



Safety in Work at Heights



Falck

Safety Services

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REGRAS

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Respeite todos os sinais de advertência, avisos de segurança e instruções;

Roupas soltas, jóias, piercings etc. não devem ser usados durante os exercícios práticos;

Não é permitido o uso de camiseta sem manga, "shorts" ou mini-saias, sendo obrigatório o uso de calças compridas e de calçados fechados;

Terão prioridade de acessar o refeitório, instrutores e assistentes;

Não transite pelas áreas de treinamento sem prévia autorização. Use o EPI nas áreas recomendadas;

Os treinandos são responsáveis por seus valores. Armários com cadeado e chaves estão disponíveis e será avisado quando devem ser usados. A FALCK Safety Services não se responsabiliza por quaisquer perdas ou danos;

O fumo é prejudicial a saúde. Só é permitido fumar em áreas previamente demarcadas;

Indivíduos considerados sob efeito do consumo de álcool ou drogas ilícitas serão desligados do treinamento e reencaminhados ao seu empregador;

Durante as instruções telefones celulares devem ser desligados;

Aconselha-se que as mulheres não façam o uso de sapato de salto fino;

Não são permitidas brincadeiras inconvenientes, empurrões, discussões e discriminação de qualquer natureza;

Os treinandos devem seguir instruções dos funcionários da FALCK durante todo o tempo;

É responsabilidade de todo treinando assegurar a segurança do treinamento dentro das melhores condições possíveis. Condições ou atos inseguros devem ser informados imediatamente aos instrutores;

Fotografias, filmagens ou qualquer imagem de propriedade da empresa, somente poderá ser obtida com prévia autorização;

Gestantes não poderão realizar os treinamentos devido aos exercícios práticos;

Se, por motivo de força maior, for necessário ausentar-se durante o período de treinamento, solicite o formulário específico para autorização de saída. Seu período de ausência será informado ao seu empregador e se extrapolar o limite de 10% da carga horária da Disciplina, será motivo para desligamento;

A Falck Safety Services garante a segurança do transporte dos treinandos durante a permanência na Empresa em veículos por ela designados, não podendo ser responsabilizada em caso de transporte em veículo particular;

Os Certificados/Carteiras serão entregues à Empresa contratante. A entrega ao portador somente mediante prévia autorização da Empresa contratante. Alunos particulares deverão aguardar o resultado das Avaliações e, quando aprovados, receberem a Carteira do Treinamento;

Pessoas que agirem em desacordo com essas regras ou que intencionalmente subtraírem ou danificarem equipamentos serão responsabilizadas e tomadas as providências que o caso venha a exigir.

DIRETRIZES GERAIS DO CURSO

• Quanto à Estruturação do Curso

O candidato, no ato da matrícula, deverá apresentar à instituição que vai ministrar o curso, cópia e o original (para verificação) ou cópia autenticada dos seguintes comprovantes:

- ✓ Atestado de boas condições de saúde física e mental;
- ✓ RG e CPF originais.

• Quanto à Frequência às Aulas

A frequência às aulas e atividades práticas são obrigatórias.

O aluno deverá obter o mínimo de 90% de frequência no total das aulas ministradas no curso.

Para efeito das alíneas descritas acima, será considerada falta: o não comparecimento às aulas, o atraso superior a 10 minutos em relação ao início de qualquer atividade programada ou a saída não autorizada durante o seu desenvolvimento.

- **Quanto à Aprovação no Curso**

Será considerado aprovado o aluno que:

- ✓ Obter nota igual ou superior a 6,0 (seis) em uma escala de 0 a 10 (zero a dez) na avaliação teórica e alcançar o conceito satisfatório nas atividades práticas.
- ✓ Tiver a frequência mínima exigida (90%).

Caso o aluno não cumpra as condições descritas nas alíneas acima, será considerado reprovado.

INTRODUCTION

According to the Ordinance SIT No. 313, Art 4º, of March 23, 2012, one of the main causes of serious and fatal accidents at work is due to events involving falls of workers at different levels. The risks of falls from a height exist in all kind of activities and tasks.



1.1 MTE - Ministério do Trabalho e Emprego

The creation of a broad Regulatory Norm that can achieve all kind of activity is an important reference tool for these works to be carried out safely.

The NR 35 sets out minimum requirements and protection measures for work at height, involving planning, organization and work execution, in order to ensure safety and health of workers that are directly or indirectly involved with this activity.

The safety at the jobs done in activity that involves the risk of falling, has become an extremely important topic considering a few devastating data information. Information of the Ministry of Labor and Employment shows that 30% of the accidents that happen annually in Brazil are due to falls while the jobs are being accomplished.

Given to the safety challenges that the offshore industry offers, such as: reduced spaces, multiple operations, presence of flammable materials, limitations to attend emergencies; the jobs that are accomplished with risk of falling, need much attention from the NR-34 that reports the Work Condition and Environment of the Naval Construction and Repair Industry, approved by the Ordinance SIT 200 from the 20/01/2011. With the objective to regulate the mandatory protection against accidents and occupational diseases, facilitating the first aid procedures to the injured ones and reach the best possible safety and health conditions of the workers involved in these activities and operations.

Serious injuries are identified at activities just like maintenance, repairs, assembly and disassembly, inspection, cleaning, painting, etc; executed in higher areas. That is why it's necessary to have the assessment, planning and the correct equipment usage, as well as the appropriate and approved devices to accomplish the jobs safely. Due to lack of knowledge or omission from a few companies and third parties, these activities do not attend the current legislation, to the technical procedures and the safe practices, therefore increasing the exposure to the risks.

OBJECTIVES

The objective of this training is to provide the all the information needed to technical professionals correctly understand the standards, related to the naval construction and repair industry involved in tasks with the risk of falling. It presents the most common risk situations, in defense of the importance to observe the correct way to execute a job at heights safely and the correct use of personal protective equipment and collective protection measures.

It's considered all activities of the Naval Construction and Repair Industry all of those developed within the installations used for this purpose or in its own vessels and structures such as ships, boats, motorboats, fixed or floating platforms, amongst others.



Offshore work at heights

NR-35 WORK AT HEIGHTS

Publication

SIT Ordinance nº. 313, of March 23, 2012

D.O.U. 27/03/12

35.1. Goal and application field

35.1.1 This Norm establishes the minimum requirements and protection measures for work at heights, involving the planning, organization and implementation, in order to ensure the safety and health of workers involved directly or indirectly with this activity.

35.1.2 It is considered work at height every activity that is performed above 2 meters from the inferior level, in which there is a risk of falling.

35.1.3 This norm complements with the official technical norms established by the competent Authorities and, in the absence or omission of these, with the applicable international norms.

35.2. Responsibilities

35.2.1 It is up to the Employer to:

- a) ensure the implementation of the protective measures laid down in this norm;
- b) ensure the implementation of the risk analysis - RA, when applicable, the issuance of the work permit - WP;
- c) develop operational procedure for the routine activities of work at height;
- d) ensure prior assessment of conditions in the work at height area, by studying, planning and implementation of actions and applicable safety complementary measures;

e) adopt the necessary measures to monitor compliance with the protective measures laid down in this norm by the contracted companies;

f) guarantee workers up to date information on the risks and control measures;

g) ensure that any work at height only begins after the safety measures defined in this norm have been adopted;

h) ensure the suspension of work at height when noticing an unexpected risk situation or condition, of which immediate neutralization or elimination is not possible;

i) establish a system for the authorization of workers for work at height;

j) ensure that all work at height is carried out under supervision, whose way will be defined by risk analysis according to the peculiarities of the activity;

k) ensure the Organization and archiving of documentation referred to in this norm.

35.2.2 It is up to the employees:

a) fulfill legal and regulatory provisions on work at height, including the procedures issued by the employer;

b) cooperate with the employer in the implementation of the provisions contained in this norm;

c) stop its activities exercising right of refusal, where they find evidence of imminent and serious risk to their safety and health or to other people, communicating the fact immediately to his superior, that it will make the appropriate measures;

d) watch over your safety and health and of others who may be affected by your actions or omissions at work.

