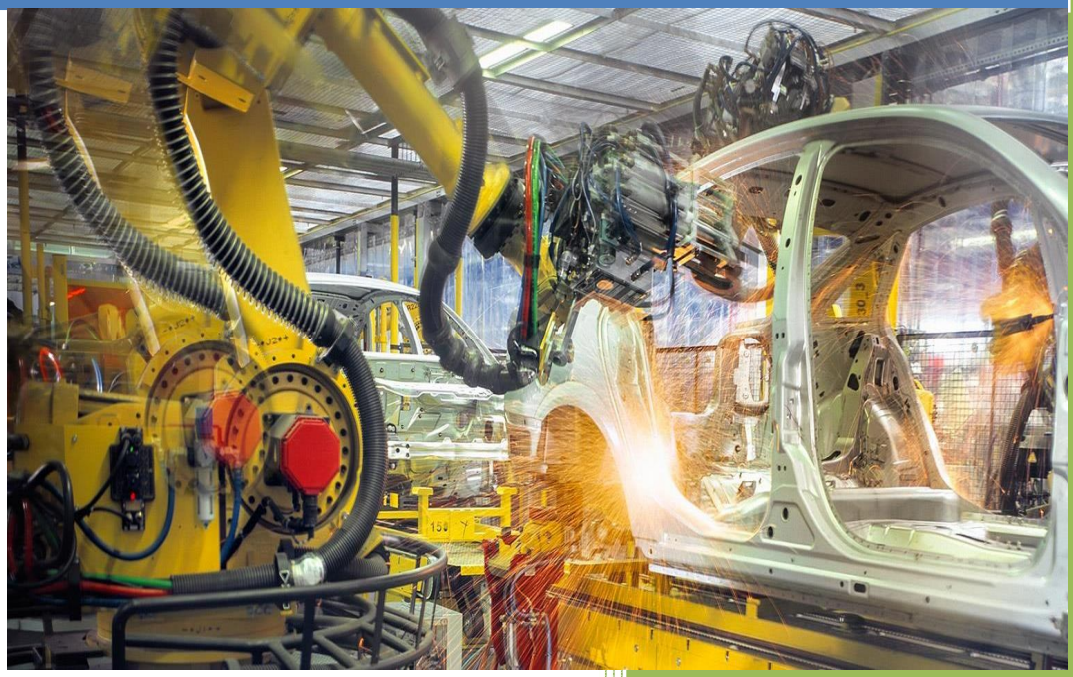
MCW Machine Safety Considerations



Electrical Safety Checklist

The Technical Team – rev 0.0

Motor Control Warehouse

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Forward:

This document has been written to assist engineers, designers, manufacturers, clients of MCW and general users of machinery, plus related personnel gain a better understanding of the requirements of the EU **Machinery Directive 2006/42/EC**, and of the measures required to conform to the directive and its harmonised standards. Please read carefully and utilise when designing and completing the safety aspects of your machine. Please make notes in the rows provided as you go through the checklist.

Machinery Directive – 2006/42/EC Synopsis:

All control systems must be designed and constructed so that they are safe:

1. They should withstand their intended workload and environmental conditions.
2. The hardware and software of a control system should be safe.
3. All possible logic errors in a control system should not escalate to a hazard situation.
4. All foreseeable human errors should not escalate to a hazard situation.
5. A machine must not start unexpectedly.
6. It must not be possible to change a machine's parameters without supervision if it can possess a safety risk.
7. Stopping of a machine must not be blocked if the power has been switched off.
8. None of the moving or transportable parts must come off or fall down when a machine is switched off.
9. Automatic or manual stopping of all moving parts must not be blocked.
10. The protective devices used must perform as expected or transmit a stop signal.
11. The devices connected with the control system must, if deemed necessary, apply to the entire assembly or a part of it (depending on the technological process).
12. In case of a wireless control, the machine must stop automatically if there is no correct signal or data transmission.

INFORMATIVE SECTION

GENERAL PRINCIPLES

1. The manufacturer of machinery or his authorised representative must ensure that a risk assessment is carried out in order to determine the health and safety requirements which apply to the machinery. The machinery must then be designed and constructed taking into account the results of the risk assessment.

By the iterative process of risk assessment and risk reduction referred to above, the manufacturer or his authorised representative shall:
— determine the limits of the machinery, which include the intended use and any reasonably foreseeable misuse thereof,
— identify the hazards that can be generated by the machinery and the associated hazardous situations,
— estimate the risks, taking into account the severity of the possible injury or damage to health and the probability of its occurrence,
— evaluate the risks, with a view to determining whether risk reduction is required, in accordance with the objective of this Directive,
— eliminate the hazards or reduce the risks associated with these hazards by application of protective measures, in the order of priority established in section 1.1.2(b).

