Technical Construction File

Related to CE Directive: 2006/42/EC (Machinery)
TCF Number: VM(23)042402MR
Date: Apr. 24, 2023

Applicant: Anhui Vmax Heavy Industry Co., Ltd.

Address: No.18 South Shengli Road, Centralized Demonstration Area, Lu'an City Of Anhui Province, China.

Product: Hydraulic Crawler Excavator

Brand name/Trade mark: VMAX

Models: VE08, VE09, VE10, VE12, VE15, VE17, VE18, VE20, VE22, VE25, VE30, VE35, VE40, VE45, VE50, VE55, VE60, VE65, VE70, VE75, VE80, VE85, VE90, VE100, VE110, VE120, VE130, VE135, VE140, VE145, VE150, VE155, VE160, VE165, VE170, VE180, VE190, VE200, VE210, VE220, VE230, VE240, VE250, VE260, VE270, VE280, VE290, VE300, VE310, VE320, VE330, VE340, VE350, VE360, VE370, VE380, VE390, VE400, VE9075, VE9088, VEW150

According to: EN ISO 12100:2010, EN 474-1:2006+A6:2019, EN 474-5:2006+A3:2013

REPORT FOR COMPLIANCE WITH

EN ISO 12100:2010, EN 474-1:2006+A6:2019, EN 474-5:2006+A3:2013

Manufacturer	Anhui Vmax Heavy Industry Co., Ltd.	
Address	No.18 South Shengli Road, Centralized Demonstration Area, Lu'an City Of Anhui Province, China.	
Trade mark :	VMAX	
Product Name	Hydraulic Crawler Excavator	
Main Model	VE10	
Series Model(s)	VE08, VE09, VE10, VE12, VE15, VE17, VE18, VE20, VE22, VE25, VE30, VE35, VE40, VE45, VE50, VE55, VE60, VE65, VE70, VE75, VE80, VE85, VE90, VE100, VE110, VE120, VE130, VE135, VE140, VE145, VE150, VE155, VE160, VE165, VE170, VE180, VE190, VE200, VE210, VE220, VE230, VE240, VE250, VE260, VE270, VE280, VE290, VE300, VE310, VE320, VE330, VE340, VE350, VE360, VE370, VE380, VE390, VE400, VE9075, VE9088, VEW150	
File No.	VM(23)042402MR	
Directive	2006/42/EC Machinery Directive	
Standards Compliance	EN ISO 12100:2010, EN 474-1:2006+A6:2019, EN 474-5:2006+A3:2013	
Date of issue	Apr.24, 2023	
Date of Testing	Apr.19, 2023- Apr.24, 2023	
Testing Laboratory	Shenzhen ZCT Technology Co., Ltd. 3F, 5th Building, Hongsheng Industrial Zone, No.4336 Bao'an Road, Bao'an District, Shenzhen, China.	
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Approved by	Winnie Wang	winnie wang

SHENZHEN ZCT TECHNOLOGY CO.,LTD. APPROVED

Content

Part I：General

1.1 General description

In order to ensure the conformity for CE marking for these machines, some main European and/or International standards have been used to made assessment of conformity, they are
-EN ISO 12100:2010
Safety of machinery - General principles for design - Risk assessment and risk reduction
-EN 474-1:2006+A6:2019 Earth-moving machinery - Safety - Part 1: General requirements
- EN 474-5:2006+A3:2013 Earth-moving machinery - Safety - Part 5: Requirements for hydraulic excavators

These applicable standards in detail have been included in the relevant sub-clauses of this technical construction file.

1.2 Variations of the series products

Regarding the whole family of the series, they can be divided into different models according to their main features. They are VE08, VE09, VE10, VE12, VE15, VE17, VE18, VE20, VE22, VE25, VE30, VE35, VE40, VE45, VE50, VE55, VE60, VE65, VE70, VE75, VE80, VE85, VE90, VE100, VE110, VE120, VE130, VE135, VE140, VE145, VE150, VE155, VE160, VE165, VE170, VE180, VE190, VE200, VE210, VE220, VE230, VE240, VE250, VE260, VE270, VE280, VE290, VE300, VE310, VE320, VE330, VE340, VE350, VE360, VE370, VE380, VE390, VE400, VE9075, VE9088, VEW150
To present the conformity of this series machine with Machinery Directive, we discuss the conformity systematically with the relative Directive and standards for VE10 as a basic evaluation in clause.

1.3 Quality control system

In order to ensure the conformity of the series production, the Anhui Vmax Heavy Industry Co., Ltd. has taken the related procedures mentioned below：

（1） Anhui Vmax Heavy Industry Co., Ltd. has applied for the certification in UDEM.

（2） Carry out the inspection for parts and components according to the TCF

Before the assemblies of the series production, the QC engineers of Anhui Vmax Heavy Industry Co., Ltd. has to check and inspect the technical specifications and intended functions of parts and components to ensure the correct use of them according to the contents of TCF and principle described in the related technical information.

（3） Carry out the inspection＆testing for the products before packing

Before packing the products, the QC engineers of Anhui Vmax Heavy Industry Co., Ltd. have to do the necessary inspection and testing to ensure the conformity of related requirements, in particularly, the testing and inspection of electrical characteristics and outer feature.

（4） Carry out the inspection for the packing

After finishing the necessary inspection and testing for the products, an inspection for the packing has to be done to ensure the necessary elements being included in this packing before shipment.

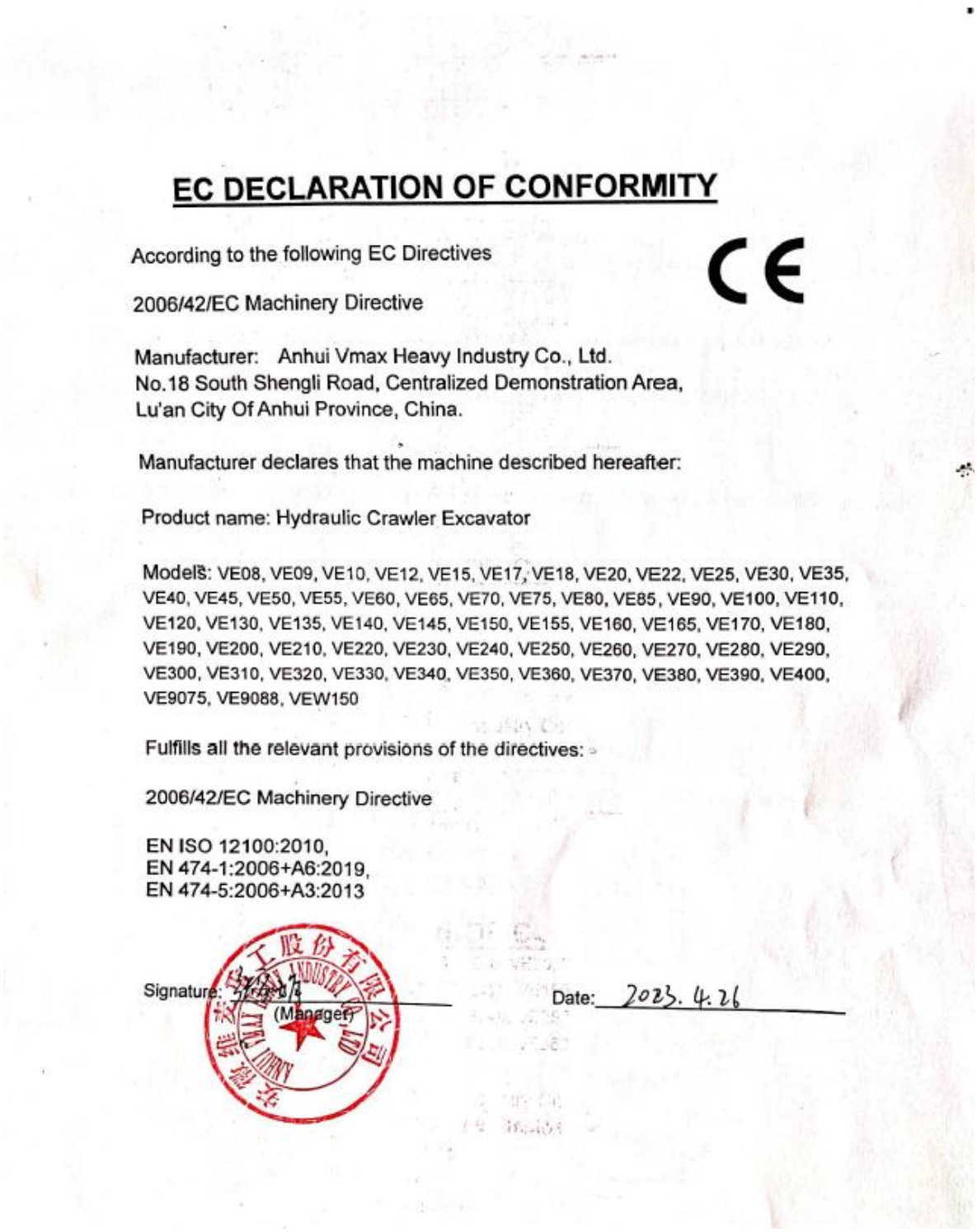
（5） Provision for the change of design

Any change of the products described in this TCF must be checked in detail and written down again in the TCF by the designer of Anhui Vmax Heavy Industry Co., Ltd. if the change may effects the related electrical or mechanical characteristics.

（6） Provision for the Quality Assurance

For the provisions of internal control measures to ensure the conformity of series production of the machines, Anhui Vmax Heavy Industry Co., Ltd. has built an internal quality control system in accordance with the international standards.

1.4 Declaration of conformity



EC DECLARATION OF CONFORMITY

According to the following EC Directives

CE

2006/42/EC Machinery Directive

Manufacturer: Anhui Vmax Heavy Industry Co., Ltd.
No.18 South Shengli Road, Centralized Demonstration Area,
Lu'an City Of Anhui Province, China.

Manufacturer declares that the machine described hereafter:

Product name: Hydraulic Crawler Excavator

Models: VE08, VE09, VE10, VE12, VE15, VE17, VE18, VE20, VE22, VE25, VE30, VE35, VE40, VE45, VE50, VE55, VE60, VE65, VE70, VE75, VE80, VE85, VE90, VE100, VE110, VE120, VE130, VE135, VE140, VE145, VE150, VE155, VE160, VE165, VE170, VE180, VE190, VE200, VE210, VE220, VE230, VE240, VE250, VE260, VE270, VE280, VE290, VE300, VE310, VE320, VE330, VE340, VE350, VE360, VE370, VE380, VE390, VE400, VE9075, VE9088, VEW150

Fulfills all the relevant provisions of the directives:

2006/42/EC Machinery Directive

EN ISO 12100:2010,
EN 474-1:2006+A6:2019,
EN 474-5:2006+A3:2013

Signature: [illegible] (Manager)

