Manual for Safety and Rigging

Éducation et culture

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FEDERATION EUROPEENNE DES ECOLES DE CIRQUE PROFESSIONNELLES

FEDEC

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Association Européenne pour la Recherche, L'Innovation et la Sécurité du Cirque

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Part1/ Introduction

SAFETY

The issue

Over the past thirty years, the world of live performances has gone through many major technical developments. The success of rock concerts and large-scale events has seen the widespread use of modular stage set equipment adapted specially for one-off or short-term productions.
In parallel to this, the development of new circus and street arts has given rise to unprecedented new apparatus and equipment that are highly aware in terms of the safety both of the performers and audiences.
This evolution in the industry, accompanied by the development of increasingly complex and mechanised equipment, has contributed to the emergence of new trades and professions associated with the construction of large structures (spectator stands, stages, scaffolding, technical grids, giant sets, and so on) and the management of working at heights. Hence the appearance of the concept of "difficult access work" or "acrobatic scaffolding" corresponding to the English term "rigging".

The rigging methods used and the major risks that they involve required the work to be carried out by experienced and well-trained professionals.

In this context, both the technicians and performers of the "circus world" need to be made aware of these techniques, as well as the corresponding methods used to prevent risks and the legal context in which they sit.

This need is reinforced by the development of circus schools that train future professionals in disciplines as sensitive as aerial acrobatics. The balance between freedom and management is, by its very nature, one of the essential issues of any process where becoming autonomous is involved.

Part1/ Introduction

2/ The Specific Nature of Circus Arts

The relationship between circus arts and employment legislation is not a straightforward one.
By their very essence, circus arts relate to a multitude of disciplines. As they have evolved, they have been enriched by artistic, aesthetic and technical innovations brought in by other forms of spectacle (theatre, music, dance, etc.), as well as by industrial and technological developments. As a result, they are particularly sensitive to the notions of mixing, researching and exploring.

In addition to this, the jobs carried out on a daily basis by circus performers present numerous specific features as a result of their nature and the level of performance that is essential for them to be achieved successfully.

Expressing emotion in the circus arts is closely linked to a certain representation of danger. In the circus, the artiste's performance makes the risk involved perceptible for the audience, as well as the performer's technical skills acquired over long period of training and assessed on a daily basis, enabling the performer to position that risk in an acceptable way.
As a result, the debate fired up in professionals by the approach taken to safety calls on a number of fundamental questions:

* How do we respect artistic requirements in the light of employment legislation?
* What are the boundaries that separate the world of art from the world of working?
* Can artistic actions be assimilated entirely with working situations?

Out of all professional practices, circus arts constitute a highly specific range of activities. Consequently, they require appropriate prevention, safety and evaluation methods to go with them.

3/ Objectives of the Module

The aim of this module is to create a common technical approach to circus equipment and apparatus. To do this, the module is built on the following programme:
* Presentation of technical knowledge and fundamental regulations;
* Dissemination of "good practices" between the various participants;
* Practical situational exercises;

Part1/ Introduction

In particular, the programme covers the following subjects:

* Techniques for protecting against falling from heights;
* Circus apparatus and equipment and the techniques used for installing them;
* Use of the rigging accessories needed to install them;
* General understanding of the physical aspects associated with this apparatus: equilibrium of forces, traction angles, dynamic actions, absorbing forces in falls, etc.
* Knowledge of the regulatory environment associated with this apparatus.

Breaking taboos?

THE SHOW MUST GO ON
GO HARD OR GO HOME
NOTHING HAPPENS UNTIL IT HAPPENS
ANYTHING THAT CAN HAPPEN ONE DAY MAY HAPPEN TODAY

part2/ Risk Management

"Being aware is already the beginning of compliance

1/ A question of attitude

"There's no such thing as zero risk"
This phrase, often used after an accident or disaster, represents an obvious statistical truth. Nevertheless, the important thing is not in the phrase itself, but in the attitude that goes with it:

Sterile attitude
A sterile attitude consists of paying lip-service to the principle and going no further. "Prevention, safety, training and checking are all very well, but they don't change much because there's no such thing as zero risk."
This point of view provides a direct benefit: It enables the reader to skip directly to the next chapter.

Constructive attitude
"There's no such thing as zero risk. So we have to maintain daily vigilance and equip ourselves with tools for understanding and management that enable us to prevent risks effectively."
This point of view requires our mind-set to evolve and demand genuine commitment from everyone.

Identifying ideologies
There are all sorts of ways of looking at risks.
And they all more or less come under one of these ideologies:

* Standard: any action involves risks, only people who don't do anything don't take any risks...
* Fatalistic: Risks are part of life...
* Suicidal: You've got to die of something...
* Absolute: We need to reduce risks to zero, apply the "precaution principle"...
* Evaluating: Of course there are risks, that's why it's a business for professionals...

* Passionate: I know it's a profession that involve risks, but it's what I love doing. I went into it with my eyes wide open...

Scale of behaviour types

* ignore
* deny
* pass off on to others
* justify
* assume
* compensate for
* analyse
* correct
* prevent

part2/ Risk Management

2/ Making a choice

The force ratios at work in the world of employment are such that the question of professional risks deserves some sort of tool so that we can see clearly.

"You have to work to live. So that's an excellent reason for staying alive at work!"

Some affirmations sound obvious:

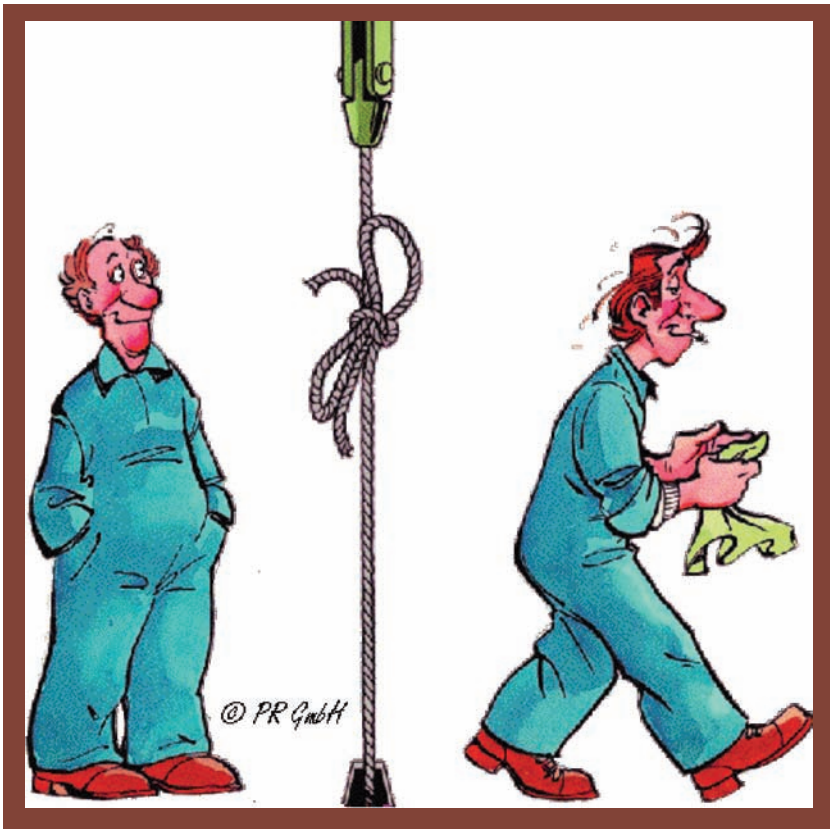
"Poverty is the result of a number of economic processes."

So why should it be less clear when it's about work?

"Professional risks are the result of a number of management processes."

As a result, professional risks can be identified, evaluated, anticipated and reduced. Provided the resources are available.

"Safety has a cost, but not a price"



3/ Keys for understanding

The risk scale

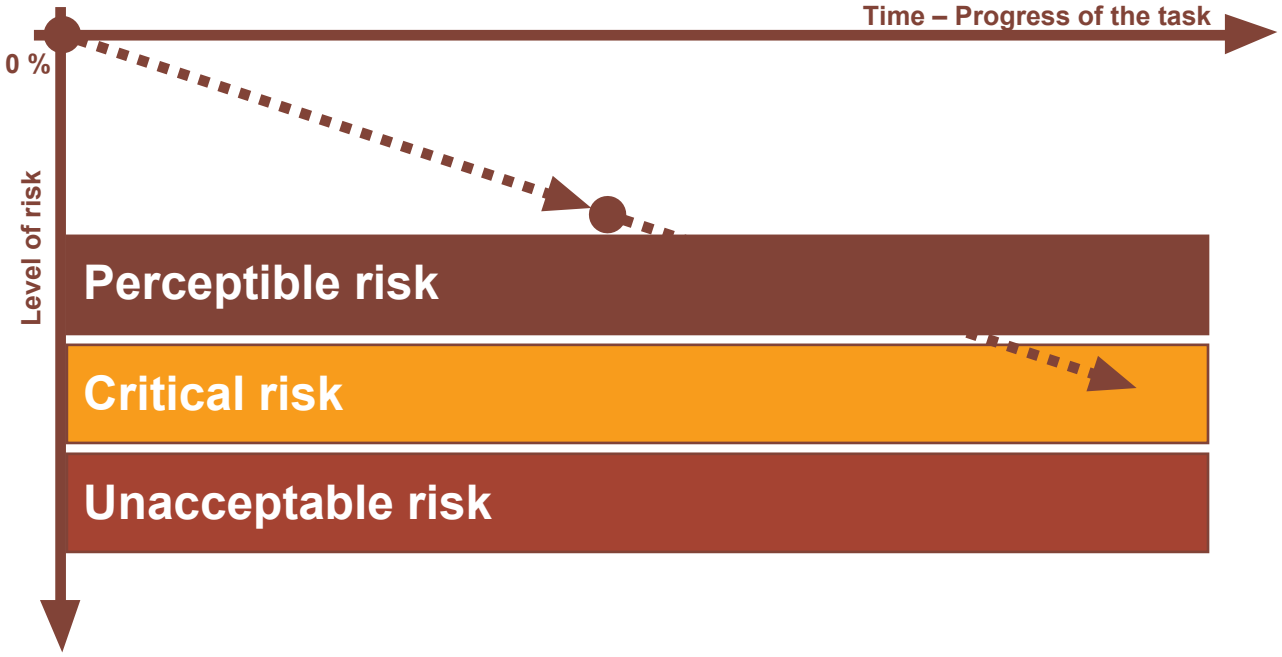
The level of risk associated with a professional task can be shown on a graph:

The way that a professional task with a low and well-controlled level of risk progresses is then represented by a slightly downward trajectory that ends up in the acceptable risk zone.

A more dangerous task is represented by a steeper slope:

part2/ Risk Management

If the task takes twice as long (double the amount of work), it results in an overall level of risk that is twice as great.



This is a simple statistical consequence.

