Drywall And Panel Hoist

Model(s):
50101000-11ft-14

According to
2006/42/EC Machinery Directive

Documents Reference

CE

EC Declaration of conformity

Product Name:

Drywall And Panel Hoist

Model(s):
50101000-11ft-14

We here declare that the products described above are in conformity with the following Directive(s):

2006/42/EC Machinery Directive

Moreover the following harmonized standards have been applied to the Model(s) above:

EN ISO 12100:2010, EN 349:1993+A1:2008, EN 953:1997+A1:2009, EN ISO 13857:2008

The technical construction files required to demonstrate that the product(s) meet(s) the requirement(s) of the aforementioned directive(s) has been compiled.

Issue place: _____

Manufacturer stamp and Signature of authorized personnel

_____

Read item 4 for more information.

In order to evaluate the main risks mentioned above, the occupational safety and health risk assessment has been conducted according to the requirement of EN ISO 12100:2010

In order to ensure the conformity for CE marking for these models, some main European and/or International standards have been used for the assessment of conformity, they are:

—EN 349:1993+A1:2008 Safety of machinery - Minimum gaps to avoid crushing of parts of the human body

—EN 953:1997+A1:2009 Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards

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

To present the conformity of this series models with Machinery Directive, we discuss the conformity systematically with the relative Directives and standards.

3.0 Quality Control System

In order to ensure the conformity of the series production, we have taken the related procedures mentioned below:

1) The complete technical construction file (TCF) has been established before applying for the CE marking certificate.
2) Carry out the inspection for parts and components according to the TCF

   Before the assemblies of the series production, the QC engineers of our company have 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 our company have to do the necessary inspection and testing to ensure the conformity of related requirements.
4) Carry out the inspection for the packing
5) Provision for the change of design
6) Provision for the Quality Assurance

DRYWALL AND PANEL HOIST

INSTRUCTION MANUAL

REV MJ030825

Introduction

The Drywall Lift allows one person to lift a drywall panel that is up to 122 x487CM in size or the small size124X114cm, without assistance. The panel can be raised to a maximum height of 335CM for attachment to level ceilings-or (with the lift's cradle tilted) to sloped ceilings or side walls. For higher ceilings, an Extension Accessory is available that increases maximum lift to470CM.

The Lift's cradle lowers to 86.4CM. off the floor for easy panel loading, and can support up to 68kgs.

These instructions explain how to assemble the Lift, operate it, disassemble it after use for easy transport and storage, and order replacement parts. We urge you to read the Important Precautions below, and the Operation sections, before trying to use the Lift.

Important Precautions

WARNING

To protect against serious injury, use common sense and observe the following precautions when operating the Drywall Lift.

- ALWAYS study these instructions before operating, and pay close attention to all warnings.
- ALWAYS inspect the unit carefully before each day's use, pay special attention to the condition of the cable.
- ALWAYS allow the Lift to reach working room temperature before use (moving a cold unit into a warm room can cause condensation, which could affect the operation of the winch brake).
- Always be sure the brake drum is clean and dry before operating.
- NEVER use the Lift if either crossarm support is not secured by its locking spring tab.
- ALWAYS keep the work area free of obstructions.
- ALWAYS wear a hard hat when operating this Lift.
- ALWAYS watch for overhead obstructions when lifting the drywall panel.
- NEVER use the Lift for any purpose other than lifting a drywall panel.
- NEVER lift more than one sheet of drywall at a time. Never lift more than 68kgs.

Contents

Assembly

Components

The Drywall Lift is shipped as several components that must be assembled before use:

- Tripod base assembly.
- Frame assembly（140CM HIGH）, which includes a winch assembly and standard (122-cm) telescoping lift sections
- Cradle assembly, without its detachable crossarms
- Two cradle crossarm assemblies

Assembly Procedure

1. Set up the tripod base:
   a. Set the base on the floor, resting on its casters.
   b. Press down on the slide yoke ring. Hold the ring down while you swing the two forward legs out until the yoke ring snaps or black place into the locking hole on the bottom of the slide tube. (See Figure 1)
   c. To prevent the tripod base from rolling backward during assembly, lower the backstop as shown.
2. Set the frame assembly onto the two "V" angles on the tripod base, and lower the frame about 1 in. until it is secured by the angles.

   Before continuing, be sure the frame is pushed all the way down and is held securely by the angles.

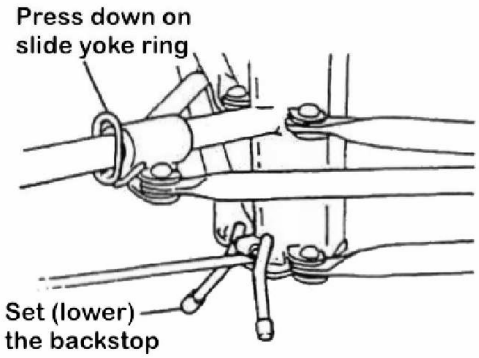
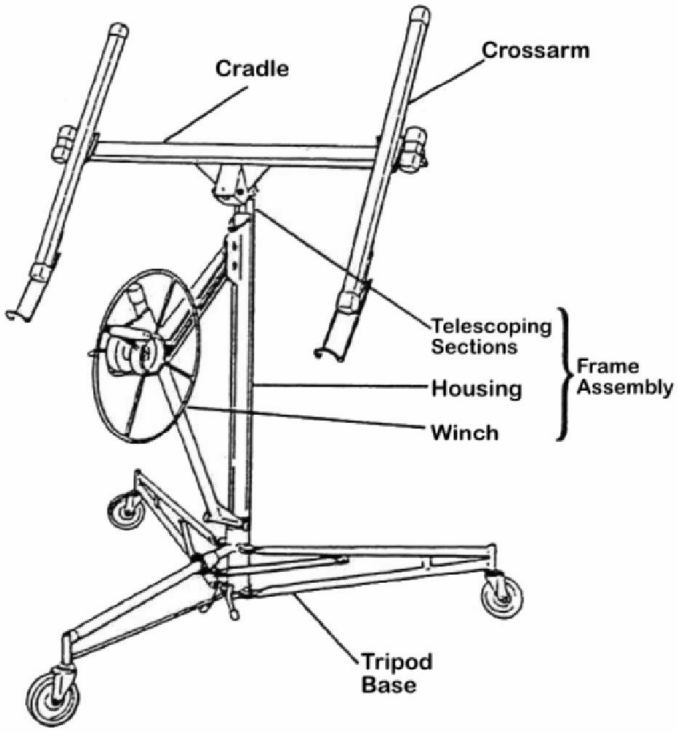


Figure 1



Componets of Drywall Lift

Assembly Procedure (continued)

3. Attach the handle to the winch wheel. Tighten the nut, then back it off slightly so the handle turns freely.
4. Move the winch assembly into its working position:
   a. Hold the winch wheel and brake arm as shown in Figure 2. Rotate the winch wheel forward slightly while you lift on the brake arm to release the brake.
   b. Raise the brake arm all the way up. Grasp the winch post, and grip the brake arm firmly with your thumb. (Figure 3)
   c. Place your right hand on top of the frame. Continue to grip the brake arm as needed to prevent cable backlash, and pull the winch assembly all the way toward you. (Figure 4)
   d. When the winch is fully extended (away from the frame housing), release the brake arm and swing the retaining hook away so it no longer secures the telescoping sections inside the frame housing.
5. Press the winch assembly slightly back toward the frame. This automatically engages the slide bar lock to keep the winch fully extended. (Figure 5)

   IMPORTANT: Before continuing, be sure that the slide bar lock is fully engaged — that is, rotated clockwise as far as possible.

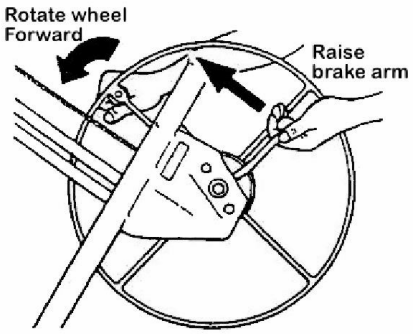


Figure 2

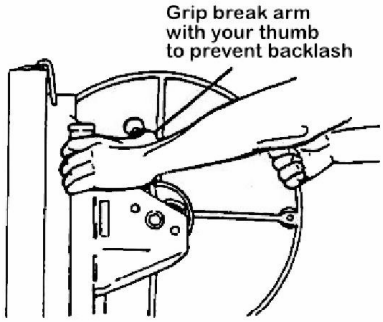


Figure 3

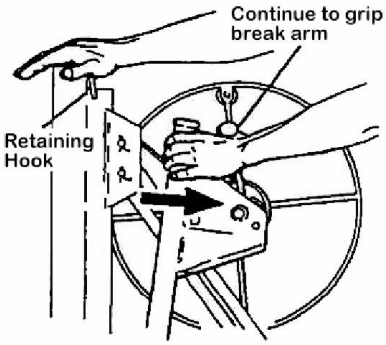


Figure 4

⚠ WARNING

To avoid injury, slide bar lock must be fully engaged if winch assembly is extended.

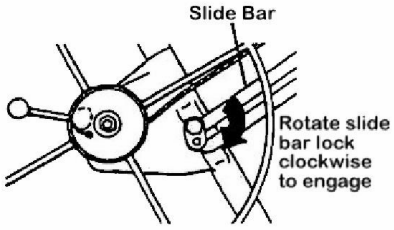


Figure 5

Assembly Procedure (continued)

6. Attach the cradle to the frame (Figure 6):
   a. Insert the cradle's post into the opening on top of the frame.
   b. Secure the cradle to the frame by snapping the tilt latch upward so it hooks over the stud on the cradle.
7. Attach the crossarms to the cradle:

   NOTE: The crossarms are interchangeable.
   a. Slide the tapered plates on the crossarms into the tapered sockets on the cradle. (Figure 7)
   b. Press each crossarm forward into the socket until the spring tab on the bottom of the crossarm snaps into place. (Figure 8)

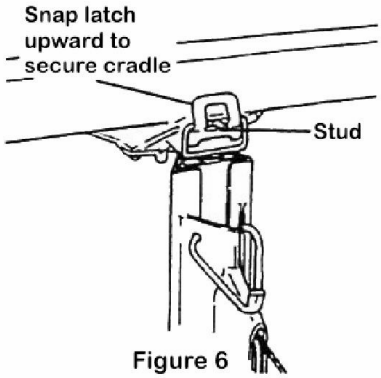


Figure 6

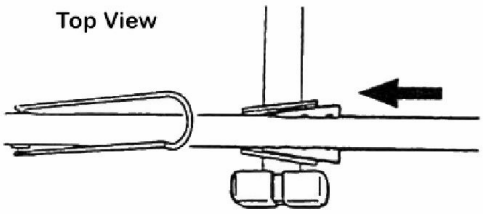


Figure 7

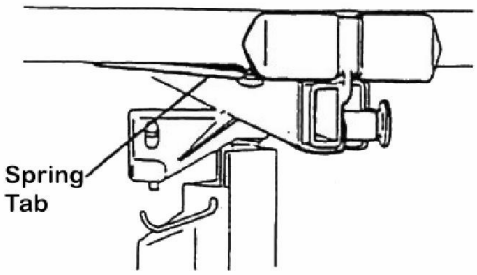
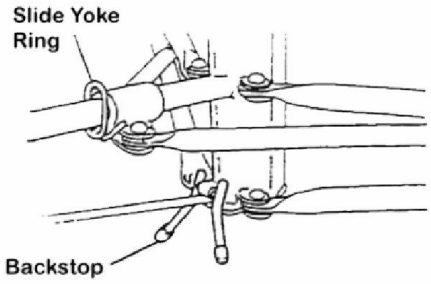


Figure 8

Operator Controls

Slide Yoke Ring

Press down on the slide yoke ring to unlatch the two forward legs so they can be rotated out to the Lift's working position or in to its storage position. A spring-loaded pin snaps into a hole on the bottom of the slide tube, to lock the folding legs position.



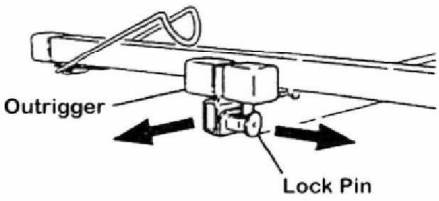
Backstop

Pivot the backstop down to prevent the base from rolling backward, or up to allow the unit to wheel freely.

Outriggers

The outriggers on the crossarms extend for supporting a longer drywall panel.

To extend an outrigger, pull out the lock pin with your right hand until you can slide the outrigger out with your left hand. The lock pin can engage to lock the outrigger at one of three positions: fully retracted; extended 53cm.; or extended87cm.(see the mark)



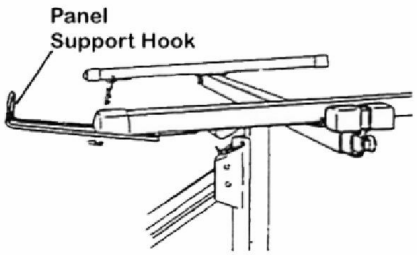
IMPORTANT: **Never load a drywall panel or operate the Lift if the lock pins are not engaged at one of these three positions, or if the outriggers are extended beyond the 56cm. position.**

To avoid damaging them, always fully retract the outriggers before transporting or storing the Lift.

Panel Support Hooks

Open the support hook on each crossarm to support the drywall panel when it is being loaded, or when the cradle is tilted.