35.3. Qualification and Training

(Becomes enforced on 27/03/2013-See in Art. 3º of ordinance No. 313/2012)

35.3.1 The employer must promote program for training of workers to carry out work at height.

35.3.2 The worker will be considered qualified to work at height when he was submitted and approved in training, theoretical and practical of a minimum of eight hours, whose programmatic content must, at least, include:

- a) norms and regulations applicable to the work at height;
- b) risk analysis and obstructing conditions;
- c) potential risks related to work at height and measures of prevention and control;
- d) systems, equipment and procedures for collective protection;
- e) personal protective equipment for work at height: selection, inspection, conservation and limitation of use;
- f) typical accidents in work at height;
- g) conduct in emergency situations, including notions of rescue techniques and first aid.

35.3.3 The employer must perform periodic training every two years and whenever any of the following situations occurs:

- a) change in procedures, conditions or working operations;
- b) event that indicates the need for new training;
- c) return to work after a period above ninety days;
- d) change of company.

35.3.3.1 The regular biennial training must have a minimum of eight hours, according to the programmed content set by the employer.

35.3.3.2 In the cases referred to in points "a", "b", "c" and "d", the time and the programmatic content must meet the situation that motivated it.

35.3.4 The initial, periodic and eventual trainings for work at height can be administered together with other trainings of the company.

35.3.5 Training should be carried out preferably during normal working hours.

35.3.5.1 The amount of time spent in training must be computed as actual work time.

35.3.6 The training must be taught by instructors with proven proficiency in the subject, under the responsibility of a professional qualified in work safety.

35.3.7 At the end of the training a certificate must be issued containing the worker's name, programmatic content, work load, date, place of training, name and qualification of the instructors and signature of the person responsible.

35.3.7.1 The certificate must be delivered to the employee and a copy filed in the company.

35.3.8 Training must be included in the employee record.

35.4. Planning, Organization and Execution

35.4.1 All work at height must be planned, organized and executed by qualified and authorized worker.

35.4.1.1 The worker is considered authorized for work at height after he is trained, his health state evaluated and was considered fit to perform this activity having a formal consent from the company.

35.4.1.2 It is up to the employer to evaluate the state of health of workers engaged in activities at height, ensuring that:

a) the evaluation system and examinations are an integral part of the occupational health medical control program (PCMSO) having to be declared on it;

b) the evaluation is performed periodically, taking into account the risks involved in each situation;

c) a medical examination is conducted toward the pathologies that can lead to sudden illness and fall from heights, considering also the psychosocial factors.

35.4.1.2.1 The suitability for work at height must be recorded in the certificate of occupational health of the worker.

35.4.1.3 The company must keep updated records that allow to know the scope of authorization for each worker to work at height.

35.4.2 Work planning must adopt, in accordance with the following hierarchy:

a) measures to avoid the work at height, always where there is alternative means of execution;

b) measures that eliminate the falling risk of workers, in the impossibility of performing the work in another way;

c) measures that minimize the consequences of the fall, when the falling risk cannot be eliminated.

35.4.3 All work at a height must be carried out under supervision, of which the way will be defined by risk analysis according to the peculiarities of the activity.

35.4.4 Service execution must consider the external influences which can change the conditions of the workplace already preceded on the risk analysis.

35.4.5 All work at height must be preceded by risk analysis.

35.4.5.1 The risk analysis must, in addition to the risks related in work at height, consider:

a) the location where the services will be executed and its surroundings;

b) the isolation and the signs around work area;

c) the establishment of the systems and anchoring points;

d) adverse weather conditions;

- e) the selection, inspection, way of usage and limitation of use of collective and individual protection systems, taking into account the technical present norms, the manufacturers guidelines and the principles of impact reduction and of the falling factors;
- f) the materials and tools falling risk;
- g) simultaneous work that present specific risks;
- h) the compliance to safety and health requirements contained in other regulatory norms;
- i) the additional risks;
- j) obstructive conditions;
- k) emergency situations and the planning of rescue and first aid, in a way to reduce the inert suspension time of the worker;
- l) the need of communication system;
- m) the supervision way.

35.4.6 For routine activities of work at height the risk analysis can be included in the respective operating procedure.

35.4.6.1 The operational procedures for the routine activities of work at height must contain at least the following:

- a) Guidelines and task requirements;
- b) Administrative guidelines;
- c) Task detailing;
- d) Risk control measures relate to the work routine;
- e) Impeditive conditions;
- f) The necessary collective and personal protection systems;
- g) Competencies and responsibilities.

35.4.7 The activities of work at height that is characterized as non-routine must be previously authorized with permit.

35.4.7.1 For non-routine activities the control measures shall be evident in the risk analysis and the work permit.

35.4.8 The work permit must be issued, approved by the person responsible for the permission, displayed at the place of the activity execution and, in the end of the work; the same must be finished and archived in such a way as to allow their traceability.

35.4.8.1 The work permit must contain:

- a) the minimum requirements to be met in order for the execution of the work;
- b) the provisions and the measures established in the risk analysis;
- c) the names of everybody involved and their authorizations.

35.4.8.2 The work permit must have validity limited to the duration of the activity, restricted to work shift and may be revalidated by the responsible in charge in stable situations, where the pre established conditions did not changed nor changes in the team.

35.5. Personal protective Equipment, Anchoring systems and Accessories

35.5.1 Personal protective equipment-PPE, anchoring systems and accessories must be specified and selected considering their efficiency, comfort, the load applied to the same and the safety factor, in case of eventual fall.

35.5.1.1 In the selection of PPE should be considered, in addition to the risks to which the worker is exposed, the additional risks.

35.5.2 Inspection of EPI, anchoring systems and accessories for fall height protection must be carried out at the acquisition and periodically, with the refusal of defective or deformed equipment.

35.5.2.1 Before the work routine, inspection of all PPE, anchoring systems and accessories must be carried out.

35.5.2.2 The result of inspections must be registered:

a) in the acquisition;

b) Periodically and routinely when PPE, anchoring systems and accessories are refused.

35.5.2.3 PPE, anchoring systems and accessories that present defects, deformities, degradation, deformities or suffer an impact from a fall must be unused and discarded, except when its restoration is provided by national technical standards or, in its absence, international standards.

35.5.3 The safety harness must be of body type and equipped with device for anchoring system connection.

35.5.3.1 The anchoring system must be established by risk analysis.

35.5.3.2 The worker must remain connected to the anchor system throughout the period of exposure to risk of falling.

35.5.3.3 The lanyard and the fall arrestor device should be secured above the waist level, adjusted in such a way as to restrict the fall distance and ensure that, in case of occurrence, such equipment will minimize the chances of having the worker colliding with lower structure.

35.5.3.4 is mandatory the use of shock absorber in the following situations:

a) When fall factor is greater than 1;

b) When the length of the lanyard is greater than 0,9 m.

35.5.4 About the anchor point, the following steps must be taken:

a) Be selected by professional enabled legally;

b) To have resistance to withstand the maximum load applicable;

c) Have its integrity inspected prior to use.

35.6. Emergency and rescue

35.6.1 The employer must provide staff for responses in the event of emergencies to work at height.

35.6.1.1 The team can be internal, external or made up by the workers who perform the work at height, in relation to the characteristics of the activities.

35.6.2 The employer must ensure that the team has the necessary resources for the emergency responses

35.6.3 The actions of responses to emergencies involving work at height must be included in the emergency plan of the company.

35.6.4 The people responsible for carrying out rescue measures must be able to perform the rescue, provide first aid and have physical and mental fitness compatible with the activity to be performed.

(Becomes enforced on 27/03/2013-See in Art. 3^o of ordinance No. 313/2012)

ASSOCIATED STANDARDS

In regards to the accidents prevention and the work at height management both shall obey the following national standards:

Ordinance MTE N° 3214/1978 – NR-06: Personal Protective Equipment – PPE – This standard, edited by the Ministry of Labor and Employment, establishes legal definitions, means of protection, marketing requirements and responsibilities as to the use of personal protective equipment.

Ordinance SIT N° 254/2011 – NR-18: Work conditions and environment on the civil construction industry – This Regulatory Standard – NR establishes administrative, planning and organization guidelines which have as objective the implementation of control measures and safety preventive systems at work processes, conditions and environment in the Construction Industry.

Ordinance MTE N° 34/2002 – NR-30: Safety and Health in Seafarer Work, annex II – Platforms and Supply Installations (Ordinance SIT N° 183/2010) – This annex from the standard edited by the Ministry of Labor and Employment establishes the minimum safety and health requirements onboard platforms and supply installations used in the exploitation and production of petroleum and gas.