Date: 2023.4.26

Part II：Assessment of conformity

2.1 Essential health and safety requirements

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
1	Essential health and safety requirements		-
1.1	General remarks		-
1.1.1	Definitions		-
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.		P
	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.		P
b)	In selecting the most appropriate methods, the manufacturer or his authorized representative must apply the following principles, in the order given:		-
	- eliminate or reduce risks as far as possible		P
	- take the necessary protection measure in relation to risks that can’t be eliminated		P
	- 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		P
c)	When designing and constructing machinery and when drafting the		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		P
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.		P
e)	Machinery must be supplied with all the special equipment and accessories essential to enable it to be adjusted, maintained and used safely.		P.
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.		P
	In particular, where fluids are used, machinery must be designed and constructed to prevent risks due to filling, use, recovery or draining.		P
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.		P
	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		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	stroboscopic effects on moving parts due to the lighting.		
	Internal parts requiring frequent inspection, and adjustment and maintenance areas, must be provided with appropriate lighting		P
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,		P
	- be packaged or designed so that it can be stored safely and without damage.		P
	Where the weight, size or shape of machinery or its various component parts prevents them from being moved by hand, the machinery or each components part must:		-
	- either be fitted with attachments for lifting gear		P
	- be designed so that it can be fitted with such attachments, or		P
	- be shaped in such a way that standard lifting gear can easily be attached		P
	Where machinery or one of its component parts is to be moved by hand, it must:		-
	- either be easily movable, or		P
	- be equipped for picking up and moving in complete safety		P
	Special arrangement must be made for the handling of tools and/or machinery parts, even if lightweight, which could be dangerous		P
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 principle ssuch as:		P
	– allowing for the variability of the operator’s physical dimensions, strength and stamina,		P
	– providing enough space for movements of the parts of the operator’s body,		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	– avoiding a machine-determined work rate,		P
	– avoiding monitoring that requires lengthy concentration,		P
	– adapting the man/machinery interface to the foreseeable characteristics of the operators.		P
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.		P
	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.		P
	Where appropriate, the operating position must be fitted with an adequate cabin designed, constructed and/or equipped to fulfill the above requirements.		P
	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.		P
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.		N
	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		N
	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.		N
	If the machinery is subject to vibrations, the seat must be designed and constructed in such a way as to reduce the		N

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		
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.		P
	Above all, they must be designed and constructed in such a way that:		-
	- they can withstand the intended operating stresses and external influences,		P
	-a fault in the hardware or the software of the control system does not lead to hazardous situations,		P
	- errors in logic don’t lead to dangerous situations		P
	-reasonably foreseeable human error during operation does not lead to hazardous situations.		P
	Particular attention must be given to the following points:		-
	– the machinery must not start unexpectedly		P
	– the parameters of the machinery must not change in an uncontrolled way, where such change may lead to hazardous situations,		P
	– the machinery must not be prevented from stopping if the stop command has already been given,		P
	– no moving part of the machinery or piece held by the machinery must fall or be ejected,		P
	– automatic or manual stopping of the moving parts, whatever they may be, must be unimpeded,		P
	– the protective devices must remain fully effective or give a stop command,		P
	– the safety-related parts of the control system must apply in a coherent way to the whole of an assembly of machinery		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	and/or partly completed machinery.		
	For cable-less control, an automatic stop must be activated when correct control signals are not received, including loss of communication.		P
1.2.2	Control devices		-
	Control devices must be:		-
	- clearly visible and identifiable, using pictograms where appropriate,		P.
	- positioned in such a way as to be safely operated without hesitation or loss of time and without ambiguity,		P
	- designed in such a way that the movement of the control device is consistent with its effect,		P.
	- located outside the danger zones, except where necessary for certain control devices such as an emergency stop or a teach pendant,		P
	- positioned in such a way that their operation cannot cause additional risk,		P
	- designed or protected in such a way that the desired effect, where a hazard is involved, can only be achieved by a deliberate action,		P
	- made in such a way as to withstand foreseeable forces; particular attention must be paid to emergency stop devices liable to be		P
	Where a control device is designed and constructed to perform several different actions, namely where there is no one-toone correspondence, the action to be performed must be clearly displayed and subject to confirmation, where necessary.		N
	their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.		P
	Machinery must be fitted with indicators as required for safe operation. The operator must be able to read them from the		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	control position.		
	The operator must be able to read them from the control position		P
	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.		P
	If neither of these possibilities is applicable, before the machinery starts,		P
	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.		
	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.		P
	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.		P
	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.		P
1.2.3	Starting		-
	It must be possible to start machinery only by voluntary actuation of a control provided for the purpose		P
	The same requirement applies:		-
	- when restarting the machinery after stoppage, whatever the cause		P
	- when effecting a significant change in the operating conditions		P
	However, the restarting of the machinery or a change in operating conditions may be effected by voluntary actuation		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	of a device other than the control device provided for the purpose, on condition that this does not lead to a hazardous situation.		
	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.		P
	Where machinery has several starting controls and the operators can therefore put each other in danger, additional devices must be fitted to rule out such risks		P
	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		P
1.2.4	Stopping		-
1.2.4.1	Normal stopping		-
	Machinery must be fitted with a control device whereby the machinery can be brought safely to a complete stop.		P
	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.		P
	The machinery’s stop control must have priority over the start controls		P
	Once the machinery or its hazardous functions have stopped, the energy supply to the actuators concerned must be cut off.		P
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.		P
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		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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,		P
	– portable hand-held and/ handguided machinery.		-
	The device must:		-
	– have clearly identifiable, clearly visible and quickly accessible control devices,		P
	– stop the hazardous process as quickly as possible, without creating additional risks,		P
	- where necessary, trigger or permit the triggering of certain safeguard movements		P
	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		P
	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		P
	The emergency stop function must be available and operational at all times, regardless of the operating mode.		P
	Emergency stop devices must be a back-up to other safeguarding measures and not a substitute for them.		P
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.		N
1.2.5	Selection of control or operating modes		-
	The control or operating mode selected must override all		N

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	other control or operating modes, with the exception of the emergency stop.		
	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.		N
	Each position of the selector must be clearly identifiable and must correspond to a single operating or control mode.		N
	The selector may be replaced by another selection method which restricts the use of certain functions of the machinery or certain categories of operator		N
	If, for certain operations, the machinery must be able to operate with a guard displaced or removed and/or a protective device disabled,		N
	the control or operating mode selector must simultaneously:		-
	- disable all other control or operating modes,		N
	- permit operation of hazardous functions only by control devices requiring sustained action,		N
	– permit the operation of hazardous functions only in reduced risk conditions		N
	while preventing hazards from linked sequences,		N
	– prevent any operation of hazardous functions by voluntary or involuntary action on the machine’s sensors.		N
	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.		N
	In addition, the operator must be able to control operation of the parts he is working on from the adjustment point.		N
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		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	machinery must not lead to a dangerous situation		
	Particular attention must be given to the following points:		-
	- the machinery must not start unexpectedly		P
	– the parameters of the machinery must not change in an uncontrolled way when such change can lead to hazardous situations,		P
	- the machinery must not be prevented from stopping if the command has already been given		P
	- no moving part of the machinery or piece held by the machinery must fall or be ejected		P
	- automatic or manual stopping of the moving parts whatever they may be must be unimpeded		P
	– the protective devices must remain fully effective or give a stop command.		P
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.		P
	If the shape of the machinery itself or its intended installation doesn't offer sufficient stability, appropriate means of anchorage must be incorporated and indicated in the instructions		P
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.		P
	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.		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	The instructions must indicate the type and frequency of inspections and maintenance required for safety reasons.		P
	They must, where appropriate, indicate the parts subject to wear and the criteria for replacement.		P
	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.		P
	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.		P
	Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to persons:		P
	- when the work piece comes into contact with the tool the later must have attained its normal working conditions		P
	- when the tool starts and/or stops the feed movement and the tool movement must be coordinated		P
1.3.3	Risked due to falling or ejected objects		-
	Precautions must be taken to prevent risks from falling or ejected objects.		P
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		P
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		N

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	constituting a risk for exposed persons.		
	For this purpose, it must be possible to start and stop separately and elements that are not protected		N
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.		P
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.		P
	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.		P
	The instructions and, where possible, a sign on the machinery shall identify these specific protective devices and how they are to be used.		P
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.		P
1.3.8.1	. Moving transmission parts		-
	Guards designed to protect persons against the hazards generated by moving transmission parts must be:		P
	– either fixed guards as referred to in section 1.4.2.1, or		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	–– interlocking movable guards as referred to in section 1.4.2.2.		P
	Interlocking movable guards should be used where frequent access is envisaged.		P
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		P
	– interlocking movable guards as referred to in section 1.4.2.2, or		P
	– protective devices as referred to in section 1.4.3, or		P
	– a combination of the above.		P
	However, when certain moving parts directly involved in the process cannot be made completely inaccessible during operation owing to operations requiring operator intervention		P
	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		P
	– adjustable guards as referred to in section 1.4.2.3 restricting access to those sections of the moving parts where access is necessary.		N
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.		N
1.4	Required characteristics of guards and protection devices		-
1.4.1	General requirement		-
	Guards and protection devices must:		-
	- be of robust construction		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	– be securely held in place,		P
	- not give rise to any additional hazard,		P
	- not be easy to bypass or render non-operational		P
	- be located at an adequate distance from the danger zone		P
	- cause minimum obstruction to the view id the production process		P
	– 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.		P
	In addition, guards must, where possible,protect against the ejection or falling of materials or objects and against emissions generated by the machinery.		P
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		P
	Their fixing systems must remain attached to the guards or to the machinery when the guards are removed.		P
	Where possible, guards must be incapable to remain in place without their fixings		P
1.4.4.2	Interlocking movable guards must:		-
	– as far as possible remain attached to the machinery when open,		P
	-– be designed and constructed in such a way that they can be adjusted only by means of an intentional action. [See 3rd hyphen of old 1.4.2.2		P
	Interlocking movable guards must be associated with an interlocking device that:		-
	– prevents the start of hazardous machinery functions until they are		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	closed, and		
	– gives a stop command whenever they are no longer closed.		P
	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:		P
	– prevents the start of hazardous machinery functions until the guard is closed and locked, and		P
	-– keeps the guard closed and locked until the risk of injury from the hazardous machinery functions has ceased.		P
	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		P
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		P
	- be readily adjustable without the use of tools		P.
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,		P
	– persons cannot reach moving parts while the parts are moving, and		P
	– the absence or failure of one of their components prevents starting or stops the moving parts.		P.
	Protective devices must be adjustable only by means of an		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	intentional action.[See 3rd hyphen of old 1.4.3]		
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 so that all hazards of an electrical nature are or can be prevented		N
	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 hazardsare governed solely by this Directive.		N
1.5.2	Static electricity		-
	Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic changes and/or be fitted with a discharging system		P
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.		N
1.5.4	Error 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.		P
	Where necessary, the instructions must give further information on these risks.		P
	Where a faulty connection can be the source of risk, incorrect		N

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		
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. The necessary steps must also be taken to avoid or protect against the risk of hot or very cold material being ejected.		P
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.		P
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.		N
	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.		N
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		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	machinery.		
1.5.9	Vibration		-
	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.		P
	The level of vibration emission may be assessed with reference to comparative emission data for similar machinery.		
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.		N
	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.		N
	Any functional non-ionising radiation emissions during setting, operation and cleaning must be limited to levels that do not have adverse effects on persons.		N
1.5.11	External radiation		-
	Machinery must be designed and constructed in such a way that external radiation does not interfere with its operation.		N
1.5.12	Laser equipment		-
	Where laser equipment is used, the following provisions should be taken into account;		N
	– laser equipment on machinery must be designed and constructed in such a way as to prevent any accidental radiation,		N
	– laser equipment on machinery must be protected in such a		N

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		N
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.		P
	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.		P
	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.		P
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.		P
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.		P
	Where appropriate, these parts must be fitted with handholds that are fixed relative to the user and that enable them to maintain their stability.		P
1.5.16	Lightning		

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		P
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.		P
	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).		P
	In the case of automated machinery and, where necessary, other machinery, a connecting device for mounting diagnostic fault-finding equipment must be provided.		P
	Automated machinery components which have to be changed frequently		P
	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.		P
1.6.2	Access to operating position 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.		P
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		N

