# THE IMPORTANCE OF THE ANCHORAGE SYSTEM FOR WORK AT HEIGHT AND RESCUE

https://doi.org/10.56238/sevened2024.037-065

Rodrigo Andrade dos Santos[1] and José Ivan Caballero Montero[2]

## ABSTRACT

The anchorage system is essential for safety in work at height and rescue operations, playing a crucial role in preventing accidents and protecting the lives of workers. This system consists of a series of components designed to support and distribute loads safely, preventing falls and ensuring stability during activities.

The primary function of the anchoring system is to provide a secure attachment point to which personal protective equipment (PPE), such as seat belts and ropes, can be attached. This is vital to prevent falls from heights that can result in serious or even fatal injuries. Proper anchoring allows the worker to move safely, increasing efficiency and confidence while performing their professional activities.

In addition, the anchoring system is crucial in rescue operations, where the safety of rescue workers and victims depends on robust and reliable anchoring. In the event of an emergency, it is essential that a well-designed and maintained anchoring system can make the difference between a successful rescue and a disaster.

To ensure the effectiveness of the anchoring system, it is essential to follow the determinations of Standard NBR 16325-1 and Standard NBR 16325-2, which deal with Protection Against Falls from Height, in addition to Regulatory Standard NR 18 and Regulatory Standard NR 35. The choice of anchor points must be judicious, considering the load capacity, the resistance of the materials and the suitability for the type of work performed. Regular inspections and maintenance of equipment are equally important to ensure that the system remains in safe operating condition.

In this way, the anchorage system is a key piece in the safety of work at height and rescue operations, providing an anchor point and a lifeline that protects workers against falls and increases the effectiveness of rescues. The correct implementation and maintenance of this system are essential to prevent accidents and save lives, underlining the importance of rigorous safety practices in the workplace.

**Keywords:** Protection against falls from height. Rescue at height. Anchoring system. Occupational safety.

[1] Eng.
Master in Housing – Civil Engineering
Occupational Safety Engineer
Institute of Technological Research of the State of São Paulo – IPT
E-mail: sarodrigoandrade@gmail.com
LATTES: http://lattes.cnpq.br/1198445862785183

[2] Eng.
Professional Master's Degree in Housing from the Institute of Technological Research of the State of São Paulo – IPT.
Institute of Technological Research of the State of São Paulo – IPT.
E-mail: ivan@baumix.com.br
LATTES: http://lattes.cnpq.br/1902541259199382

## INTRODUCTION

With the increase in the verticalization of buildings due to population growth, it is imperative to improve construction techniques for work at height and vertical techniques for rescue at height, employed by military firefighters to rescue people at risk. These situations may involve building dwellers, individuals seeking to access skyscrapers to endanger their lives, or construction workers who are trapped in poorly executed rope systems (AGUIAR, 2016).

According to Costa (2011), rescue at height is an activity performed by firefighters, which involves locating, accessing, stabilizing and transporting victims using specific techniques in elevated places. This is done based on safety standards and specific docking and lowering procedures.

The history of occupational medicine records that, from the beginning, the performance of work activities exposes workers to a variety of risks, with industrial evolutions, there have been significant advances in productivity, but also increased the dangers to the health and safety of workers.

Currently, Brazilian legislation understands that work accidents occur during the execution of activities at the service of the company and result in bodily injury or functional disturbance. These accidents can cause death, loss or permanent or temporary reduction of the ability to work. It is crucial to highlight that this definition is essential to determine the employer's responsibility and the worker's rights in cases of occupational accidents.

To minimize or avoid accidents at work, it is essential that companies adopt comprehensive preventive measures. This includes providing proper training to employees to be aware of the risks and know how to act safely. In addition, it is essential to provide and ensure the correct use of appropriate Personal Protective Equipment (PPE) for each type of activity. Performing regular maintenance on machines and facilities is also crucial to prevent failures that result in accidents. Additionally, fostering a culture of safety among employees, encouraging open communication about safety issues, and encouraging active participation in identifying and resolving issues, is key to creating a safe and healthy work environment.

Workplace accidents affect thousands of workers every year, across a wide range of economic sectors. The damage resulting from these accidents can be significant and, in some cases, irreparable. As consequences for the worker himself, the impact extends to family members, co-workers and society as a whole. It should be noted that, in addition to psychological, material and economic damage, they are among the most visible and impactful consequences.

In the workplace, several risks can trigger accidents, one of the most significant being the risk of falling from heights. This type of accident is often observed in statistics, both in terms of the number of occurrences and the severity of the damage. This underscores the importance of paying special attention to this type of risk, implementing measures aimed at eliminating or reducing the possibility of accidents of this nature to the minimum possible. Thus, the occupational safety engineering professional plays a fundamental role in applying his knowledge in the prevention of accidents in the face of the various risks present in the work environment.