Ordinance SIT N° 200/2011 – NR-34: Work Conditions and Environment on the naval construction and repair industry – This standard, edited by the Ministry of Labor and Employment, establishes the minimum requirements and protection measures for the safety, health and environment at naval construction and repair industry.

SIT Ordinance No. 313, March 23, 2012-NR-35 Work at Height – this Norm establishes the minimum standards and protection measures for work at height, involving planning, organization and implementation, in order to ensure the safety and health of workers involved directly or indirectly with this activity.

ABNT NBR 14.626:2010: Personal Protective Equipment against falling from height – sliding fall-arrestor flexible line – This Standard specifies the requirements, test methods, marking, instruction manual and packing for sliding fall- arrestors guided in flexible line.

ABNT NBR 14.628:2010: Personal Protective Equipment against falling from height – retractile fall-arrestor – This Standard specifies the requirements, test methods, marking, instruction manual and packing for retractile fall-arrestors.

ABNT NBR 14.629:2010: Personal Protective Equipment against falling from height – energy absorber – specification and test methods – This Standard specifies the requirements, test methods, marking, and usage instruction manual of energy absorbers.

ABNT NBR 15.834:2010: Personal Protective Equipment against falling from height – safety lanyard - This Standard specifies the requirements, test methods, marking, instruction manual and packing for safety lanyards of fixed and adjustable length. The safety lanyards complying with this Standard will be used as components or connection elements.

ABNT NBR 15.835:2010: Personal Protective Equipment against falling from height – abdominal safety harness and safety lanyard for positioning and restriction - This Standard specifies the requirements, test methods, marking, instruction manual and packing for abdominal safety harness and safety lanyards for positioning and restriction.

ABNT NBR 15.836:2010: Personal Protection Equipment against falling from height – safety harness (parachute type) - This Standard specifies the requirements, test methods, marking, instruction manual and packing of safety harness (parachute type).

ABNT NBR 15.837:2010: Personal Protective Equipment against falling from height – connectors - This Standard specifies the requirements, test methods, marking, instruction manual and packing for connectors of personal protective equipment to work at heights.

SAFETY LEGISLATION IN WORK AT HEIGHTS

Complementing the information provided by the previous chapter; it is important to verify a few dispositions defined at the chapter V of the CLT (Labor Law Code).

Art. 157 – It is up to the companies to:

I – follow and make the others follow the work safety and medicine standards;

II – instruct the employees, through orders, as to the precautions to take in order to avoid work accidents or occupational diseases;

III – adopt measures that are determined by the current regional organ;

IV – facilitate the inspection procedure done by the competent authority.

Art. 158 – It is up to the employees to:

I – observe the work safety and medicine standards, including instructions that are related in item II of the previous article;

II – cooperate with the company in the application of the devices from this Chapter

Also it is important to verify the Regulatory Norms, regulated by the Ministry of Labor and Employment. Some of those Regulatory Norms are directly related to work at heights.

The **NR-06** is related to Personal Protective Equipment.

We also have the NR-18 toward administrative, planning and organizational guidelines. This **NR-18** regulates the implementation of safety control measures and preventive systems in the processes, conditions and work environment in the Construction Industry.

We can also mention the **NR-30** that is related to the Seafarer Work Safety and Health. The Annex II of this NR establishes minimum work safety and health requirements onboard platforms and supply installations used in oil and gas exploitation and production process.

The **NR-34** establishes a minimum requirement and protection guidelines for safety, health and work environment at shipyard industry activities.

The **NR-35** establishes the minimum standards and protection measures for work at height, involving planning, organization and implementation, in order to ensure the safety and health of workers involved directly or indirectly with this activity.

GLOSSARY

The main definitions and terms found in the regulatory standards and technical standards applied on work at heights are:

Rope Access: Also called industrial alpinism; it's a group of specific techniques, appropriate to the industrial area, destined to the accomplishment of work at heights or in areas of difficult access.



Industrial Alpinism

Preliminary Risk Assessment - PRA: Initial evaluation of the potential risks, its cause, consequences and control measures.

Scaffold: Platform to work at great heights by using a temporary structure or supporting device.

Swing Stage Scaffold: Fixed scaffold, supported by timber-framed with the swing.

External Scaffold: Metallic scaffold simply supported, fixed on the structure to the extension of the outer plating or accommodation.

Simply Supported Scaffold: Fixed scaffold on which platform is simply supported, and it may be fixed or moved horizontally.

Safety Harness (parachute type): Personal Protective Equipment used to work at heights where there is the risk of falling.

Cross Bracing: It is a connection system between the main elements of a structure to increase the strength of the group.

Daily Safety Dialogue - DSD: Short daily meeting, in which work safety, health and environment themes will be discussed

Personal Protective Equipment: Every device or product, to be used individually by the worker, destined to the protection of risks that can threaten the work safety and health. The Personal Protective Equipment is composed by many devices that the manufacturer has associated against one or more risks that may happen simultaneously and that may threaten the work safety and health.

Fall Factor: The Fall Factor is a figure used to express the seriousness of a fall. It is the relationship between the length of the fall and the length of rope available.

Scaffold Release Form: It is a form containing a checklist of the safety requirements to be complied with in order to release the scaffold.

Frame: vertical structural piece from scaffolds, towers and ladders.

Work Permit – WP: Written document containing a group of control measures, aiming to develop a safe work, besides from the emergency and rescue measures.

Lifting Platform: Lifting work platform with vertical movement done by a hydraulic, articulated or pinion and rack system.

Anchorage Point: Point destined to support personnel for the connection of safety devices, such as ropes, steel cables, fall-arrestors and lanyards.

Temporary Anchorage Point: The point evaluated and selected to be used temporarily in order to support personnel during a specific task.

Legally Qualified Professional: The worker is considered a legally qualified professional when previously qualified and registered in the competent class council.

Absorbing system: Device destined to reduce the impact transmitted to the worker's body and to the safety system during the contention of the fall.

Inert suspension: Situation in which the worker stays suspended by the safety system, until rescued.

Lanyard: Connection device of a safety system, adjustable or not, to support, position and limit the worker's movement.

Authorized Worker: A worker is considered authorized to work at heights when qualified and once his health state is evaluated, being considered apt to execute the task.

Skilled Worker: A worker is considered trained, once he received the training under the guidance and responsibility of a legally qualified professional. The worker is considered trained to work at heights once he has done a minimum of 8 hours of theory and practical training.

Legally Licensed Worker: The worker is considered legally licensed when previously qualified and registered in the competent class council.

Qualified Worker: It's considered a qualified worker the one that can prove that he has concluded a specific course for his activity, within an institution recognized by the official learning system.

Working at Heights: Working at heights is, every activity done in different levels in which there is the risk of falling that could cause injury to the worker. This standard is applicable to any task done above two meters from the ground, where there is the risk of falling.

Fall- Arrestor: Automatic locking device made to connect the safety harness to the safety cable, with a CA (Certificate of Approval).

1. REALITY OF WORK AT HEIGHTS IN BRAZIL

It is commonly reported by safety professionals that amongst all the work accidents, the ones linked to fatalities are always related to fall from different levels. Out of the work accident that happens every year in Brazil, nearly 30% of them are due to falls.

It is not unusual to hear at the media stories of people injured or dangerously hospitalized after a fall. If we just walk around more attentively we can observe many areas where the work at heights is being done wrong. We can observe that some companies still don't comply with the law, neither training their employees in a proper way nor providing them the correct equipment to work, creating risky situations.

Statistics presents an astonishing result toward work accident. According to the Brazilian Social Security Ministry there were 512.232 work accidents in 2006. At the year of 2009 there were 723.452 accidents, where 528.279 were registered and 195.173 not registered. Out of these occurrences in 2009, 13.047 resulted in permanent incapacity of the workers and 2.496 resulted into deaths.

If we analyze part of this data through segmented areas, we can verify that the industry had 316.955 accidents related to work at heights. Food and Beverages: 66.554 WA; Textile: 27.937 WA; Chemical Products: 8.364 WA; Oil & Gas: 8.190 WA.