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		N
	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.		P
	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.		P
	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.		P
1.6.4	Operator intervention		-
	Machinery must be so designed, constructed and equipped that the need for operator intervention is limited		P
	If operator intervention can’t be avoided, it must be possible to carry it out easily and in safety		P
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		P
	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.		P
1.7	INFORMATION		-
1.7.1	Information and warnings on the machinery		-
	Information and warnings on the machinery should preferably		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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. [Compare with 1.7.2 of the old directive]		
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.		P
	Visual display units or any other interactive means of communication between the operator and the machine must be easily understood and easy to use.		P
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.		P
	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.		P
	The requirements of the specific Community Directives concerning colours and safety signals must be complied with.		P.
1.7.2	Warning of residual risks		-
	Where risks remain despite the inherent safe design measures, safeguarding and complementary protective		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	measures adopted, the necessary warnings, including warning devices, must be provided.		
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,		P
	– designation of the machinery,		P
	– the CE Marking (see Annex III),		P
	– designation of series or type		P
	– serial number, if any,		P
	– the year of construction, that is the year in which the manufacturing process is completed.		P
	It is prohibited to pre-date or post-date the machinery when affixing the CE marking.		P
	Furthermore, machinery designed and constructed for use in a potentially explosive atmosphere must be marked accordingly.		P
	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.		P
1.7.5	Instruction		-
	All machinery must be accompanied by instructions in the official Community languageor languages of the Member State in which it is placed on the market and/or put into service.		P
	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.		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	By way of exception, the maintenance instructions intended for use by specialized personnel mandated by the manufacturer or his authorised representative may be supplied in only one Community language which the specialised personnel understand.[Compare with old 1.7.4 b]		P
	The instructions must be drafted in accordance with the principles set out below.		P
1.7.5.1	. General principles for the drafting of instructions		P
	(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 authorized representative.		P
	(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’.		P
	(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.		P
	(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.		P
1.7.5.2	. Contents of the instructions		P
	-Each instruction manual must contain, where applicable, at least the following information:		P
	(a) the business name and full address of the manufacturer and of his authorized representative;		P
	(b) the designation of the machinery as marked on the		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	machinery itself, except for the serial number (see section1.7.3);		
	(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;		P
	(d) a general description of the machinery;		P
	(e) the drawings, diagrams, descriptions and explanations necessary for the use, maintenance and repair of the machinery and for checking its correct functioning;		P
	(f) a description of the workstation(s) likely to be occupied by operators;		P
	g) a description of the intended use of the machinery;		P
	(h) warnings concerning ways in which the machinery must not be used that experience has shown might occur;		P
	(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;		P
	(j) instructions relating to installation and assembly for reducing noise or vibration;		P
	(k) instructions for the putting into service and use of the machinery and, if necessary, instructions for the training of operators;		P
	(l) information about the residual risks that remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted;		N
	(m) instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided;		P
	(n) the essential characteristics of tools which may be fitted to the machinery;		P
	o) the conditions in which the machinery meets the		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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; [Comparewith the 10th hyphen of old 1.7.4. (a)]		P
	(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;		P
	(r) the description of the adjustment and maintenance operations that should be carried out by the user and the preventive maintenance measures that shouldbe observed;		P
	(s) instructions designed to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;		P
	(t) the specifications of the spare parts to be used, when these affect the health and safety of operators;		P
	(u) the following information on airborne noise emissions:		P
	– 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,		P
	– the peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 μPa),		P
	– the A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	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.		P
	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		P
	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.		P
	The operating conditions of the machinery during measurement and the measuring methods used must be described.		P
	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 metre from the floor or access platform. The position and value of the maximum sound pressure must be indicated.		P
	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;		P
	(v) where machinery is likely to emit nonionising 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		P

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	and exposed persons.		
1.7.5.3	. 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.		P
2	SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR CERTAIN CATEGORIES OF MACHINERY		-
2.1	FOODSTUFFS MACHINERY AND MACHINERY FOR COSMETICS OR PHARMACEUTICAL PRODUCTS		-
2．1．1	General		-
	Machinery intended for use with foodstuffs or with cosmetics or pharmaceutical products must be designed and constructed in such a way as to avoid any risk of infection, sickness or contagion. The following requirements must be observed:		-
	(a) materials in contact with, or intended to come into contact with, foodstuffs or cosmetics or pharmaceutical products must satisfy the conditions set down in the relevant Directives. The machinery must be designed and constructed in such a way that these materials can be cleaned before each use. Where this is not possible disposable parts must be used;		P
	(b) all surfaces in contact with foodstuffs or cosmetics or pharmaceutical products, other than surfaces of disposable parts,must:		-
	– be smooth and have neither ridges nor crevices which could harbour organic materials. The same applies to their joinings,		P
	– be designed and constructed in such a way as to reduce the projections, edges and recesses of assemblies to a		P

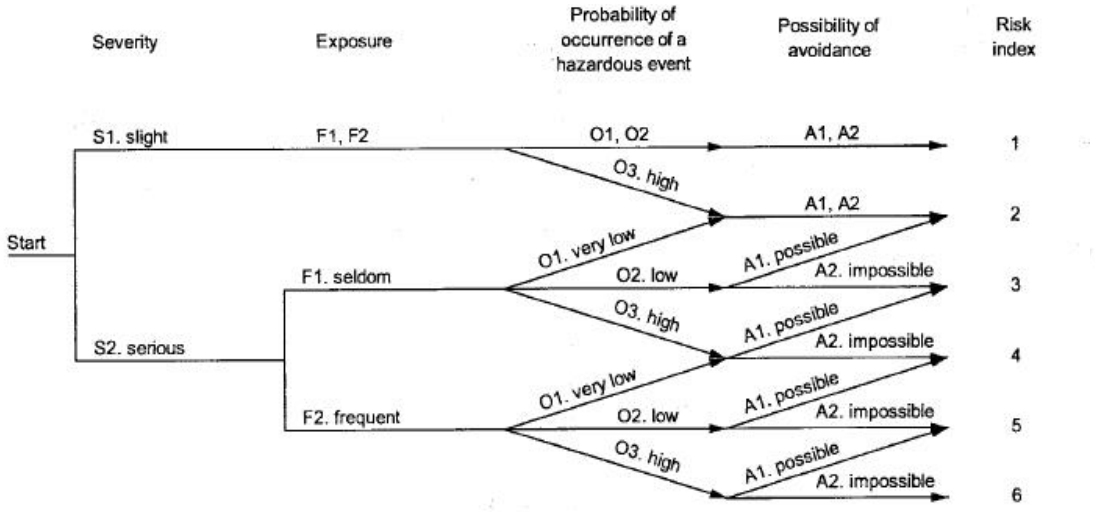
Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
	minimum,		
	– be easily cleaned and disinfected, where necessary after removing easily dismantled parts; the inside surfaces must have curves with a radius sufficient to allow thorough cleaning;		P
	(c) it must be possible for liquids, gases and aerosols deriving from foodstuffs, cosmetics or pharmaceutical products as well as from cleaning, disinfecting and rinsing fluids to be completely discharged from the machinery (if possible, in a ‘cleaning’ position);		P
	(d) machinery must be designed and constructed in such a way as to prevent any substances or living creatures, in particular insects, from entering, or any organic matter from accumulating in areas that cannot be cleaned;		P
	(e) machinery must be designed and constructed in such a way that no ancillary substances hazardous to health, including the lubricants used, can come into contact with foodstuffs, cosmetics or pharmaceutical products. Where necessary, machinery must be designed and constructed in such a way that continuing compliance with this requirement can be checked		P
2.1.2.	Instructions		-
	The instructions for foodstuffs machinery and machinery for use with cosmetics or pharmaceutical products must indicate recommended products and methods for cleaning, disinfecting and rinsing, not only for easily accessible areas but also for areas to which access is impossible or inadvisable.		P
2.2	PORTABLE HAND-HELD AND/OR HAND-GUIDED MACHINERY		N
2.3	MACHINERY FOR WORKING WOOD AND MATERIAL WITH SIMILAR PHYSICAL CHARACTERISTICS		N.

Annex Ⅰ in Directive 2006/42/EC Machinery			
Items	Requirements	Result-Remark	Verdict
3	SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET HAZARDS DUE TO THE MOBILITY OF MACHINER		-
4	SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET HAZARDS DUE TO LIFTING OPERATIONS		-
5	SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY INTENDED FOR UNDERGROUND WORK		-
6	SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY PRESENTING PARTICULAR HAZARDS DUE TO THE LIFTING OF PERSONS		-

2.2 EN ISO 12100:2010Safety of machinery — General principles for design — Risk assessment and risk reduction

2.1 Risk Estimation Method

For risk estimation, the risk graph method of ISO / TR 14121-2, figure A.3, was used as the following.



Despite the rough estimation of the risk index, if after application of well-tried protective measure it is considered that the risk is adequately reduced, no further actions will be required. Otherwise, a specific risk estimation method should be used.

2.2 Risk Assessment Methodology

The risk assessment is based on a method recommended in ISO / TR 14121-2: 2007, in which the factors Se-Cl (Fr + Pr + Av) and diagram are used to evaluate the level of risk. The meaning of those is described in the following:

(1) Se, severity of the possible harm:

1. Scratched, bruises that are cured by first aid or similar.

2. More severe scratches, bruises, stabbing which require medical attention from professionals.

3. Normally irreversible injury; it will be slightly difficult to continue work after healing, if

possible at all.

4. Irreversible injury in such a way that it will very difficult to continue work after healing, if possible at all.

(2) Fr, average interval between frequency of the exposure and its duration;

1. Interval between exposures is more than a year.

2. Interval between exposures is more than two weeks but less than or equal to a year.

3. Interval between exposures is more than a day but less than or equal to two days.

4. Interval between exposure is more than an hour but less than or equal to a day. Where the duration is short than 10 minutes, the above values may

be decreased to the next level.

5. Interval less than or equal to an hour. This value is not to be decreased at any time.

(3) Pr, possibility of occurrence of a hazardous event:

1. Negligible

2. Rarely

3. Possible

4. Likely

5. Very high

(4) Av, possibility of avoiding or limiting harm:

1. Likely

2. Possible

3. Impossible

The risk is evaluated by using matrix as below:

Severity S	Class CI (Fr + Pr + Av)				
	3-4	5-7	8-10	11-13	14-15
4					
3					
2					
1					

Where the severity, Se, cross the class, CI:

In the black area, protective measures have to be implemented to reduce risk;

In the gray area, protective measures are recommended to be implemented to further reduce risk;

In the remaining area, the risk is already adequately reduced.

2.3 Acceptance Criteria

A form is filled in with the result of this risk assessment; each hazardous situation is allocated a risk index. In this example, the estimation of each hazardous situation is made with consideration given to the following:

- a risk of 1 or 2 corresponds to the lowest priority of action (priority 3);
- a risk index of 3 or 4 corresponds to the medium priority of action (priority 2);
- and a risk index of 5 or 6 corresponds to the highest priority of action (priority 1).

Possible means of reducing risk are considered and the risk is then estimated for the final design using the same risk graph in the same manner as for the initial design. In this specific case, a risk index of 2 or less have been evaluated as representing the level at which no further risk reduction is required.