To avoid damaging them, always close the support hooks before transporting or storing the Lift.



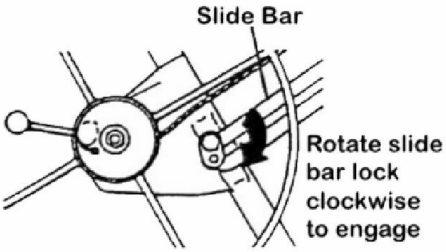
Slide Bar Lock

The slide bar lock holds the winch assembly at its operating (fully extended) position.

To fold the winch assembly against the frame (when disassembling the unit for transport or storage), disengage the lock by turning it counterclockwise as you lift on the slide bar.

When you reassemble the unit for operation, extending the winch assembly all the way and then pressing it back slightly toward the frame automatically engages the lock.

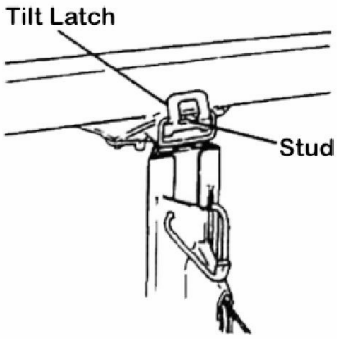
Never tighten the nut on the slide bar lock, or you will be unable to fold up the unit for transport and storage.



Operator Controls (continued)

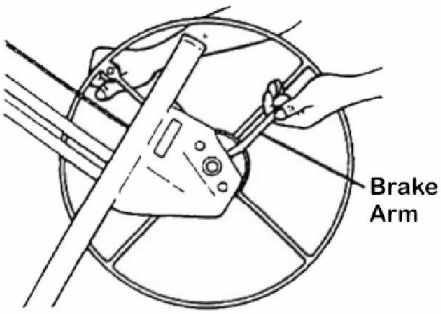
Tilt Latch

To allow the cradle to tilt (for loading a dry wall panel, or for raising the pane! to a side wall or sloped ceiling); or to remove the cradle from the frame, pivot the tilt latch out and down. To lock the cradle onto the frame without tilting, pivot the latch up to engage the stud on the cradle.
NOTE: When it is in the level (non-tilted) position, the cradle will also tilt up to 10° side-to-side.



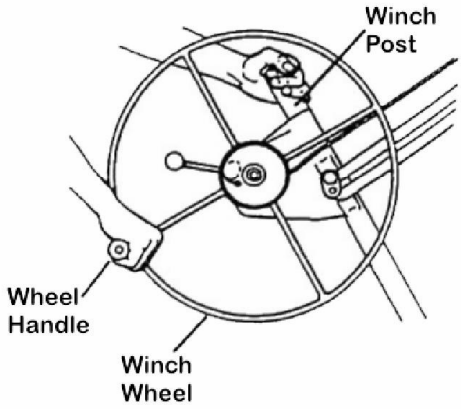
Brake Arm

A spring-loaded brake holds the cradle at whatever height you raise it by cranking the winch wheel. To lower the cradle, control the backward rotation of the winch by grasping the wheel handle as you carefully raise the brake arm to release the brake.



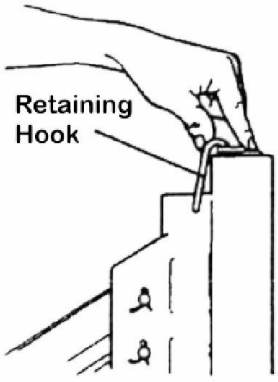
Winch Wheel, Handle, and Post

Cranking the winch (using the wheel handle) coils or uncoils the cable that raises or lowers the cradle.
Grasp the post for leverage when cranking the winch.



Retaining Hook

The retaining hook secures the telescoping sections inside the frame, for transport and storage.



Operating Procedure

IMPORTANT: Read the "Important Precautions" on page 3 before you operate the Lift.

⚠ WARNING

To avoid serious injury, follow all "Important Precautions," page 3.

Safety Check Before Operation

Before you begin operating the Lift each day:

- Inspect the unit carefully for wear or damage. Pay special attention to the cable.
- Be sure the Lift is at working room temperature before operating.
- Be sure the winch brake drum is clean and dry before operating.

⚠ WARNING

ALWAYS wear a hard hat when operating.

To Load a Drywall Panel

1. Set (lower) the backstop, so the Lift won't roll backward {see page 7).
2. Swing open the panel support hooks on the two crossarms. Be sure the cradle is turned so the support hooks are on the opposite side from the winch wheel.
3. Extend the crossarm outriggers on the cradle as needed to fully support the length of the drywall panel (see page 7).
4. Release the tilt latch to tilt the cradle (see page 8).
5. Hold the drywall panel with its face paper toward the tilted cradle, and load the panel onto the Lift as shown. Set the panel onto the support hooks, and carefully lean it against the crossarms.
6. If installing the panel on a flat ceiling, tilt the cradle back up to its level position and lock the tilt latch. If installing the panel on a side wall or a sloped ceiling, leave the cradle tilted.
7. Raise the backstop on the base, and carefully roll the Lift close to the position where the panel will be installed.

⚠ WARNING

To avoid injury:

- Use ONLY for lifting a drywall panel.
- Lift ONLY one panel at a time.
- NEVER lift more than 68kgs.

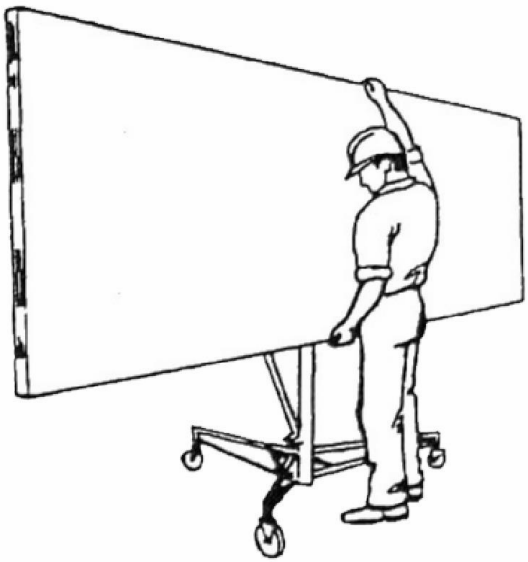


Figure 10

Operating Procedure

To Raise the Panel

IMPORTANT: Always lower the backstop before raising the panel to a sloped ceiling or a side wall.

Crank the winch wheel in the direction shown (hold the post for leverage) until the panel is at the desired height.

The brake is spring-loaded to automatically hold the cradle at the selected height when you stop cranking.

To Lower the Panel

1. Grasp the wheel handle with your right hand so you can restrain the backward rotation of the winch.

2. Retain your hold on the winch handle. Carefully release the brake with your left hand and slowly rotate the wheel backward to lower the cradle to the desired height.

Disassembly and Storage

Always store the On/wall Lift in a dry. protected area. To disassemble for more compact storage, refer to page 11.

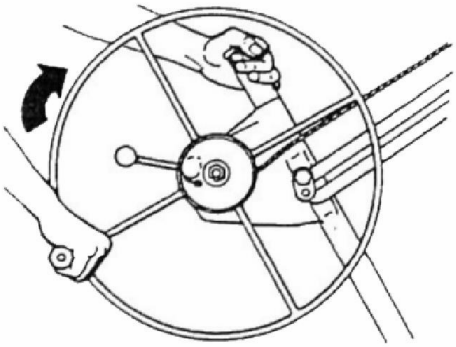


Figure 11

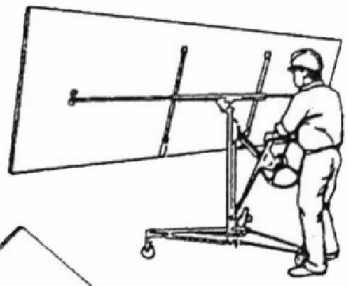


Figure 12

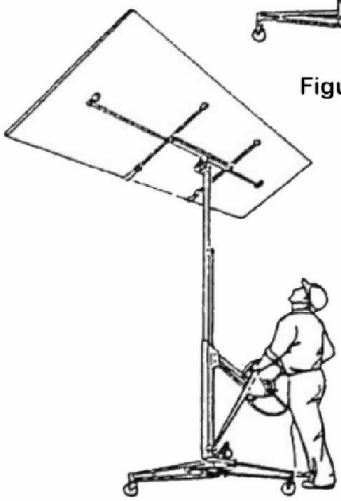


Figure 13

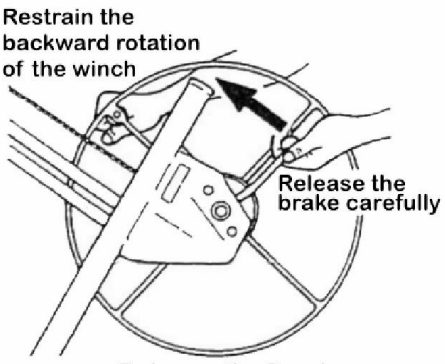
⚠ WARNING

To avoid serious injury, watch for overhead obstructions when raising panel.

⚠ CAUTION

Cradle drops rapidly when brake arm is released.

Control winch with your right hand on wheel handle BEFORE releasing brake.



To Lower the Panel
Figure 14

Disassembly

To disassemble the Drywall Lift for transport or compact storage;

1. Crank the cradle all the way down.
2. Slide the cradle outriggers all the way in until they latch. Close the panel support hooks.
3. Remove the crossarms by pressing the spring tab on the bottom and sliding the crossarm out of the tapered socket.
4. Unlock the cradle tilt latch. Lift the cradle (about7.5cm.) until you can remove it from the frame.
5. Rotate the winch wheel one full rotation forward as shown. This will raise the inner telescoping section.
6. Unlock the winch assembly by lifting the slide bar with your left hand while you rotate the slide bar lock counterclockwise with your right hand.
7. Hold the slide bar lock in this disengaged position (step 6). and press down on the telescoping sections in the frame with your left hand. The winch assembly will move toward the frame housing.
8. Crank the telescoping sections all the way down. Swing up the retaining hook as shown, and crank the telescoping sections back up slightly until secured by the hook.
9. Hold the retaining hook in this position with your left hand, and rotate the winch forward with your right hand.

   The winch assembly will fold up against the frame. When the slide bar contacts the frame, tighten the cable by turning the wheel further (just enough to hold the winch assembly in this position).
10. Carefully lift the frame/winch about 2.54cm. to free it from the tripod base.
11. To fold the base, press down on the slide yoke ring and pivot the forward legs in until they lock in the closed position.

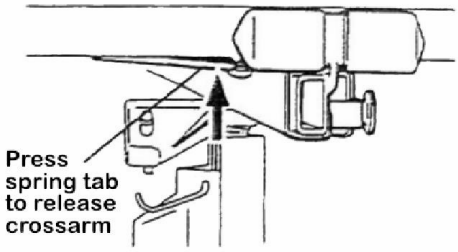


Figure 15

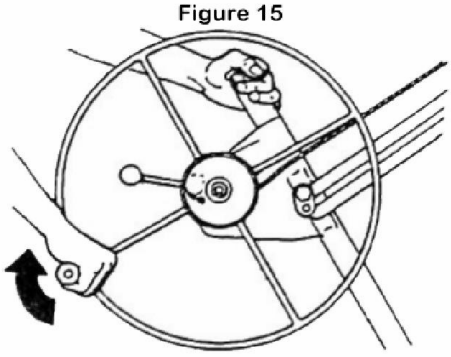


Figure 16

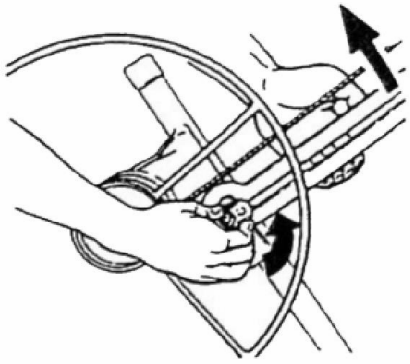


Figure 17

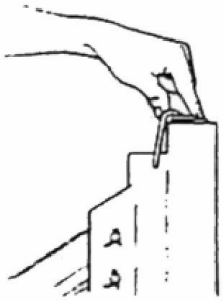


Figure 18

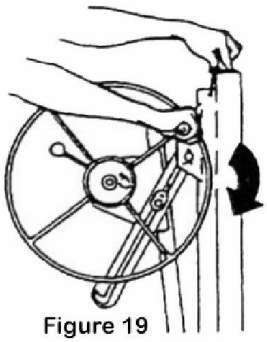


Figure 19

Maintenance

- Inspect the cable before each work day. Replace it at the first sign of wear (refer to the instructions supplied with the replacement cable).
- Occasionally oil the cable pulleys. Crank up the telescoping sections for access to the internal cable pulley. Never allow oil or grease to contact the surface of the winch brake drum.
- Occasionally oil the caster bearings.
- If the telescoping sections of the frame don't operate smoothly, apply household paraffin to the sliding surfaces.

Extension Accessory (sold separately)

For higher ceilings, an Extension Accessory is available that increases maximum lift to 4700cm (instead of the standard 3350cm).

The Accessory consists of two 182-cm telescoping sections that replace the standard1220cm sections in the frame. A longer cable is preinstalled in the telescoping sections, and must be attached to the winch drum.