In Europe, around 1.300 accidents due to falls resulting in death happened in 2006. The majority of these accidents were at the construction industry. In the United States, out of 4.070 accidents occurred in the industry in 2010, 598 were due to falls. There were 768 deadly accidents in the mining industry and natural resource industry, where 41 of them were caused by falls. In drilling activities were 7 the number of deadly accidents by falls. If we were to compare our numbers with the international scenario, we can visualize the difference. In order to improve the safety at work in height, it is possible, now a day, to have access to open sources of information that approaches this kind of practice.

2. MAIN DEFINITIONS

The work at height is characterized by every activity done in different levels of height where there is a risk of fall with possibility of injury or death. This risk standard is applicable to any work done above two meters from the floor.

PPE is every equipment, device or product for the individual usage of the worker, designated for his/her protection from risks that may threaten the work safety and health. A Combined PPE is the one composed by many apparel, in which manufacturer designed it to protect the worker against one or more simultaneous risks.

A qualified worker is the one that has been submitted to theory and practical training, of at least 8 hours, with syllabus that includes the following activities:

- The collective and individual protective equipment to work at heights: selection, inspection and limitations of its use;
- The actions in emergency situations (inert suspensions, start of fire, rescue and escape route, amongst others)

It is considered a legally qualified professional any worker previously qualified and with a register in the competent class council.

A professional is considered any qualified worker that accomplished the specific course for the activity in an institution recognized by the official educational system.

In the same way, therefore, a professional is also considered authorized to work at heights once his/her health condition is evaluated and considered apt to execute this activity.

This is a compliance with the NR-07 from the Ministry of Labor and Employment, for admission, periodic and demission; in which medical exams must be done (ASO – Occupational Health Certificate), together with other

exams, that can be required by the work doctor, attesting the capacity to work at heights.

As to the evaluation of the qualified and authorized worker's health state to work at heights, it is up to the company to:

- Make sure that the evaluation is done periodically, considering the risks involved in each situation;
- Make sure that the exams and the evaluation procedures are part of their Program of Medical Control for Occupational Health - PCMSO.

The worker's health state, even if it is not the main factor in the causes of accidents related to work at heights, must be taken into consideration and be observed due to the occupational exams.

Conditions such as epilepsy, hypertension, heart disease, vertigo, dizziness, balance disturbance and coordination problems such as labyrinthitis, obesity, anxiety, and acrophobia, amongst others, can be pointed out as examples of conditions that may predispose the worker to fall, from the same level or even from high places.

Other sociological problems must also be carefully examined. Sleeping problems, inadequate nutrition, the use of controlled medication, alcoholism and drug abuse, factors that are not always identified in the occupational exam, must be considered.

The NR 07 requires that the medical exams have to be done according to the specific activity of the job. Nevertheless, we believe that a preventive occupational healthcare professional must provide a specific protocol for the exams and also examine in detail all the current clinical history and the worker's progress.

Finally, we also recommend the personnel responsible for the execution and release of work at heights to always inquire the authorized workers before any activity if that professional is in psychological and physical conditions to carry out the work at height. Such information (positive/negative) must be registered at

the work permit, with the other evaluations, such as, for example, the arterial pressure measurement before the task is executed.

3.MAIN RISKS OF WORKING AT HEIGHTS

Unsafe actions and conditions are the most common causes of accidents related to falls. Due to the difficulty of access to some work places situated in high areas, or due to lack of qualification from workers involved in the execution of the work at heights, or even due to weather conditions (wind or rain), we can say that the work at heights deserves our



Working at height in adverse weather conditions

full attention based on its potential. It is determined the immediate interruption of the work in case of bad lighting or adverse weather conditions, such as rain and wind with speed above 40km/h, amongst others. In general, during the execution of this type of work, the worker is exposed to these risks in two stages:

- When accessing the workplace (with or without equipment or materials)
- When working (execution of the task itself)

We may have accidents involving work at heights based on excess of confidence, lack of PPE or its incorrect use, failure of the PPE/CPE, structural collapse, access to dangerous areas, falls of materials / moving objects, fatigue / phobias, noncompliance to and/or ignorance of the standards, rules or safe execution.

The most common factors of accident is related to the failure to acknowledge a problem. Also the failure in set a safe work system, to assure that the safe work systems are being followed, to provide appropriate information and to use appropriately the protection equipment.

A lot has been changed in order to make the work with heights safer. If we compare with the past we can see great changes. One of these changes is the initiative to standardize the safe practice of these tasks. We must not forget that all of us need to know and execute tasks according to what is required by law. Unsafe actions and conditions must be minimized and eliminated from our workplace.

We can find areas of high risk at places where there`s scaffolds, ladders, ramps and walkways; drilling towers; telecommunication tower; helideck; flare; metallic structures (legs, jackets, bracing, etc.); hull of vessels; confined spaces; or any other area with difference of level where there is the risk of falling.

Work`s philosophy for Fall Prevention adopts the following principles: Is it possible to execute the task on the ground level? (Example: lowering the drilling parts of tower for maintenance); is it possible to install a work platform (or another access device) in the surroundings of the workplace, to minimize the height difference? (Example: scaffolds).

4. PLANNING THE WORK AT HEIGHT

Every task that will be done that has the risk of falling must be planned. One of the most efficient ways to prepare a safe operation is the adoption of disciplined methodologies such as risk assessments and a work permit program. The planning, organization and execution of work at heights will always be part of the responsibility of a qualified and authorized worker.

The PRA consists in the initial evaluation of the potential risks, its causes, consequences and control measures, carried out by a multidisciplinary and coordinated work safety and health technical team or, in their absence, the people responsible for complying with this standards, and it must be signed by all participants.

Everyone must contribute to reduce the risks of falling, which could cause personal damage to any employee.

When planning the work at heights, one should certify that:

- Every work is being appropriately planned and supervised;
- Every work is being considered weather conditions, that may endanger the worker's life and health;
- Everyone involved in this type of activity is trained and authorized to do so;
- The workplace is safe;
- The equipment are duly inspected;
- The risk of having fragile surfaces and falling objects are appropriately controlled;
- Emergency and rescue procedures are taken into consideration.

When emergency and rescue procedures it's not possible to be done, one must ensure that the task will be executed on a safe platform. It's essential to check all the risks before starting to work, also check all the equipment needed, the precautions and also if the safety work system is being provided and implemented.

When it's not possible to eliminate the risk of falling, one must use equipment or other safety measures that will minimize the distance and the consequence of falling, in case it happens (nets, airbags). Everyone that will be working with such equipment must be trained and competent to assemble and install it. Alternatively one may be able to be raised from the floor with a temporary platform or with padding equipment.

The Preliminary Risk Assessment (PRA) must include:

- Adverse weather conditions;
- Workplace;
- Authorization for all personnel involved;
- Selection, usage and the limitations of PPE/CPE, attending the principles of impact reduction and fall factor;

- Risk of falling materials;
- Emergencies / Signaling (escape routes or means of abandonment).
Technical factors that should be considered:
- Exposure time to risk, which is needed to execute the task;
- Number of workers involved;
- Repetitive work;
- Relation between Cost x Benefit;
- Productivity;
- Physical space and interferences.

The Work Permit is a written document containing a group of control measures that seeks to provide safety during the work activity and besides including the emergency and rescue plan, this document must also:

- Be issued in three copies: one to be fixed at the work site; the other to be given to the worker's supervisor and another to be filed so it can be easily found when necessary;
- Include all the minimum requirements to be complied with and when applicable, to the provisions established within the PRA;
- Be signed by members of the work team, their supervisor and by the work safety and health personnel or, in his absence , the person responsible for complying with this standard;
- Have a expiration time frame, accordingly to each activity and it`s legal work duration, which may not go over the work shift hours.

The Work Permit must also consider:

- Inspection of PPE and CPE;
- Prevention against tools and materials falls;

- Isolation and signalization of the workplace;
- Prohibition of isolated work;
- List of everyone involved and the respective authorization;
- Rescue and first aid planning;
- Communication system;
- Availability for a firefighting team at the workplace, according to the PRA.

4.1. MAIN WORK RECOMMENDATIONS

It is up to the companies to guarantee the effective implementation of the protection measures against falls through formal and written programs assuring to the workers all updated information about the activities' risks and control measures that must be adopted. These measures must be followed by both the company's employees and third party companies' employees.