Example: building a large stadium:

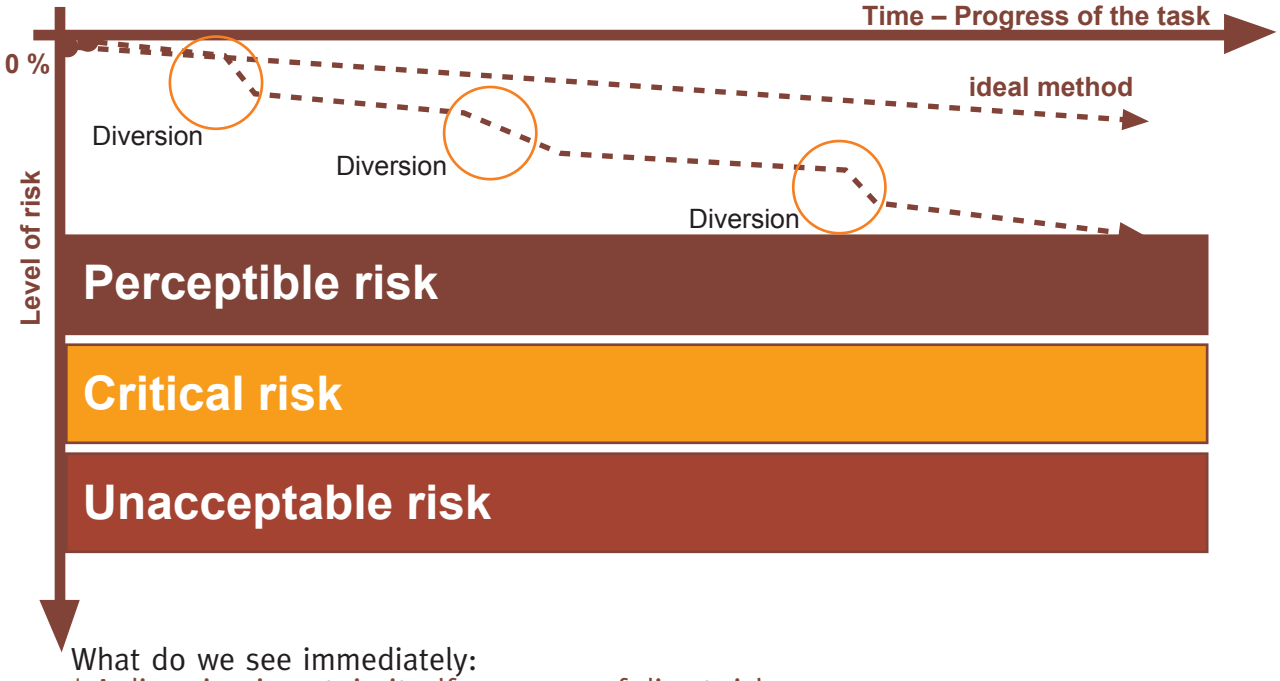
* 100 000 man-days,
* 2 dead workers.

Is that a lot? From a human point of view, certainly.
But statistically it is within the average for the construction industry.
The more the quantity of work increases, the greater the number and seriousness of accidents.

part2/ Risk Management

Diversions

A diversion is simply a small departure from the ideal way of doing something. It can be seen from a local steepening of slope on the graph.



What do we see immediately:
* A diversion is not, in itself, a source of direct risk.

But!
* The diversions accumulate,
* Each diversion takes us a little closer to the immediate danger zone,
* The accumulation of small, acceptable diversions ends up presenting an unacceptable level of risk.

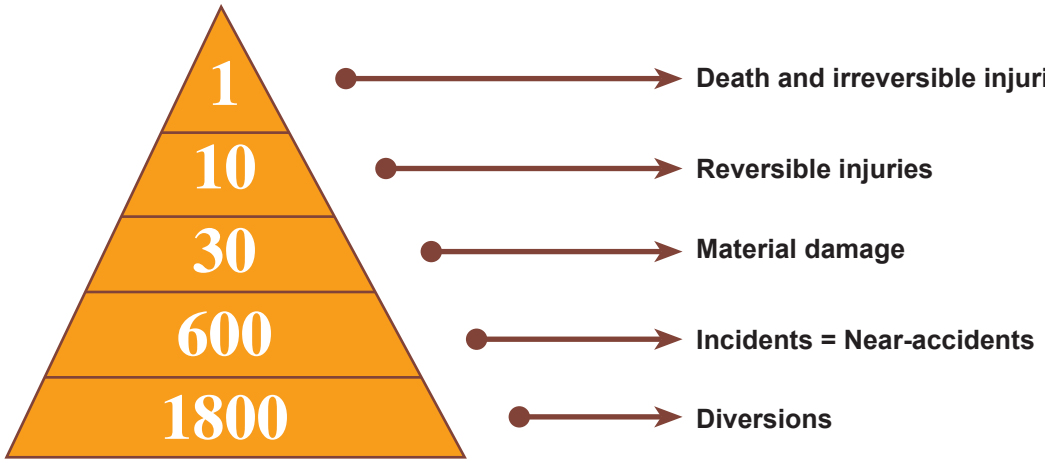
By accumulating small, acceptable, a level of unacceptable risk is always reached.

To tolerate diversions is to accept that a serious accident is coming a little closer every day.

The BIRD triangle

Analysis of the statistical breakdown of accident triggers in a job shows that the number of major (rarer) accidents is linked to the number of minor incidents.

The triangle below is considered as a relatively accurate proportion of reality:

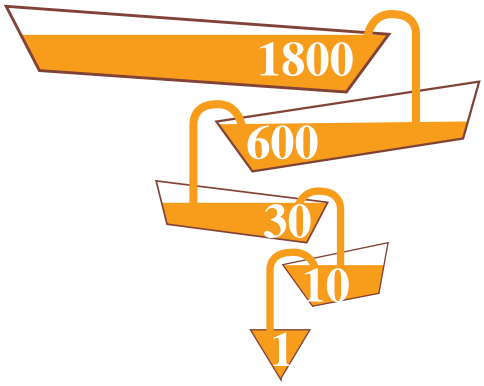


So this triangle shows that things are linked:
* There is never a single cause to a serious accident.
* It is the accumulation of minor incidents when, when put end to end, gradually result in

the triggering of serious accidents.
* We therefore have to act on the sources of risks and not tolerate diversions.

Overflowing tanks
By inverting the Bird triangle, the various levels can be considered as tanks that automatically overflow into one another.
So, statistically, we can see that:

* 3 diversions lead to one incident
* 20 incidents correspond to an incident of material damage
* 1/3 of incidents of material damage are associated with an injury
* 1 injury in every 10 is extremely serious.

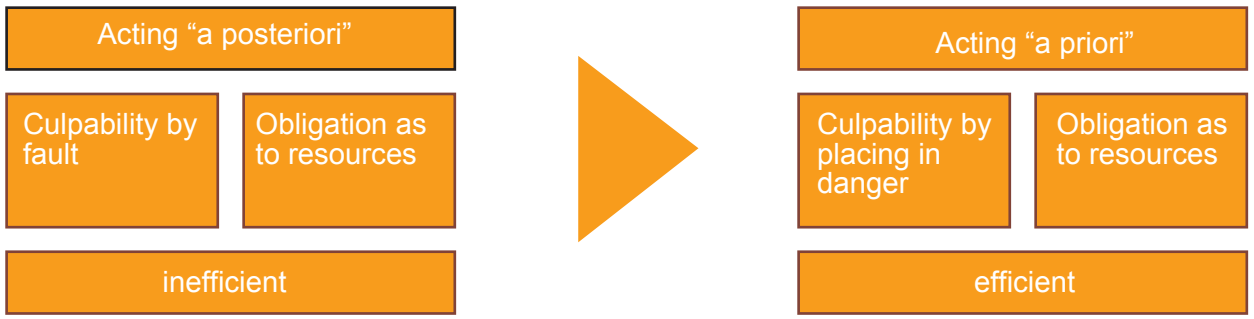


4/ Sources of solutions
There are, of course, ways of having an influence on these phenomena. In particular, we can see that:

* diversions are identifiable, and can be corrected,
* repeated incidents are a source of information about the location of risks,
* the seriousness of some injuries can be effectively reduced by using protective or emergency methods,

Having said that, some major accidents do not directly obey this cumulative process. Typically, falls from a height are not due to a series of incidents, but rather to a very significant diversion: the absence of devices to protect against falls.

III. Evolution of the Legal Framework
The benchmark legal text in this matter is European directive 89/391 issued on 12th June 1989 regarding the implementation of measures aimed at promoting improvements to the health and safety of workers in the workplace.
In the spirit of this directive, the obligations of employers have gradually moved from the principle of fault and the obligation of resources to the principle of putting other people in danger and an obligation as to results. The former works a posteriori (after the fact), while the aim of the latter (more restrictive) is to work a priori (before the fact).



1/ Chronology of an incident

Prevention

The prevention of risks is a very general principle that brings together all of the actions that can be taken, a long way upstream from the accident, in order to limit the risk factors which, when they are left to accumulate, can lead to an accident.

Risk prevention in particular includes programmes for training, inspection and maintenance.
Example in the area of live performance equipment:
* The mandatory training of users of mobile lifting platforms/cherry-pickers for staff;
* The regular inspection of electric chain hoists (every 6 or 12 months);
* The preventative maintenance of mechanical equipment;

Detecting the incident

Incident detection is a key factor in risk management. Depending on the speed at which the hazardous element moves, it may allow action to be triggered more quickly and hence avoid a disaster, or restrict the extent of the incident.

In the area of fighting fires, smoke detection is a very effective way of triggering automatic fire-extinguishing systems and of speeding up the deployment of fire-fighting resources and the emergency services.

Example in the area of live performance equipment:
* The dynamometers fitted to a complex lifting structure make it possible to identify any overload before the load-bearing capabilities of the system are exceeded.
* In the same way, in electricity, a differential circuit-breaker acts as a detection device.

Active safety

The concept of "active safety" is generally associated with equipment that acts before the accident happens in order to avoid a disaster from occurring or restricting the extent of the disaster.

In the automotive world, active safety accessories are devices that come into action in specific cases to help the driver avoid or limit an accident (ABS braking, stability control, etc.).
In the area of live performance equipment, active safety devices are unusual.

Passive safety

The concept of "passive safety" is generally associated with equipment or features that act during a disaster to limit its consequences.

In the automotive world, passive safety may be linked to passive features (the ability of the structure to absorb the shock of a crash) or equipment that acts at the time of the crash (airbags, pyrotechnic seatbelt tensioners, etc.).
This means that the distinction between active and passive is not clear because it is not linked to the passive behaviour of the equipment, but to the time at which it acts.
* Example in the area of live performance equipment: The safety slings on the equipment suspended above the audience are a passive safety device.

part3/ Safety principles

Evacuation + fighting the disaster
Some disasters are instantaneous (explosions, equipment falling, collapses), while others sometimes leave people the time to fight against the cause or evacuate people and possessions (fires, floods).
In the area of establishments that accommodate the public, evacuating people needs to be carried out under optimum safety conditions (crowd panic) and in as short a time as possible (under 5 minutes).
* Example in the area of live performance equipment: The advance positioning of fire-extinguishers close to the sources of flames is a prevention principle that significantly speeds up the implementation of fighting the effects of a fire.

Implementing methods of fighting fires must never be carried out to the detriment of the procedure for evacuating people.

Emergency services
The emergency services are those services that bring assistance to people.
For large-scale gatherings of people or activities that present specific risks the advance positioning of emergency service-providers (people) or emergency devices (equipment) is a method often used to improve the efficiency of the way the emergency is dealt with.
* Example in the area of live performance techniques: The training of working emergency staff and the advance positioning of a first aid kit and a stretcher are of value for limiting the medical consequences of an accident.

2/ To summarise
Before the incident
* Prevent
* Avoid
* Detect

During and after the incident
* Limit the consequences
* Evacuate + Fight
* Provide assistance

3/ Other principles
Solidity - Reliability
Reliability is linked directly to the operating quality of the equipment: sturdiness, stability, strength, precision, etc.
* Example: A rope of _ 12 mm is stronger than an identical rope of _ 10 mm.

Usage coefficient (design factor)
The usage coefficient is the ratio between the physical capabilities of an item of equipment and maximum constraints that it undergoes when it is used.
* Example: When a shackle is rated for a maximum usage load of 1000 daN, the manufacturer guarantees, through the CE compliance certificate, that the breaking load for the shackle is greater than 4000 daN. (usage coefficient = 4)

Tolerance
Tolerance is the equipment's sensitivity to various factors: temperature, humidity, ability to absorb shocks, etc.
* Example: Of equal strength, polyamide rope has a greater capacity to resist shocks (overloads) than hemp rope.