To Install the Accessory

Remove the Standard Telescoping Sections

1. Release the cable tension until you can loosen the cable from the mooring tab in the winch. Pull the cable out through the hole in the winch drum. (Figure 20)
2. With large pliers, grasp the top end of the two telescoping sections and lift them out of the frame housing as a unit. Pulling the free end of the cable toward the winch wheel will help raise the telescoping sections.

   Remove the telescoping sections (and the cable) completely out of the frame housing.

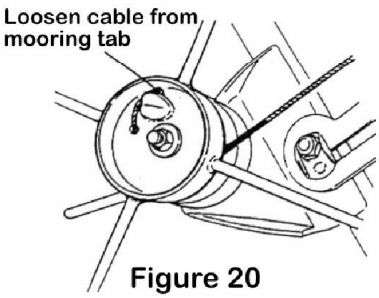


Figure 20

Extension Accessory (Continued)

Install the Longer Telescoping Sections

1. Feed the free (crimped) end of the Accessory's cable down into the pocket near the top the frame housing.

   IMPORTANT: The cable must be routed over the top of the pulley.

2. Pull the cable through the pocket, and slide the new telescoping sections down into [he frame.
3. Feed the free end of the cable under and around the winch hub, then through the hole into the winch drum.
4. Secure the crimped end of the cable firmly behind the mooring tab inside the drum.
5. Rotate the winch wheel forward to take up the slack in the cable.

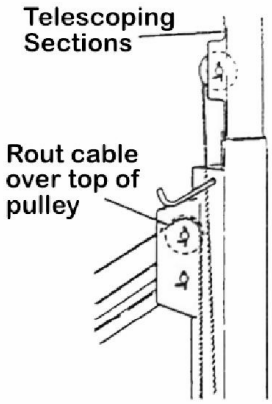


Figure 21

WARNING

To avoid serious injury, cable must pass over She top of the pulley in the frame pocket.

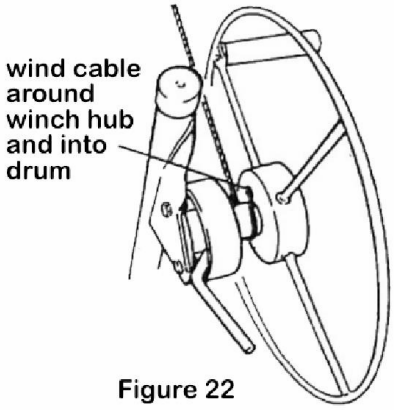


Figure 22

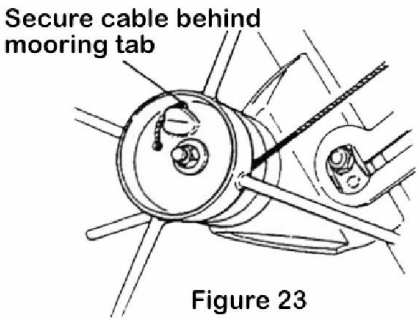
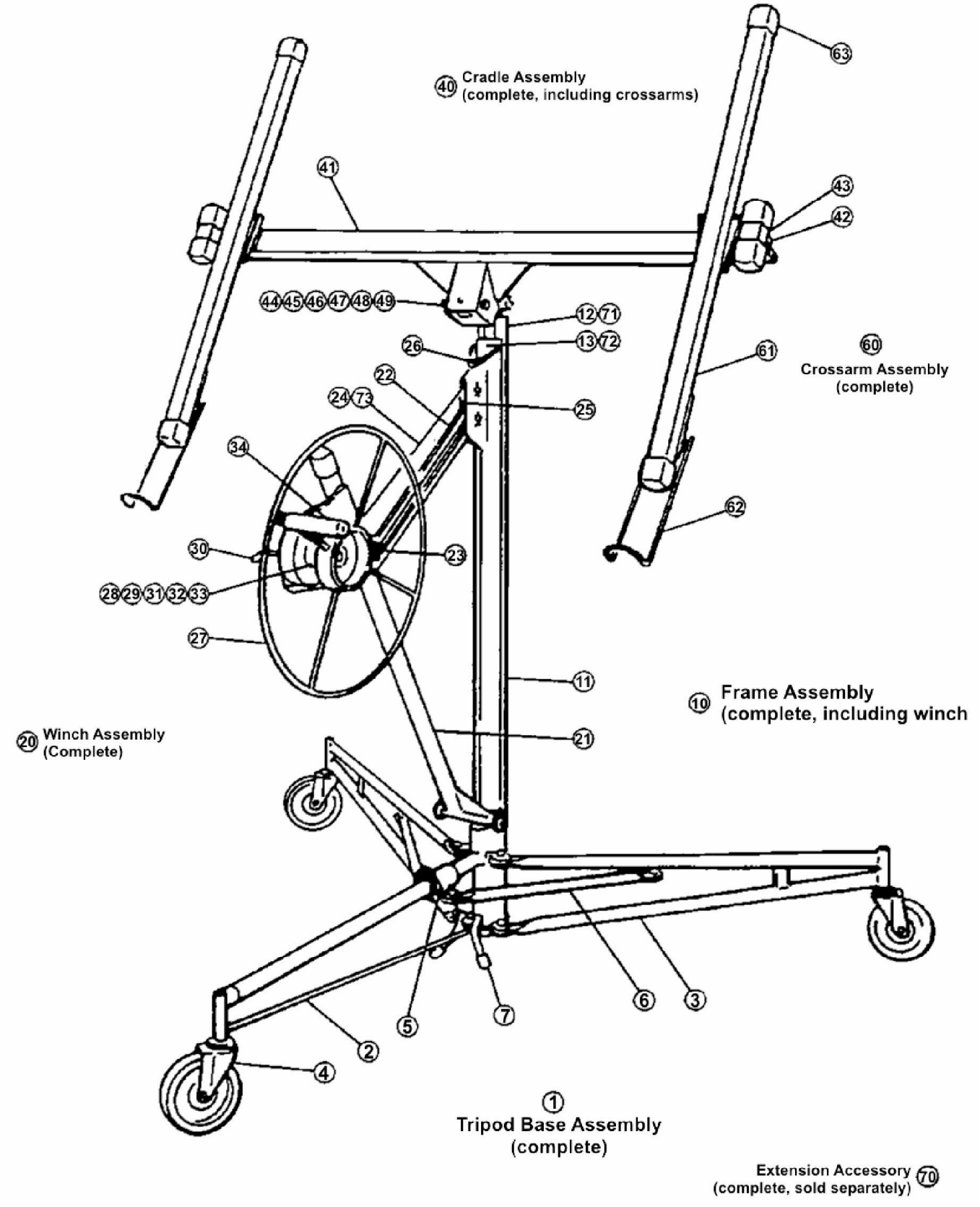


Figure 23

Parts Diagram



Parts List

Ref. No.	Description	Qty
	Tripod Base	
1	Tripod base assembly	1
2	Center Leg (with fasteners)	1
3	Outer Leg (with fasteners)	2
4	10-cm Caster	3
5	Slide Yoke Ring Tension Spring	1
6	Tie Arm (with fasteners)	2
7	Rubber Backstop Tip	2

	Frame Assembly	
10	Frame Assembly (Includes Winch Assembly)	1
11	Frame Housing	1
12	10-cm Inner Telescoping Section	1
13	10-cm Outer Telescoping Section (with pulley)	1

	Winch Assembly	
20	Winch Assembly	1
21	Winch Host (with pin and fastener)	1
22	Slide Bar (with axle and cotter pin)	1
23	Slide Bar Lock (with fasteners)	1
24	411-cm Cable*(DIA:3..5mm)	1
25	Cable Pulley (with axle and cotter pin)	3
26	Retaining Hook	1
27	Winch Wheel (with flange bearings)	1
28	2.22-cm Bushing	1
29	M12x125 Bolt (with fasteners)	1
30	Brake Arm Assembly	1
31	Brake Lining (with fasteners)	1
32	Brake Arm Tension Spring	1
33	Brake Hub (with bolts)	1
34	Winch Wheel Handle	1

Ref. No.	Description	Qty
	Cradle Assembly	
40	Cradle Assembly	1
41	Cradle Body	1
42	Outrigger Lock Pin (with spring & clip)	2
43	Outrigger (with end caps)	2
44	Cradle Mounting Lead Assembly	1
45	Mounting Head Body	1
46	Cradle Tilt Latch (with fasteners)	1
47	Tension Spring	1
48	Compression Spring	2
49	Hinge Pin (with bolts)	1

	Cradle Crossarms	
60	Crossarm Assembly	2
61	Crossarm Body	2
62	Panel Support Lock (with fasteners)	2
63	Crossarm End Cap	2

	Extension Accessory (Sold Separately)	
70	Extension Accessory	1
71	1820cm Inner Telescoping Section	1
72	1820cm Outer Telescoping Section	1
73	528-cm Cable*	1

*IMPORTANT: Carefully follow the instructions supplied with the replacement cable.

5.0 Hazards List

The significant hazards are set out in the following listing based on EN ISO 12100. Also shown are the sections references in this European Standard in which the safety requirements and/or measures or rules are described for showing the conformity to the safety requirements.

	EN 12100		Present	
			Yes	No
1	**Mechanical hazards** due to: 1) machine's parts or working pieces a) shape; b) related position; c) mass and balancing (potential energy of the element which can fall down under gravity effect); d) mass and speed (kinetic energy of the element which can move under controlled and uncontrolled movement); 2) energy accumulation into the machine due to: e) elastic element (springs); f) fluid and gas under pressure; g) vacuum effect;		X	
1.1	Crushing hazard		X	
1.2	Shearing hazard		X	
1.3	Cutting or severing hazard		X	
1.4	Entanglement hazard		X	
1.5	Drawing-in or trapping hazard		X	
1.6	Impact hazard		X	
1.7	Stabbing or puncture hazard		X	
1.8	Friction or abrasion hazard		X	
1.9	High pressure fluid or gas ejection hazard		X	
1.10	Parts ejection		X	
1.11	Lack of stability		X	
1.12	Slip, trip, fall related to the machine		X	
2	**Electrical hazard due to**			
2.1	Direct and indirect electrical contact between people and live parts			X
2.2	Electrostatic phenomena			X
2.3	Thermal radiation or other phenomena such as projection of molten particles, and chemical effects from short circuits, overloads, etc.	.		X
2.4	External influences	.		X
3	**Thermal hazards i.e. resulting in**			
3.1	Burns and scalds, by a possible contact of persons, by flames or explosions and also by the radiator of heat source	.		X
3.2	Health-damaging effects by hot or cold work environment			X
4	**Hazards generated by noise, resulting i.e. in:**			
4.1	Hearing losses (deafness), other physiological disorder (i.e. loss of balance, loss of awareness, etc.)			X
4.2	Interference with speech communication, acoustic signal, etc.			X
5	**Hazards generated by vibration (resulting in a variety of neurological and vascular disorders)**			X
6	**Hazards generated by radiation**			
6.1	Radiation at low frequency, radio frequency, microwaves, electric arcs	.		X
6.2	Infrared-ray, light, UV-ray, lasers			X
6.3	X-ray, γ-ray			X
6.4	α-ray, β-ray, electron or ion beam, neutron beam			X
7	**Hazards generated by materials and substances processed, used or exhausted by machinery i.e.**			
7.1	Hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	.	X	
7.2	Fire or explosion hazards	.	X	
7.3	Biological and micro-biological (viral or bacterial) hazards		X	
8	**Hazards generated by neglecting ergonomic principles in machine design (mismatch of machinery with human characteristics and abilities) caused i.e. by**			
8.1	Unhealthy postures or excessive efforts.			X
8.2	Inadequate consideration of human hand-arm or foot-leg anatomy			X
8.3	Neglected use of PPE			X
8.4	Inadequate area lighting			X
8.5	Mental overload or underload, stress, etc.			X
8.6	Human error			X
9	**Hazards combination**			X
10	**Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders, i.e.**			
10.1	Failure, malfunction of control system (unexpected start up, unexpected overrun)			X
10.2	Unexpected ejection of machine parts or fluids.			X
10.3	Control malfunctioning			X

10.4	Error of fitting			X
10.5	Overturn, unexpected loss of machine stability			X
11	**Hazardous due to means/devices related to the safety missing or in wrong position**			
11.1	Missing guards			X
11.2	Missing safety devices			X
11.3	Starting and stopping devices			X
11.4	Safety sign			X
11.5	Information and warning means			X
11.6	Energy disconnecting devices			X
11.7	Emergency devices			X
11.8	Working piece feeding			X
11.9	Maintenance equipment			X
11.10	Gas evacuation			X
	Hazards due to mobility			
12	**Inadequate lighting**			X
13	**Instability**			X
14	**Neglected ergonomic of the control position**			
14.1	Hazards due to dangerous environment (contact with moving parts, exhaust, etc.)	.		X
14.2	Inadequate visibility by the operators			X
14.3	Inadequate seating			X
14.4	Inadequate controls			X
14.5	Starting in machine with engine			X
14.6	Road traffic			X
14.7	Pedestrian control			X
15	**Mechanical hazards**			
15.1	Uncontrolled movement			X
15.2	Parts ejection			X
15.3	Roll over			X
15.4	Falling objects			X
15.5	Inadequate access			X
15.6	Towing			X
15.7	Batteries			X
16	**Hazards due to lifting operation**			
16.1	Lack of stability			X
16.2	Derailment			X
16.3	Loss of mechanical strength of the machine			X
16.4	Uncontrolled movement			X
16.5	Falling loads			X
17	**Inadequate view**			X
18	**Lighting**			X
19	**Overloading**		X	