Whenever there is a change in the environmental conditions, or situations that could be or couldn't be foreseen, which contradicts the safety recommendations established in the work plan and eventually become potentially dangerous to the physical and psychological integrity of the worker, the task must be immediately interrupted and informed to the supervisor responsible for the work execution.

In order to have a safe work at heights execution the following steps must be taken:

- Isolation and signalization of the work area before the activity starts;
- Adoption of measures to keep tools and materials from falling, including in case of the task interruption;
- De-energize, lock-out and tag-out of all electrical installation at heights near the work area;

- Protection or barriers installation in order to avoid accidental contact with electrical structures at heights, in accordance to the procedures from the local unity, if de-energizing it`s not possible.
- Immediate interruption of the work at heights in case of poor lighting or adverse weather conditions, such as rain and wind with speed above 40km/h, amongst other requirements.
- The transposition of floors with difference in levels above thirty centimeters must be done by ladders or ramps.
- The ladders, ramps and walkways that are used collectively for people and materials circulation must have a solid structure, handrail and footer.
- Every safety harness must be appropriately adjusted onto the body allowing enough space for movement, but safe enough so that the user does not slip and escape from the equipment, in case of a fall the shock force must be evenly distributed onto the body. The worker must observe if the adjustment will allow proper movement for working.
- Equipments and devices that have suffered tension due to a fall must be submitted to an accurate inspection, which is performed by a qualified professional, to assure its integrity and validation.
- Special care must be taken with the carts and baskets that are suspended by cranes and it`s used for people transportation.

4.2. WORK AT HEIGHTS WITH LADDERS

When we approach about work with ladders, ramps and walkways, it is established that:

- The transposition of floors with elevation above thirty centimeters must be done by ladders or ramps.

- The ladders that are used collectively, and the ramps and walkways used for circulation of people and materials must have a solid construction, handrail and footer.
- For construction of ladders, ramps and walkways, it is necessary to use dry wood with high quality, which may not have any knots or cracks that may compromise its resistance. Also, it is not allowed the use of paint to cover any imperfection.

Besides from what in mentioned above, there are other guidelines for use and installation of the ladders. About temporary ladders:

- Cannot be wooden for hot work;
- It must have handrail and footer;
- It must be set accordantly to the flow of workers, if used collectively;
- Must be dimensioned accordantly to the flow of workers, with minimum width of 80 cm;
- It must have an intermediate platform for each 2,9m at least;
- Each level must have width and length at least the same as the ladder's width.

The ladders must be restricted for use in temporary accesses and small services, and:

- It must have dimensions of maximum seven meters of extension and even space between the steps, ranging from 25 to 30 centimeters;
- It must be installed in a way that is going to exceed in one meter from the upper floor;
- It must be fixed at the inferior and superior floors or have a device that will prevent the worker from slipping;

- It must have non-skid steps; and
- It must be supported on a resistant floor.

It is forbidden to use ladders:

- With single frame and close to unprotected power line and energized equipment;
- Around doors or pathways, gaps and openings;
- In areas where there is a risk of objects or materials falling;
- Trestle type, if doesn't have devices to keep them constantly open and that have more than 6m when closed.

The vertical fixed ladders, with 6m or more, must have:

- Railings from two meters above the base until one meter above the last work surface;
- An intermediate level to rest, protected with railings and tool board, on each 9 meters level.

4.3. WORK WITH PLATFORMS

The fixed platforms:

- It must be projected, approved, installed and kept in a way to support the maximum allowed weight.
- The platform's project and its structure (supporting and fixing) must be done by a legally qualified professional.
- It is forbidden the use of any mean to reach higher places on top of the platform's work floor.

- A visible and indelible plate containing the indication of the maximum cargo allowed must be fixed on the platforms.

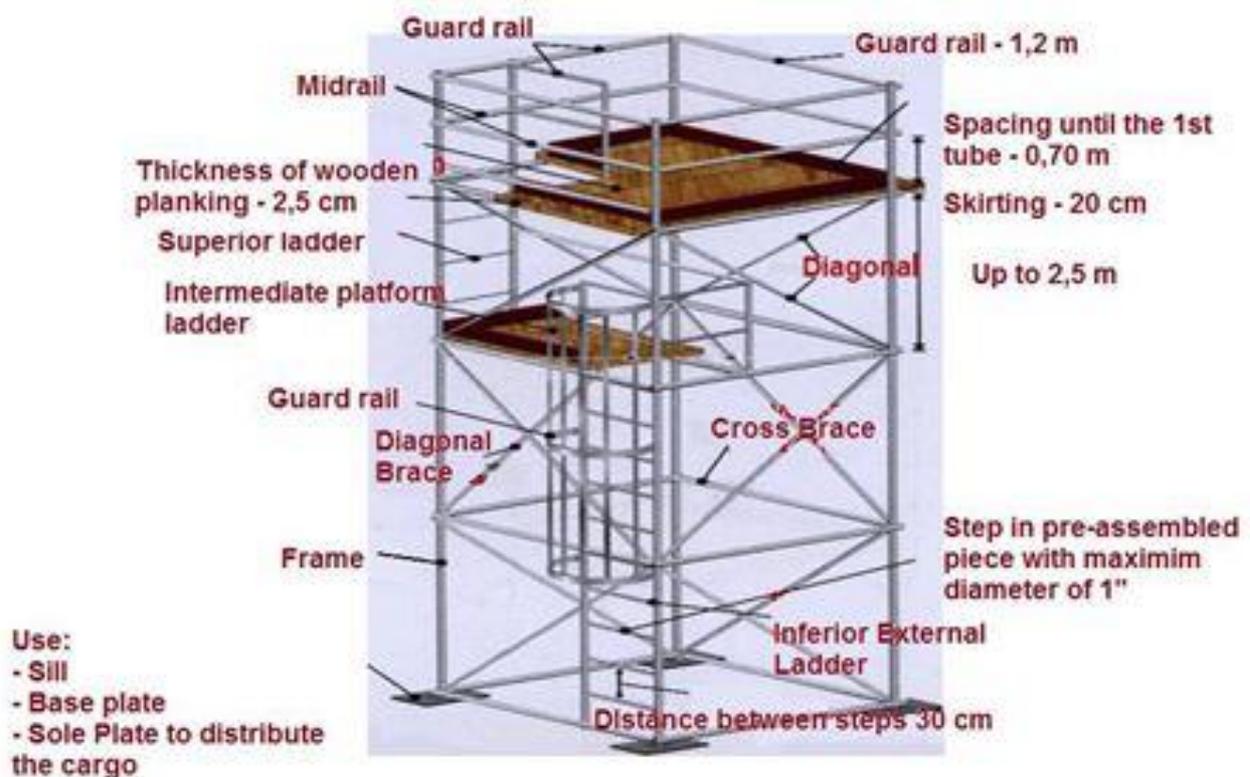
The lifting platforms:

- Observe the manufacturer's specifications to assemble, disassemble and about periodic inspections, under technical responsibility of the legally qualified professional;
- Its installation, maintenance and periodic inspection must be done by a skilled professional under the supervision of a legally qualified professional;
- Operation only by qualified professional;
- Every user must receive guidance about the correct carrying and positioning of the material on the platform;
- Must have sound signalization, emergency stop button and safety devices that guarantee a perfect leveling without exceeding the maximum leaning;
- Emergency stop and manual descend by the operator in case of failure;
- Electronic devices that will keep the worker from moving when open;
- The improvisation at moving areas and connecting platforms is forbidden during assembly.

4.4. WORK WITH SCAFFOLDS

They are platforms to work at greater heights by using a temporary structure or a supporting device.

Every scaffold must have a Scaffolding Release Form. It is a form that has a checklist with the safety requirements to be complied and to allow work on the scaffolds.



Scaffold and its correspondent components

The types of scaffold:

- Moving Scaffold
it is a fixed scaffold supported by a moving framework.
- External scaffold

Metallic scaffold simply supported, fixed to the structure in the extension of the vessel's side or accommodation.

- Simply supported scaffold:

Scaffold on which platform is simply supported; it may be fixed or with horizontal movement.



Simply supported scaffold

The main procedures for preparation and use of scaffolds in work at heights are:

- The dimensioning of scaffolds and its supporting and fixing structure must be done by a legally qualified professional.
- The scaffold project's calculation must be kept on the establishment.
- The Work Permit must be issued every time the scaffolds are assemble, disassemble and have maintenance.
- The assembly, disassembly and maintenance must be executed by a qualified worker under the responsibility of the supervisor.