2. The obligations laid down by the essential health and safety requirements only apply when the corresponding hazard exists for the machinery in question when it is used under the conditions foreseen by the manufacturer or his authorised representative or in foreseeable abnormal situations. In any event, the principles of safety integration referred to in section 1.1.2 and the obligations concerning marking of machinery and instructions referred to in sections 1.7.3 and 1.7.4 apply.

3. The essential health and safety requirements laid down in this Annex are mandatory; However, being reasonable, it may not be possible to 100% meet the objectives set by them in every instance. In that event, the machinery must, as far as possible, be designed and constructed with the purpose of approaching these objectives.

4. This Annex is organised in several parts. The first one has a general scope and is applicable to all kinds of machinery. The other parts refer to certain kinds of more specific hazards. Nevertheless, it is essential to examine the whole of this Annex in order to be sure of meeting all the relevant essential requirements. When machinery is being designed, the requirements of the general part and the requirements of one or more of the other parts shall be taken into account, depending on the results of the risk assessment carried out in accordance with point 1 of these General Principles.

1 ESSENTIAL HEALTH AND SAFETY REQUIREMENTS

1.1 GENERAL REMARKS

1.1.1 Definitions

For the purpose of this Annex:
(a) 'hazard' means a potential source of injury or damage to health;
(b) 'danger zone' means any zone within and/or around machinery in which a person is subject to a risk to his health or safety;
(c) 'exposed person' means any person wholly or partially in a danger zone;
(d) 'operator' means the person or persons installing, operating, adjusting, maintaining, cleaning, repairing or moving machinery;
(e) 'risk' means a combination of the probability and the degree of an injury or damage to health that can arise in a hazardous situation;
(f) 'guard' means a part of the machinery used specifically to provide protection by means of a physical barrier;
(g) 'protective device' means a device (other than a guard) which reduces the risk, either alone or in conjunction with a guard;
(h) 'intended use' means the use of machinery in accordance with the information provided in the instructions for use;
(i) 'reasonably foreseeable misuse' means the use of machinery in a way not intended in the instructions for use, but which may result from readily predictable human behaviour.

1.1.2 Principles of safety integration
(a) Machinery must be designed and constructed so that it is fitted for its function, and can be operated, adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen but also taking into account any reasonably foreseeable misuse thereof. The aim of measures taken must be to eliminate any risk throughout the foreseeable lifetime of the machinery including the phases of transport, assembly, dismantling, disabling and scrapping.
Remarks :-
(b) In selecting the most appropriate methods, the manufacturer or his authorised representative 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 protective measures in relation to risks that cannot be eliminated, — inform users of the residual risks due to any shortcomings of the protective measures adopted, indicate whether any particular training is required and specify any need to provide personal protective equipment.
Remarks :-
(c) When designing and constructing machinery and when drafting the instructions, the manufacturer or his authorised representative must envisage not only the intended use of the machinery but also any reasonably foreseeable misuse thereof. The machinery must be designed and constructed in such a way as to prevent abnormal use if such use would engender a risk. Where appropriate, the instructions must draw the user's attention to ways — which experience has shown might occur — in which the machinery should not be used.
Remarks :-
(d) Machinery must be designed and constructed to take account of the constraints to which the operator is subject as a result of the necessary or foreseeable use of personal protective equipment.
Remarks :-
(e) Machinery must be supplied with all the special equipment and accessories essential to enable it to be adjusted, maintained and used safely.
Remarks :-

1.1.3 Materials and products
The materials used to construct machinery or products used or created during its use must not endanger persons' safety or health. In particular, where fluids are used, machinery must be designed and constructed to prevent risks due to filling, use, recovery or draining.
Remarks:-

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1.1.4 Lighting
Machinery must be supplied with integral lighting suitable for the operations concerned where the absence thereof is likely to cause a risk despite ambient lighting of normal intensity. Internal parts requiring frequent inspection and adjustment, and maintenance areas must be provided with appropriate lighting.
Remarks :-
Machinery must be designed and constructed so 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 on moving parts due to the lighting.
Remarks :-
Internal parts requiring frequent inspection and adjustment, and maintenance areas must be provided with appropriate lighting.
Remarks :-