6.0 Essential Health and Safety Requirements(Annex I machinery directive 2006/42/EC)

Please check all row and Change Applicable/Not Applicable if is the case. A = Applicable; NA = Not Applicable

Ref.	E. H. S. R.	A	NA	Meet the requirement?
1.1	General remarks	X		Y
1.1.1	Definition	X		Y
1.1.2	Principles of safety integration	X		Y
1.1.3	Materials and products	X		Y
1.1.4	Lighting	X		Y
1.1.5	Design of machinery to facilitate its handling	X		Y
1.2	Controls			
1.2.1	Safety and reliability of control systems	X		Y
1.2.2	Control devices	X		Y
1.2.3	Starting	X		Y
1.2.4	Stopping device (normal stopping, emergency stop)	X		Y
1.2.5	Mode selection	X		Y
1.2.6	Failure of the power supply	X		Y
1.2.7	Failure of the control circuit	X		Y
1.2.8	Software		X	
1.3	Protection against mechanical hazards			
1.3.1	Stability	X		Y
1.3.2	Risk of break-up during operation	X		Y
1.3.3	Risks due to falling or ejected objects	X		
1.3.4	Risks due to surfaces, edges or angles	X		Y
1.3.5	Risks related to combined machinery	X		Y
1.3.6	Risks relating to variations in the rotational speed of tools	X		
1.3.7	Prevention of risks related to moving parts	X		Y
1.3.8	Choice of protection against risks related to moving parts (transmission parts, moving parts directly involved in the process, etc.)	X		Y
1.4	Required characteristics of guards and protection devices	X		Y
1.4.1	General requirements	X		Y
1.4.2	Special requirements for guards	X		Y
1.4.2.1	Fixed guards	X		Y
1.4.2.2	Movable guards	X		Y
1.4.2.3	Adjustable guards restricting access	X		
1.4.3	Special requirements for protection devices	X		Y
1.5	Protection against other hazards	X		Y
1.5.1	Electricity supply		X	
1.5.2	Static electricity		X	
1.5.3	Energy supply other than electricity		X	
1.5.4	Errors of fitting		X	
1.5.5	Extreme temperatures		X	
1.5.6	Fire		X	
1.5.7	Explosion		X	
1.5.8	Noise		X	
1.5.9	Vibration		X	
1.5.10	Radiation		X	
1.5.11	External radiation		X	
1.5.12	Laser equipment		X	
1.5.13	Emissions of dust, gases, etc.	X		Y
1.5.14	Risk of being trapped in a machine	X		Y
1.5.15	Risk of slipping, tripping or falling	X		Y
1.6	Maintenance			
1.6.1	Machinery maintenance	X		Y
1.6.2	Access to operating position and servicing points	X		Y
1.6.3	Isolation of energy sources	X		Y
1.6.4	Operator intervention	X		Y
1.6.5	Cleaning of internal parts	X		Y
1.7	Indicators	X		Y
1.7.0	Information devices	X		Y
1.7.1	Warning devices	X		Y
1.7.2	Warning of residual risks	X		Y
1.7.3	Marking	X		Y
1.7.4	Instructions	X		Y

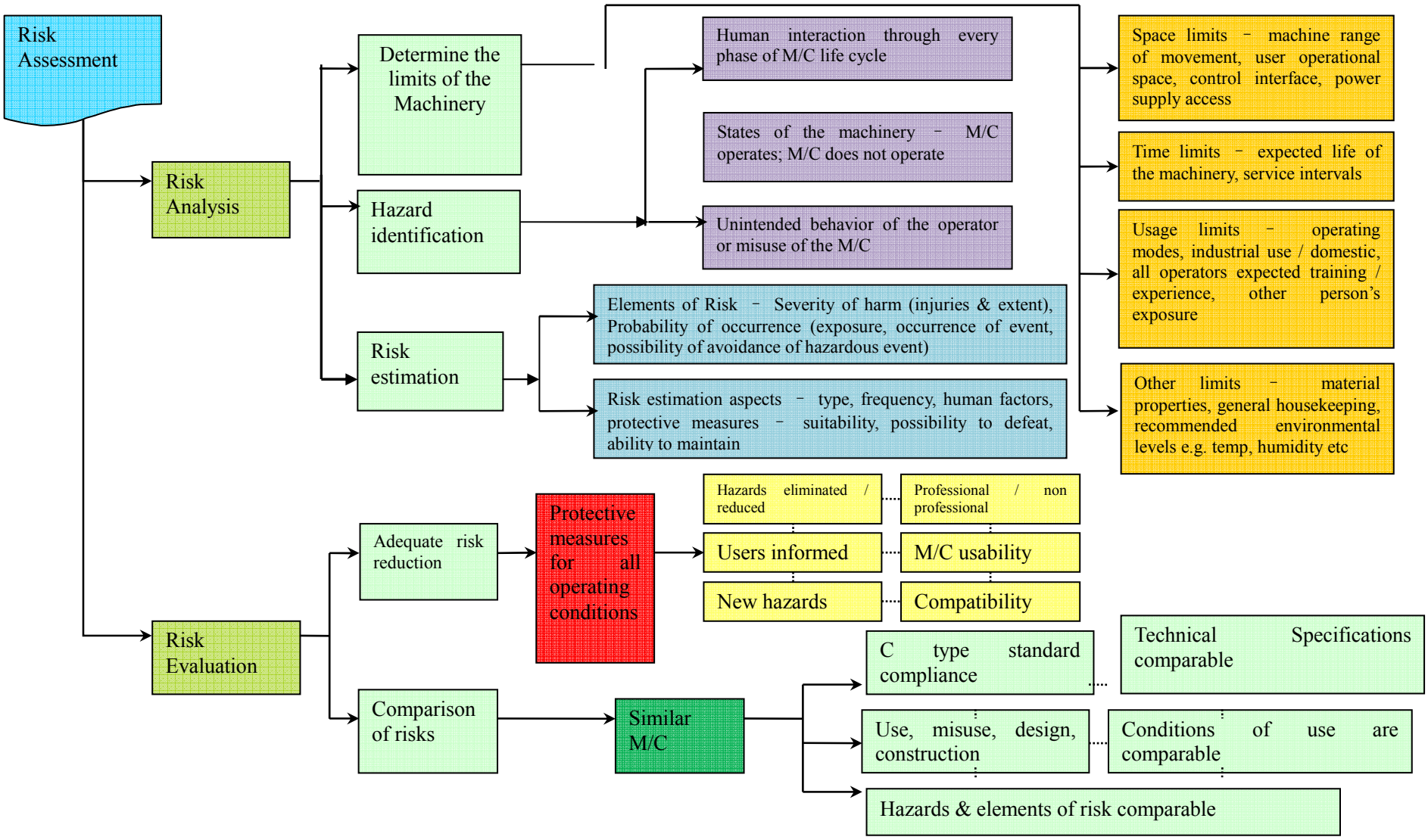
7.0 List of The Applied Norms

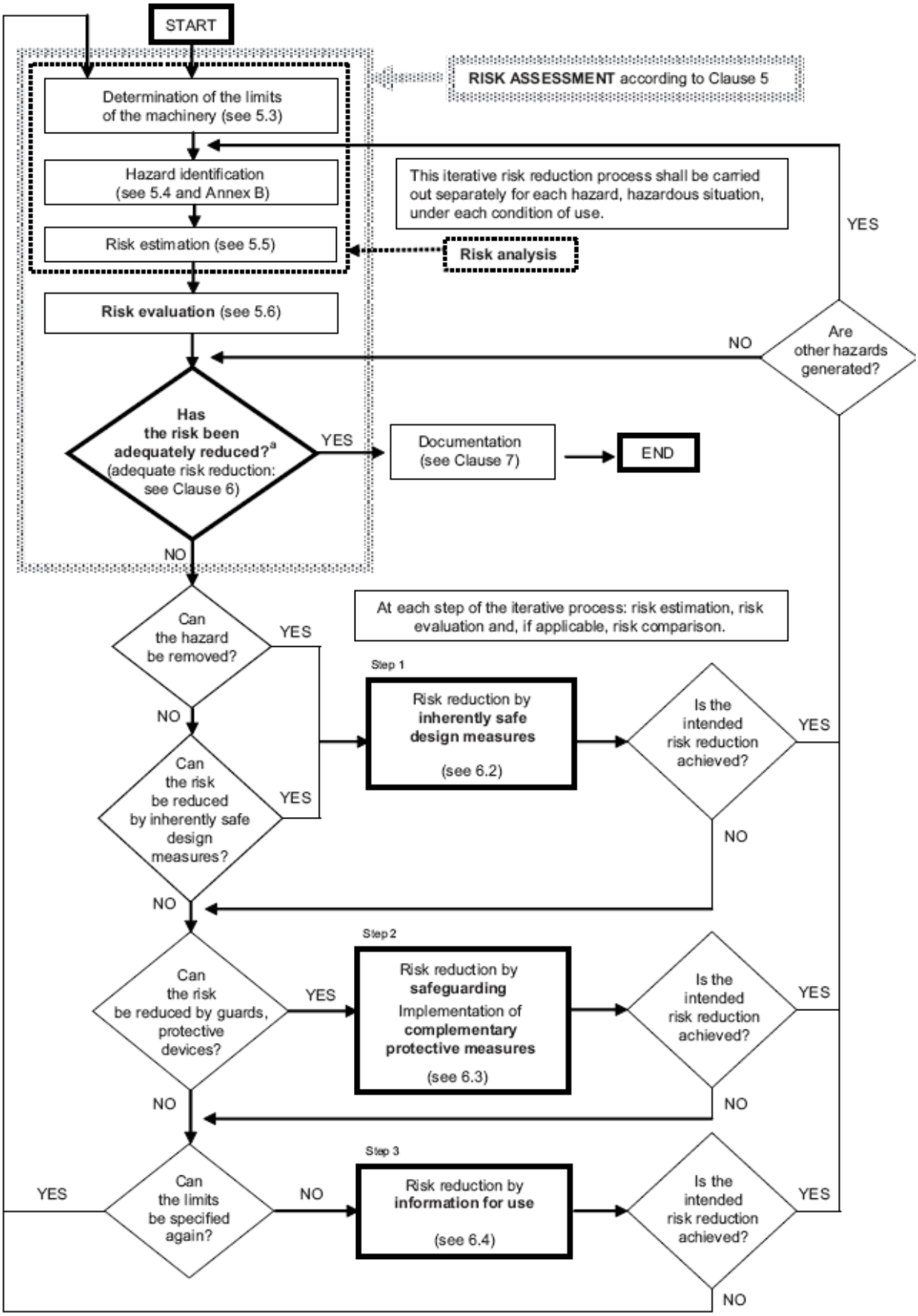
Norms number	Description
EN ISO 12100:2010	Machinery risk assessment and risk reduction
EN 349:1993+A1:2008	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
EN 953:1997+A1:2009	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
EN ISO 13857:2008	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)

8.0 Risk Evaluation Report According to EN ISO 12100:2010

Machinery Information	
Machine	Drywall And Panel Hoist
Variants	50101000-11ft-14
Capacity	/
Options	
Manufacturers Experience	More than 10 years
Known accidents for this type of machinery	/
Machinery C type standards	/
Other relevant standards	EN ISO 12100:2010

Expected Use and Limits of Use	
The Machinery is intended for the sole purpose of	changing the shape of a workpiece by the application of pressure
Machinery is to be used in the following sector (Industrial / Non Industrial / Domestic)	Non Industrial
Machinery is intended to be operated by	Skilled
Are there any physical limiting factors?	Yes
What are the physical limiting factors?	
Anticipated level of training of Machinery installer(s)	Skilled
Anticipated level of training of Machinery operator(s)	Skilled
Anticipated level of training of Machinery maintainer(s)	Skilled
Anticipated level of training of other Machinery operator(s)	Skilled
Are there other persons exposed to the Machinery hazards?	Yes
Will operators be safety trained?	Yes
Are members of the public exposed to the Machinery hazards?	No
Mass and dimensions of the machinery	Please check the specifications of the machine
Maximum speed of the machinery (Linear / Rotational modes of travel)	/
Machinery is designed for a foreseen life (Years)	8-10 years
The machinery uses the following energy sources (Air, Water, Electricity, Hydraulic)	Hydraulic


Risk Assessment
Risk Analysis
Determine the limits of the Machinery
Hazard identification
Risk estimation
Human interaction through every phase of M/C life cycle
States of the machinery – M/C operates; M/C does not operate
Unintended behavior of the operator or misuse of the M/C
Elements of Risk – Severity of harm (injuries & extent), Probability of occurrence (exposure, occurrence of event, possibility of avoidance of hazardous event)
Risk estimation aspects – type, frequency, human factors, protective measures – suitability, possibility to defeat, ability to maintain
Space limits – machine range of movement, user operational space, control interface, power supply access
Time limits – expected life of the machinery, service intervals
Usage limits – operating modes, industrial use / domestic, all operators expected training / experience, other person's exposure
Other limits – material properties, general housekeeping, recommended environmental levels e.g. temp, humidity etc
Risk Evaluation
Adequate risk reduction
Protective measures for all operating conditions
Hazards eliminated / reduced
Professional / non professional
Users informed
M/C usability
New hazards
Compatibility
Comparison of risks
Similar M/C
C type standard compliance
Technical Specifications comparable
Use, misuse, design, construction
Conditions of use are comparable
Hazards & elements of risk comparable