1. Mechanical	
Sub-clause of EN 12100:2010	–6.2.2.1; –6.2.2.2; –6.2.3 a); –6.2.3 b); –6.2.6; –6.2.10; –6.3.1; –6.3.2; – 6.3.3; – 6.3.5.2; – 6.3.5.4; – 6.3.5.5; – 6.3.5.6; –6.4.1; – 6.4.3; – 6.4.4; – 6.4.5
Origin	– acceleration, deceleration;– angular parts;– approach of a moving element to a fixed part;– cutting parts;– elastic elements;– falling objects;– high pressure;– instability; – moving elements;– rotating elements;– rough, slippery surface;– sharp edges;

No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
1.1	Being run over	When the machine is running	Se 3, Fr 1, Pr 2, Av 1, Cl 4	1.Designed to comply with the standards 2. Read the instructions before using the machine
1.2	Being thrown	When the machine is running	Se 3, Fr 1, Pr 2, Av 1, Cl 4	1.Designed to comply with the standards 2. Read the instructions before using the machine
1.3	Crushing	When the machine is running	Se 3, Fr 3, Pr 2, Av 1, Cl 6	1.Designed to comply with the standards 2. Read the instructions before using the machine
1.4	Cutting or severing	Not applicable		

1.5	Drawing in or trapping	When the machine is running	Se 3, Fr 1, Pr 2, Av 1, Cl 4	1. warning signs was used 2. appropriate brake system was provided 3. Read the instructions before using the machine 4． appropriate safety guard was provided
1.6	Entanglement	When maintaining the machine	Se 3, Fr 1, Pr 2, Av 1, Cl 4	1.Designed to comply with the standards 2. Read the instructions before using the machine
1.7	Friction or abrasion	When maintaining the machine or the machine is running	Se 2, Fr 4, Pr 1 Av 1, Cl 6	1. warning signs was used 2. appropriate brake system was provided 3. Read the instructions before using the machine
1.8	Impact	When maintaining the machine or the machine is running	Se 2, Fr 4, Pr 1 Av 1, Cl 6	1. warning signs was used 2. appropriate brake system was provided 3. Read the instructions before using the machine
1.9	Injection	Not applicable		
1.10	Shearing	When maintaining the machine or the machine is running	Se 2, Fr 2, Pr 1 Av 1, Cl 6	1. warning signs was used 2. appropriate brake system was provided 3. Read the instructions before using the machine

1.11	Slip, trip and fall of person	When maintaining the machine or the machine is running	Se 2, Fr 4, Pr 1 Av 1, Cl 6	1. warning signs was used 2. appropriate safety guard was provided 3. Read the instructions before using the machine
1.12	Stabbing or puncture	When maintaining the machine or the machine is running	Se 2, Fr 4, Pr 1 Av 1, Cl 6	1.Designed to comply with the standards 2. Read the instructions before using the machine
1.13	Suffocation	Not applicable		

2. Electrical				
Sub-clause of EN 12100:2010	–6.2.9; –6.3.2; –6.3.3.2; –6.3.5.4; –6.4.4; –6.4.5			
Origin	– electromagnetic phenomena; – live parts; – not enough distance to live parts under high voltage; – overload; — short-circuit			
No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
2.1	Burn	Not applicable		
2.2	Electrocution	Not applicable		
2.3	Falling, being thrown	Not applicable	-	-
2.4	Fire	Not applicable		

2.5	Shock	Not applicable		

3. Thermal				
Sub-clause of EN 12100:2010	– 6.2.4 b); – 6.2.8 c); – 6.3.2.7; – 6.3.3.2.1; – 6.3.4.5;			
Origin	– explosion; – flame; – objects or materials with a high or low temperature;.			
No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
3.1	Burn	Not applicable		
3.2	Dehydration;	Not applicable	-	-
3.3	Discomfort;	Not applicable	-	-

4. Noise	
Sub-clause of EN 12100:2010	－6.2.2.2; －6.2.3 c); －6.2.4 c); －6.2.8 c); －6.3.1; －6.3.2.1 b); －6.3.2.5.1; －6.3.3.2.1; －6.3.4.2; －6.4.3; －6.4.5.1 b) and c);
Origin	－ cavitation phenomena;－ exhausting system;－ gas leaking at high speed; － manufacturing process (stamping, cutting, etc.);－ moving parts; － scraping surfaces;－ unbalanced rotating parts;－ whistling pneumatics; － worn parts.

No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
4.1	Discomfort	1. when machine is running	Se 3, Fr 1, Pr 2, Av 1, Cl 4-	1.Designed to comply with the standards
4.2	Loss of awareness	Not applicable	-	-
4.3	Loss of balance	Not applicable	-	-
4.4	Permanent hear loss	Not applicable		
4.5	Stress	Not applicable		
4.6	Tinnitus	Not applicable		
4.7	Tiredness	Not applicable		

	Any other (for example, mechanical, electrical) as a consequence of an interference with speech	Not applicable		

5. Vibration	
Sub-clause of EN 12100:2010	– 6.2.2.2; – 6.2.3 c); – 6.2.8 c); – 6.3.3.2.1; – 6.3.4.3; – 6.4.5.1 c);
Origin	– cavitation phenomena; – misalignment of moving parts; – mobile equipment; – scraping surfaces; – unbalanced rotating parts; – vibrating equipment; – worn parts.

No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
5.1	Discomfort	1. when machine is running	Se 3, Fr 1, Pr 2, Av 1, Cl 4-	1.Designed to comply with the standards
5.2	Low-back morbidity	Not applicable		
5.3	Neurological disorder	Not applicable		
5.4	Osteo-articular disorder	Not applicable		
5.5	Trauma of the spine	Not applicable		
5.6	Vascular disorder	Not applicable		

6. Radiation	
Sub-clause of EN 12100:2010	– 6.2.2.2;– 6.2.3 c);– 6.3.3.2.1;– 6.3.4.5;– 6.4.5.1 c);
Origin	– ionizing radiation source;– low frequency electromagnetic radiation; – optical radiation (infrared, visible and ultraviolet), including laser; – radio frequency electromagnetic radiation.

No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
6.1	Burn	Not applicable		
6.2	Damage to eyes and skin	Not applicable		
6.3	Effects on reproductive capability	Not applicable		
6.4	Genetic mutation	Not applicable		
6.5	Headache, insomnia,	Not applicable		

7.Material/ substance hazards				
Sub-clause of EN 12100:2010	– 6.2.2.2;– 6.2.3 b);– 6.2.3 c);– 6.2.4 a);– 6.2.4 b);– 6.3.1; – 6.3.3.2.1;– 6.3.4.4;– 6.4.5.1 c);– 6.4.5.1 g);			
Origin	– aerosol; – biological and microbiological (viral or bacterial) agent; – combustible; – dust; – explosive; – fibre; – flammable; – fluid; – fume; – oxidizer.			
No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
7.1	Breathing difficulties, suffocation	Not applicable		
7.2	Cancer	Not applicable		
7.3	Corrosion	Not applicable		
7.4	Effects on reproductive capability	Not applicable		
7.5	Explosion	Not applicable		
7.6	Fire	Not applicable		
7.7	Infection	Not applicable		

7.8	Mutation	Not applicable		
7.9	Poisoning	Not applicable		
7.10	Sensitization	Not applicable		

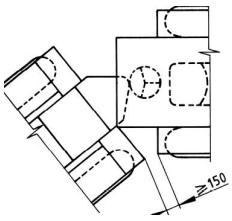
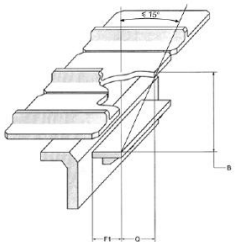
8. Ergonomic hazards	
Sub-clause of EN 12100:2010	－6.2.2.1;－6.2.7;－6.2.8;－6.2.11.8;－6.3.2.1;－6.3.3.2.1;
Origin	－ access;－ design or location of indicators and visual displays units; － design, location or identification of control devices; － effort; － flicker, dazzling, shadow, stroboscopic effect; － local lighting; － mental overload/underload;－ posture;－ repetitive activity;－ visibility － oxidizer.

No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
8.1	Breathing difficulties, suffocation	Not applicable		
8.2	Cancer	Not applicable		
8.3	Corrosion	Not applicable		
8.4	Effects on reproductive capability	Not applicable		
8.5	Explosion	Not applicable		

9. Associated with Environment in which the Machine is Used				
Sub-clause of EN 12100:2010	—6.2.6;—6.2.11.11;—6.3.2.1;—6.4.5.1 b);			
Origin	— dust and fog;— electromagnetic disturbance;— lightning;— moisture; — snow;— temperature;— water;— wind;— lack of oxygen.			
No.	Potential Consequences	Hazardous Situation	Risk Estimation	Risk Reduction and Protective Measures
9.1	Burn	Not applicable		
9.2	Slight disease	Not applicable		
9.3	Slipping, falling	Not applicable		
9.4	Suffocation	Not applicable		

2.3 EN 474-1:2006+A6:2019 Earth-moving machinery - Safety - Part 1: General requirements

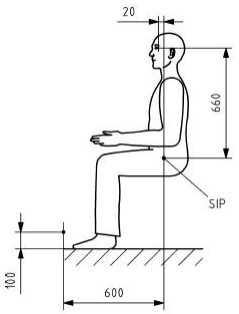
EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
1	Scope		-
2	Normative references		-
3	Terms and definitions		-
4	List of significant hazards		-
5	Safety requirements and/or measures		-
5.1	General		-
	Earth-moving machinery shall comply with the safety requirements and/or protective measures of this European Standard, as far as not modified by requirements of the relevant specific part of the standard series. In addition, the machine shall be designed according to the principles of EN ISO 12100-1:2003 and EN ISO 12100-2:2003 for hazards relevant but not significant which are not dealt with by this EuropeanStandard.		P
5.2	Access		-
5.2.1	General requirements		-
	Adequate access systems shall be provided to the operator's station and areas where routine maintenance has to be performed by the operator as described in the operator's manual. Access system shall comply with EN ISO 2867:2006.		P
5.2.2	Access to articulated machines		-
	On machines with articulated frames and in the fully articulated steering position, a minimum clearance of 150 mm for the lower limbs shall be provided between firm structures or components with relative movement		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	in the path of the access systems to the operator's station, as illustrated in Figure 1. 		
5.2.3	Access system on crawler machines with step(s)		-
	Access step(s) integrated in the track frame shall meet the requirements as stated below (see also Figure 2). A step of an access system can be retracted under an angle of ≤ 15°, if at least the basic dimension of riser height dimension B, and the tread depth *F*1 according to Figure 1 and Table 1 of EN ISO 2867:2006 is met, measured from the outer edges of the track shoes. In such a case, taken into account the limited view during egress, the step width shall be at least as wide as the minimum in accordance with Table 1 of EN ISO 2867:2006. 		P
5.3	Operator's station		-
5.3.1	General requirements		-
5.3.1.1	Machinery equipment		-
	Machines with an operating mass less than 1 500 kg are not required to have a cab.		P
	Machines with an operating mass greater than or		-