Perception of the anomaly
Perception of the anomaly is the ability, for the operator, to perceive the weakness or defect in the device before a serious incident occurs, (movement, flexing, abnormal tension).
* Example: A rope with a large capacity to distort (elasticity) makes it possible to detect overloads. By contrast, with a metal cable (more rigid), it is not possible to detect too heavy a load visually.

Redundancy (Single Failure-Proof)
Redundancy is a fundamental concept in the area of equipment safety.

Redundancy is generally assured by adding an "independent device with different technology".
The aim of redundancy is to avoid a single failure resulting in a technical incident. It requires at least two simultaneous technical failures to cause an incident that, statistically, virtually never occurs.
* Example: The lights used for a live performance are attached by a hook and secured by a separate sling.

Positive security
The concept of "positive security" means that the device is designed in such a way that any "natural" failure of the device causes the system to be made secure (fail-safe).
* Example: The safety brake on a lifting winch operates through the "lack of power", in order words the electrical current enables the springs to be retracted by an electromagnetic mechanism, which causes the braking action. As a result, any problem with the electrical power will cause the brake to operate.

Security of commands
The security of a system of commands is linked to a multitude of technical criteria.
* Example: A command requiring a voluntary action by the operator (push-button held in) is safer than an automatically programmed device.
* Example: To avoid inadvertent pressure activating a command, push-buttons are generally enclosed in a metal cylinder.
* Example: An emergency stop is a device that cuts the main supply of current in the system instantly. If there is an electrical or mechanical problem, it makes it possible to bypass the electronics and programming and stop the system entirely.

Part4 / Laws & Standards

Table of contents

NB : The legal texts are globally stemming from European directives related to equipments and safety at work. Nevertheless the references of the articles are depending on the national legislations. If you are looking for the reference in your country, we suggest you to refer to the European directive translated in the language you need.
All the other legal references are stemming from the French legislation.

LAWS & STANDARDS

1/ Summary

The regulations that apply to live performance activities are not clearly identifiable.

In the main, they depend on the employment code whose requirements are often considered as incompatible with artistic needs.
Why is why two memoranda have supplemented and given details of the legal context:

* The "SAFETY in LIVE PERFORMANCE" memorandum, published in April 1999 by the National Council of Stage Design, with the support of the Ministry for Culture;
* The "Design and Manufacture of Circus Apparatus" memorandum, published in October 2003 by the Hors-Les-Murs association, with the support of the Ministry for Culture;

Although the applicable technical provisions have to be searched for in part in various decrees (se below), and the organisational provisions have to be taken in full from the employment code (Training, risk assessment, prevention, etc.).

In addition, it should be pointed out that some presumably non-compliant practices can generally be implemented provided appropriate compensatory measures can also be used:

* Risk prevention: organisation, anticipation, evaluation of sources of danger, evaluation of human and material needs, evaluation of aggravating factors (speed, fatigue, poor lighting, etc.)
* An exact evaluation of the static and dynamic loads in each element,
* Selection and use of suitable equipment and accessories of appropriate quality: CE-compliant lifting tools, CMU-marked and inspected regularly,
* Securing of sensitive devices by an additional method that is separate and of a different design,
* Installation of collective protective devices for people (lifelines, safety nets, foam mattress, etc.) as a default if it is not possible for technical reasons, choice and correct usage to have individual protective devices (harnesses, tethers, absorbers, etc.),

2/ Warning

There are many regulations that apply to live performance activities and their ramifications are complex.

Consequently, this chapter does not claim to be exhaustive. It features the most significant extracts of the various texts. Some other legal information is inserted directly into the various chapters in question.

3/ Hierarchy of texts

The various regulatory texts may originate from various levels of legal power:

* European directives
* "Generalist" codes
* Construction and housing code
* Town-planning code
* Employment code
* Social security code
* Code of territorial collectivities
* Highway code
* Insurance code
* etc.
* "Sanctions" code:
* Civil code
* Criminal code
* Non-classified texts:
* Acts
* Decrees
* Orders
* Ministerial circulars
* Technical norms and standards
* Standards with an application decree
* Ratified standards
* Simple standards
* ISO (International)
* CE (European)
* NF, NBN, DIN, BS, etc. (French, Belgian, German, British)
* Collective agreements
* Industry standards
* Company policies and procedures
* Hierarchical instructions

4/ European Directive 89-391, known as the "Framework Directive"

Directive 89/391 amended by regulation n° 1882/2003; relative to the implementation of measures designed to promote the improvement of the health and safety of workers in the workplace.
The ***basic text*** sets out the main principles for preventing professional risks and the obligation as to results of employers. The scope of this text is too general to be presented here.

5/ European Directive 89-655 "Work Equipment"

Directive 89/655 amended by directives 95/63 and 2001/45; relative to the minimum health and safety requirements for the use of work equipment by workers in the workplace.
VII. European Directive 89-654 "Workplace"

6/ Directive 89/654; relative to the minimum health and safety requirements in workplaces.

Part4 / Laws & Standards

7/ European Directive 89-686 "Manufacture of PPE"

Directive 89/686 amended by directives 93/68, 93/95 and 96/58; relative to the harmonisation of the legislation in Member States relative to Personal Protection Equipment (PPE).

8/ European Directive 89-656 "Use of PPE"

Directive 89/656; relative to the minimum health and safety requirements for the use of personal protection equipment by workers in the workplace.

9/ European Directive 2006-42 known as "Machine Directive"

Directive 98/37 amended by directives 95/16 and 2006/42; relative to machines. Extracts:

4. additional essential health and safety requirements to counter hazards due to lifting operations

4.1.1. Definitions
c) "Usage Coefficient": arithmetical ratio between the load that a component can sustain, guaranteed by the manufacturer or the manufacturer's representative, and the maximum usage load indicated on the component.

4.1.2.3. Mechanical strength
The machine and lifting tools, as well as their components must be able to stand up to the constraints to which they are subjected when in operation and, if needs be, when not in operation, in the installation and operating conditions intended for them and in all possible configurations, taking account, where appropriate, of the effect of weather factors and the forces exerted by people. This requirement must also be complied with during transport, assembly and dismantling.
The machine and lifting tools must be designed and constructed in such a way that they avoid failures caused by fatigue and wear, taking account of the planned usage. The materials used must be selected taking account of the intended environments for use, especially with regard to corrosion, abrasion, knocks and shocks, extreme temperatures, fatigue, fragility and ageing.

4.1.2.5. Lifting tools and their components
Lifting tools and their components must be sized to take account of fatigue and ageing for a number of operating cycles that corresponds to the service life set out in the service conditions specified for a specific application.
Comment from the French employment code: Decree issued on 1st August 1965 relative to safety on worksites: Ratio between the dimension of pulleys and the type of cables:

In addition:
*a) the **usage coefficient** of the **metal cable** and end components must be selected in such a way as to ensure an appropriate level of safety; in general, this coefficient is **5**. Cables must not be spliced or looped in any way, except at their extremities;*

*b) when welded link **chains** are used, they must be of the short-link type. The usage coefficient of chains must be chosen in a way that ensures an appropriate level of safety; in general, this coefficient is **4**;*

*c) the usage coefficient of **cables or slings made from textile fibres** depends on the material used, the manufacturing process, dimensions and use. This coefficient must be chosen in a way that ensures an appropriate level of safety; in general, this coefficient is **7**,*

*d) the usage coefficient of all **metal components** in a sling, or components used with a sling, is selected in such a way as to ensure an appropriate level of safety; in general, this coefficient is **4**;*

on condition that it can be demonstrated that the materials used are of very good quality and the manufacturing process is appropriate for the intended use. If this is not the case, the coefficient is generally set at a higher level in order to obtain an equivalent level of safety.

Usage coefficients

4 for chains and metal accessories,
5 for metal cables and their ends,
7 for accessories made from textiles, natural and synthetic.

4.3. INFORMATION AND MARKINGS

Every lifting accessory must display the following markings:

* identification of the manufacturer;
* identification of the maximum usage load;
* "CE" marking.

For accessories [...] on which it is materially impossible to place the markings, the information dealt with in paragraph 1 must be shown on a plate or other methods securely attached to the accessory.
These indications must be legible and placed in a location where they are not likely to disappear as the result of machining, wear, etc. nor compromise the strength of the accessory.

4.4. INSTRUCTION NOTICE

Each lifting accessory or each commercially indivisible batch of lifting accessories must be accompanied by an instruction notice giving the following instructions as a minimum:

*** the intended use;**
*** any restrictions on use;**
*** the instructions for assembly, use and maintenance;**
*** the static testing coefficient used.**

The requirements of successive "Machine Directives" have been transcribed on a number of occasions into the various national legislations of countries within the European Union. In France, these details are featured in annexes 1 and 2 scheduled by article R 233-84 of the employment code.

10/ Memorandum: "Design and manufacture of circus apparatus"

Ministry for culture -Hors-Les-Murs Association - October 2003

Dynamic factors

The dynamic factor linked to the use of aerial apparatus is the arithmetic ratio between the maximum stress applied to the apparatus by the acrobats and their mass. This ratio is due to the movement of the acrobats (fouettés, releases, catches, falls, spins, etc.) and the centrifugal forces induced by the sway.
The research work associated with the drafting of this memorandum resulted in the definition of the following dynamic factors:

* Fixed apparatus: dynamic factor = 2
* Swaying apparatus: dynamic factor = 5

11/ "Acrobatics" decree issued on 12th September 1960

Article 1

*[...] aerial acrobatic acts, in which the performers have to work at **over 5 metres** above the*

ground and, in addition, have to carry out releases, i.e. at certain moments, lose all contact, either with the apparatus or with a partner.

Article 2
Prior to any aerial acrobatic act (or any rehearsal of the act), as defined in article 1, the business involved have to ***install a safety net*** *attached with every form of security required, to the superstructure of the venue where the performances or rehearsals are taking place. [editor's note: A* ***foam mat*** *appropriate to accommodate the height of any fall is also acceptable]*

Article 3
Should the proper installation of a safety net such as that described in article ***2 be impossible,*** *the performers must, when they are working,* ***wear a safety harness attached by a tether to an anchor point on the superstructure of the venue.***
[...]

12/ "Lifting persons" decree issued on 2nd December 1998

setting out the conditions that load-lifting equipment must comply with to be able to be used to lift persons.

EMPLOYMENT CODE Art. R. 233-13-3
The lifting of persons is only allowed with the work equipment and accessories designed for this purpose. *However, work equipment not intended to lift persons may be used to reach a work location or to carry out work when the use of equipment specially designed for lifting persons is technically impossible or exposes those persons to a* ***greater risk associated with the working environment. [...]***
Work equipment not intended to lift persons may also be used for this purpose if, ***in an emergency, the evacuation*** *of these persons so requires.*

Article 1
Under the conditions set out in article R. 233-13-3 of the employment code, equipment used to lift loads can be used to lift persons on condition that it meet the obligations set out in the articles below.

Article 2
The total weight of the passenger compartment, persons and loads lifted and transported must not exceed 50% for anchored equipment and 40% for mobile equipment of the nominal load, at maximum range, within the configuration used.
[...]

IMPORTANT! The spirit of article 2 constitutes a minimum criterion to comply with in the live performance industry.

Article 12
The apparatus must be fitted with devices preventing the passenger compartment from drifting dangerously or falling unexpectedly in free fall should there be a total or partial failure of the power, or when the actions of the operator cease.

13/ "Lifting persons" circular issued on 15th June 1999

This circular sets out the conditions of application and any interpretation of the decree issued on 2nd December 1998.