START
RISK ASSESSMENT according to Clause 5
Determination of the limits of the machinery (see 5.3)
Hazard identification (see 5.4 and Annex B)
Risk estimation (see 5.5)
Risk analysis
This iterative risk reduction process shall be carried out separately for each hazard, hazardous situation, under each condition of use.
Risk evaluation (see 5.6)
Are other hazards generated?
YES
NO
Has the risk been adequately reduced?[a] (adequate risk reduction: see Clause 6)
YES
Documentation (see Clause 7)
END
NO
At each step of the iterative process: risk estimation, risk evaluation and, if applicable, risk comparison.
Can the hazard be removed?
YES
NO
Step 1
Risk reduction by inherently safe design measures (see 6.2)
Is the intended risk reduction achieved?
YES
NO
Can the risk be reduced by inherently safe design measures?
YES
NO
Step 2
Can the risk be reduced by guards, protective devices?
YES
NO
Risk reduction by safeguarding Implementation of complementary protective measures (see 6.3)
Is the intended risk reduction achieved?
YES
NO
Step 3
Can the limits be specified again?
YES
NO
Risk reduction by information for use (see 6.4)
Is the intended risk reduction achieved?
YES
NO

Risk Assessment Strategy									
To implement risk assessment and risk reduction the designer shall take the following actions, in the order given (see Figure 1):									
a) Determine the limits of the machinery, which include the intended use and any reasonably foreseeable misuse thereof;									
b) Identify the hazards and associated hazardous situations;									
c) Estimate the risk for each identified hazard and hazardous situation;									
d) Evaluate the risk and take decisions about the need for risk reduction;									
The final step is related to risk reduction.									
e) Eliminate the hazard or reduce the risk associated with the hazard by means of protective measures.									
Follow the above steps to analyze the risks associated with machinery.									
Risk assessment is always followed where possible risk reduction and iteration of the process can be required to eliminate hazards as far as practicable and to implement protective measures to reduce risks.									
Protective Measures									
Protective measures are the measures implemented by the designer and the user, protective measures designed into the product are generally more effective and tend to be cheaper to implement.									
The objective is to achieve the most practicable risk reduction taking into account the following:									
a) Safety of the machine in all the phases of the life cycle									
b) Ability of the machine to perform its function									
c) The usability of the machine									
d) The manufacturing, operational and dismantling cost of the machine									
Risk reduction									
Following a risk assessment risk reduction may be required. This can be achieved by the elimination of the hazard or by separately or simultaneously reducing each of the elements that determine the associated risk.									
a) Severity of harm from the hazard,									
b) Probability of the occurrence of that harm.									
All protective measures that are intended to meet this objective shall be applied using the “Three Step Method”.									
Step 1: Inherently safe design measures									
Inherently safe design measures eliminate hazards or reduce the associated risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine.									
NOTE 1: This stage is the only one at which hazards can be eliminated, thus avoiding the need for additional protective measures such as safeguarding or complementary protective measures.									

Step 2: Safeguarding and/or complementary protective measures									
Taking into account the intended use and the reasonably foreseeable misuse, appropriately selected safeguarding and complementary protective measures can be used to reduce risk when it is not practicable to eliminate a hazard, or reduce its associated risk sufficiently, using inherently safe design measures.									
Step 3: Information for use									
Where risks remain despite inherently safe design measures, safeguarding and the adoption of complementary protective measures, the residual risks shall be identified in the information for use. The information for use shall include, but not be limited to, the following:									
	Operating procedures for the use of the machinery consistent with the expected ability of personnel who use the machinery or other persons who can be exposed to the hazards associated with the machinery.								
	The recommended safe working practices for the use of the machinery and the related training requirements adequately described.								
	Sufficient information, including warning of residual risks for the different phases of the life of the machinery.								
	The description of any recommended personal protective equipment, including detail as to its need as well as to training needed for its use.								
Information for use shall not be a substitute for the correct application of inherently safe design measures, safeguarding or complementary protective measures.									
NOTE 2: Adequate protective measures associated with each of the operating modes and intervention procedures reduce the possibility of operators being induced to use hazardous intervention techniques in case of technical difficulties.									
Prior to beginning work the first time, the operators are expected to have read and understood the safety section of the instructions that accompany the machinery, and to be familiar with the location and operation of each control, and to have received appropriate training / competence assessment.									

Risk Estimation						
Hazards should be assessed at all phases of the machine life i.e. construction, transportation, assembly, installation, commissioning, use, maintenance, dismantling & disposal.						
Risk is a function of the combination of the **severity of harm** and the **probability of occurrence** of that harm. Information taken from the determined limits of the machinery will allow the risk assessor to correctly estimate the risks.						
The severity of harm is estimated by considering the *severity of injury* or damage to health and the *extent of the harm*. The probability of occurrence is itself a function of the *exposure of person*(s) to the hazard, the *occurrence of a hazardous event* and the *possibility to avoid* or limit the harm.						
Severity of Harm						
When completing risk assessments, the risk from the most likely severity of harm that is likely to occur from each identified hazard shall be considered and the highest foreseeable severity shall also be taken into account, even if the probability is low. The **severity of harm** can be distinguished in better detail by considering the **severity of injury** and the **extent of that harm**.						
Probability of Occurrence of that harm						
This is a combination of factors that can be split into the **Frequency of Exposure** and **Possibility of Avoidance**. The frequency of exposure takes into account the *frequency of access, the nature of access, the number of persons* requiring access to the hazard zone and the *time spend within the hazard zone*. Also there are other element to identification of possibility of avoidance which considers the machines history (reliability / known problems) and the type of machine by using comparison of risks to similar machines. Each factor must be considered when "scoring" the frequency of exposure during the examination of the machinery.						
The possibility of avoidance considers the skill of the operators / persons exposed to the harm, how quickly the hazardous situation develops and how easy it is for the operator / persons exposed to the harm to identify a risk.						
The risk score is calculated by multiplying: severity of injury x extent of harm, frequency of exposure x possibility of avoidance using the following scoring system:						

	Rating	Description	Score
Severity of Injury	High	irreversible e.g. loss of limb, or fatality	3
SOI	Medium	recoverable e.g. broken bone or deep cuts	2
	Low	reversible, minor cuts and bruises	1
Extent of Harm	Several	Multiple persons exposed to hazard	2
EOH	One	Single person exposed to hazardous situation	1
Frequency of Exposure	High	frequent e.g. more than once every 10 minutes	3
FOE	Medium	regularly e.g. once per hour	2
	Low	infrequent e.g. once per week	1
Possibility of Avoidance	High	obvious and slow moving	1
POA	Medium	can get out of the way with normal reactions	2
	Low	hazard not obvious and moving fast	3

Note: The scoring for Possibility of Avoidance is reversed from the other 2 categories.

For each hazard the objective is to get to a risk score of 4 or less.

Once the risk has been assessed, appropriate elimination and reduction measures should be taken and the risk rating recalculated.

Risk reduction can be done by separately or simultaneously reducing each of the elements which determine the risk, SOI, EOH, FOE and POA. The measures taken should be re-evaluated to check if they have introduced any new hazards.

The risk assessment process should be repeated until an acceptable risk level is achieved.
This called an “iterative” process.

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
1			**Mechanical**													
1.1	1.3.7	6.2.2.1 6.2.2.2	Crushing 													
1.2	1.3.4	6.2.2.1 6.2.2.2	Cutting or severing 	Risk related to people in working area						Keep free the working zone from unqualified person, children. Use the tool only on good condition for light and visibility						
1.3	1.3.7	6.2.2.1 6.2.2.2	Drawing-in or trapping 													
1.4	1.3.7	6.2.2.1 6.2.2.2	Entanglement 	Glove, clothe and hat may get entangled in tool	2	1	1	1	2	Hold the tool in the correct way during work; Do not wear jewels, fluttering clothes; Thus furl the hair with a hat.	1	1	1	1	1	

1.5	1.3.4	6.2.2.1 6.2.2.2	Friction or abrasion 														
				Not applicable													
1.6	1.3.3	6.2.2.1 6.2.2.2	Impact 	Manually operated handle may have an impact on operator.	2	1	2	2	8	The direction of rotation of winding handles remains the same regardless of gearing.	2	1	1	1	2		
1.7	1.3.2	6.2.10	Injection (e.g. high pressure fluid 														
1.8	1.3.7	6.2.2.1	Shearing 														
				Not applicable													
1.10	1.5.15	6.3.5.6	Slipping, tripping and falling 														
1.11	1.3.4	6.2.2.1	Stabbing puncture 														
				Not applicable													

1.12	1.1.7 1.1.13	6.2.3	Suffocation 														
				Not applicable													
1.13	1.3.3	6.2.3 6.3.1	Falling or ejected objects														
1.14	1.3.1	6.2.6 6.3.2.6	Stability														
1.15	1.3.2	6.2.3	Break up of machine														
1.16	1.1.5	6.2.2.1	Run over (e.g. transportation) 														
				Not applicable													

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
2			**Electrical**													
2.1	1.5.1	6.2.9	Contact electrocution													
				Not applicable												
2.2	1.5.2	6.2.9	Indirect contact - electrocution													
				Not applicable												
2.3	1.5.1	6.2.9	Approach to electrical parts													
				Not applicable												
2.4	1.5.5	6.2.9	Electrical burns													
				Not applicable												
2.5	1.5.2	6.2.9	Electrostatic phenomena													
				Not applicable												

2.6	1.5.10	6.2.3	Effects on medical implants													
				Not applicable												
2.7	1.5.6	6.3.5.4	Fire													
				Not applicable												
2.8	1.3.3	6.2.3 6.3.1	Projection of molten particles													
				Not applicable												
2.9	1.1.6	6.2.8	Shock (e.g. after incident)													
2.10	1.5.15	6.3.5.6	Falling / being thrown (e.g. during electrocution)													
				Not applicable												

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
3			**Thermal**													
3.1	1.5.5	6.2.3	Burn 													
3.2	1.1.6	6.2.8	Dehydration													
3.3	1.1.6	6.2.8	Discomfort													
3.4	1.5.5	6.2.9	Frostbite 													
3.5	1.5.5	6.2.3	Injuries by the radiation of heat sources													
3.6	1.5.5	6.2.3	Scald 													

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
4			**Noise**													
4.1	1.5.8	6.2.2.2	Permanent hearing loss													
4.2	1.5.8	6.2.2.2	Tinnitus													
4.3	1.5.8	6.2.2.2 6.2.8	Interference of speech													
4.4	1.1.6	6.2.8	Loss of awareness													
4.5	1.1.6	6.2.8	Loss of balance													
4.6	1.1.6	6.2.8	Discomfort 	Long time use the tool may make operator discomfort.	2	1	1	1	2	Wearing ear plug during work.	1	1	1	1	1	
4.7	1.1.6	6.2.8	Stress													

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
5			**Vibration**													
5.1	1.5.9	6.2.3 6.3.4.3	Handheld													
				Vibration can damage arms and hands.	2	1	1	1	2	Stop use the tool if you feel physical inconvenience, swarming or pain.	1	1	1	1	1	
5.2	1.5.9	6.2.3 6.3.4.3	Whole body													
5.3	1.5.9	6.2.3 6.3.4.3	Discomfort													
5.4	1.5.9	6.2.3 6.3.4.3	Low-back morbidity													
5.5	1.5.9	6.2.3 6.3.4.3	Neurological disorder													

5.6	1.5.9	6.2.3 6.3.4.3	Osteo-articular disorder													
5.7	1.5.9	6.2.3 6.3.4.3	Trauma of the spine													
5.8	1.5.9	6.2.3 6.3.4.3	Vascular disorder													

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
6			**Radiation**													
6.1	1.5.10	6.2.2.2 6.2.3	Ionizing													
				Not applicable												
6.2	1.5.11	6.3.4.5	Low frequency electromagnetic													
6.3	1.5.10	6.2.3 6.3.4.5	Optical (e.g. infrared,ultraviolet) 													
6.4	1.5.12	6.2.3 6.3.4.5	Laser 													
6.5	1.5.10	6.2.3 6.3.4.5 6.3.5.1	Radio frequency electromagnetic													

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
7			**Material**													
7.1	1.1.3 1.5.13	6.2.2.2 6.2.3 6.2.4	Breathing / suffocation (aerosols, dust, fibers, fluids, gas) 													
				Dust, air shoot and particles may cause discomfort to user.	2	1	1	1	2	Wear anti-dust mask and safety goggles.	1	1	1	1	1	
7.2	1.1.3 1.5.13	6.2.2.2 6.2.3	Cancer (biological / microbiological agents)													
				Not applicable												
7.3	1.1.3	6.2.2.2 6.2.3	Corrosion													
7.4	1.1.3	6.2.2.2 6.2.3	Effects of reproduction capability													
				Not applicable												
7.5	1.1.3	6.2.2.2 6.2.4 6.3.1	Explosion 													
				Not applicable												

7.6	1.1.3	6.2.2.2 6.2.3 6.2.4	Fire 													
7.7	1.1.3	6.2.2.2 6.2.3	Infection / sensitization / mutation													
				Not applicable												
7.8	1.1.3 1.5.13	6.2.2.2 6.2.3	Poisoning													