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	equal to 1 500 kg shall be equipped with a cab, unless the foreseeable adverse weather conditions allow all-year operation without a cab (negotiated between manufacturer and user).		
	Machines shall be equipped with a cab and a contamination protective system if the machine is intended for use in unhealthy environments, e. g. contaminated areas (negotiated between manufacturer and user). See 5.14.1.		P
	If a hazard due to projection of splinters exists, e. g. operation with a hydraulic- or demolition-hammer, an adequate protection such as bullet proof glass, mesh guard or an equivalent protection is required.		P
5.3.1.2	Minimum space		-
	The minimum space available to the operator shall be as defined in EN ISO 3411:1999 (except as amended in 5.3.2.5).		P
	For compact machines the minimum space envelope width (dimension 920 mm in EN ISO 3411:1999, Figure 5) may be reduced to 650 mm.		P
	The minimum space and location of the controls at the operator's station shall meet the requirements specified in EN ISO 6682:1995.		P
5.3.1.3	Moving parts		-
	Measures shall be taken to avoid accidental contact from the operating position with moving parts, e. g. the wheels, or tracks or working equipment and/or attachment in accordance with relevant subclauses of 5.14.		P
5.3.1.4	Engine exhaust		-
	The engine exhaust system shall release the exhaust gas away from the operator and the air inlet of the cab.		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
5.3.1.5	Instruction storage		-
	A space intended for the safekeeping of the operator’s manual and other instructions shall be provided near the operator's station. The space shall be lockable, unless the operator's station can be locked.		P
5.3.1.6	Sharp edges		-
	The operator's space within the operator's station, e. g. ceiling, inner walls, instrument panels and access to the operator's station shall not present any sharp edges or acute angles/corners. Radius of corners and bluntness of edges shall comply with ISO 12508:1994 to avoid sharp edges (see also 5.14.6).		P
5.3.2	Operator's station equipped with a cab		-
5.3.2.1	Climatic conditions		-
	The cab shall protect the operator against foreseeable adverse climatic conditions. Provisions shall be made to install a ventilation system, an adjustable heating system and a system for defrosting windows. For details see 5.3.2.6 to 5.3.2.8.		P
5.3.2.2	Pipes and hoses		-
	Pipes and hoses located inside the cab which contain fluids that are dangerous, for example because of theirpressure (greater than 5 MPa), temperature (greater than 50°C) shall be guarded, see EN ISO 3457:2003, Clause 9.		P
5.3.2.3	Primary access opening		-
	A primary access opening shall be provided. The dimensions shall comply with EN ISO 2867:2006, Figure 4 and Table 4.		P
5.3.2.4	Alternative opening (emergency exit)		-

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	An alternative opening shall be provided on a side other than that of the primary opening. The dimensions shall comply with EN ISO 2867:2006, Clause 11. A window panel or another door is acceptable if they are easy to open or remove without the use of keys or tools. Latches may be used if they can be opened from the inside without the use of keys or tools. The break of a suitable size of glass pane is considered equivalent to an alternative opening. In such a case the necessary pane hammer, immediately accessible to the operator, shall be provided and stored in the cab.		P
5.3.2.5	Space envelope height		-
	The minimum space envelope height *R*1 as defined in Figure 5 of EN ISO 3411:1999 and measured from the seat index point (SIP), as defined in EN ISO 5353:1998, shall meet the values given in Table 1. Table 1 — Space envelope height related to machine classification Machine classification Minimum space envelope height mm from the SIP Compact machines 920 All other machines 1 000 The minimum dimensions given in Table 1 are also required for machines having a front or rear window which are located (in an opened position) above the operator's seat.		P
5.3.2.6	Heating and ventilation system		-
	If a heating system is fitted it shall either:		-
	a) comply with ISO 10263-4:1994, or		P
	b) have the capability of increasing the temperature of the air inside the cab and maintain a temperature of + 18°C at expected ambient temperature the machine is intended for. The minimum capacity of the		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	heating system shall have a Δ*T* of 25°C (Δ*T* of 25 K) within 30 min. The test shall run starting with the engine at working temperature as specified by the manufacturer. Measurement of the system capacity shall be made at three points. The three points shall be located in a vertical plane through the SIP and parallel to the longitudinal axis of the machine as follows (see Figure 3): 1) at filament position centre-point as defined in ISO 5006:2006; 2) at the SIP as defined in EN ISO 5353:1998; 3) 100 mm above floor plate and 600 mm in front of SIP.  		
	c) Alternatively, the heating capacity can be determined by calculation. The ventilation system shall be capable of providing the cab with filtered fresh air at the minimum of 43 m3/h. The filter shall be tested according to ISO 10263-2:1994. NOTE The filter element selection depends on the intended operating environment conditions.		P
5.3.2.7	Defrosting system		-
	Machine with a cab shall provide facilities to defrost the front and rear window(s), for example by means of a		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	heating system or a particular defrosting device.		
5.3.2.8	Pressurisation system		-
	Where a cab is provided with a pressurisation system, it shall be tested according to ISO 10263-3:1994 and shall provide an interior relative pressure of at least 50 Pa.		P
5.3.2.9	Doors and windows		-
	Doors, windows and flaps shall be securely held in their functional positions; measures shall be taken for preventing inadvertent opening. Doors shall be retained at their intended operating position(s) by a positive engagement device. A primary opening designed to be held securely open as an intended operating position, shall be releasable from the operator's station.		P
5.3.2.10	Inner lighting		-
	The cab shall be fitted with a fixed inner lighting system and be able to function with the engine at a stop, to make it possible to illuminate the operator's station and to read the operation manual in darkness.		P
5.3.3	Roll-over protective structures (ROPS)		-
5.3.3.1	General		-
	Earth-moving machinery shall be equipped with a roll-over protective structure (ROPS). The ROPS shall comply with EN 13510:2000. When specific parts of the standard specify that a ROPS is not required for covered machines, anchorage points are not required.		P
5.3.3.2	ROPS for derivative machinery		-
	For derivative machinery, the ROPS shall be designed taking into account the operating mass (see		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	ISO 6016:1998) of the derivative machinery in the heaviest configuration as specified by the manufacturer.		
5.3.4	Falling-object protective structures (FOPS)		-
	protective structure (FOPS) can be fitted, when they are intended for applications where there is a risk of falling objects. If FOPS is fitted it shall comply with EN 13627:2000. If a provision for FOPS is required by specific parts of the standard, the manufacturer shall provide on demand the corresponding FOPS.		P
5.3.5	Elevating operator's station		-
5.3.6	Replacement of operator protective structure		-
	In case any part of the protective structure (e. g. ROPS, TOPS, FOPS) is affected by a plastic deformation and/or rupture (e. g. by roll-over, tip-over or object impact), the protective structure has to be replaced according to manufacturer's specifications. See also 7.2.		P
5.4	Seats		-
5.4.1	Operator's seat		-
5.4.1.1	General requirement		-
	Machinery with provision for a seated operator shall be fitted with an adjustable seat that supports the operator in a position, which allows the operator to control the machine under intended operating conditions.		P
5.4.1.2	Dimensions		-
	The seat dimensions shall comply with ISO 11112:1995.		P
.4.1.3. 5	Adjustment		-

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	All adjustments to accommodate the operator's size shall comply with ISO 11112:1995, Table 1 and be adjustable without the use of any tool. For compact machines (see 3.1.1) the following seat adjustments apply: either the fore and aft adjustment (see ISO 11112:1995, Table 1, *l*2) shall be at least ± 35 mm or the corresponding adjustment of frequently used operator's controls shall be provided; vertical adjustment (ISO 11112:1995, Table 1, *h*1) is not required.		P
5.4.1.4	Vibration		-
	The operator's seat shall meet the requirements of EN ISO 7096:2000 with regard to its ability to reduce the vibration transmitted to the operator.		P
5.4.1.5	Restraint system		-
	Machines fitted with ROPS or TOPS (tip over protective structure) shall have an operator restraint system that meets the requirements specified in EN ISO 6683:2005.		P
5.4.2	Additional seat		-
5.4.2.1	Instructor's seat		-
	If an additional seat for an instructor is installed in the operator's station, it shall be padded and provide adequate space for the instructor. The instructor shall also have available a conveniently placed handhold.		P
5.4.2.2	Second operator's seat		-
	If a second operator's seat is required for a specific machine, which can be frequently or alternatively used by the operator to perform the application of the machine, this seat shall fulfil the requirements for seats as specified in 5.4 and the safety structures as specified		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	in 5.3.3 (ROPS) and 5.3.4 (FOPS).		
5.5	Operator's controls and indicators		-
5.5.1	General		-
	The controls (hand levers, pedals, switches etc.) and indicators of the machine, equipment, attachment, shall be chosen, designed, constructed and arranged according to ISO 10968:2004, so that: a) they are of easy access, in accordance with EN ISO 6682:1995 and ISO 10968:2004; b) neutral positions of controls shall be in accordance with 5.3 of ISO 10968:2004; c) they are clearly identified (see ISO 6405-1:2004 and ISO 6405-2:1993) in the operator's station and explained in the operation manual (see 7.2); d) the movement of the controls to activate the functions and indicators shall correspond to the intended effect or common practice whenever possible; e) the normal engine stop device shall be within the zone of reach (see EN ISO 6682:1995); f) when a control is designed and constructed to carry out several functions of the machine, e. g. keyboard, joystick control, the activated function shall be clearly identified; g) for requirements on joy-sticks, see also ISO 10968:2004; h) for safety related functions of control system(s) having no electronic components, the principles outlined in EN 954-1:1996 shall be used or methods giving similar protection.		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
5.5.2	Starting system		-
	The starting system of earth-moving machinery shall be provided with a starting device (e. g. key) and shall comply with ISO 10264:1990 or have a similar protection. Earth-moving machines shall be so designed that hazardous movement of the machine or its working equipment and/or attachment shall not be possible without action on the controls whilst starting the engine.		P
5.5.3	Inadvertent activation		-
	Pedals shall have an appropriate size, shape and be adequately spaced. The pedals shall have a slipresistant surface and be easy to clean. If the pedals of an earth-moving machine have the same function (clutch, brake, and accelerator) as on a motor vehicle, they shall be arranged in the same manner to avoid the risk of confusion.		P
5.5.5	Emergency attachment lowering		-
	If the engine is stopped it shall be possible to: a) lower the equipment/attachment to the ground/frame; b) see the equipment/attachment lowering from the operator actuating position of the lowering control; c) release the residual pressure in each hydraulic and pneumatic circuit, which can cause a risk. The means to lower the attachment and the device to release the residual pressure can be located outside the operator's station and shall be described in the operation manual.		P
5.5.6	Uncontrolled motion		-
	Machine and equipment or attachment movement from the holding position, other than by actuation of		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	the controls by the operator, due to drift or creep (e. g. by leaking) or when power supply stops, shall be limited to the extent that it can not create a risk to exposed persons.		
5.5.7	Remote control		-
	Remot operator controlled earth-moving machinery shall comply with the requirements as specified in ISO 15817:2005.		P
5.5.8	Control panels, indicators and symbols		-
5.5.8.1	Control panels		-
	The operator shall be able to see from the operator's station, in both daylight and darkness, the necessary indicators to check the proper function of the machine. Glare shall be minimised.		P
5.5.8.2	Operating instrumentation		-
	Control indicators for safe and proper operation of the machine, shall follow the safety colours and safety signs/requirements according to ISO 6011:2003.		P
5.5.8.3	Symbols		-
	Symbols for use on operator controls and other displays on earth-moving machinery shall follow, e. g., ISO 6405-1:2004 or ISO 6405-2:1993.		P
5.5.9	Controls of ride-on machinery accessible from ground level		-
	On ride-on machinery where controls are accessible from the ground, means shall be provided to minimise the possibility to actuate the controls from the ground (e. g. protection by door, guard or by locking systems).		P
5.6	Steering system		-
5.6.1	General		-
	The steering system shall be such that the movement		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	of the steering control shall correspond to the intended direction of steering.		
5.6.2	Rubber-tyred machines		-
	Steering system of rubber-tyred machinery with a forward/reverse travel speed greater than 20 km/h shall comply with EN 12643:1997.		P
5.6.3	Crawler machines		-
	Steering system of crawler machines with a forward/reverse travel speed greater than 20 km/h shall be gradual.		P
5.7	Brake systems		-
	Earth-moving machines shall be equipped with service brake system, secondary brake system and parking brake system, efficient under all conditions of service, load, speed, terrain and slope, according to the intended use of the machine.		P
	Brake systems shall comply with the following requirements:		-
	for wheeled machines with EN ISO 3450:1996; for crawler machines with ISO 10265:1998.		P
5.8	Visibility		-
5.8.1	Operator's field of view		-
	Earth-moving machines shall be designed in accordance with ISO 5006:2006 so that the operator has sufficient visibility from the operator's station in relation to the travel and work areas of the machine that are necessary for the intended use of the machine. The travel mode as specified in ISO 5006:2006 is considered to be representative for testing visibility in both travel and operating modes. NOTE It is sufficient to measure the machine with the most challenging standard attachment within the limits of the intended use.		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	Earth-moving machines shall be equipped with rear view mirrors according to ISO 14401-1:2004 and ISO 14401-2:2004.		
5.8.2	Lighting, signalling and marking lights, and reflex-reflector devices		P
	Work lights and reflex-reflector devices shall be provided and shall comply with ISO 12509:2004. Lighting, signalling and marking lights, if provided, shall comply with the appropriate clauses of ISO 12509:2004.		P
5.9	Warning devices and safety signs		-
	Earth-moving machinery shall be equipped with:		-
	an audible warning device (horn) controlled from the operator's station, the A-weighed sound pressure level of which shall be greater than or equal to 93 dB. The value shall be measured 7 m from the foremost point of the machine with equipment/attachment in its travel position as defined in ISO/DIS 6395:2004. The test procedure shall be in accordance with ISO 9533:1989;		P
	safety signs (see Annex C for examples. See also 7.1).		P
5.10	Tyres and rims		-
	Rubber-tyred earth-moving machinery shall have tyre and rim load performance adapted to the purpose and application.		P
5.11	Stability		-
	Earth-moving machinery with working equipment and/or attachments and optional equipment shall be designed and constructed so that stability is provided under all intended operating conditions, as specified by the manufacturer in the operation manual.		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	Devices intended to increase the stability of earth-moving machinery in working mode (e. g. outriggers, oscillating axle locking) shall be fitted with interlocking devices, e. g. check valve which keeps them in position in case of hose failure or in case of oil leakage		
5.12	Object handling		-
5.12.1	Lifting device(s) for object handling		-
	The lifting device(s) may be either fixed or removable. This device may be located on a bucket, on an arm or any other part of the machine or may be a separate device and shall be:		P
	so located and designed that the risk of being damaged during normal earth moving operations is minimised;		P
	designed so that hooking device prevents unintentional unhooking of the load.		P
5.12.2	Lowering control device		-
	Machines used in object handling application (see machine specific parts), which require a boom lowering control device, shall conform with ISO 8643:1997.		P
5.13	Noise		-
5.13.1	Noise reduction		-
5.13.1.1	Noise reduction at source at the design stage		-
	Machinery shall 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.		P
	When designing machinery, the available information and technical measures to control noise at source		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	shall be taken into account. Recommended practice for the design of low-noise machinery is given in EN ISO 11688-1:1998.		
5.13.1.2	Noise reduction by protective measures		-
	In addition to 5.13.1.1, it is recommended to equip the machines with protective measures/devices to reduce the noise emitted.		P
	For example, the following measures may be applied: a cab as defined in 5.3; enclosure of the engine(s) and cooling system; exhaust mufflers.		P
5.13.1.3	Information on noise emission		-
	Information on noise emission shall be given by the manufacturer in the operation manual, see 7.2.		P
5.13.2	Noise emission measurement		-
5.13.2.1	Sound power level		-
	The sound power level for the different types of earth-moving machinery shall be measured according to ISO/DIS 6395:2004 unless otherwise stated in the machine specific parts of this standard.		P
5.13.2.2	Emission sound pressure level at the operator's station		-
	The emission sound pressure level at the operator's station for the different types of earth-moving machinery shall be measured according to ISO/DIS 6396:2004 unless otherwise stated in the machine specific parts of this standard.		P
5.14	Protective measures and devices		-
5.14.1	Contaminated area		-