- The assembly and disassembly procedure must be interrupted immediately in case of bad lighting and adverse weather conditions, such as wind with speed above 40km/h, amongst others.
- It`s mandatory for the person assembling the scaffold to be using a safety harness (parachute harness style), with a double lanyard and the appropriate tools must be packed and connected to the harness.
- The areas must be isolated during the assembly, disassembly or maintenance procedures.
- The scaffolds that are being assembled, disassembled or maintained must have signalization plates:
 - ✓ Red → forbidden to use
 - ✓ Green → free to use
- The scaffolds can only be used after they are approved by a work safety and health professional or, in his absence, by all the people with the responsibility of following this standard, together with the personnel in charge of the task.
- The approval must be recorded on the "Scaffolding Release Form" which will be filled in, signed and fixed on the scaffold.
- The scaffolds must be fixed to a secure, cable-stayed or anchored point structures that, will resist the action of the wind and the supported cargo load weight.
- The fixation does not need to be done when the scaffold's tower does not exceed, in height, three times the smallest dimension of the supporting base.
- The moving scaffold's structure must be braced and anchored to eliminate any oscillations.
- The frames must be firmly supported on sills above a solid and leveled base capable of withstand the strain and the transmitted load weights.

- There can only be used scaffolds up to six meters high, with casters with locks and supported on flat surfaces.
- The pieces must be inspected and evaluated periodically, consigning the results in a checklist under the supervision of a legally qualified professional.
- The work floor should have full lining, must be non-slippery, leveled and fixed in a safe and resistant ground, remaining clear.

- The correction from overlap is allowed, when it is:
 - ✓ Foreseen in the scaffold's project or if the technical inevitability of the overlap is justified by a work safety and health professional or in their absence, by the person responsible for following this standard;
 - ✓ Supported by a platform and with at least twenty centimeters on each side, creating a overlap of, at least, forty centimeters, including the mandatory signalization of the area (indicating the existence of the obstacle and painting of a warning banner on the floor), as well as the careful fixation of the anchor points, so it will not allow it to move up from the floor.
 - ✓ Except the side facing the work area, the scaffold's platform must be protected all around its perimeter with:
 - ✓ Rigid guardrail, fixed and made by two metallic tubes, placed horizontally, at distances of seventy centimeters and one meter and twenty centimeters from the platform;
 - ✓ Skirting, next to the board, with minimum height of twenty centimeters.

- When there is the possibility of falling towards the internal area, the appropriate protection such as guardrails and skirting must be foreseen.

- The openings on the floors must be protected with a fixed guardrail and skirting.
- The scaffolds' floors, placed more than one meter high, must have ladders or ramps.
- It is forbidden to remove or block the scaffold's safety devices;
- The use of ladders and other means to reach higher places from the scaffold's working floor is forbidden;
- The displacement of scaffolds with workers and/or tools on them is forbidden.
- In case it's necessary to install a cargo lifting equipment, one must choose the appropriate area according to the scaffold's project, in order to not implicate on it's stability and safety.
- The tower's anchorage is mandatory when the height reaches above nine meters.

4.5. WORK WITH RISKS OF FALLING IN THE WATER

The NR-18, related to the work conditions and environment in the construction industry, foresees a few requirements related to any work that involves the risk of falling in the water.

- In the execution of any work with the risk of falling in the water, one must use lifejackets or other floating equipment.
- There must always be, in the surroundings and in an easy access area, enough duly equipped life rafts.
- The work platforms must have a safety line, anchored to a fixed point, which may be used when the weather conditions do not allow the use of vessels.
- Work execution over the water at night, platform's safety signalization and rescue equipment must have waterproof lighting system.

- The lighting system must be intrinsically safe.
- The working platform's supporting surfaces must be non-slippery.
- It is forbidden to leave loosen materials and tools on the working platforms.
- Around the working platforms, there must be guardrails installed, firmly fixed to the structure.
- In any activity, it is mandatory the permanent presence of a qualified personnel for rescue, application of first aid and cardio respiratory resuscitation procedures.
- The Work on floating must comply with the provisions in the Regulations for Maritime Traffic and International Regulations to Prevent Collisions at Sea - RIPEAM 72, from the Maritime Ministry .
- The lifejackets (class 4) must be orange, have engraved the company's name and maximum capacity in Kg (kilograms).
- There must be the same number of lifejackets as to the number of workers and crewmembers.
- It is forbidden to store onboard rags soaked in oil or any volatile substance.
- It is mandatory to install an appropriate number and capacity of fire extinguishers.
- It is mandatory to use boots with elastic on the side.

4.6. ANCHORAGE

Before mentioning about anchorages it is important to distinguish between the definition of anchorage, anchor point and mooring

- **Mooring** is every moving or fixed, natural or artificial, structural element, that is the most resistant point in the selection and assembly of an anchorage system. It must be strong enough to support the shock caused by the worker's fall.

- An **anchor point** is the existent point within the permanently or temporarily mooring, where can be installed a fall arrestor system. The best examples of anchor points are the pad eyes and the beams.
- **Anchorage** is the assembly of a fall arrestor system involving connectors, ropes, steel cables or another device chosen to be used on the anchor point.

The choice of the best anchor point to assemble the anchoring safety systems it`s also a critical decision for the personnel responsible to allow the work at heights.

As to the anchorage points, the following steps must be taken:

- Inspection of all points before their use;
- Identification of the permanent points and the maximum cargo weight applicable;
- Test of the cargo in all temporary points before its use.

The anchor points may be fixed permanently or temporarily. The temporary anchor points are the ones that have been evaluated and selected to be used temporarily in order to support the personnel during a specific task.

The dimensioning of maximum cargo weight from the permanent anchor point must be done by a legally qualified professional. The procedure for cargo test on the temporary points must be created by the legally qualified professional, which will supervise the execution. One must store in the establishment the project`s calculation registry, from the permanent anchor points and the cargo test results done on the temporary anchor points.

The permanent anchor points must be identified. It is recommended that the anchor points are marked in yellow showing its resistance capacity and the maximum number of people anchored by each point.

Temporary anchor points may also be used in the installation of fall arrestor systems; it may be beams, pad eyes, steel cables, metallic tubes and etc... It is important for the anchorage to be sufficiently resistant to support the impact caused by the worker's weight. The use of temporary anchor points must also be evaluated by a legally qualified professional.

5. WOORK AT HEIGHTS EQUIPMENTS

According to the guidelines given by the NR-6, the MTE is responsible for the issue of CA (Approval Certificate), without it the PPE, manufactured in Brazil or abroad, will not be legal for sale or to be used by the workers. The CA for equipment to work at heights is issued only upon the results of laboratory tests, now-a-days done exclusively by the Fundacentro. According to the legislation, every test on protection equipment will take into consideration the whole group of the equipment and no longer the device individually. For example, the CA is for the safety harness + lanyard and not for the safety harness or for the lanyard.

The NR-06 requires from the companies to provide to employees an appropriate PPE for the risks involved, being free of charge, in perfect condition of usage and operation, within the following characteristics:

- Whenever generally natural measures do not provide complete protection against the risks of work accidents or professional and work related diseases;
- While the collective protection measures are being implemented;
- In order to attend emergency situations.

It is up to the employer the following responsibilities regarding the PPE:

- Provide appropriate PPE according to the risk of each specific activity;
- Require the correct use from the employers and others;
- Only provide approved PPE with the indication of the Approval Certificate – CA, issued by the competent national organ related to work safety and health matter from the Ministry of Labor and Employment;
- Guide and train the workers about its appropriate use, storage and conservation;
- Immediately substitute, when damaged or lost;
- Be responsible for the periodic hygiene and maintenance;
- Inform the MTE of any observed irregularity.

It is up to the employees the following responsibilities regarding the PPE:

- Use only for its intended purpose;
- Be responsible for its storage and conservation;
- Inform the employer of any changes that could make it inappropriate to be used;
- Follow the employer's specifications about the appropriate use.

The PPE, its accessories and anchorage systems to work at heights must be selected considering the cargo weight to be applied on them and their respective safety factor, if there is the risk of fall.