The decree lists a limited number of the situations in which the use of equipment for lifting loads is possible for lifting persons. These situations are extremely rare, and the use of equipment designed to lift loads to lift persons will, effectively, be prohibited [...]. [...], work conducted at a height, whether it be work carried out for commercial purposes or building works, must be carried out with apparatus that has been specially designed to lift persons or all other safe means of access and work. [...]

These latter situations, in which as an exception to the general basic principle, resorting to load-lifting equipment to lift persons is authorised, are as follows:

* when the use of specially designed equipment is not possible for technical reasons: this involves working configurations for which appropriate lifting equipment for persons **do not exist on the market** (e.g. certain work carried out a great heights in shipyards). This exception does not cover a situation where there may be a large distance from the potential supplier of appropriate equipment or where the cost of supplying such equipment is very high,

* when the use of specially designed equipment exposes the persons to a **higher level of risk** associated with the working environment: this, for example, might be a case resulting from working on the top of a chimney that has been struck by lightning, shoring up an unstable cliff, stacking containers on top of one another,

* when the use of equipment that has not been specially designed is required for **the evacuation of persons** in an emergency.

* If the manager of the establishment is not faced with one of these situations, he is obliged to use a lifting device that has been specially designed to lift persons.

* Consequently, it is only in one of these very rare situations that the manager is permitted to resort, under his own responsibility, to using equipment for lifting loads. [...]

14/ "ERP" decree issued on 25th June 1980

SECTION 2: STAGE AREAS THAT CAN BE SEPARATED FROM THE AUDITORIUM (WHERE THERE IS A FIRE CURTAIN)

Article L 65: Fittings and sets
§ 1 Staircases, ladders, service bridges, the framework of grills, floor supports, ***machinery and in general*** *all stable installations or where fixed equipment is fitted within the stage area must be made from* ***incombustible materials. However, this provision does not apply to pulleys and ropes used for sets.***

SECTION 3: STAGE AREAS THAT ARE PART OF THE AUDITORIUM
(WHERE THERE IS A FIRE CURTAIN)

Article L 78: Technical fittings
§ 2 ***Technical ceilings must be made from incombustible materials.*** *[...]*
§ 3 All technical equipment must be attached in a way that never poses a risk for the audience. Mobile equipment other than sets, situated above the audience's heads must be ***attached by two separate systems with different designs.***

The staff in the establishment must make an inspection round before the performance to ensure that no equipment that is likely to fall on the audience has been left on components of the technical ceilings. [...]

Article L 80: Sets
§ 3 Mobile sets that are part of the show underway are permitted if all of the following provisions are complied with:
** their movements do not compromise either the safety or ability to evacuate the audience;*
** each anchor point must be duplicated by a separate anchoring system with a different design;*
** the anchoring systems must be inspected and verified by an accredited body.*

Part4 / Laws & Standards

15/ In plain language...

Interpreting, or even combining, these various regulatory requirements is not always straightforward. Consequently, we have to consider the following principles:

Lifting loads above the audience's head:
Equipment used to life loads above the audience must:

* Comply with the requirements of the marking code (name of the manufacturer, CMU, CE);
* Not be used in excess of their maximum operating load (CMU);
* Be properly installed, in accordance with industry standards and the instruction manual;
* Be secured by a "separate system of a different design".

Lifting loads above workers (performers and technicians):
The equipment used to lift loads above workers must:

* Comply with the requirements of the marking code (name of the manufacturer, CMU, CE) ;
* Be properly installed, in accordance with industry standards and the instruction manual;
* Not be used in excess of their maximum operating load (CMU) and be secured by a "separate system of a different design"

Or

* Not be used in excess of half of their CMU rating.

Lifting technicians:
Lifting persons with equipment other than that designed for that purpose (PEMP-type mobile lifting platform) is totally forbidden by the regulations. No preventative measure, no additional safety device is sufficient to make a standard lifting device into a solution that is appropriate for lifting persons.
Working on ropes is only permitted to the extent that a conventional solution that makes it possible to give preference to collective protection measures is technically impossible, which is extremely rare. Such techniques must then be implemented in accordance with the regulations: double rope, double hook, installation of a mobile safety device on a flexible support or an anti-fall device with automatic rappel.

Lifting performers:
Lifting performers with equipment other than that designed to lift persons is only allowed where the use of compliant devices would disrupt the desired artistic effect to too great and extent.
Example: presence of an unsightly handrail at the front of the stage, on a raised set or when appearing in a safety cage
Which is why "theatre machinery lift" safety cages are specifically excluded from the European directive governing machinery compliance.
Nonetheless, we should highlight two important points:

* This exclusion only covers elements that are directly visible to the audience. Example: A hoist, concealed in the grill, intended to lift a performer must either comply with the regulatory requirements that apply to devices that lift persons more than 3 metres (certification procedure via an accredited European body), or be duplicated by an independent device of the "mobile anti-fall type on flexible support" (EN standard 353-2) or "anti-fall device with automatic rappel" (EN standard 360) which will be attached directly to the frame of the building.
* This exclusion does not give the employer dispensation from implementing every appropriate compensatory measure to comply with regulations and industry standards. Example: A lack of safety rail round the outside of a safety cage does not give the designer/manufacturer dispensation from installing a compliant device to prevent the risk of shearing.
* This exclusion does not give the performer dispensation from wearing a compliant safety

harness, if necessary worn under his costume, that at least meets the requirements of "support at work" in the area of protection against falls from heights. (EN standard 358)

16/ Safety in live performance memorandum

Ministry for culture - National council of stage design - April 1999

LIFTING, HANDLING LOADS, LIFTING PERSONS
Lifting operations, handling loads, especially manually and lifting persons are the source of over one-third of accidents in "live performances". Numerous situations, for example:

* [...] actor "flying",
* [...] attachment to and slinging from a structure or scaffolding tower

These situations present major risks and are the subject of specific regulations in the employment code.

Risks relative to "Flying" during performances.
Risk: Falling from a great height.
Performers will mandatorily be equipped with a harness that complies with EN standard 361 (if required incorporated as part of the performer's costume). This harness will be **connected** by standard-compliant clasps and tethers (CE marking) to:

* The elements required for the flight to take place (hoists, booms, etc.).
* **A fixed structure in the building** designed, tested and checked for this purpose, fitted with a standard-compliant anti-fall device (possible with a winder).

Standards: EN 353-1; EN 353-2; EN 354; EN 358; EN 360; EN 362; EN 363; EN 365; EN 795.

Risk: Collision with an element of the set.
Vertical or horizontal movements at a speed greater than 1.5 m/second may only be carried out in areas where there are no structures (set, gangway, stage), including areas that are likely to be affected by swaying.

The elements used to carry out the movements (hoists, booms, one-off equipment, etc.) will have a level of reliability equivalent at least to that required to lift loads over the heads of persons.

Also, so that the speeds and spaces defined above cannot be reached even if elements malfunction or operators make mistakes, implement the necessary resources:

* mechanical stop on movements,
* speed limiter . [...]

Verification of sets and equipment
The aim of classification is to define the level of monitoring of the structure (internal or external) and the documents relating to it, based on an assessment of the risk inherent to operating each element of a set in the same production. In the same production, each set or element of a set may have a particular classification based on the criteria set out below. [...]

Category C
Included in this category are all set elements of a greater complexity than those in category B, i.e. :
* [...] equipment built into the rigging loft weighing more than 200 kg,
* as well as **any element that lifts persons** (flying, appearance, etc.) and elements built in a precarious position [...]

It should be reminded that it is up to the producer to evaluate the risks involved in any working situation (see Article L 230-2 of the Employment Code). As a result, for all elements that are not included in the categories above, the category should be classified after analysis of the risks.

Method of inspection
Category C element
An inspection that includes checking the calculation notes will be carried out by a person who at least has the **accreditation from bodies that specialise in inspecting structures.**

Documents supplied: execution plans on a scale of 1:20 and 1:50, calculation notes, assembly plans. As in category B, the lead time for supplying these documents will be stated in the contract.
It is up to the producer to decide on when an inspection body should become involved, and whether there is any doubt as to the qualifications of the persons given responsibility for these assignments.

17/ "Risk Prevention Act" passed on 31st December 1991

Amending the employment code and the public health code for the purpose of promoting the prevention of professional risks and transposing the European directives relating to health and safety in the workplace.

EMPLOYMENT CODE Art. L. 230-2
I. The establishment manager will take the measures required to ensure safety and protect the health of the workers in the establishment, including temporary workers. [...]
II. - The establishment manager will implement the measures provided for in I above on the basis of the following general prevention principles:
a) Avoid risks;
b) Evaluate those risks that cannot be avoided;
c) Fight risks at their source;
d) Fit the work to the person, (design of workstations [...])
e) Take account of the state of development of technology;
f) Replace that is dangerous by something less dangerous;
g) Plan prevention by incorporating [...] the way the work is organised [...] ;
h) Take collective protection measures by giving the priority over personal protection measures;
i) Give appropriate instructions to the workers.

EMPLOYMENT CODE Art. L.230-3
[...] it is the responsibility of every worker to take care, based on his/her training and capabilities, of his/her health and safety, as well as the health and safety of the other people involved as the result of his/her actions or omissions at work.

EMPLOYMENT CODE Art. L.230-4
The provisions of article L.230-3 do not affect the principle of the responsibility of employers or establishment managers.

18/ Right of withdrawal

Employment Code Art. L.231-8-1
No sanction or no deduction of salary may be taken against a salaried worker or group of salaried workers who have withdrawn from a working situation where they had a reasonable reason for thinking that there was a serious and imminent danger [...].

19/ Training obligation

See also the chapter on "Mandatory Training"

Employment Code Art. L.230-2
Establishment managers will take any measures necessary to ensure the safety [...] of workers [...] These measures include actions to prevent professional risks, information and training, as well as the implementation of appropriate organisation and resources.

Employment Code Art. L.231-8
The existence of inexcusable misconduct on the part of the employer [...] presumed to be in place for salaried workers under fixed-period contracts and salaried workers made available to a company [...] allocated to these working positions [...] for which they may not have been given advanced safety training. [...]

20/ Supply of Working and Protective Equipment

Employment Code Art. R.233-1
Establishment managers must make the necessary working equipment available to workers that is appropriate for the work to be carried out or suitably adapted for that purpose with a view to preserving the health and safety of workers. [...]
In addition, establishment managers must made available the appropriate personal protective equipment.
The equipment mentioned above does not constitute a benefit in kind. [...]

Employment Code Art. R.233-42
[...] the personal protective equipment and work clothes dealt with in article R. 233-1 must be provided free of charge by the establishment manager, who will also ensure they are working properly and are in satisfactory hygienic condition by carrying out the necessary maintenance, repairs and replacements.
Personal protective equipment is reserved for personal use in the context of the professional activities of the person it is allotted to. [...]

21/ "Working at heights" decree issued on 1st September 2004

See Employment Code articles R233-13-20 to R233-13-37

EMPLOYMENT CODE: Article R233-13-21
When temporary work at height cannot be carried out from the work surface [...]. Priority must be given to equipment that ensures the collective protection of workers. [...]

EMPLOYMENT CODE Art. R. 233-13-23
The techniques of access and positioning using ropes must not be used to create a place of work. However, if this is not possible otherwise [...], they can be used for temporary working at heights.

EMPLOYMENT CODE Art. R. 233-13-24
It must be possible to access placed of work for carrying out work at heights in total safety. [...] This means of access must [...] enable assistance to be provided quickly to anyone in difficult and allow evacuation in the event of imminent danger.

EMPLOYMENT CODE Art. R. 233-13-37
The use of access and positioning techniques involving ropes must comply with the following conditions:
a) The system must have at least two semi-static work ropes, [...] These two devices are anchored separately and the two anchoring points must be the subject of a calculation note drawn up by the establishment manager or by a qualified person;

b) Workers must be fitted with an appropriate safety harness to prevent them falling (full harness compliant with EN standard 361), [...]

c) Any tools [...] must be tied on [...];

d) [...] in such a way that help can be brought immediately to the worker in the event of an emergency;

e) Workers must be given appropriate and specific training for the operations envisaged and for any rescue procedures, [...]