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
8			**Ergonomic**													
8.1	1.1.6	6.2.8	Discomfort - unhealthy postures													
				Long operation time may cause discomfort during operation.	2	1	1	1	2	Skilled operator	1	1	1	1	1	The operator should be skilled. Has been provided in the instruction manual
8.2	1.1.6	6.2.8	Musculoskeletal disorder - inadequate consideration of anatomy													
				Not applicable												
8.3	1.1.6 1.2.2	6.2.8	Fatigue													
8.4	1.1.6	6.2.8	Stress													
				Not applicable												
8.5	1.1.6	6.3.2.1	Mental overload / underload													
				Not applicable												

8.6	1.1.4	6.2.7	Inadequate local lighting	Can't operate safe during operation	2	2	1	1	4	Provide adequate lighting if the light unfavorable, the operation should be stopped.	1	1	1	1	1	The user should be provided adequate light. The warnings has been provided in instruction manual
8.7	1.2.2	6.2.11.8 6.3.2.1	Human error	Can't operate safe during operation	2	2	2	1	8	Skilled operator	2	1	1	1	2	The operator should be skilled. The warning sings have been provided in the instruction manual
8.8	1.1.6 1.2.2	6.2.11.8	Inadequate manual controls	Not applicable												

Hazard ID #	EHSR	EN 12100 Clause	Generic Hazards	Actual Hazard - inc location, activity & persons at risk	Risk Estimation					Measures taken to eliminate or reduce risk	Risk Re-estimation					Residual Risks - information provided & warning labels
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
9			**Environmental**													
9.1	1.5.6 1.5.7	6.3.2.1 6.4.5.1	Dust / fog													
				Not applicable												
9.2	1.5.16	6.2.11.11	Lightning													
9.3	1.3.2	6.2.3 6.3.4.5	Water / moisture													
9.4	1.3.2	6.2.3 6.3.4.5	Pollution													
9.5	1.5.5	6.4.5.1	Temperature													
9.6	1.3.2	6.3.2.1	Snow / ice													

				Not applicable													
9.7	1.3.1	6.2.6	Wind														
				Not applicable													
9.8	1.1.7	6.4.5.1 6.3.5.3	Lack of oxygen														
				Not applicable													

Hazard ID #	**EHSR**	**EN 12100 Clause**	**Generic Hazards**	**Actual Hazard - inc location, activity & persons at risk**	**Risk Estimation**					**Measures taken to eliminate or reduce risk**	**Risk Re-estimation**					**Residual Risks - information provided & warning labels**
					SOI	EOH	FOE	POA	RISK		SOI	EOH	FOE	POA	RISK	Users Must be Warned of Residual Risks
10			**Combination**													
10.1			Repetitive activity + effort + high environmental temperature													

Conclusions: From risk evaluation results that if the machine is used under normal safety condition and following what is written in the use and maintenance manual, there are not situation with strong risk. For each dangerous situation some warning and precaution are listed in the manual, which allow the operators to work with low risk, also in the manual there is a list of safety advices to reduce the risks.

9.0 General Test Report

INFORMATION	
Applicant Name:	Qingdao Jiangyuan Hand Truck Co., Ltd.
Address:	Tieshan Industrial Park, Huangdao District, Qingdao, Shandong, China
Manufacturer Name:	Qingdao Jiangyuan Hand Truck Co., Ltd.
Address:	Tieshan Industrial Park, Huangdao District, Qingdao, Shandong, China

PROJECT INFORMATION	
Product name:	Drywall And Panel Hoist
Model(s)	50101000-11ft-14
Standard/Edition	EN ISO 12100:2010, EN 349:1993+A1:2008,EN 953:1997+A1:2009, EN ISO 13857:2008
Requested Service	☒ Full or partial pre-test for the following certification [■]CE- MD [■]CE- LVD [ ]CE- EMC [ ] Others____

SAMPLE RECORDS		
Sample	**Quantity**	**Description**
50101000-11ft-14	**1**	**Complete ,Well for testing**

Conclusion:
The sample(s) were tested according to the standard(s) specified above and found COMPLIANCE with the applicable requirements…

Testing Introduction

Test item particulars:
Equipment mobility.....Potable
1 Practical tests for Type Testing Procedure
2 Practical tests for fitness for purpose test when 50101000-11ft-14 has been type tested

Test case verdicts
Test case does not apply to the test object.....: N/A
Test item does meet the requirement.....: P(Pass)
Test item does not meet the requirement.....: F(Fail)

General remarks
The test results presented in this report relate only to the object tested.
This report shall not be reproduced except in full without the written approval of the testing laboratory.
The test results presented in this report relate only to the item(s) tested,
"(see remark #)" refers to a remark appended to the report,
"(see Annex #)" refers to an annex appended to the report.
Throughout this report a comma is used as the decimal separator.

Clause	Requirement-Test	Result	Verdict
EN ISO 12100:2010			
6	**Risk reduction**		
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk: —severity of harm from the hazard under consideration; —probability of occurrence of that harm. All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2). **Step 1: Inherently safe design measures** **Step 2: Safeguarding and/or complementary protective measures** **Step 3: Information for use**	**P**	
6.2 Inherently safe design measures			
6.2.1	**General**		
	Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding can fail or be violated and information for use may not be followed. Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine.	**P**	

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
6.2.2 Consideration of geometrical factors and physical aspects			
6.2.2.1	**Geometrical factors**		
	Such factors include the following. a)The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position — reducing blind spots, for example — and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example: —the travelling and working area of mobile machines; —the zone of movement of lifted loads or of the carrier of machinery for lifting persons; —the area of contact of the tool of a hand-held or hand-guided machine with the material being worked. The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones. b) The form and the relative location of the mechanical components parts: for instance, crushing and shearing hazards are avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857). c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can "trap" parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a "trap" shall be capped. d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).	P	
6.2.2.2	**Physical aspects**		
	Such aspects include the following: a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard; b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy; c) limiting the emissions by acting on the characteristics of the source using measures for reducing 1) noise emission at source (see ISO/TR 11688-1), 2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1)], 3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding), and 4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN 12198-3)].	**P**	
6.2.3	**Taking into account general technical knowledge of machine design**		
	This general technical knowledge can be derived from technical specifications for design (standards, design codes, calculation rules, etc.), which should be used to cover a) mechanical stresses such as —stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies, —stress limitation by overload prevention (bursting disk, pressure-limiting valves, breakage points, torque-limiting devices, etc.), —avoiding fatigue in elements under variable stresses (notably cyclic stresses), and —static and dynamic balancing of rotating elements, b) materials and their properties such as —resistance to corrosion, ageing, abrasion and wear, —hardness, ductility, brittleness, —homogeneity, —toxicity, and —flammability, and c) emission values for —noise, —vibration, —hazardous substances, and	**P**	

	—radiation. When the reliability of particular components or assemblies is critical for safety (for example, ropes, chains,lifting accessories for lifting loads or persons), stress limits shall be multiplied by appropriate workingcoefficients.		
6.2.4	**Choice of appropriate technology**		
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain applications such as the following: a)on machines intended for use in explosive atmospheres, using —appropriately selected pneumatic or hydraulic control system and machine actuators, —intrinsically safe electrical equipment (see IEC 60079-11); b)for particular products to be processed (for example, by a solvent), by using equipment that ensures the temperature will remain far below the flash point; c)the use of alternative equipment to avoid high noise levels, such as —electrical instead of pneumatic equipment, —in certain conditions, water-cutting instead of mechanical equipment.	**N/A**	
6.2.5	**Applying principle of positive mechanical action**		
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).	**P**	
6.2.6	**Provisions for stability**		
	Machines shall be designed so that they have sufficient stability to allow them to be used safely in their specified conditions of use. Factors to be taken into account include —the geometry of the base, —the weight distribution, including loading, —the dynamic forces due to movements of parts of the machine, of the machine itself or of elements held by the machine which can result in an overturning moment, —vibration, —oscillations of the centre of gravity, —characteristics of the supporting surface in case of travelling or installation on different sites (ground conditions, slope, etc.), and —external forces, such as wind pressure and manual forces. Stability shall be considered in all phases of the life cycle of the machine, including handling, travelling, installation, use, dismantling, disabling and scrapping. Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.	P	
6.2.7	**Provisions for maintainability**		
	When designing a machine, the following maintainability factors shall be taken into account to enable maintenance of the machine: —accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used; —ease of handling, taking into account human capabilities; —limitation of the number of special tools and equipment.	P	
6.2.8	**Observing ergonomic principles**		
	Ergonomic principles shall be taken into account in designing machinery so as to reduce the mental or physical stress of, and strain on, the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design. NOTE Also improved are the performance and reliability of operation and hence the reduction in the probability of errors at all stages of machine use. Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2). All elements of the operator–machine interface, such as controls, signalling or data display elements shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. See EN 614-1, EN 13861 and IEC 61310-1. The designer's attention is particularly drawn to following ergonomic aspects of machine design. a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators). b) Design machines, especially hand-held and mobile machines, so as to enable them to be operated easily, taking into account human effort, actuation of controls and hand, arm and leg anatomy. c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures. d) Avoid linking the operator's working rhythm to an automatic succession of cycles. e) Provide local lighting on or in the machine for the illumination of the working area and of	P	

	adjusting, setting-up and frequent maintenance zones when the design features of the machine and/or its guards render the ambient lighting inadequate. Flicker, dazzling, shadows and stroboscopic effects shall be avoided if they can cause a risk. If the position or the lighting source has to be adjusted, its location shall be such that it does not cause any risk to persons making the adjustment. f) Select, locate and identify manual controls (actuators) so that —they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4), —they can be safely operated without hesitation or loss of time and without ambiguity (for example, a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation), —their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3), and —their operation cannot cause additional risk. See also ISO 9355-3.		
6.2.9	**Electrical hazards**		
	For the design of the electrical equipment of machines, IEC 60204-1 gives general provisions about disconnection and switching of electrical circuits and for protection against electric shock. For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).	P	
6.2.10	**Pneumatic and hydraulic hazard**		
	Pneumatic and hydraulic equipment of machinery shall be designed so that —the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices), —no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum, —no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures, —air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or regulations for these elements, —all elements of the equipment, especially pipes and hoses, are protected against harmful external effects, —as far as possible, reservoirs and similar vessels (for example, gas-loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, Clause 5), and —all elements which remain under pressure after isolation of the machine from its power supply are provided with clearly identified exhaust devices, and there is a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine.	P	
6.2.11 Applying inherently safe design measures to control systems			
6.2.11.1	**General**		
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061). The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behavior. Typical causes of hazardous machine behavior are —an unsuitable design or modification (accidental or deliberate) of the control system logic, —a temporary or permanent defect or failure of one or several components of the control system, —a variation or a failure in the power supply of the control system, and —inappropriate selection, design and location of the control devices. Typical examples of hazardous machine behaviour are —unexpected start-up (see ISO 14118), —uncontrolled speed change, —failure to stop moving parts, —dropping or ejection of part of the machine or of a workpiece clamped by the machine, and —machine action resulting from inhibition (defeating or failure) of protective devices. In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause (6.2.11) and in 6.2.12. These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1, IEC 60204-1 and IEC 62061). Control systems shall be designed to enable the operator to interact with the machine safely and easily. This requires one or several of the following solutions:	N/A	

	—systematic analysis of start and stop conditions; —provision for specific operating modes (for example, start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the work pieces contained in the machine, operation of a part of the machine in case of a failure of a machine element); —clear display of the faults; —measures to prevent accidental generation of unexpected start commands (for example, shrouded start device) likely to cause dangerous machine behavior (see ISO 14118:2000, Figure 1); —maintained stop commands (for example, interlock) to prevent restarting that could result in dangerous machine behavior (see ISO 14118:2000, Figure 1). An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation. The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone. Likewise, it shall be obvious which control devices (for example, emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone. The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention. Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or work pieces and/or loads held by the machinery, to the safe design parameters (for example, range, speed, acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (swinging of loads, etc.). For example: —the travelling speed of mobile pedestrian controlled machinery other than remote-controlled shall be compatible with walking speed; —the range, speed, acceleration and deceleration of movements of the person-carrier and carrying vehicle for lifting persons shall be limited to non-hazardous values, taking into account the total reaction time of the operator and the machine; —the range of movements of parts of machinery for lifting loads shall be kept within specified limits. When the machinery contains various elements that can be operated independently, the control system shall be designed to prevent risks arising out of a lack of coordination (for example, collision prevention system).		
6.2.11.2	**Starting of an internal power source/switching on an external power supply**		
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation. For example: —starting the internal combustion engine shall not lead to movement of a mobile machine; —connection to mains electricity supply shall not result in the starting of working parts of a machine. See IEC 60204-1:2005, 7.5 (see also Annexes A and B).	N/A	
6.2.11.3	**Starting/stopping of a mechanism**		
	The primary action for starting or accelerating the movement of a mechanism should be performed by the application or an increase of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 0 to state 1 (where state 1 represents the highest energy state). The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 1 to state 0 (where state 1 represents the highest energy state). In certain applications, such as high-voltage switchgear, this principle cannot be followed, in which case other measures should be applied to achieve the same level of confidence for the stopping or slowing down. When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (for example, a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system.	P	
6.2.11.4	**Restart after power interruption**		
	If a hazard could be generated, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (for example, by use of a self-maintained relay, contactor or valve).	P	
6.2.11.5	**Interruption of power supply**		
	Machinery shall be designed to prevent hazardous situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met: —the stopping function of the machinery shall remain; —all devices whose permanent operation is required for safety shall operate in an effective way	P	