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	If an earth-moving machine is intended to be used in a contaminated environment, special precautions to protect the operator (e. g. fresh air filter systems or system to provide breathing air to the operator) are needed if any hazard exists (see also 5.3.1.1).		P
5.14.2	Hot parts Parts which are hot in operation shall be designed, constructed, positioned or provided with a thermal guard to minimise the risk of contact with hot parts and/or surfaces in close proximity to the primary opening, operating position and maintenance area according to EN ISO 13732-1:2006.		P
5.14.3	Moving parts All moving parts which create a hazard shall be designed, constructed, positioned or provided with protection devices to minimise the risk of crushing, shearing and cutting.		P
5.14.4	Guards		-
	Guards shall be designed to be securely held in place and prevent access to dangerous areas and parts where a hazard exists. Engine compartment panels are regarded as guards. Guards shall comply with EN ISO 3457:2003. Movable guards shall as far as possible remain attached to the machine when open. Movable guards shall be fitted with a support system (e. g. springs, gas cylinders) to secure them in opened position up to a wind speed of 8 m/s.		P
5.14.5	Articulated frame lock		-
	Articulated machines shall be equipped with an articulated frame lock according to ISO 10570:2004.		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
5.14.6	Sharp edges and acute angles		-
	Earth-moving machinery with a design speed according to ISO 6014:1986 greater than 25 km/h shall be equipped with fenders according to EN ISO 3457:2003 that protect the operator's station from debris ejected by the tyres or tracks if the risk exists. Earth moving machines without cab shall have fenders that comply with EN ISO 3457:2003.		P
5.14.7	Fenders		-
	Earth-moving machinery with a design speed according to ISO 6014:1986 greater than 25 km/h shall be equipped with fenders according to EN ISO 3457:2003 that protect the operator's station from debris ejected by the tyres or tracks if the risk exists. Earth moving machines without cab shall have fenders that comply with EN ISO 3457:2003.		P
5.15	Retrieval, transportation, lifting and towing		-
5.15.1	Common use		-
	The devices for retrieval, tie-down, lifting, and towing may be the same if allowed by the configuration of the machine.		P
5.15.2	Retrieval		-
	Retrieval points shall be provided at the front and/or rear of the earth-moving machines according to ISO 10532:1995. Attachment points for retrieving of the machine shall be described in the operation manual as well as permissible forces and correct use.		P
5.15.3	Tie-down		-
	To transport earth-moving machinery safely, tie-down points to anchor the machine e.g. on a trailer, shall be provided and clearly identified on the machine (see ISO 6405-1:2004, symbol 7.27). Instructions for		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	their use shall be included in the operation manual.		
5.15.4	Lifting		-
	be clearly identified on machines or subassemblies that are to be lifted in one piece. The method of lifting heavy attachments, components and machines shall be described in the operation manual (see 7.2). For lifting symbol, see ISO 6405-1:2004, symbol 7.23.		P
5.15.5	Towing		-
	Towing device(s) (hooks, ears etc.) shall be provided on the machine. They shall comply with ISO 10532:1995. Their location, permissible forces, the correct use when towing as well as the maximum towing speed and distance shall be clearly specified in the operator's manual. If a pin is part of the towing device, the pin shall be permanently attached to the device. The securing device for the pin shall not be detachable.		P
5.15.6	Transportation		-
	Stabilisers, outriggers or other moveable devices that can cause a hazard during transportation or travelling shall be secured lockable in their transport position. Instructions for secure locking shall be provided in the operation manual.		P
5.16	Electro-magnetic compatibility (EMC)		-
	Earth-moving machines shall comply with the requirements of electromagnetic compatibility as specified in EN 13309:2000. The antenna shall be located successively on the left- and right-hand sides of the earth-moving machine, with the antenna parallel to the plane of the		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	longitudinal symmetry of earth-moving machine and in line with:		
	a) for diesel engines: the SIP (see EN ISO 5353:1998), see Figure 4;		P
	b) for spark ignition engines: the engine mid-point, see Figure 5.		P
5.17	Electrical and electronic systems		-
5.17.1	General		-
	environmental conditions (corresponding to the intended use of the machine) which can cause deterioration. Electrical component insulation shall have flame-retardant properties. Lead-through e. g. through frames and bulkheads, shall be protected from abrasion. Electrical wires/cables not protected by over-current devices shall not be strapped in direct contact with pipes and hoses containing fuel. Safety related electrical function shall comply with ISO/DIS 15998:2005.		P
5.17.2	Degree of protection		-
	Depending on the location/installation of electrical and electronic components, the following degrees of protection are required: all components installed exterior to the machine or directly exposed to the environment shall have a minimum degree of protection which corresponds to IP 55 according to EN 60529:1991; for all components installed in the operator's cab or protected against the environment, the protection shall be designed and executed to safeguard a correct function under expected and intended conditions.		P
5.17.3	Electrical connections		-