22/ Sources, links and references

European directives:
http://europa.eu.int/eur-lex
http://europa.eu.int/eur-lex/fr/lif/ind/fr_analytical_index_05.html

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French law:
www.legifrance.gouv.fr
www.lexinter.net

ERP:
www.interieur.gouv.fr
www.interieur.gouv.fr/rubriques/c/c5_defense_secu_civil/c52_prevention/sec_incendie
www.batpi.fr
www.apsighe.com
www.synamap.fr
www.pc-securite.dpn.ch
www.ssiap.com

Belgian law:
www.just.fgov.be
www.juridat.be
www.droitbelge.be

Standards:
www.boutique.afnor.fr
www.ibn.be
www.bsi-global.com
www.ansi.org

Other:
www.europe.osha.eu.int
www.hse.gov.uk
www.osha.gov
www.esta.org
www.usitt.org
www.iatse-intl.org
www.plasa.org
www.safety-rocks.org

Part5/ Powers & liabilities

POWERS & LIABILITIES

1/ Type of liability

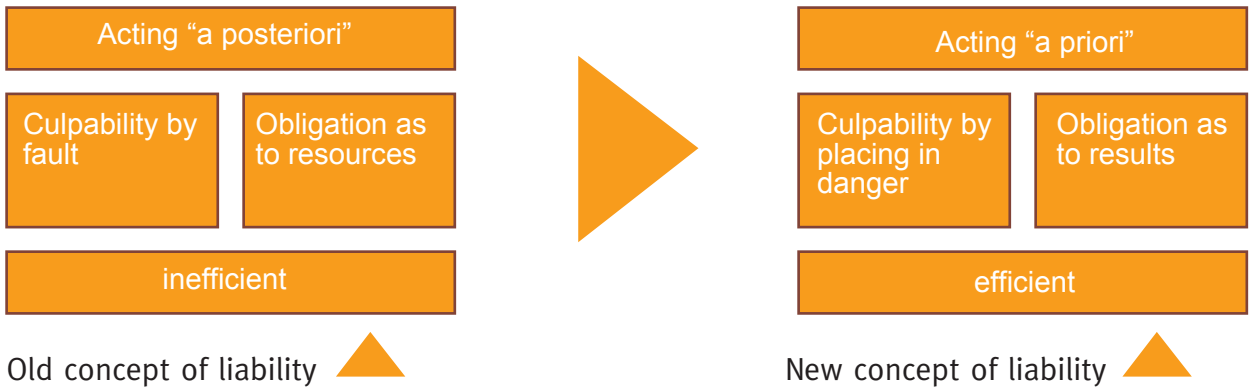
Public liability
Public liability is designed to remedy damages caused to an individual.

Criminal liability
Criminal liability requires the person who carries out an infringement of some kind to answer for his actions before society as a whole; criminal liability is designed to punish conduct that is contrary to the rules laid down by society.

2/ Type of obligation

Obligation as to resources
The old concept of liability was based essentially on the principle of an obligation as to resources: the establishment manager was required to put human and material resources in place that corresponded to regulatory requirements.

Obligation as to results
The new concept of liability is based on the principle of an obligation as to results: the establishment manager is required to put in place human and material resources that are appropriate for ensuring the avoidance of all accidents.
In other words, the fact that an accident has occurred is sufficient to question what are suitable measures. In the eyes of the law, therefore, some form of personal liability is looked for. Fate cannot be used as an excuse.



3/ Person responsible

See also the chapter on "Laws and Standards"

A PRIORI responsibility of the establishment manager
Article L230-2 requires the establishment manager to take the measures necessary to ensure the safety and protect the physical and mental health of the workers in the establishment, including temporary workers. These measures include actions to safeguard against the risks of the profession, provide information and training, as well as put in place a suitable form of organisation and appropriate resources.

This means that as a result of his position, the establishment manager is responsible "a priori" if there is an accident at work. It is up to him personally to make sure that the rules of hygiene and safety are applied strictly, constantly and at all times. He can, however, transfer this responsibility by organising for his powers to be delegated.

General responsibility of employees
Article L230-3 states that each worker must "take care, based on his training and in accordance with his capabilities, of his own health and safety, as well as the health and

safety of other persons affected by his actions or omissions at work."

Delegation of powers in hygiene and safety matters
Depending on the size and geographic arrangement of the company, and as the company manager cannot be present everywhere at all times, jurisprudence allows him to transfer his powers - and hence his responsibilities - to a person with sufficient skills and resources to assume those responsibilities.

Delegation is a genuine tool for organising safety in the company, making it possible to choose someone closer 'on the ground' who can take action when there are breaches of safety rules, and hence who is more suitable for providing a remedy. (The absence of delegation may be viewed by the courts as culpable negligence.)

Once the delegation of powers has been put in place, the person taking them on (the delegatee) assumes the criminal liability that is usually the responsibility of the company manager for those obligations that have been transferred to him.

The material reality of the act of delegation depends mainly on:

* the competence of the delegatee (training, technical knowledge, experience),
* the authority he is given (hierarchical, decision-making, financial),
* the resources (human and material) placed at his disposal,

Written delegation is preferable, although not sufficient.

Public works managers, technical directors and other technical managers should expect to be considered as being "responsible" in the sense of delegating powers, i.e. in the place of the head of the association or producer.

Notion of "Competent Person"
The establishment manager is responsible for calling on a person whose competence he is sure of and must be able to provide all of the references required to enable him to assess the competence of the person concerned. In some cases, regulations or recommendations state clearly what the provisions are that relate to the competence of operators (training, certificates, etc.). See for example the competence references incorporated as part of recommendation CNAMTS R.408 relative to scaffolding.

4/ Right of withdrawal

When a salaried worker finds himself in a working situation that presents a serious and imminent danger to his life or health, he has the right to stop the work he is doing and, if necessary, leave the area to seek a place of safety. However, the decision taken by the salaried worker must not create a new situation of serious and imminent danger for other persons.

The right of withdrawal will not result in any sanction or deduction from wages.

The salaried worker must warn his employer or representative immediately, in writing if possible, of the danger of the situation (alarm procedure). He can also turn to staff representatives or the Safety and Hygiene Committee.

The salaried worker does not need the consent of his employer to make use of his right of withdrawal. The employer may not ask the salaried worker to resume working for as long as the serious and imminent danger persists.

Part5/ Powers & liabilities

5/ Type of misconduct

Classification of the various level of seriousness of acts of misconduct

- Serious

Clumsiness
= Lack of knowledge and ability in carrying out the task

Carelessness
= Lack of concern for danger or its consequences

Inattention
Lack of attention to the process for carrying out the task, distraction

Negligence
= Lack of care and attention leading to the a
accumulation of acts of carelessness, inattention and their consequences

Infringement
= Carelessness or inattention in direct relation to the
non-compliance with rules, the consequences of which were
not foreseeable (no awareness of the seriousness of the danger)

+ Serious

Deliberate infringement
Carelessness or inattention in direct relation to
the non-compliance with rules, the consequences
of which were foreseeable
(awareness of the seriousness of the danger)

Carelessness, negligence or inattention

There is an offence committed, when the law so provides, in the event of there being carelessness, negligence or lack of an obligation as to care or safety, as provided by the law or regulations, if it is established that the perpetrator of the acts has not applied normal due diligence given, where applicable, the nature of his duties or functions and skills, as well as the power and resources at his disposal. (article 121-3 of the French Criminal Code)
A contracting agent who deliberately makes a non-compliant item of equipment available to a worker is committing an offence that is punishable by law.
The employer (or the party delegated by the employer) is not exempted from his liability simply by invoking the fact of his absence at the time the events took place, or of any misconduct committed by the victim, except where said misconduct was not the sole and unforeseeable cause of the accident.

Breach of regulations

Breaching a law or regulation involves the responsibility of the persons in question. In particular if this breach is deliberate, in other words if it was a conscious act, carried out in full knowledge of what was being done.

Endangering others

This involves a manifestly deliberate violation of a specific safety or care obligation imposed by law or the regulations, which directly exposes another person to the risk of death or injury that might result in physical injury or permanent disability. (article 223-1)
This infringement might include working at heights without protective gear, handling toxic substances without the proper protection, or operating defective machinery. The penalties for this are one year in prison and a fine of 15 000 ¤.

Inexcusable misconduct by the employer

By virtue of the employment contract linking him to his salaried employee, the employer is bound by an obligation as to safety and results vis-à-vis the employee. Failing to meet this obligation is deemed to be inexcusable when the employer was aware of or should have been aware of the danger to which the salaried worker was exposed and that the employer did not take the necessary measures to prevent or protect the worker from such dangers.
As a result, this notion is no longer a voluntary act or omission nor does it have an intentional element.

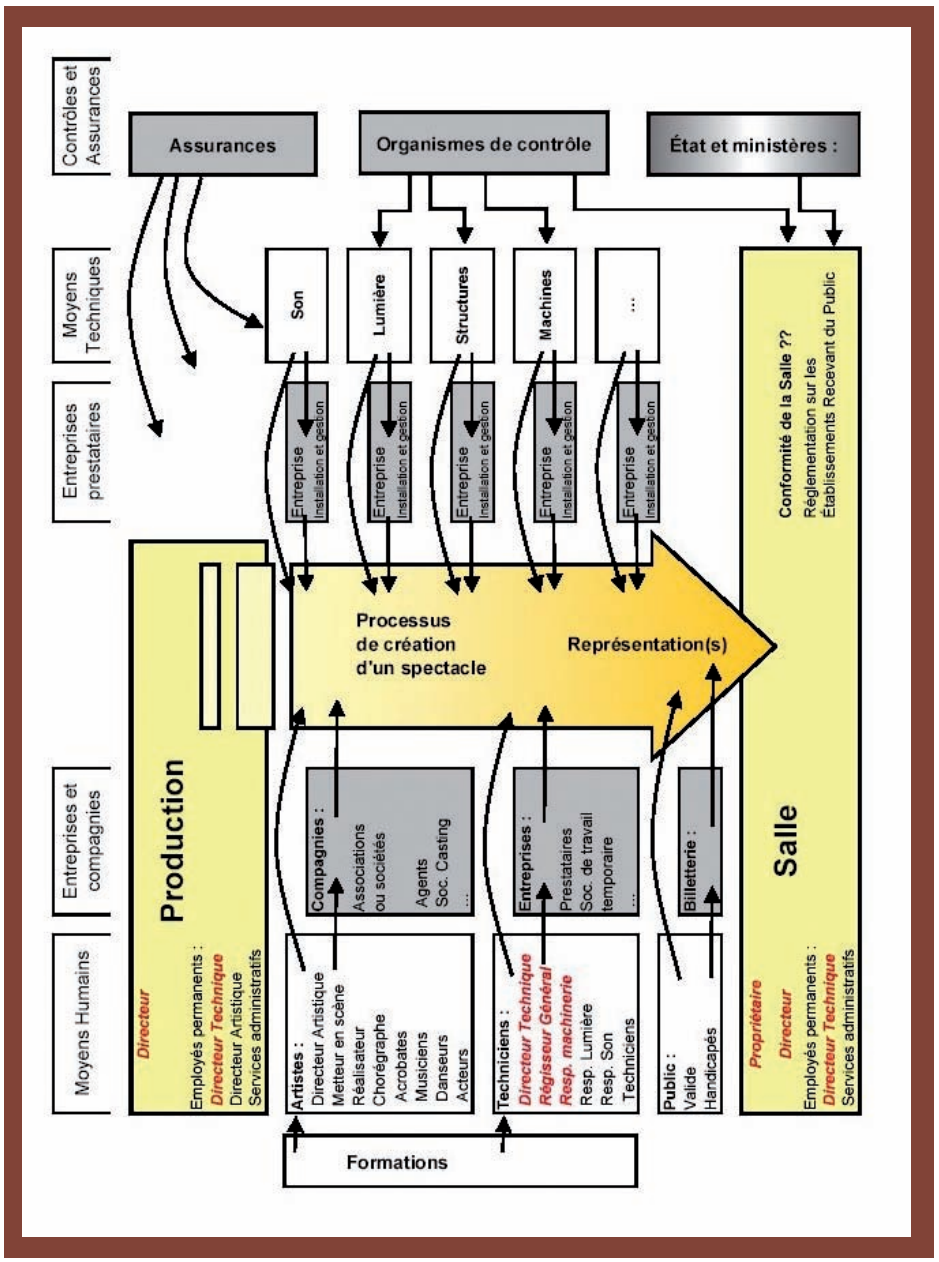
Part5/ Powers & liabilities

Consequences: The effect of acknowledging an act of inexcusable misconduct is to increase the compensation paid and the victim also has the right to require the employer to remedy any personal prejudice he has suffered (physical trauma, mental trauma, disfigurement, etc.)