1.1.5 Design of machinery to facilitate its handling
Machinery, or each component part thereof, must: — be capable of being handled and transported safely, — be packaged or designed so that it can be stored safely and without damage.
Remarks :-
During the transportation of the machinery and/or its component parts, there must be no possibility of sudden movements or of hazards due to instability as long as the machinery and/or its component parts are handled in accordance with the instructions.
Remarks :-
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, or — be shaped in such a way that standard lifting gear can easily be attached.
Remarks :-
Where machinery or one of its component parts is to be moved by hand, it must: — either be easily moveable, or — be equipped for picking up and moving safely.
Remarks :-
Special arrangements must be made for the handling of tools and/or machinery parts which, even if lightweight, could be hazardous.
Remarks :-

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1.1.6 Ergonomics
Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator must be reduced to the minimum possible, taking into account ergonomic principles such as: — allowing for the variability of the operator's physical dimensions, strength and stamina, — providing enough space for movements of the parts of the operator's body, — avoiding a machine-determined work rate, — avoiding monitoring that requires lengthy concentration, — adapting the man/machinery interface to the foreseeable characteristics of the operators.
Remarks :-

1.1.7 Operating positions
The operating position must be designed and constructed in such a way as to avoid any risk due to exhaust gases and/or lack of oxygen.
Remarks :-
If the machinery is intended to be used in a hazardous environment presenting risks to the health and safety of the operator or if the machinery itself gives rise to a hazardous environment, adequate means must be provided to ensure that the operator has good working conditions and is protected against any foreseeable hazards.
Remarks :-
Where appropriate, the operating position must be fitted with an adequate cabin designed, constructed and/or equipped to fulfil the above requirements. The exit must allow rapid evacuation. Moreover, when applicable, an emergency exit must be provided in a direction which is different from the usual exit.
Remarks :-

1.1.8 Seating
Where appropriate and where the working conditions so permit, work stations constituting an integral part of the machinery must be designed for the installation of seats. If the operator is intended to sit during operation and the operating position is an integral part of the machinery, the seat must be provided with the machinery.
Remarks :-
The operator's seat must enable him to maintain a stable position. Furthermore, the seat and its distance from the control devices must be capable of being adapted to the operator.
Remarks :-
If the machinery is subject to vibrations, the seat must be designed and constructed in such a way as to reduce the vibrations transmitted to the operator to the lowest level that is reasonably possible. The seat mountings must withstand all stresses to which they can be subjected. Where there is no floor beneath the feet of the operator, footrests covered with a slip-resistant material must be provided.
Remarks :-

1.2 CONTROL SYSTEMS

1.2.1 Safety and reliability of control systems

Control systems must be designed and constructed in such a way as to prevent hazardous situations from arising.

Above all, they must be designed and constructed in such a way that:
— they can withstand the intended operating stresses and external influences,
— a fault in the hardware or the software of the control system does not lead to hazardous situations,
— errors in the control system logic do not lead to hazardous situations,
— reasonably foreseeable human error during operation does not lead to hazardous situations.

Particular attention must be given to the following points:
— the machinery must not start unexpectedly,
— the parameters of the machinery must not change in an uncontrolled way, where such change may lead to hazardous situations,
— the machinery must not be prevented from stopping if the stop 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 protective devices must remain fully effective or give a stop command,
— the safety-related parts of the control system must apply in a coherent way to the whole of an assembly of machinery and/or partly completed machinery.

Remarks :-

For cable-less control, an automatic stop must be activated when correct control signals are not received, including loss of communication.

Remarks :-

1.2.2 Control devices Control devices must be:	
— clearly visible and identifiable, using pictograms where appropriate,	
Remarks :-	
— positioned in such a way as to be safely operated without hesitation or loss of time and without ambiguity, — designed in such a way that the movement of the control device is consistent with its effect,	
Remarks :-	
— located outside the danger zones, except where necessary for certain control devices such as an emergency stop or a teach pendant, — positioned in such a way that their operation cannot cause additional risk,	
Remarks :-	
— designed or protected in such a way that the desired effect, where a hazard is involved, can only be achieved by a deliberate action,	
Remarks :-.	
— made in such a way as to withstand foreseeable forces; particular attention must be paid to emergency stop devices liable to be subjected to considerable forces.	
Remarks :-	
Where a control device is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence, the action to be performed must be clearly displayed and subject to confirmation, where necessary. Control devices 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.	
Remarks :-	
Machinery must be fitted with indicators as required for safe operation. The operator must be able to read them from the control position.	
Remarks :-	