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	In order to avoid incorrect connections, electric wires and cables used to connect components in electric circuits shall be marked and identified. This requirement does not apply to electrical circuits of anti-theft systems. NOTE ISO 9247:1990 should be used as guidance.		P
5.17.4	Over-current protective devices		-
	Electric equipment except the starter motor, alternator and pre-heater, shall be protected with an over-current device (e. g. fuse) or other device giving the same protection.		P
5.17.5	Batteries		-
	Batteries shall be firmly attached in a ventilated space. The batteries shall be provided with handles and/or grips. Batteries and/or battery locations shall be designed and built or covered to minimise any hazard to the operator caused by battery acid or acid vapours in the event of overturning of the machine. Live parts (not connected to the frame) and/or connectors shall be covered with insulation material.		P
5.17.6	Battery disconnection		-
	It shall be possible to disconnect batteries easily e.g. by a quick coupling or an accessible isolator switch. The symbol according to ISO 6405-1:2004 shall be used for identification.		P
5.17.7	Electric connector of auxiliary starting aids		-
	If electrical connectors for auxiliary starting aid or power supply are mounted on the machine, the connectors shall be in accordance with ISO 11862:1993.		P
5.17.8	Electric socket for lighting		-
	An electric socket intended for the connection of a		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	lighting device for service and maintenance use shall be provided on the machine and shall be easily accessible. The design of the sockets shall prevent incorrect connection.		
5.18	Pressurised systems		-
5.18.1	General		-
	Pressurised equipment shall be designed and constructed to withstand loading to pressure to which they are subjected and shall be designed in accordance with EN 982:1996.		P
5.18.2	Hydraulic lines		-
	Pipes and hoses shall be located and if necessary, restrained to minimise deterioration e. g. through contact with hot surfaces, sharp edges and other damage-causing sources. Visual inspection of hoses and fittings shall be possible. Pipes and hoses located inside frames are exempt from this requirement.		P
5.18.3	Hydraulic hoses		-
	Hydraulic hoses containing fluid with a pressure of more than 5 MPa (50 bar) and/or having a temperature over 50°C, and which are located within 1,0 m from any surface of DLV (as defined in EN ISO 3164:1999), shall be guarded in accordance with EN ISO 3457:2003 (see also 5.3.2.2).		P
	Any part or component which diverts a possible jet of fluid, can be regarded as a sufficient protection device.		P
	Hoses intended to withstand a pressure of more than 15 MPa (150 bar) shall not be installed by means of reusable fittings. Fittings which require dedicated tooling (such as a press) and parts authorised by the		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	manufacturer of the earth-moving machine, are not considered as reusable fittings.		
5.19	Fuel tanks, hydraulic tanks and pressure vessels		-
5.19.1	General		-
	Fuel and hydraulic tanks shall be provided with a fluid level indicator. Pressure in the tanks exceeding the specified pressure shall be automatically compensated by a suitable device (vent, safety valve etc.).		P
5.19.2	Filler openings		-
	Filler openings of tanks (except window washer tanks) shall:		P
	have easy access for filling;		P
	have provisions for lockable filler caps. Filler caps located inside lockable compartments (e. g. engine compartment), or caps which can only be opened with a special tool, do not need a lockable provision;		P
	be located outside the cab, except the hydraulic oil tank on compact machines.		P
5.19.3	Fuel tanks		-
	Fuel tanks shall withstand an internal pressure of 0,03 MPa (0,3 bar) without permanent deformation or leakage. Non-metallic fuel tanks shall be made of flame retardant material. The speed of flame spread shall not exceed 50 mm/min, when tested according to ISO 3795:1989.		P
5.19.4	Air Pressure vessels		-
	Simple pressure vessels shall be designed and tested to comply with EN 286-2:1992.		P
5.20	Fire protection		-
5.20. 1	Fire resistance		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	The interior, upholstery and insulation of the cab and other parts of the machine where insulation materials are used, shall be made of flame retardant materials. The burning rate shall not exceed 200 mm/min, tested in accordance with ISO 3795:1989.		P
5.20.2	Fire extinguisher		-
	Earth-moving machinery with an operating mass of more than 1 500 kg (see ISO 6016:1998) shall have space for installation of fire extinguisher(s) easily accessible to the operator, or a built-in extinguishing system to permit the operator a safe exit of the machine.		P
5.21	Attachments and attachment bracket		-
	Attachments and attachment bracket shall meet the requirement specified in Annex B.		P
5.20.2	Fire extinguisher		-
	Earth-moving machinery with an operating mass of more than 1 500 kg (see ISO 6016:1998) shall have space for installation of fire extinguisher(s) easily accessible to the operator, or a built-in extinguishing system to permit the operator a safe exit of the machine.		P
5.21	Attachments and attachment bracket		-
	Attachments and attachment bracket shall meet the requirement specified in Annex B.		P
5.22	Maintenance		-
5.22.1	General		-
	Machines shall be designed and built so that the routine lubrication and maintenance operations can be carried out safely, whenever possible with the engine stopped. Where it is only possible to undertake checks or maintenance with the engine running, the		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	safe procedure shall be described in the operation manual.		
	Openings intended for maintenance purposes shall comply with EN ISO 2860:1999.		P
	The design of the machine shall preferably permit lubrication and filling of tanks from the ground.		P
5.22.2	Frequent maintenance		-
	Components (batteries, lubrication fittings, filters etc.) which require frequent maintenance shall be easily accessible for checking and changing.		P
	A lockable storage box shall be provided on the machine for tools and accessories as recommended by the manufacturer.		P
5.22.3	Support devices		-
	On machines where maintenance can only be performed with equipment in a raised position, such equipment shall be mechanically secured with a device according to ISO 10533:1993.		P
	If the support device(s) is (are) required for daily maintenance, it (they) shall be permanently affixed to the machine or be stored on a safe place on the machine.		P
	Engine access panels shall be provided with a device to hold it in open position.		P
5.22.4	Access to the engine compartment		-
	The engine compartment shall be guarded against unauthorised access by one of the following means:		P
	a) a locking device;		P
	b) an installation that requires the use of a tool or key;		P
	c) a guard latch control inside a lockable compartment (e. g. cab).		P
5.22.5	Tiltable cab support device		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	If the operator's cab has an integral tilt system for maintenance, servicing or other non-operational purpose, the cab or system shall be equipped with a support device to hold the cab in the fully raised or tilted position. This system shall meet the requirements of ISO 13333:1994.		P
	When a cab is tilted, a locking system of the controls shall be available to avoid unintended movement of the machine and equipment/attachment actuated by the controls located in the cab.		P
	An automatic locking device (in closed position) is required if daily maintenance is needed below a tilted cab.		P
5.23	Underground operation in non-explosive atmosphere		-
	The requirements regarding use of earth-moving machinery in underground operations in non-explosive atmosphere are specified in Annex F.		P
6	Verification of safety requirements/measures		P
7	Information for use		-
7.1	Warning signs		P
7.2	Operation manual		-
7.2 .1	Operation manual		P
7.2.2	Information concerning hand-arm and whole-body vibration emission		P
7.2.3	Instructions and information for use and maintenance of the machine		-
	The operation manual shall contain the following, if applicable:		-
	1) machine description; 2) description of instrumentation and operator's controls; 3) instructions for adjustment and maintenance of the		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	operator's seat; 4) information whether personal protection equipment is necessary; 5) safety relevant technical data; 6) information on the need for a well-trained and competent operator; 7) advice that operator and other personnel fully acquaint themselves with the operation manual before operating the machine; 8) description of danger zone around the machine and advice that all persons be kept outside the danger zone during operation; 9) safety instructions concerning the stability of the machine including its attachments; advice that all rated operating capacities/rated lift capacities are based on the criteria of the machine being level on a firm supporting ground. When the machine is operated in conditions that deviate from these criteria (e.g. on soft or uneven ground, on a slope or when subject to slide loads), these conditions shall be taken into account by the operator; 10) information on the machine configuration and the setting of any safety devices to ensure stability when travelling; 11) instructions on the position of the control to lower the attachment and release residual pressure; 12) indication that the machine user has to determine whether special hazards exist in his application, such as toxic gases, ground (underfoot) conditions that require special precautionary measures to eliminate or reduce the hazard;		
	13) safety precautions to minimise chemical hazards		P

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	during operation, maintenance and dismantling of the machine; 14) the range of temperature in which the machine is intended to operate and be stored; 15) guidance for the selection of the ventilation filter element; 16) guidance on the need for FOPS and the selection of the level of FOPS where applicable; 17) operating instructions (e.g. use of intended access systems, for machines equipped with ROPS or TOPS, use of restraint system, use of machines equipped with FOPS where the risk of falling object occurs, proper use of attachment bracket and its locking and check procedure, use of heating and ventilation system); 18) safety instructions for object handling application; 19) information on secure locking of stabilisers, outriggers; 20) safety instructions for operation in areas where special hazards exist (e. g. lines (gas, electricity) in the ground; close to overhead electric lines; below ground in enclosed areas; in contaminated areas); 21) instructions regarding safety rules, pressure, inflation and checking of rubber tyres; 22) safety instructions for retrieving, towing and transportation (clear indication of attachment points for retrieving and towing, respective attachment points for transportation); 23) safety instructions for lifting the machine, heavy attachment or parts of the machine; 24) safety instructions for maintenance and repair;		

EN 474-1:2006+A6:2019			
Items	Requirements	Result-Remark	Verdict
	25) maintenance operations requiring the engine running; 26) rules about reuse/replacement of hoses/hose fittings; 27) instructions whether or not the safety structure (e.g.: ROPS, TOPS, FOPS) can be repaired after damage and the rules and conditions for repair; 28) recommendations for tools and accessories; 29) safety instructions for preservation and storage according to ISO 6749:1984; 30) provisions for limiting proximity hazards; 31) information that it is not allowed to transport or lift persons with an earth-moving machinery if the machine is not designed and equipped for this purpose; 32) information and instructions to ensure that the whole-body vibration emission during machine use is kept to a minimum and in order to avoid health damages of the operator; the adjustment of the operator's seat to the operator's weight and height according to the seat manufacturer's specifications; the preservation of the operating terrain in good condition; the intended use of the machine; taking into account the actual ground conditions and special vibration effects resulting from the actual working mode; the attachment manufacturer shall provide instructions concerning mounting and use of the attachment.		
7.3	Machine marking		P

2.4 EN 474-5:2006+A3:2013 Earth-moving machinery - Safety - Part 5: Requirements for hydraulic excavators

EN 474-5:2006+A3:2013			
Items	Requirements	Result-Remark	Verdict
1	Scope		-
2	Normative references		-
3	Terms and definitions		-
4	List of significant hazards		-
5	Safety requirements and/or measures		-
5.1	General		-
	Hydraulic excavators shall comply with the requirements of EN 474-1:2006, as far as not modified or replaced by the requirements of this part.		P
5.2	Access		-
	EN 474-1:2006, 5.2 applies with the exception that dimension *G*, in EN ISO 2867:2006, Figure 2, can be greater than 600 mm when the hand rails/hand holds are in the door opening.		P
5.3	Operator's station		-
5.3.1	Minimum space envelope		-
	On excavators with retractable front window, the cab height above SIP shall not be less than 920 mm measured with the window retracted into the cab.		P
5.3.2	Operator's protection		-
	EN 474-1:2006, 5.3.4 is replaced by the following: Excavators shall be designed so that an operator's protective guard can be fitted. The manufacturer according to the intended use of the machine shall offer a protective guard. The protective guard shall be in accordance with ISO 10262:1998. Compact excavators with an operating mass (see ISO 6016:1998) less than or equal to 1 500 kg are excluded from the requirements for a protective guard according to ISO 10262:1998.		P

EN 474-5:2006+A3:2013			
Items	Requirements	Result-Remark	Verdict
5.3.2.2	Roll over and tip over protective structures (ROPS and TOPS)		-
	EN 474-1:2006, 5.3.3 does not apply for hydraulic excavator except for walking excavators, see 5.8.3: Compact excavators having an operating mass greater than 1 000 kg shall be fitted with a tip over protective structure (TOPS) according to EN 13531:2001.		P
5.3.2.3	Protection for log application		-
	The excavator shall be equipped with a front protection and, if a relevant hazard exists, with a top protection, according to ISO 10262:1998.		P
5.3.3	Operator's seat		-
5.3.3.1	Seat adjustment for compact excavators		-
	EN 474-1:2006, 5.4.1.3, 2nd paragraph only applies to excavators with an operating mass (see ISO 6016:1998) of less than 3 000 kg.		P
5.3.3.2	Vibration		-
	EN 474-1:2006, 5.4.1.4, applies to excavators except for compact excavators. The seat, except for compact excavators, shall comply with spectral class EM 6 of EN ISO 7096:2000. NOTE According to EN ISO 7096:2000, 1.2.2, there is no requirement on seat suspension for seats used in excavators.		P
5.3.3.3	Rear window		-
	EN 474-1:2006, 5.3.2.9 applies with the exception that the rear window of an excavator does not need to be equipped with window wipers, washers and defrosters.		P
5.4	Controls for driving and steering		-
	EN 474-1:2006, 5.5.1 d) and 5.6.1 apply with the		P

EN 474-5:2006+A3:2013			
Items	Requirements	Result-Remark	Verdict
	following addition relating to controls for driving and steering:		
	The movements of the controls for driving and steering do not need to correspond to the intended direction of movement if the upper structure is not in the normal driving direction.		P
	EN 474-1:2006, 5.6.2 applies only to excavators with a travelling speed of higher than 30 km/h measured according to ISO 6014:1986.		P
	For machines with a travel speed equal to or lower than 30 km/h EN 12643:1997 shall be applied, except for the requirements for emergency steering.		P
5.5	Swing brakes		-
	Swing brakes shall comply with the requirements as defined in Annex C.		P
5.6	Stability and safety devices		-
5.6.1	General		-
	EN 474-1:2006, 5.11 applies with the additions given in 5.6.2 to 5.6.4.		P
	All rated capacities as defined hereafter are based on test and/or calculations of machines being level and on firm supporting surface.		P
	The mass of the intended load, its density and the location of its centre of gravity as well as the mass of the attachment and the attachment bracket, if fitted, shall be included in the determination of the rated lift capacity and the size/capacity of the attachment.		P
	To provide a sufficient stability, the rated lift capacity in intended operations shall be determined in accordance with 5.6.2 to 5.6.4		P
5.6.2	Bucket and shovel application		-
	The rated lift capacity for an excavator used in bucket or shovel application shall be determined		P