Inexcusable misconduct by the worker
When setting the amount of compensation, the board of the fund or committee delegated for that purpose may, if it is of the opinion that the accident was caused by an act of inexcusable misconduct by the victim, reduce the amount of compensation, except where the beneficiary resorts to action before the courts with jurisdiction.
Social Security Code, article L453-1

The fact of a worker not protecting himself properly against falling from a height constitutes, to the extent that the level of training, information and necessary equipment are not in question, an act of inexcusable misconduct that is likely to result in the victim and his family having to bear the financial consequences themselves.

6/ Organisation of work in the live performance sector



Part6/ Falls from height

1/ Introduction

SPECTACULAR, adj.: [relating to a thing or event] Something that is eye-catching, that strikes the imagination through its remarkable character, appeals to the emotions, is thought-provoking. Something that produces or seeks to produce a visual and emotional effect. A spectacular set. Striking, astonishing, extraordinary, impressive, sensational.

The live performance and events industry is faced frequently with the risks associated with using a variety of equipment or working methods that have a reputation for being dangerous:

* Erecting/dismantling metal structures (scaffolding, lifting towers, aluminium grills and beams, etc.) within tight deadlines;
* Erecting /dismantling suspended equipment (lights, sound, sets, etc.) within tight deadlines;
* Presence of technicians on unsecured structures;
* Use of industrial lifting equipment, lifting loads above people's heads;
* Lifting persons, aerial artistic performances;

Why does the use of this equipment and these techniques constitute a standard today?

* Because this is a competitive sector and one that has to be increasingly "spectacular";
* Because 'hijacking' techniques taken from manufacturing and building has always been more economical than developing specific products;
* Because, in making their business choices, producers voluntarily neglect the aspects of these operations that are linked to safety;

With a specific amount in his budget, a producer will generally prefer to emphasise the artistic impact of the show (which can be seen directly by the buyer) rather than the safety of the working conditions (which cannot be seen by the buyer).

This business-driven drift has become so commonplace these days that the technicians and performers themselves hide behind budget-related arguments to justify the poor level of safety in their working conditions.

The extent, in number and seriousness, of accidents relating to falls from heights in the live performance and events industry can be attributed to the following factors:

* Widespread usage of metal structures and lifting equipment,
* A lack of skills, knowledge and thoroughness on the part of technicians,
* A lack of taking safety into account in designing equipment and in working methods.

2/ Statistics

Falls from height represent the second most common cause of professional deaths, behind road accidents: 90 deaths per year in France alone.

In the building industry, one death in every three is caused by falling from a height.

One fall in ten leads to permanent disability or death.

Contrary to information often banded about in the live performance industry, accidents at work in the sector are relatively serious and numerous.

The essential facts that come out of the statistics are: (see attachment)

Live performance technicians allocated to construction duties (stages and sets) and lifting

Part6/ Falls from height

equipment are exposed to risks that are 10x greater than for the average office employee.

The main risks to which live performance technicians are exposed are:

* Transport and carrying accidents;
* Falling from heights (scaffolding, structures, ladders);
* Collisions with loads when lifting (including falling equipment);
* Accidents associated with forklift trucks;

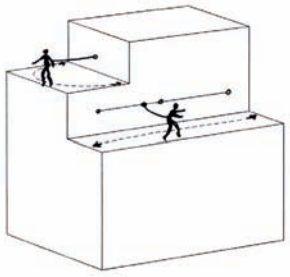
The SERIOUSNESS index of accidents linked to erection and dismantling jobs is 6x higher than the average for other professions.

The FREQUENCY index of accidents linked to erection and dismantling jobs is 3x higher than the average for other professions.

The SOCIAL SECURITY SUBSCRIPTION index for erection and dismantling jobs is 6x to 9x higher than the average for other professions.

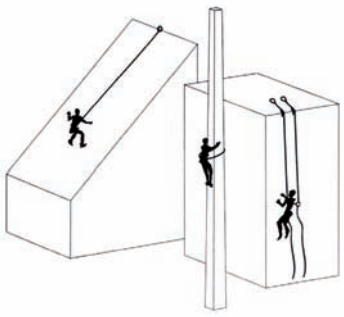
3/ Protection against falls: Three principles

The "Held" principle work restraint
Personal protective equipment prevents the worker from reaching the dangerous zone. In this case, the PPE must at least comply with the standards for "Support at work".



No dynamic effect

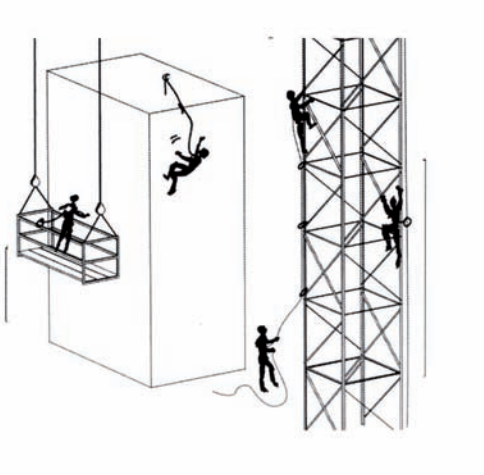
The "Support at work" principle
The personal protection device holds the worker in position at his work at all times so that falls and any dynamic effect can be avoided.
In this case, the PPE must at least comply with the standards for "Support at work".



No dynamic effect

The "Anti-fall" principle
The personal protection device does not hold the worker in position at his work at all times. It is designed and used to prevent any fall, in total safety.

In this case, the PPE undergoes major dynamic stress and must at least comply with the standards for "Protection against falling from height" or "Anti-fall".



Major dynamic effect

4/ European regulations

Directive 2001/45/EC
Directive 2001/45/EC relating to the minimum health and safety requirements for workers at work to use work equipment.

(9) Any employer who intends carrying out temporary work at a height must select equipment that provides adequate protection against the risk of falling from a height.

(10) In general, the collective protection measures aimed at preventing falls offer better protection than personal protection measures. The choice and use of the right equipment for each specific location with a view to preventing and eliminating risks should, where appropriate, be accompanied by specific training and supplementary study.

(11) [...] Consequently, the specific and appropriate training of workers is necessary.

ATTACHMENT: Provisions regarding the use of work equipment made available for temporary works at a height: General provisions

4.1.1. [...] Priority must be given to collective protection measures over personal protection measures.

4.1.3. The techniques used for access and positioning by way of ropes may only be used in circumstances where, depending on assessment of the risk, the work in question can be carried out safely and where the use of other work equipment is not justified. Taking account of the risk evaluation and in particular depending on the length of the works and the ergonomic constraints, a seat fitted with the appropriate accessories must be provided.

4.4. Specific provisions regarding the use of access and positioning techniques using ropes. The use of access and positioning techniques using ropes must comply with the following conditions:

Part6/ Falls from height

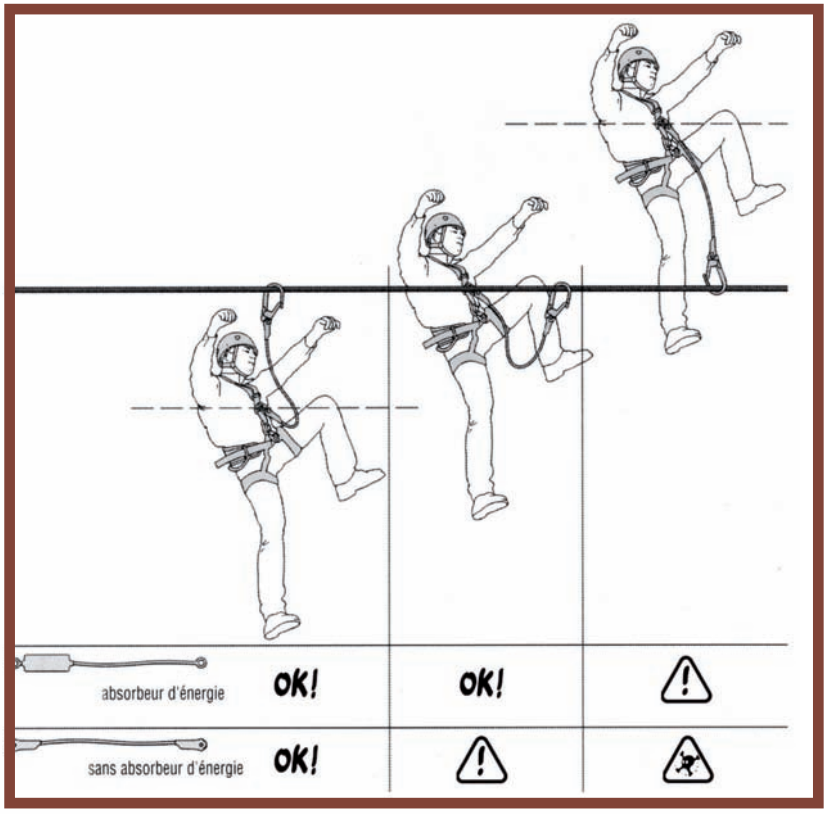
a) the system must have at least two ropes, each anchored separately, one providing a method of access, descent and support (working rope) and the other providing assistance in an emergency (safety rope);
b) workers must be fitted with an appropriate harness. They must also use it and be connected by this harness to the safety rope;
c) the working rope must be fitted with a safe descent and ascent mechanism and also feature a self-locking system should the worker lose control of his movements. The safety rope must be fitted with an anti-fall device that accompanies the worker's movements;
d) the tools and other accessories to be used by a worker must be attached to the worker's harness or seat or attached by another appropriate means;
e) the work must be properly scheduled and supervised in such a way that help can be provided immediately to the worker should an emergency arise;
f) workers involved in such work must, in accordance with article 7, receive appropriate and specific training for the operations envisaged, in particular for rescue procedures.

See also the chapter on "Laws and Standards"

5/ Parameters governing falls from a height

In terms of physics, a fall from a height is characterised by:

* The physical mass of the person;
* The height of the fall;
* The absorption height;
* The headroom.