It is highly recommended that all PPE have an inspection form with all information about its history of usage, considering any deformations, impacts, falls, exhaustion, tensions, corrosions, contaminations or other seen damages. Before and after every work at heights, it must be kept individual report for each equipment used informing the conditions they were found, used and stored.

The choice of PPE must always depend on the activity to be developed. Either on the work at height, a self-rescue situation, the worker's fall or the worker's rescue, the objective is always to guarantee a safe descend displacement of the worker to the floor. All the main Personal Protective Equipments when working at heights are:

5.1. SAFETY HARNESS

The safety harness to work at heights must be the parachute style.

The harness itself does not fulfill its role to protect the worker from falling.

It must be connected to a fall arrestor system which is also CA approved, to be used in combination with hardness by the worker when executing the activity.

Every safety harness must be fitted with enough adjustment so that the worker will not slip and escape from the equipment, and not suffer any trauma in case of a fall providing the most (uniform distribution of the shock) or avoiding other effects from the harness' syndrome. This adjustment must allow comfort and freedom of the worker's movement.

When the work at heights is done above two meters, the safety harness is mandatory and must be connected to an anchorage, preferably, above the head and never below the waist.



Type of harness proper for work at heights

5.2. FALL ARRESTOR

There are two types of fall arrestors: fall arrestor with fixed line and retractile fall arrestor.

The fall arrestor with fixed life line can be the one installed with ropes (usually 12 mm) or steel cables (usually 8 mm), both also certified to be used exclusively with lifting people. The ropes or steel cables that will be used as a safety line must have a fall arrestor installed, regardless of the structure on which the worker is working on.



When using fall arrestors, it must go through an evaluation before the vertical progression to check the compatibility of the locking system with the thickness of the rope or steel cable and test its operation.



The retractile fall arrestor device may use the steel cable or textile material (usually a synthetic strap made out of polyamide). These devices may also have self rescue systems to facilitate the recovery of the worker who fell. There are different sizes of fall arrestors according to the displacement need or estimated distance of the fall.

In the technical impossibility to use a safety cable, as shown in the PRA approved by the qualified Safety personnel, there shall be an alternative means of protection against the fall from heights

5.3. LANYARDS

The lanyards are composed of a textile material (polyamide and/or polyester) and have connectors (Hooks) made of steel in different amplitudes. They are devices used to climb on metallic structures or for restrict displacement on work at heights.

The lanyards may have an energy absorption system (ABS) or not. In order to use the lanyards with ABS, the user must know the maximum length of the device once activated in case of fall. Usually it is recommended to use lanyards in work at heights above 6 meters. The lanyard or absorption system must be fixed above the worker's waist level, adjusted in a way to limit the fall and assure that, in this situation, the work will not collide with the inferior structure. In case of falls, once the lanyard's ABS system is activated, all the equipment must be discarded. The same is applied to lanyards without ABS system.



Types of Lanyard

During the vertical progressions or temporary positioning, it is forbidden to "strangle" the lanyards. The amplitude of the connector must be evaluated before planning activities at heights.

5.4. CONNECTORS

They are also called carabiners. They are made of steel or aluminum. In operations at heights in industrial areas one must use steel carabiners.



Several types of connectors

5.5. PULLEYS

They are devices used in the systems of mechanical advantage (effort reduction) and Tyrolean systems. They are built by steel or aluminum. In the industrial areas they must be built of steel. There are also pulleys to be used with ropes and pulleys to be used with steel cables.

It is also important to remember that the responsible person for allowing the work at heights must provide pulleys destined to move people.



Different types of Pulleys

5.6. ROPES

They are manufactured of synthetic material, usually, from polyester fibers and from polyamide. They can be used as life lines (horizontal and vertical), displacement with the need of lifting, industrial climbing techniques and rescue operations.

However the ropes, devices which are essential to work at heights, need to be according to the Brazilian safety standards. The NR-34 mentions that in the execution of activities that need rope access technical procedures of industrial climbing must be used, according to what is established in the national technical Standards or, in its absence, international standards.

The resistance of a rope depends on the material it is made out of and the way its fibers are braided. Overall in Brazil the national manufacturers test their products in the IPT – Institute of Technological Researches. It is where the rupture resistance tests and stretching measurement are done. They are tested, by static tests, without assembled knots.

However, it is important to remember that the IPT tests do not follow a national standard (because there is not one) or are not aligned with any international standard (European or American).

6. HORIZONTAL OR VERTICAL DISPLACEMENT

The workers performing work at heights, when it is necessary to move on areas with the risk of falling, must be protected by using the PPE required for the task and its accessories.

Initially they must be using a safety harness (parachute type) connected to a safety device against falls.

This device could be a life line (horizontal or vertical), a fall arrestor (a rope or a steel cable), a retractile fall arrestor or a lanyard.



Horizontal Displacement

❖ Work with Displacement

➤ Restrict Displacement

The worker must be protected using the safety harness connected to a double or single lanyard, in order to limit the displacement therefore keeping the worker from reaching the area that has the risk of falls.

➤ Controlled

The worker must be protected using a safety harness connected to a fall arrestor (rope or steel cable) or to a retractile fall arrestor.

➤ Positioned

This situation happens mostly with electricians and assemblers. In this case, one must use the safety harness connected to a strap or a positioning lanyard.

7. CLIMBING ON METALLIC STRUCTURES

Before climbing, select the appropriate anchor point:

- Install the anchorage (if it is not installed yet);
- Visualize surrounding areas for physical contact because of swinging movements;
- Select and inspect the equipment/tools to be used, keeping them in containers or tied;
- Test the equipment before starting the movement;
- Plan a route to climb;
- Perform a clinical evaluation on the worker;



Climb

During the climb:

- Every horizontal life line must be installed above the waist line or at least 1,20m;
- It is recommended, when climbing a ladder or an structure, to use three physical contact points (two hands and one foot or two feet and one hand);
- When moving on the structures the worker must use the double lanyard correctly



Climbing a metallic structure

❖ Access by Rope

Vertical movement technique used to perform tasks in industrial areas where it is difficult to access, and where the progression route, established by the team, to the work place consists of ropes.

In the execution of activities with ropes, industrial climbing technical procedures must be used, as established on the Brazilian National Technical Standards (ABNT/ABENDE) or, in its absence, on international standards (IRATA) and the companies responsible for services that use these techniques must also be certified according to these standards.

The worker must submit to formal operational procedures, covering safety aspects with minimum requirements to be met, describing each worker's responsibility within the qualification level according to the activity developed by the work team and a self-rescue and rescue plan by the professionals in case of emergency.

The following requirements must be followed when performing a task using techniques to access with ropes:

- The work team must be qualified to rescue at heights and be composed by at least three people, including a supervisor.
- During the activity performance, the worker must be connected to at least two anchor points.
- The equipment and ropes used must be certified according to national standards or, in its absence, international standards.
- The equipment used to access with ropes must be stored and kept according to the recommendations by the manufacturer / supplier.
- The information by the manufacturer/supplier must be stored in a way to allow traceability.
- The work done using ropes to access must be immediately interrupted in case of bad illumination and adverse weather conditions, such as rain and wind with speed above forty kilometers per hour, amongst others.
- The work team must take a radio or other communicating equipment.

8. FALLING DYNAMICS

8.1. SHOCK ENERGY

It happens in static equipment or material (without energy absorption). The energy created by the shock of the fall is transferred to the worker and to the anchorage system. This energy is calculated using the following formula:

$$\mathbf{PE \text{ (Potencial Energy)} = m.h.g}$$

being m=mass; h=height; g=gravity

(Where PE is potential energy and g is gravity: 9.8 m/s. Rounded up to 10 m/s)

Example: A person weighting 100 kg + 1 lanyard of 1,5 m

$$\mathbf{PE = 100 \times 1.5 \times 10 = 1.500 \text{ kgf/j}}$$

Researches revealed that the human body resists shock energy of, maximum, 1,250kgf/j. Therefore, the solution for the problem above is to always keep the point, on which the person is anchored, above the head.

8.2. FALL FACTOR

The fall factor is applied when using dynamic equipment or systems (with energy absorption).