The current legislation that addresses the issue of work at height is Regulatory Standard 35 (NR 35), which establishes requirements and protection measures to ensure the safety of workers who work in this condition. In addition, the Regulatory Standard – NR 6 deals specifically with Personal Protective Equipment, establishing requirements for its use, ensuring quality and effectiveness in the protection of workers.

## HISTORY OF OCCUPATIONAL MEDICINE IN THE WORLD

Bernardino Ramazzini was an Italian physician born in Carpi in 1633, widely recognized as the father of Occupational Medicine. He wrote the book "The Diseases of Workers", published in 1700. In this work, Ramazzini cataloged 54 different professions and described the main health problems faced by workers in each of them. He highlighted the crucial importance of physicians understanding their patients' current and past occupations in order to make accurate diagnoses and apply appropriate treatments. This pioneering approach launched by Ramazzini established the foundations of Occupational Medicine, becoming fundamental for the understanding and prevention of occupational diseases.

The Industrial Revolution, which began in England in the eighteenth century, caused profound changes in the way production and people's lifestyles were organized. These transformations also boosted the development of Occupational Medicine. Schilling, (1981). Since then, following the evolutions and demands of production processes and social movements, Occupational Medicine has adapted its practices, incorporating new approaches and work instruments. This was done interdisciplinarily, outlining not only the field of Occupational Health, but also, more recently, that of Workers' Health. This evolution reflects the growing understanding of the importance of workplace health and safety to the well-being of workers and the effective functioning of organizations.

History records that in 1830, at the initiative of the textile entrepreneur Robert Dernham, during the English Industrial Revolution, he was concerned about the fact that his workers did not have any medical care other than that provided by philanthropic institutions,

he assigned his personal physician Dr. Robert Baker to work inside the factory, to investigate the effects of work on workers, and to create preventive measures. This was one of the first documented examples of a systematic approach to assessing and mitigating workers' health risks in the industrial environment.

This model quickly expanded to other countries, following the industrialization process. The concern with providing medical services to workers began to gain prominence on the international scene. Among other factors, the great importance of protecting workers' health motivated the creation of two important organizations worldwide: the International Labor Organization (ILO), in 1919, and the World Health Organization (WHO), in 1948. Together, these two entities established, in 1950, the objective of Occupational Health: to adapt work to man and each man to his activity. This view reflects the importance of creating safe and healthy work environments where workers can perform their duties effectively and without compromising their health and well-being.

In 1995, the concept of "Occupational Health" or "Occupational Health" was revised and expanded by the Joint Committee of the International Labor Organization (ILO) and the World Health Organization (WHO). The concept was stated in the following terms:

> The main focus of Occupational Health should be directed towards three objectives: The maintenance and promotion of the health of workers and their work capacity; Improving working conditions so that they are compatible with health and safety; The development of business cultures and work organisations that contribute to health and safety and promote a positive social climate, favouring the improvement of business productivity. The concept of corporate culture, in this context, refers to value systems adopted by a specific company. In practice, it is reflected in management systems and methods, personnel policies, participation policies, qualification and training policies, and quality management. (ANAMAT, 2024).

## HISTORY OF OCCUPATIONAL MEDICINE IN BRAZIL

In Brazil, in 1921, the Labor Inspectorate was established, initially limited to Rio de Janeiro. With the constitutional reform of 1926, the Union's competence to legislate on the subject was established. In 1931, during the government of Getúlio Vargas, the National Department of Labor was created, with the responsibility of supervising compliance with laws related to work accidents, working hours, vacations, union organization and protection of the work of women and minors. A year later, regional inspectorates were established in the Brazilian states, later transformed into Regional Labor Delegations. (ANAMAT, 2024).

The obligation to report accidents of this nature to the police authority was established by decree in 1934, by the National Department of Labor, which also provided for the imposition of administrative fines. Decree-laws of 1940, for example, defined the competence of the Ministry of Agriculture to inspect and establish work standards in the mines.

The growth of industries resulted in an increase in the number of urban workers, which, consequently, brought new concerns to the Brazilian government. It is in this scenario that the Consolidation of Labor Laws (CLT) emerged in the country in 1943, which represented a milestone in Brazilian labor legislation. With the CLT, the first references to hygiene and safety at work in Brazil were established. This legislation consolidated several workers' rights and established standards to ensure decent working conditions, including measures to protect the health and safety of workers.

In the 1940s, the Internal Accident Prevention Commissions (CIPAs) emerged, organized by the companies. The Ordinance of the Ministry of Labor that created the CIPAs was structured by the Brazilian Association of Occupational Medicine and is considered one of the most effective measures in the context of actions to prevent occupational accidents. The first commissions brought good results and encouraged the holding of congresses on accident prevention. Doctors began to focus more on the specific diseases of workers, especially those that affected many people at the time, such as lead poisoning. This concern led doctors to improve their studies and companies to invest more in Occupational Health. This period was marked by significant advances in the awareness and prevention of occupational diseases in Brazil. (ANAMAT, 2024).