1.2.2 Control devices (Continued)
From each control position, the operator must be able to ensure that no-one is in the danger zones, or the control system must be designed and constructed in such a way that starting is prevented while someone is in the danger zone. If neither of these possibilities is applicable, before the machinery starts, an acoustic and/or visual warning signal must be given. The exposed persons must have time to leave the danger zone or prevent the machinery starting up.
Remarks :-
If necessary, means must be provided to ensure that the machinery can be controlled only from control positions located in one or more predetermined zones or locations.
Remarks :-
Where there is more than one control position, the control system must be designed in such a way that the use of one of them precludes the use of the others, except for stop controls and emergency stops.
Remarks :-
When machinery has two or more operating positions, each position must be provided with all the required control devices without the operators hindering or putting each other into a hazardous situation.
Remarks :-

1.2.3 Starting
It must be possible to start machinery only by voluntary actuation of a control device 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.
Remarks :-
However, the restarting of the machinery or a change in operating conditions may be effected by voluntary actuation of a device other than the control device provided for the purpose, on condition that this does not lead to a hazardous situation.
Remarks :-
For machinery functioning in automatic mode, the starting of the machinery, restarting after a stoppage, or a change in operating conditions may be possible without intervention, provided this does not lead to a hazardous situation.
Remarks :-
Where machinery has several starting control devices and the operators can therefore put each other in danger, additional devices must be fitted to rule out such risks. If safety requires that starting and/or stopping must be performed in a specific sequence, there must be devices which ensure that these operations are performed in the correct order.
Remarks :-

1.2.4 Stopping 1.2.4.1 Normal stop
Machinery must be fitted with a control device whereby the machinery can be brought safely to a complete stop.
Remarks :-
Each workstation must be fitted with a control device to stop some or all of the functions of the machinery, depending on the existing hazards, so that the machinery is rendered safe.
Remarks :-
The machinery's stop control must have priority over the start controls.
Remarks :-
Once the machinery or its hazardous functions have stopped, the energy supply to the actuators concerned must be cut off.
Remarks :-

1.2.4 Stopping 1.2.4.2 Operational stop
Where, for operational reasons, a stop control that does not cut off the energy supply to the actuators is required, the stop condition must be monitored and maintained.
Remarks :-

1.2.4 Stopping

1.2.4.3 Emergency stop

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

Remarks :-

The following exceptions apply:

— machinery 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,
— portable hand-held and/or hand-guided machinery.

Remarks :-

The device must:

— have clearly identifiable, clearly visible and quickly accessible control devices,
— stop the hazardous process as quickly as possible, without creating additional risks,
— where necessary, trigger or permit the triggering of certain safeguard movements.

Remarks :-

Once active operation of the emergency stop device 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.

Remarks :-

The emergency stop function must be available and operational at all times, regardless of the operating mode.

Remarks :-

Emergency stop devices must be a back-up to other safeguarding measures and not a substitute for them.

Remarks :-

1.2.4 Stopping 1.2.4.4 Assembly of machinery
In the case of machinery or parts of machinery designed to work together, the machinery must be designed and constructed in such a way that the stop controls, including the emergency stop devices, can stop not only the machinery itself but also all related equipment, if its continued operation may be dangerous.
Remarks :-

1.2.5 Selection of control or operating modes
The control or operating mode selected must override all other control or operating modes, with the exception of the emergency stop.
Remarks :-
If machinery has been designed and constructed to allow its use in several control or operating modes requiring different protective measures and/or work procedures, it must be fitted with a mode selector which can be locked in each position. Each position of the selector must be clearly identifiable and must correspond to a single operating or control mode.
Remarks :-
The selector may be replaced by another selection method which restricts the use of certain functions of the machinery to certain categories of operator.
Remarks :-
If, for certain operations, the machinery must be able to operate with a guard displaced or removed and/or a protective device disabled, the control or operating mode selector must simultaneously: — disable all other control or operating modes, — permit operation of hazardous functions only by control devices requiring sustained action, — permit the operation of hazardous functions only in reduced risk conditions while preventing hazards from linked sequences, — prevent any operation of hazardous functions by voluntary or involuntary action on the machine's sensors. If these four conditions cannot be fulfilled simultaneously, the control or operating mode selector must activate other protective measures designed and constructed to ensure a safe intervention zone.
Remarks :-

1.2.6 Failure of the power supply

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

Particular attention must be given to the following points:
— the machinery must not start unexpectedly,
— the parameters of the machinery must not change in an uncontrolled way when such change can lead to hazardous situations,
— 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 protective devices must remain fully effective or give a stop command.