	to maintain safety (for example, locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery); —parts of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.		
6.2.11.6	**Use of automatic monitoring**		
	Automatic monitoring is intended to ensure that a safety function or functions implemented by a protective measure do not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed such that hazards are generated. Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function. In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (for example, the beginning of the machine cycle). The protective measure may be, for example, —the stopping of the hazardous process, —preventing the restart of this process after the first stop following the failure, or —the triggering of an alarm.	**N/A**	
6.2.11.7 Safety functions implemented by programmable electronic control systems			
6.2.11.7.1	**General**		
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behavior on detection of a fault shall be considered (see also the IEC 61508 series for further guidance). NOTE Both ISO 13849-1 and IEC 62061, specific to machinery safety, provide guidance applicable to programmable electronic control systems. The programmable electronic control system should be installed and validated to ensure that the specified performance [for example, safety integrity level (SIL) in IEC 61508] for each safety function has been achieved. Validation comprises testing and analysis (for example, static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.	P	
6.2.11.7.2	**Hardware aspects**		
	The hardware (including, for example, sensors, actuators and logic solvers) shall be selected, and/or designed and installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of —architectural constraints (the configuration of the system, its ability to tolerate faults, its behavior on detection of a fault, etc.), —selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and —the incorporation of measures and techniques within the hardware so as to avoid systematic failures and control systematic faults.	P	
6.2.11.7.3	**Software aspects**		
	The software, including internal operating software (or system software) and application software, shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3). Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)]. When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the authorized persons).	N/A	
6.2.11.8	**Principles relating to manual control**		
	These are as follows. a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8, item f). b) A stop control device shall be placed near each start control device. Where the start/stop function is performed by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released. c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as	**N/A**	

	emergency stop or teach pendant. d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone. 1) The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions. 2) On machinery intended for lifting persons, controls for lifting and lowering and, if appropriate, for moving the carrier shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements. e) If it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a portable control unit (such as a teach pendant), with which the operator can enter danger zones. f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1, ISO 9355-3 and ISO 447). g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be implemented to ensure the presence of the operator at the control position (for example, by the design and location of control devices). h) For cableless control, an automatic stop shall be performed when correct control signals are not received, including loss of communication (see IEC 60204-1).		
6.2.11.9	**Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance**		
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put into operation, the safety of the operator shall be achieved using a specific control mode which simultaneously a) disables all other control modes, b) permits operation of the hazardous elements only by continuous actuation of an enabling device, a two-hand control device or a hold-to-run control device, c) permits operation of the hazardous elements only in reduced risk conditions (for example, reduced speed, reduced power/force, step-by-step, for example, with a limited movement control device), and d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors. NOTE For some special machinery other protective measures can be appropriate. This control mode shall be associated with one or more of the following measures: —restriction of access to the danger zone as far as possible; —emergency stop control within immediate reach of the operator; —portable control unit (teach pendant) and/or local controls (allowing sight of the controlled elements). See IEC 60204-1.	**N/A**	
6.2.11.10	**Selection of control and operating modes**		
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (for example, to allow for adjustment, setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position. Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode. The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (for example, access codes for certain numerically controlled functions).	**P**	
6.2.11.11	**Applying measures to achieve electromagnetic compatibility (EMC)**		
	For guidance on electromagnetic compatibility, see IEC 60204-1 and IEC 61000-6.	P	
6.2.11.12	**Provision of diagnostic systems to aid fault-finding**		
	Diagnostic systems to aid fault-finding should be included in the control system so that there is no need to disable any protective measure. NOTE Such systems not only improve availability and maintainability of machinery, they also reduce the exposure of maintenance staff to hazards.	N/A	
6.2.12 Minimizing probability of failure of safety functions			
6.2.12.1	**General**		
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine. The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by the measures given in 6.2.12.2 to 6.2.12.4.	**P**	
6.2.12.2	**Use of reliable components**		

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
	"Reliable components" means components which are capable of withstanding all disturbances and stresses associated with the usage of the equipment in the conditions of intended use (including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above (see also 6.2.13). NOTE 1 "Reliable components" is not a synonym for "well-tried components" (see ISO 13849-1:2006, 6.2.4). NOTE 2 Environmental conditions for consideration include impact, vibration, cold, heat, moisture, dust, corrosive and/or abrasive substances, static electricity and magnetic and electric fields. Disturbances which can be generated by those conditions include insulation failures and temporary or permanent failures in the function of control system components.	**P**	
6.2.12.3	**Use of "oriented failure mode" components**		
	"Oriented failure mode" components or systems are those in which the predominant failure mode is known in advance and which can be used so that the effect of such a failure on the machine function can be predicted. NOTE In some cases, it will be necessary to take additional measures to limit the negative effects of such a failure. The use of such components should always be considered, particularly in cases where redundancy (see 6.2.12.4) is not employed.	**N/A**	
6.2.12.4	**Duplication (or redundancy) of components or subsystems**		
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component or components continue to perform the respective function(s), thereby ensuring that the safety function remains available. In order to allow the proper action to be initiated, component failure shall be detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection, provided that the inspection interval is shorter than the expected lifetime of the components. Diversity of design and/or technology can be used to avoid common cause failures (for example, from electromagnetic disturbance) or common mode failures.	**N/A**	
6.2.13	**Limiting exposure to hazards through reliability of equipment**		
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring intervention, thereby reducing exposure to hazards. This applies to power systems (operative part, see Annex A) as well as to control systems, and to safety functions as well as to other functions of machinery. Safety-related components (for example, certain sensors) of known reliability shall be used. The elements of guards and of protective devices shall be especially reliable, as their failure can expose persons to hazards, and also because poor reliability would encourage attempts to defeat them.	**P**	
6.2.14	**Limiting exposure to hazards through mechanization or automation of loading (feeding)/unloading (removal) operations**		
	Mechanization and automation of machine loading/unloading operations and, more generally, of handling operations — of workpieces, materials or substances — limits the risk generated by these operations by reducing the exposure of persons to hazards at the operating points. Automation can be achieved by, for example, robots, handling devices, transfer mechanisms and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables. While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being corrected. Care shall be taken to ensure that the use of these devices does not introduce further hazards, such as trapping or crushing, between the devices and parts of the machine or workpieces/materials being processed. Suitable safeguards (see 6.3) shall be provided if this cannot be ensured. Automatic feeding and removal devices with their own control systems and the control system of the associated machine shall be interconnected after thorough study of how all safety functions are performed in all the control and operation modes of the entire equipment.	**P**	
6.2.15	**Limiting exposure to hazards through location of setting and maintenance points outside danger zones**		
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.	**P**	
6.3 Safeguarding and complementary protective measures			
6.3.1	**General**		
	Guards and protective devices shall be used to protect persons whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented. NOTE The different kinds of guards and protective devices are defined in 3.27 and 3.28. Certain safeguards may be used to avoid exposure to more than one hazard. EXAMPLE A fixed guard preventing access to a zone where a mechanical hazard is present used to reduce noise levels and collect toxic emissions.	**P**	

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
6.3.2 Selection and implementation of guards and protective devices			
6.3.2.1	**General**		
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazards generated by moving parts, according to the nature of those parts (see Figure 4) and to the need for access to the danger zone(s). The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine. In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery. As the need for frequency of access increases, this inevitably leads to the fixed guard not being replaced. This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment). A combination of safeguards can sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device can be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard. Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards including a) hazards from falling or ejected objects, using, for example, protection in the form of a falling object protection structure (FOPS), b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.), c) hazards due to the environment (protection against heat, cold, foul weather, etc.), d) hazards due to tipping over or rolling over of machinery, using, for example, protection in the form of roll-over or tip-over protection structures (ROPS and TOPS). The design of enclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.	**P**	
6.3.2.2	**Where access to the hazard zone is not required during normal operation**		
	Where access to the hazard zone is not required during normal operation of the machinery, safeguards should be selected from the following: a) fixed guards (see also ISO 14120); b) interlocking guards with or without guard locking (see also 6.3.3.2.3, ISO 14119 and ISO 14120); c) self-closing guards (see ISO 14120:2002, 3.3.2); d)sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496) or pressure-sensitive protective devices (see ISO 13856).	**P**	
6.3.2.3	**Where access to the hazard zone is required during normal operation**		
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following: a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document); b) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496); c) adjustable guards; d) self-closing guards (see ISO 14120:2002, 3.3.2); e) two-hand control devices (see ISO 13851); f) interlocking guards with a start function (control guard) (see 6.3.3.2.5).	**P**	
6.3.2.4	**Where access to the hazard zone is required for machine setting, teaching, process changeover, fault-finding, cleaning or maintenance**		
	production operator also ensure the protection of personnel carrying out setting, teaching, process changeover, fault-finding, cleaning or maintenance, without hindering them in the performance of their task. Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2). NOTE Isolation and energy dissipation for machine shut-down (see 6.3.5.4, and also ISO 14118:2000, 4.1 and Clause 5) ensure the highest level of safety when carrying out tasks (especially maintenance and repair tasks) that do not require the machine to remain connected to its power supply.	**P**	
6.3.2.5 Selection and implementation of sensitive protective equipment1)			
6.3.2.5.1 Selection	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications. The following provisions are intended to provide the designer with criteria for selecting, for each application, the most suitable device(s).	**P**	

	Types of sensitive protective equipment include —light curtains, —scanning devices, for example, laser scanners, —pressure-sensitive mats, and —trip bars, trip wires. Sensitive protective equipment can be used —for tripping purposes, —for presence sensing, —for both tripping and presence sensing, or —to re-initiate machine operation — a practice subject to stringent conditions. NOTE Some types of sensitive protective equipment can be unsuitable either for presence sensing or for tripping purposes. The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment: —tendency for the machinery to eject materials or component parts; —necessity to guard against emissions (noise, radiation, dust, etc.); —erratic or excessive machine stopping time; —inability of a machine to stop part-way through a cycle.		
6.3.2.5.2	**Implementation**		
	Consideration should be given to a) the size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment), b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment), c) the possibility of circumvention, and d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air). NOTE 1 IEC 61496 defines the detection capability of electrosensitive protective equipment. Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that —a command is given as soon as a person or part of a person is detected, —the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment is maintained by the control system until a new command is given, —restarting the hazardous machine function(s) results from the voluntary actuation by the operator of a control device placed outside the hazard zone, where this zone can be observed by the operator, —the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and —the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected. NOTE 2 Muting is the temporary automatic suspension of a safety function(s) by safety-related parts of the control system (see ISO 13849-1). For detailed consideration of the fault behaviour of, for example, active optoelectronic protective devices, IEC 61496 should be taken into account.	**P**	
6.3.2.5.3	**Additional requirements for sensitive protective equipment when used for cycle initiation**		
	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control. Cycle initiation by sensitive protective equipment shall be subject to the following conditions: a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used; b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied — in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring of control and braking systems; c) the cycle time of the machine is short and the facility to re-initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle; d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to	**P**	

	enter the hazard zone; e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation; f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions. NOTE 1 The hazard zone as referred to in d) is any zone where the hazardous function (including ancillary equipment and transmission elements) is initiated by clearing of the sensing field. NOTE 2 See also IEC/TS 62046.		
6.3.2.6	**Protective measures for stability**		
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 6.2.6), it shall be maintained by the use of protective measures such as —anchorage bolts, —locking devices, —movement limiters or mechanical stops, —acceleration or deceleration limiters, —load limiters, and —alarms warning of the approach to stability or tipping limits.	**P**	
6.3.2.7	**Other protective devices**		
	error of the operator can generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular —when the operator has insufficient visibility of the hazard zone, —when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed, mass, angle, etc.), and — when hazards can result from operations other than those controlled by the operator. The necessary devices include a) devices for limiting parameters of movement (distance, angle, velocity, acceleration), b) overloading and moment limiting devices, c) devices to prevent collisions or interference with other machines, d) devices for preventing hazards to pedestrian operators of mobile machinery or other pedestrians, e) torque limiting devices, and breakage points to prevent excessive stress of components and assemblies, f) devices for limiting pressure or temperature, g) devices for monitoring emissions, h) devices to prevent operation in the absence of the operator at the control position, i) devices to prevent lifting operations unless stabilizers are in place, j) devices to limit inclination of the machine on a slope, and k) devices to ensure that components are in a safe position before travelling. Automatic protective measures triggered by such devices that take operation of the machinery out of the control of the operator (for example, automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3).	**P**	
6.3.3 Requirements for design of guards and protective devices			
6.3.3.1	**General requirements**		
	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them. NOTE For additional information, see ISO 14120, ISO 13849-1, ISO 13851, ISO 14119, ISO 13856, IEC 61496 and IEC 62061. Guards and protective devices shall a) be of robust construction, b) not give rise to any additional hazard, c) not be easy to bypass or render non-operational, d) be located at an adequate distance from the danger zone (see ISO 13855 and ISO 13857), e) cause minimum obstruction to the view of the production process, and f) enable essential work to be carried out for the installation and/or replacement of tools and for maintenance by allowing access only to the area where the work has to be carried out — if possible, without the guard having to be removed or protective device having to be disabled. For openings in the guards, see ISO 13857.	**P**	
6.3.3.2 Requirements for guards			
6.3.3.2.1	**Functions of guards**		