The fall is harder:

* The greater the physical mass of the person;
* The greater the height of the fall;

Part6/ Falls from height

The height of the fall is greater:

* The longer the tether;
* The lower the tether is attached;

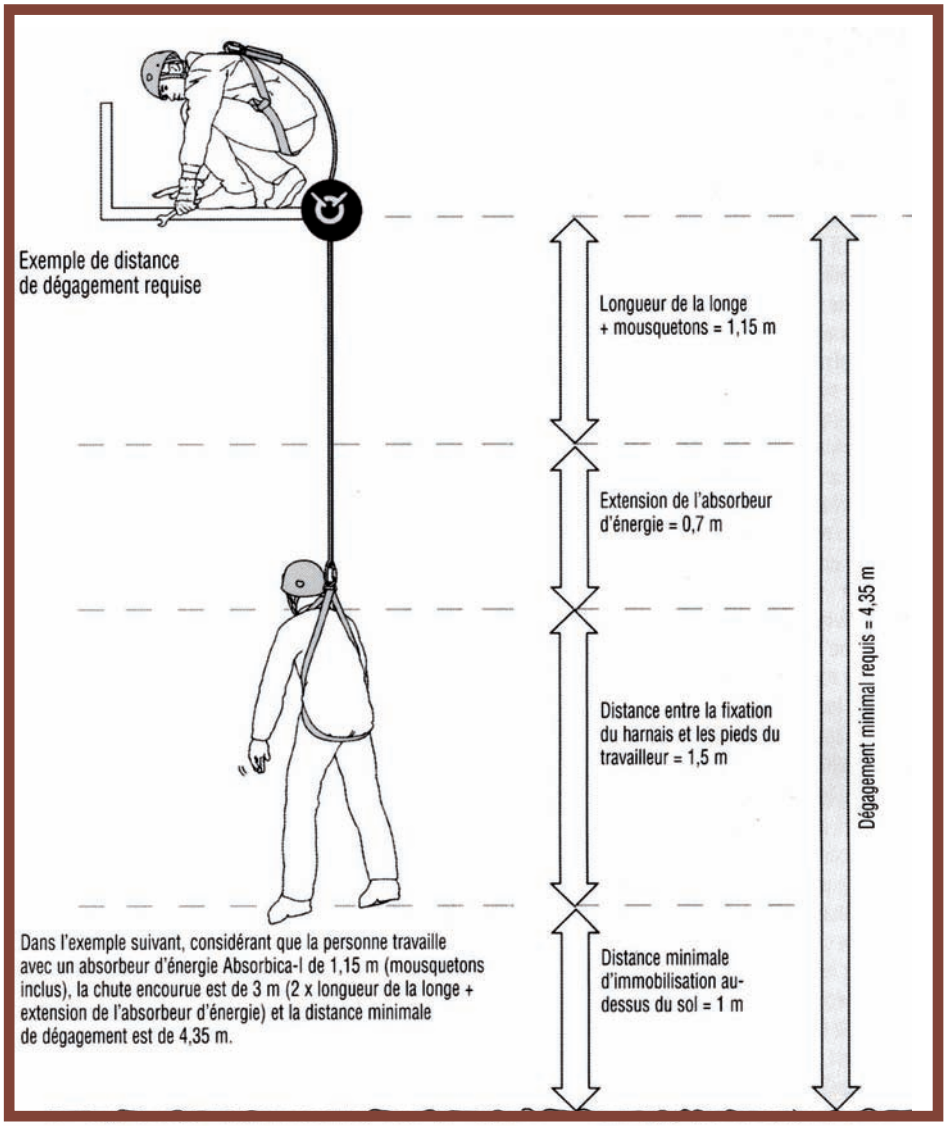
Absorbing the fall is easier:

* The shorter the fall;
* The higher the absorption height;

As a result, to limit the effects of a fall, short tethers should be used, fitted with an energy absorber and attached as high on the structure as possible.

To stop a fall in total safety, you have to limit the dynamic stress exerted by the person and the equipment as much as possible. The soft absorption of a fall automatically requires a certain distance for the fall to be absorbed, which is why energy absorbers extend for a certain distance so that they can slow down the person's fall while restricting the dynamic stress to a maximum of 600 daN.

Absorbing a fall always requires the device to extend a certain amount and, as a result, there needs to be a certain amount of free height below the person. This free height is called the "Minimum headroom".



Part6/ Falls from height

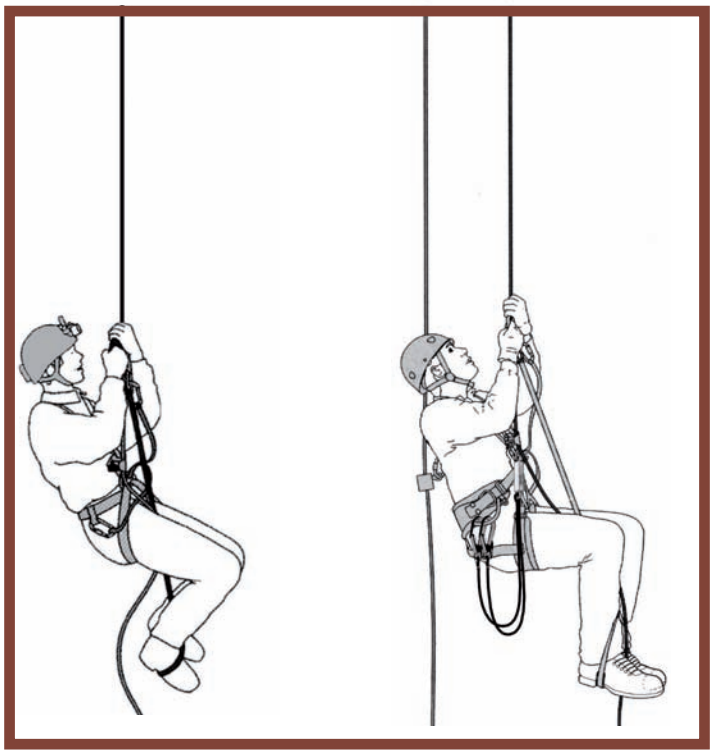
To absorb a fall in total safety, the following need to be taken into consideration:

Length of the tether	+	Extension of the absorber	+	Extension of the absorber	+	Safety distance	≤	Available headroom

Anti-fall measures are only generally considered to be effective above a height of 3 m. Between 1 m and 3 m, it is preferable to use a work support device.

Work posionning or restraint.

6/ What differences are there between SPORTS equipment and WORK equipment?



Sports equipment meets strength criteria that are insufficient to accommodate the constraints generated by falling from a height!

Sports equipment is designed based on less
- **demanding**
- **dynamic**
- **criteria.**

Climbing harness:
Standard
NF EN 12277: Mountaineering and rock-climbing equipment: Type C harness

Technical Committee
"Equipment for sports, playgrounds and other leisure equipment" CEN/TC 136

Technical specifications
* Harness consisting of a belt and elements under the pelvis, encircling the thighs
* This type of harness cannot hold an unconscious person in the "head up" position.
* Static test to 1500 daN in upright position,
* No test in the upside down position,
* No dynamic test

Part6/ Falls from height

Work support belt:
Standard
NF EN 358: PPE for work support and prevention of falling from a height: Work support belt.

Technical Committee
"Protection against falling from heights, including work belts" CEN/TC 160

Technical specifications

* Device to grip the body, surrounding the body at the waist
* This type of harness cannot hold an unconscious person in the "head up" position.
* Static wrench test on anchor points to 1500 daN,
* No test in the upside down position,
* Dynamic test with a 100 kg dummy falling 1 m and held by a 1 m dynamic rope (type EN 892 11 mm: shock force = 1).

Work harness without shoulder straps:
Standard
NF EN 813: PPE for the prevention of falls from a height: Belt with thigh straps

Technical Committee
"Protection against falling from heights, including work belts" CEN/TC 160

Technical specifications

* Harness consisting of a belt and elements under the pelvis, encircling the thighs
* This type of harness cannot hold an unconscious person in the "head up" position.
* Static test to 1500 daN in upright position,
* No test in the upside down position,
* Dynamic test with a 100 kg dummy falling 2 m and held by a 1 m dynamic rope (type EN 892: shock force = 2)

Full anti-fall harness:
Standard
NF EN 361: PPE against falls from a height: Anti-fall harness

Technical Committee
"Protection against falling from heights, including work belts" CEN/TC 160

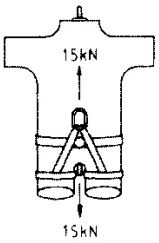
Technical specifications

* Device to grip the body, designed to stop falls [...] and adjusted in an appropriate manner on the body of an individual to hold him in place during a fall and after the fall has been arrested.
* This type of harness is capable of holding an unconscious person in the "head up" position.
* Static test to 1500 daN in the upright position,
* Static test to 1000 daN in the upside down position,
* 2 consecutive dynamic tests with a 100 kg dummy falling 4 m and held by a 2 m dynamic rope (type EN 892 11 mm: shock force = 2) (The rope has to cause an impact of at least 900 daN on the first test). The first dummy was head up, the second dummy head down.
* On completion, the dummy has to be positioned head up and the angle formed by the longitudinal axis on the dorsal surface of the bent dummy and the vertical has to be more than 50°.

Part6/ Falls from height

SPORT	≠	WORK
No dynamic test		**dynamic test**

≠



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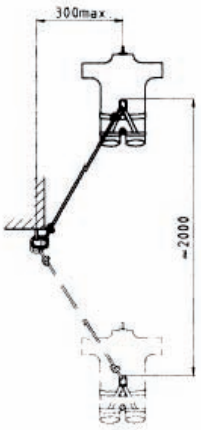


7/ Speed of emergency assistance

Only two anchor points enable an unconscious person suspended from a harness to be held correctly:

* Chest anchor point,
* Back anchor point,

Using an abdominal anchor point or a sports harness exposes the user to the risk of being suspended head down and being subjected to a rush of blood to the head, as well as severe cardiac and breathing problems.

As an indication, professional risk-prevention bodies usually consider that a person in this situation must be given emergency assistance in less than 6 minutes. (risk of death)

Time to provide assistance with abdominal anchor point ≤ 6 minutes

Time to provide assistance with chest or back anchor point ≤ 20 minutes

This means that the advance positioning of emergency resources, as well as the permanent availability of an emergency team with sufficient training and practice are essential conditions for the survival of the person left suspended after a fall.

This statutory obligation for "emergency programming" is featured in Directive 2001/45/EC, as well as in various National Employment Codes.