Remarks :-

1.3 PROTECTION AGAINST MECHANICAL HAZARDS

1.3.1 Risk of loss of stability

Machinery and its components and fittings must be stable enough to avoid overturning, falling or uncontrolled movements during transportation, assembly, dismantling and any other action involving the machinery.

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.

Remarks :-

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.

The durability of the materials used must be adequate for the nature of the working environment foreseen by the manufacturer or his authorised representative, in particular as regards the phenomena of fatigue, ageing, corrosion and abrasion.

Remarks :-.

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

Remarks :-

Where a risk of rupture or disintegration remains despite the measures taken, the parts concerned must be mounted, positioned and/or guarded in such a way that any fragments will be contained, preventing hazardous situations.

Remarks :-

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 to ensure that no risk is posed by a rupture.

Remarks :-

Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to persons:

— when the workpiece comes into contact with the tool, the latter must have attained its normal working condition,
— when the tool starts and/or stops (intentionally or accidentally), the feed movement and the tool movement must be coordinated.

Remarks :-

1.3.3 Risks due to falling or ejected objects
Precautions must be taken to prevent risks from falling or ejected objects.
Remarks :-

1.3.4 Risks due to surfaces, edges or angles
Insofar 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.
Remarks :-

1.3.5 Risks related to combined machinery
Where the machinery is intended to carry out several different operations with 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 risk for exposed persons. For this purpose, it must be possible to start and stop separately any elements that are not protected.
Remarks :-

1.3.6 Risks related to variations in operating conditions
Where the machinery performs operations under different conditions of use, it must be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably.
Remarks :-

1.3.7 Risks related to moving parts
The moving parts of machinery must be designed and constructed in such a way as to prevent risks of contact which could lead to accidents or must, where risks persist, be fitted with guards or protective devices.
Remarks :-
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, the necessary specific protective devices and tools must, when appropriate, be provided to enable the equipment to be safely unblocked. The instructions and, where possible, a sign on the machinery shall identify these specific protective devices and how they are to be used.
Remarks :-

1.3.8 Choice of protection against risks arising from moving parts

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

1.3.8.1 Moving transmission parts

Guards designed to protect persons against the hazards generated by moving transmission parts must be:

— either fixed guards as referred to in section 1.4.2.1, or
— interlocking movable guards as referred to in section 1.4.2.2.

Interlocking movable guards should be used where frequent access is envisaged.

Remarks :-

1.3.8.2 Moving parts involved in the process

Guards or protective devices designed to protect persons against the hazards generated by moving parts involved in the process must be:

— either fixed guards as referred to in section 1.4.2.1, or
— interlocking movable guards as referred to in section 1.4.2.2, or
— protective devices as referred to in section 1.4.3, or
— a combination of the above.

Remarks :-

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

— fixed guards or interlocking movable guards preventing access to those sections of the parts that are not used in the work, and
— adjustable guards as referred to in section 1.4.2.3 restricting access to those sections of the moving parts where access is necessary.

Remarks :-

1.3.9 Risks of uncontrolled movements

When a part of the machinery has been stopped, any drift away from the stopping position, for whatever reason other than action on the control devices, must be prevented or must be such that it does not present a hazard.

Remarks :-

1.4 REQUIRED CHARACTERISTICS OF GUARDS AND PROTECTIVE DEVICES

1.4.1 General requirements

Guards and protective devices must:

— be of robust construction,
— be securely held in place,
— not give rise to any additional hazard,
— 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 the installation and/or replacement of tools and for maintenance purposes by restricting access exclusively to the area where the work has to be done, if possible without the guard having to be removed or the protective device having to be disabled.

In addition, guards must, where possible, protect against the ejection or falling of materials or objects and against emissions generated by the machinery.

Remarks :-

1.4.2 Special requirements for guards

1.4.2.1 Fixed guards

Fixed guards must be fixed by systems that can be opened or removed only with tools.

Their fixing systems must remain attached to the guards or to the machinery when the guards are removed.

Where possible, guards must be incapable of remaining in place without their fixings.

Remarks :-

1.4.2.2 Interlocking movable guards

Interlocking movable guards must:

— as far as possible remain attached to the machinery when open,
— be designed and constructed in such a way that they can be adjusted only by means of an intentional action.

Interlocking movable guards must be associated with an interlocking device that:

— prevents the start of hazardous machinery functions until they are closed and
— gives a stop command whenever they are no longer closed.

Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery functions has ceased, movable guards must be associated with a guard locking device in addition to an interlocking device that:

— prevents the start of hazardous machinery functions until the guard is closed and locked, and
— keeps the guard closed and locked until the risk of injury from the hazardous machinery functions has ceased.

Interlocking movable guards must be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous machinery functions.

Remarks :-

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, depending on the type of work involved, and — readily adjustable without the use of tools.
Remarks :-

1.4.3. Special requirements for protective devices
Protective devices must be designed and incorporated into the control system in such a way that: — moving parts cannot start up while they are within the operator's reach, — persons cannot reach moving parts while the parts are moving, and — the absence or failure of one of their components prevents starting or stops the moving parts. Protective devices must be adjustable only by means of an intentional action.
Remarks :-

1.5 RISKS DUE TO OTHER HAZARDS

1.5.1 Electricity supply

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

The safety objectives set out in Directive 73/23/EEC shall apply to machinery. However, the obligations concerning conformity assessment and the placing on the market and/or putting into service of machinery with regard to electrical hazards are governed solely by this Directive.

Remarks :-

1.5.2 Static electricity

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

Remarks :-

1.5.3 Energy supply other than electricity

Where machinery is powered by source of energy other than electricity, it must be so designed, constructed and equipped as to avoid all potential risks associated with such sources of energy.

Remarks :-

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 and construction of such parts or, failing this, by information given on the parts themselves and/or their housings. The same information must be given on moving parts and/or their housings where the direction of movement needs to be known in order to avoid a risk.

Where necessary, the instructions must give further information on these risks.

Where a faulty connection can be the source of risk, incorrect connections must be made impossible by design or, failing this, by information given on the elements to be connected and, where appropriate, on the means of connection.

Remarks :-

1.5.5 Extreme temperatures
Steps must be taken to eliminate any risk of injury arising from contact with or proximity to machinery parts or materials at high or very low temperatures.
Remarks :-
The necessary steps must also be taken to avoid or protect against the risk of hot or very cold material being ejected.
Remarks :-

1.5.6 Fire
Machinery must be designed and constructed in such a way as to avoid any 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.
Remarks :-

1.5.7 Explosion
Machinery must be designed and constructed in such a way as 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.
Remarks :-
Machinery must comply, as far as the risk of explosion due to its use in a potentially explosive atmosphere is concerned, with the provisions of the specific Community Directives.
Remarks :-

1.5.8 Noise
Machinery must be designed and constructed in such a way 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. The level of noise emission may be assessed with reference to comparative emission data for similar machinery.
Remarks :-

1.5.9 Vibrations
Machinery must be designed and constructed in such a way 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. The level of vibration emission may be assessed with reference to comparative emission data for similar machinery.
Remarks :-

1.5.10 Radiation
Undesirable radiation emissions from the machinery must be eliminated or be reduced to levels that do not have adverse effects on persons.
Remarks :-
Any functional ionising radiation emissions must be limited to the lowest level which is sufficient for the proper functioning of the machinery during setting, operation and cleaning. Where a risk exists, the necessary protective measures must be taken.
Remarks :-
Any functional non-ionising radiation emissions during setting, operation and cleaning must be limited to levels that do not have adverse effects on persons.
Remarks :-

1.5.11 External radiation
Machinery must be designed and constructed in such a way that external radiation does not interfere with its operation.
Remarks :-

1.5.12 Laser radiation
Where laser equipment is used, the following should be taken into account: — laser equipment on machinery must be designed and constructed in such a way as to prevent any accidental radiation, — laser equipment on machinery must be protected in such a way 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 laser radiation.
Remarks :-

1.5.13 Emissions of hazardous materials and substances

Machinery must be designed and constructed in such a way that risks of inhalation, ingestion, contact with the skin, eyes and mucous membranes and penetration through the skin of hazardous materials and substances which it produces can be avoided.

Where a hazard cannot be eliminated, the machinery must be so equipped that hazardous materials and substances can be contained, evacuated, precipitated by water spraying, filtered or treated by another equally effective method.

Where the process is not totally enclosed during normal operation of the machinery, the devices for containment and/or evacuation must be situated in such a way as to have the maximum effect.

Remarks :-

1.5.14 Risk of being trapped in a machine

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

Remarks :-

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 in such a way as to prevent persons slipping, tripping or falling on or off these parts.

Where appropriate, these parts must be fitted with handholds that are fixed relative to the user and that enable them to maintain their stability.