It is calculated by the following formula:

$$F_q = \frac{\textit{Altura da queda}}{\textit{Tamanho da corda}}$$

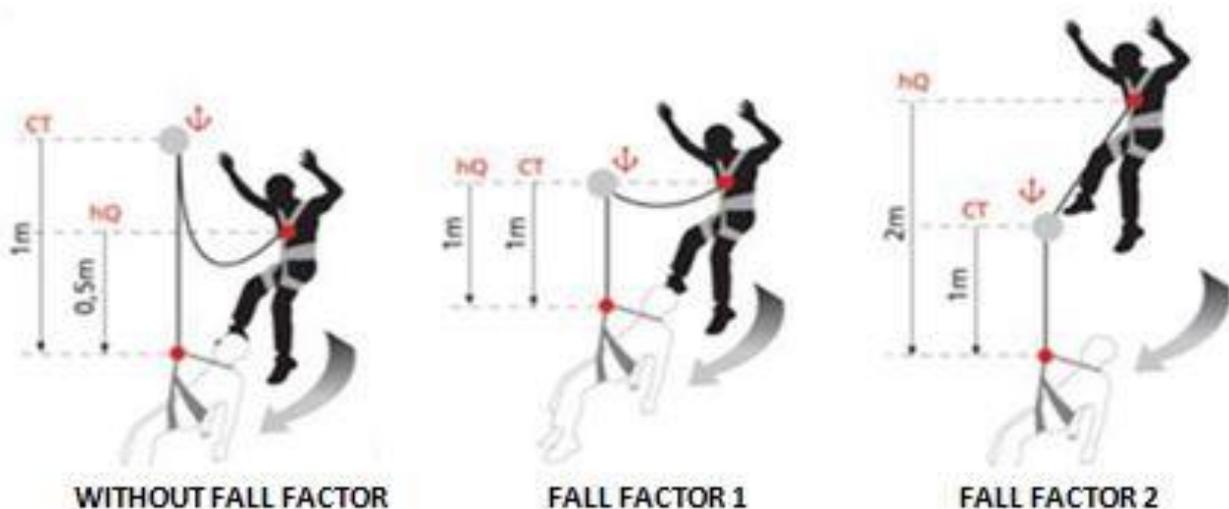
The following parameters are used as safety factors in case of falls when working at heights:

- Factor 1: Semi-static rope;
- Factor 2: Dynamic rope;
- Factor 5: Energy absorber

Examples: 1 rope of 50 m + fall distance of 50 m

$$FF = 50 / 50 = 1$$

Therefore we can allow a maximum fall factor of 1.



8.3. SUSPENSION TRAUMA

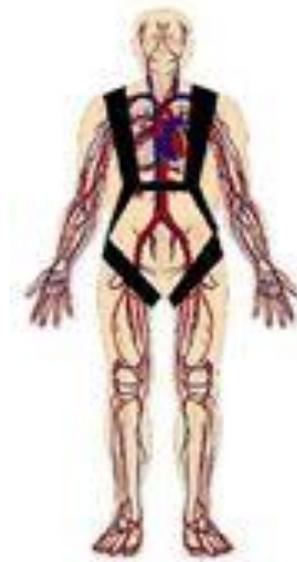
Suspension trauma or harness syndrome can happen when someone is suspended by the safety harness for a long period of time during the job execution or in case of falls followed by a long period of inertia still using the safety harness.

In these situations, the straps on the legs can compress the blood vessels, making the blood pumped by the heart accumulate on the legs (inferior limbs). When this happens the return of blood is compromised.

The heart, and therefore the brain, will not receive enough blood to work appropriately, leading to a series of reactions that can culminate with the loss of consciousness and, in extreme situations, the worker's death.

In case of suspension trauma the worker may have the following symptoms:

- Pallor;
- Nausea;
- Blurred vision;
- Cold sweat;
- Cramps;
- Weakness;
- Edema of lower limbs (swelling);
- Unconsciousness;
- Death



Circulatory System

We must also mention that the workers may suffer traumas that are not related to the circulatory system. We are referring to ortho-muscular traumas. In these cases the worker may have the following injuries:

- Hematomas;
- Excoriations;
- Lacerations;
- Bleeding;
- Bone fractures (open or closed);
- Pulled muscles or joints;
- Disruption of muscles;
- Disruption of organs (internal bleeding – rigidity of abdomen).

Many factors can help reducing the possibility of suspension trauma. Amongst them we can highlight the following:

- Control the work time suspended;
- Put the safety harness correctly
- Adjust correctly the leg straps;
- Avoid being static (always move and be careful when flexing the legs);
- When next to firm surfaces, use them to support and rest the legs;
- Use, when available, seats like chairs;
- Use the safety harness connected to a shock absorber device or system;
- Foresee rescue plans;



Inert suspension

If the workers is rescued with life from a situation where there was suspension trauma (harness syndrome) a few measures must be adopted in order to avoid worsening the person's condition and helping with the gradual recovery:

- After lowering, never lay the casualty down with legs horizontally stretched;
- Let the casualty lay down sideways, with the legs bent, as in fetal position;
- If possible, remove the harness (in last case, cut it) or loosen the straps;
- Check the pulse and the breathing;
- Call for help of professional from the medical department (preferably specialized).

9. EMERGENCY AND RESCUE PLANS

Although the companies tend to adopt safer practices of work at heights, emergency situations involving accidents may happen with workers. Therefore, a few preventive measures should be implemented in case of imminent hazard or accidents:

- Emergency procedures, for example, for evacuation of workers from temporary work at heights areas in case of fires;
- Passages, in any direction, between the access means and platforms that allow a fast evacuation of the workers in case of imminent hazard;
- Information to the workers that there are emergency procedures in the area;
- Means to activate the alarm and how to use it;
- Possibility to hire emergency services from the area;
- Existence of appropriate first aid equipment;
- Existence of trained workers or team responsible for first aid and rescue measures.

In case any rescue action of injured workers during the activities with work at heights is needed, these actions must be done by a specialized team or by trained workers that are involved with the company's work safety and occupational health department.

It is important that the people responsible for the execution of rescue measures, besides from assuring that they are physically and mentally compatible with the activity they are going to perform, assure they have specific training for the execution of the necessary rescue measures.

9.1. PROCEDURES TO RESCUE AT HEIGHTS

The company must create and implement appropriate emergency and rescue procedures to work at heights containing, at least:

- Description of possible accident scenarios, obtained from the PRA;
- Description of rescue and first aid measures to be performed in case of emergency;
- Selection and usage techniques of communication, emergency illumination, rescue, first aid equipment and casualty transportation;
- Activation of team responsible for the execution of rescue and first aid measures;
- Periodic rescuing and firefighting drill exercise, considering possible accident scenarios of work at heights, performing drills at least once a year.

9.2. RESCUE EQUIPMENT

The equipment to be used in rescue operations at heights will depend on the technique chosen to access the casualty. If the technique chosen, for example, is an access by ropes, the casualty approach and the equipment selection will not be the same as the one used on a rescue procedure where the access to the casualty is done from the work area or from the same level where the casualty is found.



Rescue Drill

Pulley systems (mechanic advantage), automatic devices for controlled descend, evacuation triangles (rescue triangle) and stretchers are a few examples of equipment that have a wide range of types with distinct applications that may be evaluated when adopting specific rescue plans according to the type of work at heights is being performed.

If your need is rescue or evacuation, the choice of the appropriate tool to work is critical. Once chosen, make sure that the workers are duly trained to use them correctly, safely and appropriately. Remember to always rescue an injured worker as fast and safely as possible, asking the worker to keep the legs in movement to help with the blood flow and to never lay down an unconscious or still worker, which has a suspension trauma signs.



Interchangeable pulley system with automatic lock



Automatic controlled descend equipment – self-rescue



Stoke Stretcher



Rescue chair



Reeves stretcher

REFERENCE DOCUMENTS

The following documents were used as information source during the preparation of this reference manual:

- Ministry of Labor and Employment NR-34: Work Conditions and Environment on the Naval Construction and Repair Industry;
- Ministry of Labor and Employment NR-30: Safety and Health on Seafarer
- Work, Annex II – Platforms and Supply Vessels;
- Ministry of Labor and Employment NR-06: Personal Protective Equipment - PPE;
- Technical Recommendation of Procedures – Protection Measures Against Falls from Heights, MTE/Fundacentro, 2001;
- Policy 2001/45/CE – Work at Heights