Part6/ Falls from height

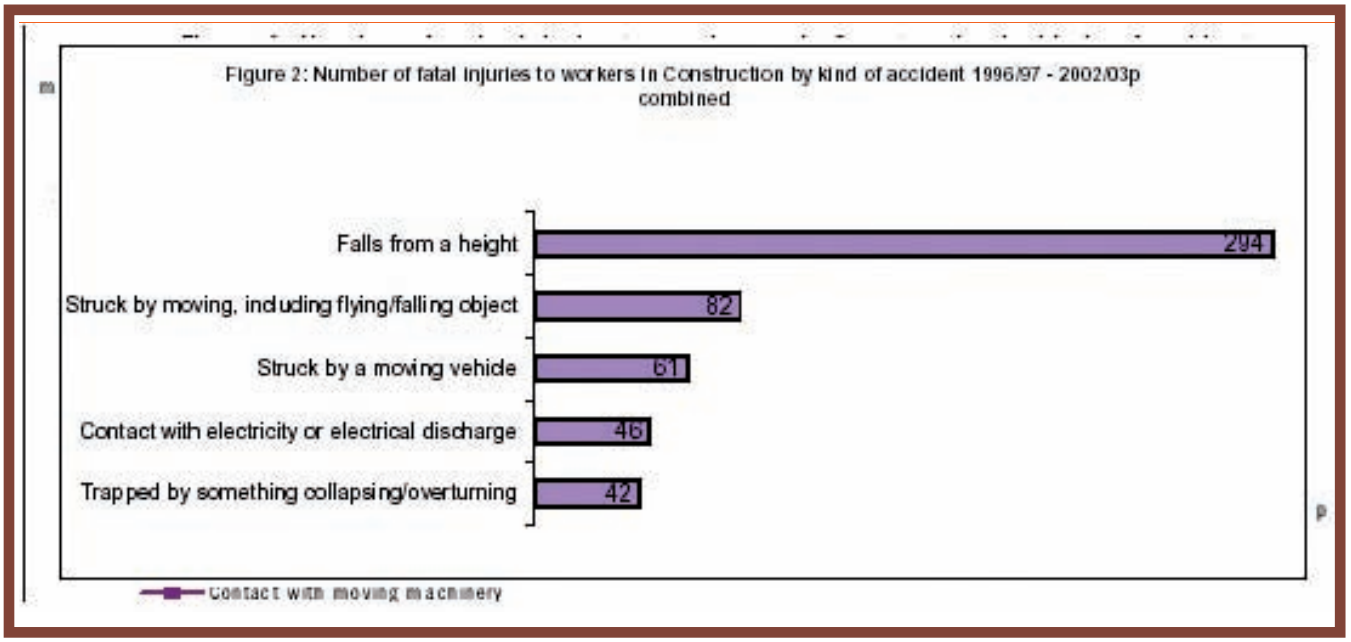
8/ Statistics

Statistics for accidents at work, France: source CNAM: 2001

Live performance industry

N° of risk		Frequency index	Frequency rate	Seriousness level	Seriousness index
452CA	Metal structures (metal frames, metal beams)	189.30	108.04	5.98	114.12
452TA	Lifting, hoisting	125.40	69.39	5.16	103.20
452TB	Erecting scaffolding	164.99	93.69	5.11	92.49
923AA	Public concert, concert hall, phonographic listening room	7.58	6.18	0.33	0.00
923AB	Literary and artistic creation and performance	9.84	8.75	0.47	4.99
923AC	Performers, for all their activities	4.03	7.29	0.34	5.42
923BA	Services associated with live performances	22.70	16.56	0.91	19.38
923DB	Management of live performance halls (theatre, music-hall, cabaret, fixed circus) (all staff, except performers)	7.11	17.67	0.71	10.89
923DC	Management of cultural social and educational equipment and other live performance halls (staff not covered elsewhere, especially to risk 92.3 AC)	18.47	14.19	0.65	9.51
923FA	Fairground attractions (except performers) without assembly of roundabouts	36.45	31.16	2.00	0.00
923FB	Fairground attractions (except performers) with assembly of roundabouts or marquees	58.10	52.25	3.80	4.13

Part6/ Falls from height



MANDATORY TRAINING

1/ Regulations

Also see the chapter on "Laws & Standards"

In all regulatory texts, there is an obligation on the part of the employer to provide information and training for workers in the face of the risks of the jobs entrusted to them. It therefore appears necessary to make an assessment of all these obligations in the trades relating to live performances and events:

Employment Code Art. L.230-2
The manager of the establishment will take any measures necessary to ensure the safety [...] of workers [...]. These measures include programmes for preventing professional risks, information and training, as well as the implementation of a suitable working organisation and resources.

Employment Code Art. L.231-3-1
It is the responsibility of every establishment manager to organise practical and appropriate training in safety for workers.

Employment Code Art. L.231-8
The existence of inexcusable misconduct on the part of the employer [...] presumed to be established for salaried workers under fixed-period contracts and the salaried workers made available to a company [...] allocated to specific work positions [...] for which they might not have been given advanced safety training. [...]

Employment Code Art. L.231-34
The purpose of safety training is to teach salaried workers about the precautions to be taken to ensure their own safety, as well as the safety of other people employed in the establishment.
To this end, the information, courses and instructions required are given to them in relation to the conditions for moving about the works, as well as carrying out their work and the measures that they are required to take in the event of an accident or incident.

Employment Code Art. L.231-36
The purpose of safety training relating to carrying out work is to teach salaried workers, based on the risks to which they are exposed, about what to do and the safest action to take. Where possible, this is done using demonstrations, by explaining the operating procedures used if these procedures have an effect on their safety or the safety of other salaried workers, and by showing them how the safety and emergency systems work, as well as explaining the reasons behind what they do.
This training should be part of the overall training or professional instructions given to salaried workers. Training is provided in the workplace or, if this is not possible, under equivalent conditions.

Employment Code Art. L.231-38
[...] salaried workers allocated to tasks that include, partly or in full, the use of machinery, whether portable or not, the handling or use of chemicals, goods handling operations, maintenance work on equipment and installations at the establishment, driving vehicles, operating lifting equipment or machinery of any kind, work that places them in contact with dangerous animals, operations with scaffolding, and the use of access and positioning techniques using ropes, are given safety training.

Employment Code Art. L.231-42
In the event of a serious accident at work or work-related illness [...], the employer will proceed with [...] the analysis of the working conditions [...]. After advice from the committee

for hygiene, safety and working conditions, the employer will organise appropriate safety training where necessary for the benefit of salaried workers [...].

Employment Code Art. R.231-71
[...] the employer is required to give workers whose job includes the manual handling of materials:
Adequate training on the safety relating to the fulfilment of these operations; as part of this training, which must be essentially practical in nature, workers will be instructed in the actions and physical postures to adopt to carry out the manual handling of materials in safety.

Employment Code Art. L.233-2
The establishment manager must provide appropriate information to workers whose job it is to work with or maintain work equipment:

a) About the conditions for using or maintaining this work equipment;
b) About any instructions or directions regarding the equipment;
c) About the action to take in foreseeable abnormal situations;
d) About the conclusions drawn from the experience gained, enabling certain risks to be eliminated.

The establishment manager must also inform all of the workers in the establishment about the risks relating to them due, on the one hand, to the work equipment located in their immediate working environment, even if they do not use this equipment personally and, on the other hand, about any modifications that relate to this equipment.

Employment Code Art. R.233-3
[...] the safety training given to workers whose job it is to operate or maintain work equipment must be repeated and updated as often as is necessary to take account of changes to the work equipment for which these workers are responsible.

Employment Code Art. R.233-44
The establishment manager must provide those workers who have to use Personal Protective Equipment with adequate training that includes instructions in how to wear this Personal Protective Equipment should it be required. This training must be repeated as often as is necessary for the equipment to be used in accordance with the instructions for use dealt with in the previous paragraph.

2/ Mandatory training for each individual area

Electricity:
Electrical accreditations: these are issued by the employer after a training course has been completed. The various types are defined by the UTE 18-510 standard issued in November 1988.

Accreditations were made mandatory by the decree issued on 14th November 1988: Article 46 I - The employer must ensure that workers have sufficient training to enable them to be aware of and apply the safety regulations to be complied with in order to avoid the hazards caused by electricity in carrying out the tasks entrusted to them.

Qualified electrician: In every 1st or 2nd category establishment (even 3rd or 4th category if the safety committee deems it to be necessary), the presence of a qualified electrician is required while there is an audience present. (Article ERP EL13)

Qualified electrician = an electrician who has achieved an official level of training (BTS, CAP,

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etc.)

Work equipment:
Safety training for workers responsible for operating or maintaining work equipment is mandatory. This applies in particular to all machines.
This training was made mandatory by articles L.231-38 and R 233-3 of the Employment Code. (see above)

Personal protective equipment:
Adequate training for staff who have to use a mandatory item of personal protective equipment; training must include instruction on wearing this equipment (a harness, for example). This training was made mandatory by article R 233-44 of the Employment Code. (see above)

Fireworks:
For setting off fireworks, a permit must always be applied for from the town hall. In excess of 35 kg of active materials, or if K4 is being used, a declaration file must be submitted to the local préfecture offices at the place where the explosives are to be set off. A qualification certificate for K4 fireworks is mandatory and is issued after a training course and an examination set by the préfecture.

Fire:
In any establishment that employs more than 50 salaried workers, staff must be trained to fight fires. It is mandatory to provide exercises during which staff learn how to use fire-fighting equipment. These exercises and trials were made mandatory (every six months) by article R 232-12 of the Employment Code.
In ERPs, the same type of instruction exercise is provided for in article ERP MS51.

Fire safety agents must be present during times that establishments are open to the public. This training was made mandatory by articles ERP MS48 and L14.

Manual handling of loads:
Training was made mandatory by the Employment Code, article R 231-71. (see above)

Lifting equipment:
It is forbidden to entrust the operation of lifting equipment to untrained staff (decree issued on 23rd August 1947 - article 32). Authorisation to operate lifting equipment where a "risk" is involved has been mandatory since 1st January 2000 (decree issued on 2nd December 1998). This relates, for example, to counterbalanced machinery and structures, motors and bridges.

Equipment and machinery on site:
Authorisation to operate issued by the employer after a training course has been attended, was made mandatory by the decree issued on 8th January 1965, article 42. Employment Code article R 123-13-19 and recommendations CNAM R 372, R 386 & R 389. In addition, the operation of certain types of equipment involving specific risks on account of their characteristics or purpose is subject to obtaining an operating permit issued by the works manager. This is based on an evaluation carried out by the works manager withon 3 criteria:

* A medical suitability examination conducted by the company doctor
* A check on the knowledge and ability of the operator in terms of operating the work equipment safely. (The CACES aptitude test is a good way of verifying this knowledge)
* A check of the worker's knowledge of the work site and any instructions to be complied with on site.

CACES = certificate of aptitude for operating in safety

Part7/ Mandatory training

Since 1st January 2000 (recommendation R386), CNAM has recommended that operating plant and machinery must only be entrusted to operators whose aptitude is recognised by a CACES (certificate of aptitude for operating in safety) certificate. There is a CACES certificate for each type of machine and it requires a top-up training course every 5 years.

Forklift trucks:
Made mandatory by the order of 21st September 1982.

Cherry-pickers/mobile platforms:
Driving a mobile lifting platform is subject to a certain number of obligations, in particular in relation to staff training:

First and foremost, it should be remembered that article R233-13-3 of the Employment Code states that the lifting of persons is only permitted with work equipment and accessories intended for that purpose. Article R233-13-l9 of the Employment Code imposes the obligation of training workers who operate self-propelled mobile work equipment and work equipment used for lifting.

Licence for a presenter of live performances:
To obtain a licence as a category 1 presenter of live performances, i.e. a licence to operate premises where live performances are staged, the applicant has to demonstrate safety training for live performances that is suited to the venue of the show, or demonstrate the presence within the company of a person qualified in the area of live performance safety. (Decree issued on 29th June 2000 and order of 19th June 2000).

Welding: fire permit:
Hot- work (blowtorch welding, arc welding, oxy-acetylene welding) requires prevention and monitoring measures during and after these operations.
The obligation of having a fire permit enables each of the parties (employer, operator, outside company) to measure the risks associated with the work (decree issued on 20th February 1992).

First Aid:
In any workshop where hazardous work is carried out, on any worksite employing twenty people or more for at least fifteen days, there must be a member of staff who is trained in First Aid in the workplace (Employment Code, articles L.231-34 and R.241-39).

Scaffolding:
Recommendation CNAM R 408 issued on 10th June 2004 details the principles and safety measures to be adopted by employers and salaried workers when erecting/dismantling scaffolding. This recommendation aims to prevent the risks associated with falling from a height, falling objects, materials handling, electrification, collapse or toppling of scaffolding.

* Mandatory training of riggers for erection and dismantling.
* A skills certificate based on these frames of reference is issued by the works manager.
* Mandatory training of workers using scaffolding.
* Acceptance of scaffolding before use: a qualified person in the company has to check and accept the scaffolding and, once it has been erected, give permission to use it.

Demountable stands:
Qualification as a technician specialising in demountable stands is obtained after attending a training course and enables demountable stands to be checked for establishments of fewer than 300 people (articles ERP GE 6-7-8). For establishments with more than 300 people, the intervention of an accredited body for "sturdiness" assignments in the sense of the Spinetta Act is required. These compliance certificates are mandatory as part of an application to open an ERP and must be presented to the safety committee. As stands are similar to scaffolding-type metal structures, as covered by recommendation CNAM R 408 issued on 10th June 2004, there is a need to comply with the spirit of the recommendation.