Remarks :-

1.5.16 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 charge to earth.

Remarks :-

1.6 MAINTENANCE

1.6.1 Machinery maintenance

Adjustment 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, measures must be taken to ensure that these operations can be carried out safely (see section 1.2.5).

Remarks :-

In the case of automated machinery and, where necessary, other machinery, a connecting device for mounting diagnostic fault-finding equipment must be provided.

Remarks :-

Automated machinery components which have to be changed frequently must be capable of being removed and replaced easily and safely. Access to the components must enable these tasks to be carried out with the necessary technical means in accordance with a specified operating method.

Remarks :-

1.6.2 Access to operating positions and servicing points

Machinery must be designed and constructed in such a way as to allow access in safety to all areas where intervention is necessary during operation, adjustment and maintenance of the machinery.

Remarks :-

1.6.3 Isolation of energy sources
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 persons. Isolators must also be capable of being locked where an operator is unable, from any of the points to which he has access, to check that the energy is still cut off. In the case of machinery capable of being plugged into an electricity supply, removal of the plug is sufficient, provided that the operator can check from any of the points to which he has access that the plug remains removed.
Remarks :-
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 persons.
Remarks :-
As an exception to the requirement laid down in the previous paragraphs, certain circuits may remain connected to their energy sources in order, for example, to hold parts, to protect information, to light interiors, etc. In this case, special steps must be taken to ensure operator safety.
Remarks :-

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 safely.
Remarks :-

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 impossible to avoid entering the machinery, it must be designed and constructed in such a way as to allow cleaning to take place safely.
Remarks :-

1.7 INFORMATION

1.7.1 Information and warnings on the machinery

Information and warnings on the machinery should preferably be provided in the form of readily understandable symbols or pictograms. Any written or verbal information and warnings must be expressed in an official Community language or languages, which may be determined in accordance with the Treaty by the Member State in which the machinery is placed on the market and/or put into service and may be accompanied, on request, by versions in any other official Community language or languages understood by the operators.

Remarks :-

1.7.1.1 Information and information devices

The information needed to control machinery must be provided in a form that is unambiguous and easily understood. It must not be excessive to the extent of overloading the operator.

Visual display units or any other interactive means of communication between the operator and the machine must be easily understood and easy to use.

Remarks :-

1.7.1.2 Warning devices

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

Remarks :-.

Where machinery is equipped with warning devices these must be unambiguous and easily perceived. The operator must have facilities to check the operation of such warning devices at all times.

Remarks :- No warning devices

The requirements of the specific Community Directives concerning colours and safety signals must be complied with.

Remarks :-

1.7.2 Warning of residual risks

Where risks remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted, the necessary warnings, including warning devices, must be provided.

Remarks :-

1.7.3 Marking of machinery

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

— the business name and full address of the manufacturer and, where applicable, his authorised representative,
— designation of the machinery,
— the CE Marking (see Annex III),
— designation of series or type,
— serial number, if any,
— the year of construction, that is the year in which the manufacturing process is completed.

It is prohibited to pre-date or post-date the machinery when affixing the CE marking.

Furthermore, machinery designed and constructed for use in a potentially explosive atmosphere must be marked accordingly.

Machinery must also bear full information relevant to its type and essential for safe use. Such information is subject to the requirements set out in section 1.7.1.

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

Remarks :-

1.7.4 Instructions

All machinery must be accompanied by instructions in the official Community language or languages of the Member State in which it is placed on the market and/or put into service.

The instructions accompanying the machinery must be either 'Original instructions' or a 'Translation of the original instructions', in which case the translation must be accompanied by the original instructions.

By way of exception, the maintenance instructions intended for use by specialised personnel mandated by the manufacturer or his authorised representative may be supplied in only one Community language which the specialised personnel understand.

The instructions must be drafted in accordance with the principles set out below

Remarks :-

1.7.4.1 General principles for the drafting of instructions

(a) The instructions must be drafted in one or more official Community languages. The words 'Original instructions' must appear on the language version(s) verified by the manufacturer or his authorised representative.

(b) Where no 'Original instructions' exist in the official language(s) of the country where the machinery is to be used, a translation into that/those language(s) must be provided by the manufacturer or his authorised representative or by the person bringing the machinery into the language area in question. The translations must bear the words 'Translation of the original instructions'.

(c) The contents of the instructions must cover not only the intended use of the machinery but also take into account any reasonably foreseeable misuse thereof.

