performance of the tests.

5. The impartiality of inspection staff shall be guaranteed. Their remuneration shall not depend on the number of tests carried out or on the results of such tests.

6. The body shall take out liability insurance unless its liability is assumed by the State in accordance with national law, or the Member State itself is directly responsible for the tests.

7. The staff of the body shall be bound to observe professional secrecy with regard to all information gained in carrying out its tasks (except vis-à-vis the competent administrative authorities of the State in which its activities are carried out) under this Directive or any provision of national law giving effect to it.