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
	The functions that guards can achieve are —prevention of access to the space enclosed by the guard, and/or —containment/capture of materials, workpieces, chips, liquids which can be ejected or dropped by the machine, and reduction of emissions (noise, radiation, hazardous substances such as dust, fumes, gases) that can be generated by the machine. Additionally, they could need to have particular properties relating to electricity, temperature, fire, explosion, vibration, visibility (see ISO 14120) and operator position ergonomics (for example, usability, operator's movements, postures, repetitive movements).	**P**	
6.3.3.2.2	**Requirements for fixed guards**		
	Fixed guards shall be securely held in place either —permanently (for example by welding), or —by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120). NOTE A fixed guard can be hinged to assist in its opening.	**P**	
6.3.3.2.3	**Requirements for movable guards**		
	Movable guards which provide protection against hazards generated by moving transmission parts shall a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides), and b) be interlocking (with guard locking when necessary) (see ISO 14119). See Figure 4. Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that —moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up, with this able to be achieved by interlocking guards, with guard locking when necessary, —they can be adjusted only by an intentional action, such as the use of a tool or a key, and —the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6). See Figure 4 and ISO 14119.	**P**	
6.3.3.2.4	**Requirements for adjustable guards**		
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed. Manually adjustable guards shall be —designed so that the adjustment remains fixed during a given operation, and —readily adjustable without the use of tools.	**P**	
6.3.3.2.5	**Requirements for interlocking guards with a start function (control guards)**		
	An interlocking guard with a start function may only be used provided that a) all requirements for interlocking guards are satisfied (see ISO 14119), b) the cycle time of the machine is short, c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and, when this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine, d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120), e) all other guards, whether fixed (removable type) or movable, are interlocking guards, f) the interlocking device associated with the interlocking guard with a start function is designed such that —for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) — its failure cannot lead to an unintended/unexpected start-up, and g) the guard is securely held open (for example, by a spring or counterweight) such that it cannot initiate a start while falling by its own weight.	P	
6.3.3.2.6	**Hazards from guards**		
	Care shall be taken to prevent hazards which could be generated by —the guard construction (sharp edges or corners, material, noise emission, etc.), —the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall).	P	
6.3.3.3	**Technical characteristics of protective devices**		
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured. Protective devices shall be selected on the basis of their having met the appropriate product standard (for example, IEC 61496 for active optoelectronic protective devices) or shall be designed according to one or several of the principles formulated in ISO 13849-1 or IEC 62061. Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.	P	
6.3.3.4	**Provisions for alternative types of safeguards**		

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it is known that it will be necessary to change the safeguards because of the range of work to be carried out.	P	
6.3.4	**Safeguarding to reduce emissions**		
6.3.4.1	**General**		
	If the measures for the reduction of emissions at source specified in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).	P	
6.3.4.2	**Noise**		
	Additional protective measures against noise include —enclosures (see ISO 15667), —screens fitted to the machine, and —silencers (see ISO 14163).	P	64.4dB(A)
6.3.4.3	**Vibration**		
	Additional protective measures against vibration include —vibration isolators, such as damping devices placed between the source and the exposed person, —resilient mounting, and —suspended seats. For measures for vibration isolation of stationary industrial machinery see EN 1299.	N/A	
6.3.4.4	**Hazardous substances**		
	Additional protective measures against hazardous substances include —encapsulation of the machine (enclosure with negative pressure), —local exhaust ventilation with filtration, —wetting with liquids, and —special ventilation in the area of the machine (air curtains, cabins for operators). See ISO 14123-1.	NE	
6.3.4.5	**Radiation**		
	Additional protective measures against radiation include —use of filtering and absorption, and —use of attenuating screens or guards.	N/A	
6.3.5	**Complementary protective measures**		
6.3.5.1	**General**		
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use, could have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to, those dealt with in 6.3.5.2 to 6.3.5.6.	P	
6.3.5.2	**Components and elements to achieve emergency stop function**		
	If, following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function for enabling actual or impending emergency situations to be averted, the following requirements apply: —the actuators shall be clearly identifiable, clearly visible and readily accessible; —the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution; —the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary. NOTE For more detailed provisions, see ISO 13850. Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but shall only permit restarting. More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.	P	
6.3.5.3	**Measures for the escape and rescue of trapped persons**		
	Measures for the escape and rescue of trapped persons may consist, among others, of —escape routes and shelters in installations generating operator-trapping hazards, —arrangements for moving some elements by hand, after an emergency stop, —arrangements for reversing the movement of some elements, —anchorage points for descender devices, —means of communication to enable trapped operators to call for help.	P	
6.3.5.4	**Measures for isolation and energy dissipation**		
	Machines shall be equipped with the technical means to achieve isolation from power supply(ies) and dissipation of stored energy by means of the following actions: a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies; b) locking (or otherwise securing) all the isolating units in the isolating position; c) dissipating or, if this is not possible or practicable, restraining (containing) any stored energy	P	

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
	which can give rise to a hazard; d) verifying, by means of safe working procedures, that the actions taken according to a), b) and c) above have produced the desired effect. See ISO 14118:2000, Clause 5, and IEC 60204-1:2005, 5.5 and 5.6.		
6.3.5.5	**Provisions for easy and safe handling of machines and their heavy component parts**		
	Machines and their component parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear. These attachments may be, among others, —standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing, —appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground, —fork locating devices for machines to be transported by a lift truck, —lifting and stowing gear and appliances integrated into the machine. Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement. See also 6.4.4 c), item 3).	P	
6.3.5.6	**Measures for safe access to machinery**		
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance to be carried out as far as possible by a person remaining at ground level. Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks; however, care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery. The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and, depending on the height from the ground, shall be provided with suitable guard-rails (see ISO 14122-3). In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points. Means of access to parts of machinery located at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for ladders). As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations). Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening. The necessary aids for access shall be provided (steps, handholds, etc.). Control devices shall be designed and located to prevent their being used as aids for access. When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open. For detailed provisions see ISO 14122.	P	
6.4 Information for use			
6.4.1	**General requirements**		
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2).Information for use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users. NOTE See also IEC 62079 for structuring and presentation of information for use.	P	
6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes. The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk. The information shall indicate, as appropriate, —the need for training, —the need for personal protective equipment, and —the possible need for additional guards or protective devices (see Figure 2, Footnote d). It shall not exclude uses of the machine that can reasonably be expected from its designation and description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.	P	
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use of the machine (setting, teaching/programming or process changeover, operation, cleaning, fault-finding and maintenance) and, if necessary, dismantling, disabling and scrapping.	P	
6.4.2	**Location and nature of information for use**		

	Depending on the risk, the time when the information is needed by the user and the machine design, it shall be decided whether the information — or parts thereof — are to be given a) in/on the machine itself (see 6.4.3 and 6.4.4), b) in accompanying documents (in particular instruction handbook, see 6.4.5), c) on the packaging, d) by other means such as signals and warnings outside the machine. Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).	P	
6.4.3	**Signals and warning devices**		
	Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event such as machine start-up or overspeed. Such signals may also be used to warn the operator before the triggering of automatic protective measures (see 6.3.2.7). It is essential that these signals a) be emitted before the occurrence of the hazardous event, b) be unambiguous, c) be clearly perceived and differentiated from all other signals used, and d) be clearly recognized by the operator and other persons. The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices. The attention of designers is drawn to the possibility of "sensorial saturation", which can result from too many visual and/or acoustic signals and which can also lead to defeating the warning devices. NOTE Consultation of the user on this subject is often necessary.	P	
6.4.4	**Markings, signs (pictograms) and written warnings**		
	Machinery shall bear all markings which are necessary a) for its unambiguous identification, including at least 1) the name and address of the manufacturer, 2) the designation of series or type, and 3) the serial number, if any, b) in order to indicate its compliance with mandatory requirements, comprising 1) marking, and 2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres), c) for its safe use, for example, 1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load, 5) necessity of wearing personal protective equipment, 6) guard adjustment data, and 7) frequency of inspection. Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine. Signs or written warnings indicating only "Danger" shall not be used. Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related. Readily understandable signs (pictograms) should be used in preference to written warnings. Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be Used. Written warnings shall be drawn up in the language(s) of the country in which the machine will be used for the first time and, on request, in the language(s) understood by operators. NOTE In some countries the use of specific language(s) is covered by legal requirements. Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms, symbols and colors in particular). See IEC 60204-1 as regards marking of electrical equipment. See ISO 4413 and ISO 4414 for hydraulic and pneumatic equipment.	P	
6.4.5	**Accompanying documents (in particular — instruction handbook)**		
6.4.5.1	**Contents**		
	The instruction handbook or other written instructions (for example, on the packaging) shall contain, among others, the following: a) information relating to transport, handling and storage of the machine, such as 1) storage conditions for the machine, 2) dimensions, mass value(s), position of the centre(s) of gravity, and 3) indications for handling (for example, drawings indicating application points for lifting equipment); b) information relating to installation and commissioning of the machine, such as 1) fixing/anchoring and dampening of noise and vibration requirements,	P	

Standard: EN ISO 12100:2010			
Clause	**Requirement-Test**	**Result**	**Verdict**
	2) assembly and mounting conditions, 3) space needed for use and maintenance, 4) permissible environmental conditions (for example, temperature, moisture, vibration, electromagnetic radiation), 5) instructions for connecting the machine to power supply (particularly on protection against electrical overloading), 6) advice on waste removal/disposal, and 7) if necessary, recommendations related to protective measures which have to be implemented by the user — for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals; c) information relating to the machine itself, such as 1) detailed description of the machine, its fittings, guards and/or protective devices, 2) the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate, 3) diagrams (especially schematic representation of safety functions), 4) data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties) used, 5) technical documentation of electrical equipment (see IEC 60204), and 6) documents attesting that the machine complies with mandatory requirements; d) information relating to the use of the machine, such as that related to or describing 1) intended use, 2) manual controls (actuators), 3) setting and adjustment, 4) modes and means for stopping (especially emergency stop), 5) risks which could not be eliminated by the protective measures implemented by the designer, 6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications, 7) reasonably foreseeable misuse and prohibited applications, 8) fault identification and location, for repair and for restarting after an intervention, and 9) personal protective equipment needed to be used and the training that is required; e) information for maintenance, such as 1) the nature and frequency of inspections for safety functions, 2) specification of the spare parts to be used when these can affect the health and safety of operators, 3) instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example, maintenance staff, specialists), 4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and 5) drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks); f) information relating to dismantling, disabling and scrapping; g) information for emergency situations, such as 1) the operating method to be followed in the event of accident or breakdown, 2) the type of fire-fighting equipment to be used, and 3) a warning of possible emission or leakage of hazardous substance(s) and, if possible, an indication of means for fighting their effects; h) maintenance instructions provided for skilled persons [item e) 3) above] and maintenance instructions provided for unskilled persons [item e) 4) above], that need to appear clearly separated from each other.		
6.4.5.2	**Production of instruction handbook**		
	The following applies to the production and presentation of the instruction handbook. a) The type fount and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colors, symbols and/or large print. b) The information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language is to be used, each should be readily distinguished from another, and efforts should be made to keep the translated text and relevant illustration together. NOTE In some countries the use of specific language(s) is covered by legal requirements. c) Whenever helpful to the understanding, text should be supported by illustrations. These illustrations should be supplemented with written details enabling, for example, manual controls (actuators) to be located and identified. They should not be separated from the accompanying text and should follow sequential operations. d) Consideration should be given to presenting information in tabular form where this will aid	P	

	understanding. Tables should be adjacent to the relevant text. e) The use of colors should be considered, particularly in relation to components requiring quick identification. f) When information for use is lengthy, a table of contents and/or an index should be provided. g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		
6.4.5.3	**Drafting and editing information for use**		
	The following applies to the drafting and editing of information for use. a) Relationship to model: the information shall clearly relate to the specific model of machine and, if necessary, other appropriate identification (for example, by serial number). b) Communication principles: when information for use is being prepared, the communication process "see – think – use" should be followed in order to achieve the maximum effect and should follow sequential operations. The questions, "How?" and "Why?" should be anticipated and the answers provided. c) Information for use shall be as simple and as brief as possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms. d) When it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional user. If personal protective equipment is required for the safe use of the machine, clear advice should be given, for example, on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale. e) Durability and availability of the documents: documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It can be useful to mark them "keep for future reference". Where information for use is kept in electronic form (CD, DVD, tape, hard disk, etc.), information on safety-related issues that need immediate action shall always be backed up with a hard copy that is readily available.	P	
7 Documentation of risk assessment and risk reduction			
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use); b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.); c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment; d) the information on which risk assessment was based (see 5.2): 1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.); 2) the uncertainty associated with the data used and its impact on the risk assessment; e) the risk reduction objectives to be achieved by protective measures; f) the protective measures implemented to eliminate identified hazards or to reduce risk; g) residual risks associated with the machinery; h) the result of the risk assessment (see Figure 1); i) any forms completed during the risk assessment. Standards or other specifications used to select protective measures referred to in f) above should be referenced. NOTE No requirement is given in this International Standard to deliver the risk assessment documentation together with the machine. See ISO/TR 14121-2 for information on documentation.	P	

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