(d) In the case of machinery intended for use by non-professional operators, the wording and layout of the instructions for use must take into account the level of general education and acumen that can reasonably be expected from such operators.

Remarks :-

1.7.4.2 Contents of the instruction manual
Each instruction manual must contain, where applicable, at least the following information:
(a) the business name and full address of the manufacturer and of his authorised representative;
(b) the designation of the machinery as marked on the machinery itself, except for the serial number (see section 1.7.3);
(c) the EC declaration of conformity, or a document setting out the contents of the EC declaration of conformity, showing the particulars of the machinery, not necessarily including the serial number and the signature;
(d) a general description of the machinery;
(e) the drawings, diagrams, descriptions and explanations necessary for the use, maintenance and repair of the machinery and for checking its correct functioning;
(f) a description of the workstation(s) likely to be occupied by operators;
(h) warnings concerning ways in which the machinery must not be used that experience has shown might occur;
(i) assembly, installation and connection instructions, including drawings, diagrams and the means of attachment and the designation of the chassis or installation on which the machinery is to be mounted;
(j) instructions relating to installation and assembly for reducing noise or vibration;
(k) instructions for the putting into service and use of the machinery and, if necessary, instructions for the training of operators;
(l) information about the residual risks that remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted;
(m) instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided;
(n) the essential characteristics of tools which may be fitted to the machinery;
(o) the conditions in which the machinery meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;
(p) instructions with a view to ensuring that transport, handling and storage operations can be made safely, giving the mass of the machinery and of its various parts where these are regularly to be transported separately;
(q) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;

1.7.4.2 Contents of the instructions (continued)

(r) the description of the adjustment and maintenance operations that should be carried out by the user and the preventive maintenance measures that should be observed;

(s) instructions designed to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;

(t) the specifications of the spare parts to be used, when these affect the health and safety of operators;

(u) the following information on airborne noise emissions:

— the A-weighted emission 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,
— the peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 μPa),
— the A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds 80 dB(A)

These values must be either those actually measured for the machinery in question or those established on the basis of measurements taken for technically comparable machinery which is representative of the machinery to be produced.

In the case of very large machinery, instead of the A-weighted sound power level, the A-weighted emission 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. Whenever sound emission values are indicated the uncertainties surrounding these values must be specified. The operating conditions of the machinery during measurement and the measuring methods used must be described.

Where the workstation(s) are undefined or cannot be defined, A-weighted sound pressure levels must be measured at a distance of 1 metre from the surface of the machinery and at a height of 1,6 metres from the floor or access platform. The position and value of the maximum sound pressure must be indicated.

Where specific Community Directives lay down other requirements for the measurement of sound pressure levels or sound power levels, those Directives must be applied and the corresponding provisions of this section shall not apply;

(v) where machinery is likely to emit non-ionising radiation which may cause harm to persons, in particular persons with active or non-active implantable medical devices, information concerning the radiation emitted for the operator and exposed persons.

Remarks :-

1.7.4.3 Sales literature

Sales literature describing the machinery must not contradict the instructions as regards health and safety aspects. Sales literature describing the performance characteristics of machinery must contain the same information on emissions as is contained in the instructions.

Remarks :-

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

Foodstuffs machinery, machinery for cosmetics or pharmaceutical products, hand-held and/or hand-guided machinery, portable fixing and other impact machinery, machinery for working wood and material with similar physical characteristics must meet all the essential health and safety requirements described in this chapter (see General Principles, point 4).

2.1 FOODSTUFFS MACHINERY AND MACHINERY FOR COSMETICS OR PHARMACEUTICAL PRODUCTS

Remarks :-

2.2 PORTABLE HAND-HELD AND / OR HAND-GUIDED MACHINERY

Remarks :-

2.3 MACHINERY FOR WORKING WOOD AND MATERIAL WITH SIMILAR PHYSICAL CHARACTERISTICS

Remarks :-

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

Machinery presenting hazards due to its mobility must meet all the essential health and safety requirements described in this chapter (see General Principles, point 4).

Remarks :-

4 SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET HAZARDS DUE TO LIFTING OPERATIONS

Remarks :-

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

Machinery intended for underground work must meet all the essential health and safety requirements described in this chapter (see General Principles, point 4).

Remarks :-

6 SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY PRESENTING PARTICULAR HAZARDS DUE TO THE LIFTING OF PERSONS

Machinery presenting hazards due to the lifting of persons must meet all the relevant essential health and safety requirements described in this chapter (see General Principles, point 4).

Remarks :-

Disclaimer:

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