EN 474-5:2006+A3:2013			
Items	Requirements	Result-Remark	Verdict
	either by:		
	rated tipping load according to ISO 10567:1992, 3.7, in the most unfavourable position; or		P
	hydraulic lift capacity according to ISO 10567:1992, 3.9. whichever is less.		P
	The volumetric rating of the bucket or shovel shall be determined according to ISO 7451:1997 or ISO 7546:1983.		P
5.6.3	Log application		-
	The rated lift capacity in *stationary* log application shall be determined either by:		-
	rated tipping load according to ISO 10567:1992, 3.7, with a log in the most unfavourable position; or		P
	hydraulic lift capacity according to ISO 10567:1992, 3.9. whichever is less.		P
	The rated lift capacity in moving (driving with load) log application shall be determined either by:		P
	rated tipping load as 60 % of the tipping load according to ISO 10567:1992, 3.6, with a log in the most unfavourable position; or		P
	hydraulic lift capacity according to ISO 10567:1992, 3.9. whichever is less.		P
5.6.4	Object handling application		-
5.6.4.1	General		-
	The rated lift capacity of excavators shall be determined according to 5.6.4.2.		P
5.6.4.2	Rated lift capacity in object handling		-
	The rated lift capacity in object handling shall be determined according to ISO 10567:1992, 3.11.		P
5.6.4.3	Rated lift capacity table in object handling		-
	A table of the rated lift capacity in object handling, established by the manufacturer, shall be provided. Annex B gives an example for such a table. The		P

EN 474-5:2006+A3:2013			
Items	Requirements	Result-Remark	Verdict
	table(s) shall be available at the operator's station for each object-handling configuration specified in the operation manual.		
5.6.4.4	Load safety devices		-
	Excavators used in object handling operations and with a maximum rated lift capacity according EN 474-1, 3.5 greater than or equal to 1 000 kg, at a minimum lift point radius, as defined in 3.4 of ISO 10567:1992, or an overturning moment greater than or equal to 40 000 Nm, shall be equipped with:		P
	a) an acoustic or visual warning device which indicates to the operator when the rated lift capacity or corresponding load moment is reached and continues as long as the load or load moment is exceeded. The rated lift capacity is defined in 5.6.4.2. This device may be deactivated while the excavator equipment is performing operations other than object handling. The activation shall be clearly indicated. The control of the deactivation shall be within the operator's zone of comfort according to EN ISO 6682:1995. A warning sign shall be placed close to the control device indicating the need for activation during object handling.		P
	b) a boom-lowering control device on the raising boom cylinder(s) in accordance with ISO 8643:1997.		P
5.6.4.5	Other applications		-
	The rated lift capacity of derivated machinery shall be determined by the manufacturer according to the load specification given in 5.6.4.2 and 5.6.4.3, whereby the comparable hazard has to be considered for the special application.		P

EN 474-5:2006+A3:2013			
Items	Requirements	Result-Remark	Verdict
5.7	Parking brake for compact crawler excavator		P
5.8	Specific requirements for walking excavators		P
6	Information for use		P
	EN 474-1:2005, 7.2 applies with the following additions:		-
	description of the excavator configuration required for object handling; parking procedure for compact crawler excavators; description of excavator stability in different applications; safety instructions for selection and for use of additional protective guards, see 5.3.2 (e. g. demolition work); prescription of special precautions for walking excavators; instruction shall be given for compact excavators (less than or equal to 1 500 kg) which are not fitted with a protective guard that they shall not be used for applications where the risk of falling objects is given; special instructions for log application (reduced travelling speed, avoidance ofabrupt brake- or steeringaction, central fixing of the trunk, transport-position during movement etc.); necessity of a front guard and top guard, in log application; instructions for the functioning, the use and the deactivation of the load safety devices of 5.6.4; object handling capacity table e.g. in accordance with Annex B.		P

Annex：Technical Information

A.1 Specifications table

A.2 Electrical circuit diagram

A.3 Hydraulischematic diagram

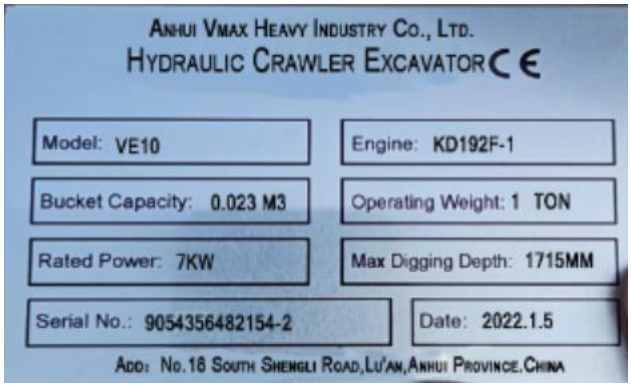
A.4 Electrical parts list

A.5 Instruction manual

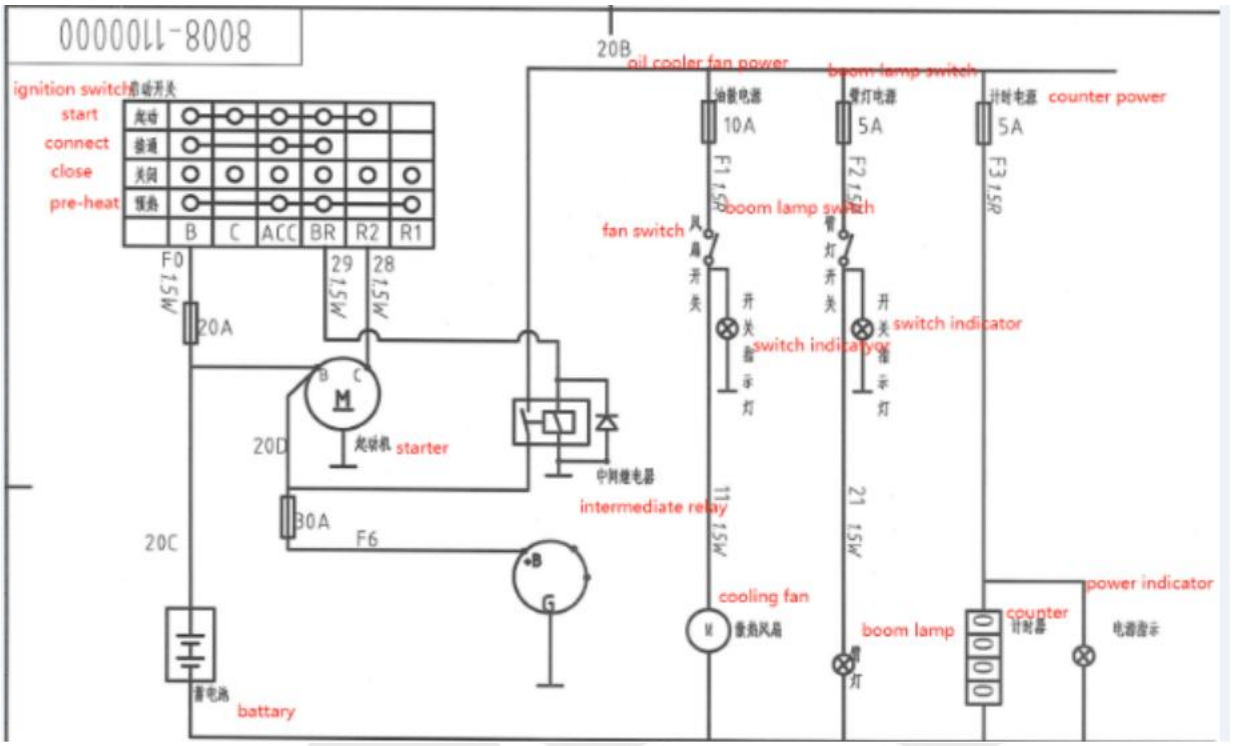
A.6 The photo of the machine

Annex：Technical Information

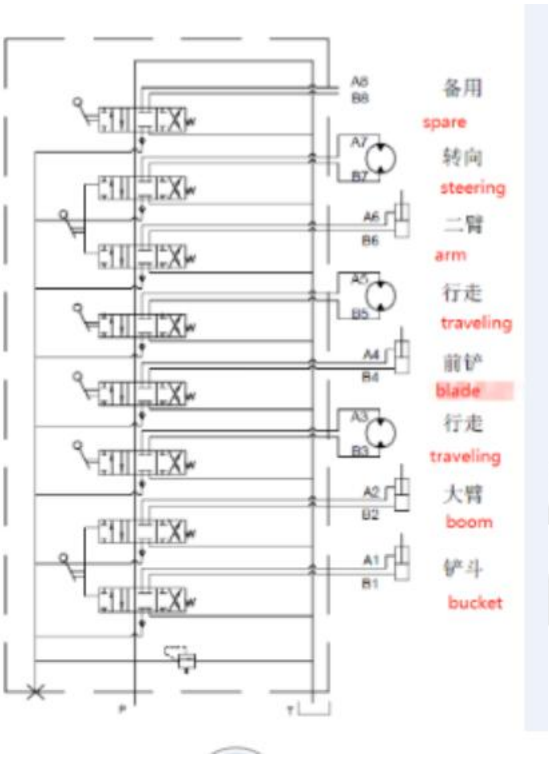
A.1 Specifications table

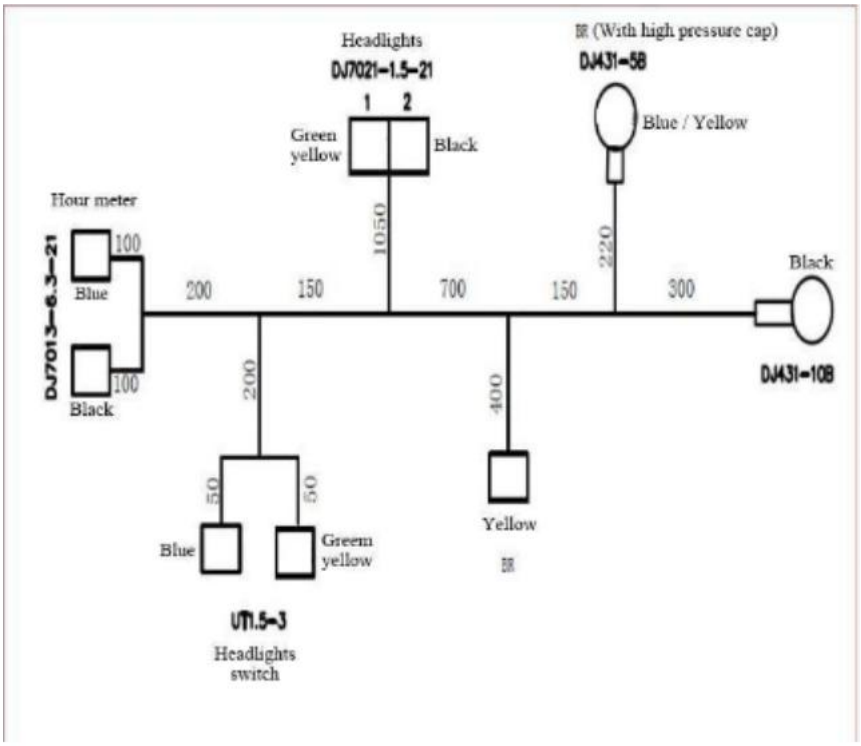


A.2 Electrical circuit diagram



A.3 Hydraulischematic diagram





A.4 Electrical parts list

名称 Name		数量 Quantity
整机线束	Wiring harness	1
发动机搭铁线	Engine is wired	1
螺栓M8*20	Bolt M8×20	4
弹簧垫圈 8	Washer 8	4
平垫 8	Washer 8	4
灯翘板开关	Lamp switch	1
油散翘板开关	hydraulic oil Cooling switch	1
启动马达B线	Start motor line B	1
机械计时器	Mechanical Timer	1
LDE挖掘机工作灯	Work lamp	1
电磁总开关	Main electromagnetic switch	1
固定式卡箍 12	Fixed clamp 12	1
固定式卡箍 24	Fixed clamp 24	2
螺栓M6*16	Bolt M6×16	3
弹簧垫圈 6	Washer 6	3
平垫 6	Washer 6	3

A.6 The photo of the machine

======END======