In 1947, the International Labour Organization (ILO) adopted Convention No. 81, which states that each member of the organization must have a system of labour inspection in industrial and commercial establishments. The experience of industrialized countries resulted in Recommendation No. 112 of 1959, also established by the ILO, which addressed "Occupational Medicine Services". This recommendation was later replaced by ILO Convention No. 161 of 1985, together with its respective Recommendation, No. 171. These conventions and recommendations highlight the importance of protecting the health and safety of workers at the international level and provide guidelines for the implementation of effective occupational health services worldwide.

In Brazil, this development occurred late and followed the model of First World countries. In the sphere of institutions, the creation of Fundacentro in 1966 stands out, which was a national version of the models of institutes developed abroad from the 1950s onwards. Fundacentro has played a crucial role in promoting occupational health and safety in Brazil by providing research, training, and technical assistance to companies and workers. Its creation reflected the growing recognition of the importance of occupational health and the need for effective measures to protect Brazilian workers. (ANAMAT, 2024).

## DATA ON OCCUPATIONAL ACCIDENTS IN BRAZIL

The work environment can present a variety of risks to workers due to its characteristics or conditions of carrying out activities. When these risks are not given due importance and measures are not taken to control them, this can result in accidents involving employees.

According to Article 19 of Law 8,213 of 1991, work accidents are defined as those that occur during the development of the employee's professional activities, resulting in physical or psychological damage, whether permanently or temporarily, as stated in the aforementioned Law:

> An occupational accident is one that occurs due to the exercise of work in the service of a company or domestic employer or by the exercise of work [...], causing bodily injury or functional disturbance that causes death or the loss or reduction, permanent or temporary, of the capacity to work. (BRAZIL, 1991).

It is essential for employers to recognize and assess the risks present in the work environment and implement preventive measures to ensure the safety and health of workers. This can include providing proper training, utilizing protective equipment, keeping facilities in safe condition, and promoting a culture of workplace safety. By prioritizing accident prevention and worker protection, it is possible to create a safer work environment and reduce the risk of incidents occurring. When safety measures are neglected or ignored, accidents become more likely to occur.

Data from the National Institute of Social Security (INSS) indicated 603,825 accidents and 2,694 work-related deaths in Brazil in 2023. In addition to the consequences on the health of workers and the lives of their families, occupational accidents generate economic impacts, reducing productivity. (SESI, 2024).

According to the Smartlab platform, organized by the Labor Prosecutor's Office and the International Labor Organization, the sum of the duration of each benefit granted allows you to calculate the number of lost working days. In 2022, 17.9 million days lost due to sick pay due to work accidents and 8.4 million days lost due to disability retirement due to work accidents were recorded in the country. (BRAZIL, 2023).

From January 2022 to July 25, 2023, the São Paulo State Department of Health (SES-SP) recorded 46.9 thousand work accidents and 177 deaths resulting from work accidents. (SÃO PAULO, 2023).

## RISK OF FALLING FROM HEIGHT AND OCCUPATIONAL SAFETY STANDARDS

The risk of falling from height is common in various economic activities. Construction and building maintenance services are areas where this danger is particularly evident. The consequences of these accidents often result in serious injuries and can often be fatal. Therefore, working at height should be avoided whenever possible; however, when it is indispensable, it must follow the strictest safety criteria.

According to Regulatory Standard NR-35, work at height is defined as any activity performed at a height greater than 2.00 meters in relation to the lower level, where there is a risk of falling. To ensure the safety and physical and psychological integrity of workers, the occupational safety professional is based on legislation and specific safety standards. Among the standards applicable to work at height, NBR 16325-1 and NBR 16325-2 stand out, in addition to Regulatory Standards NR-18 and NR-35. In addition, FUNDACENTRO offers technical recommendations and procedures to ensure the safety of workers involved in work at height activities.

## REGULATORY STANDARD 18

Regulatory Standard 18 (NR 18) establishes guidelines for the installation of anchor points, including minimum specifications for the anchoring equipment used. In its item 18.15.56.1, NR 18 defines the requirements for the installation of anchor points as follows:

> In buildings with at least four floors or a height of 12m (twelve meters) from the ground level, devices must be installed for the anchoring of scaffolding support equipment and safety cables for the use of personal protection to be used in the cleaning, maintenance and restoration services of facades. (BRAZIL, 2015).

Regulatory Standard 18 in its item 18.15.56.2 provides that anchor points must meet the following requirements:

- Be arranged in order to serve the entire perimeter of the building.
- To support a punctual load of 1,500 kgf (one thousand five hundred kilograms-force).
- Be included in the structural design of the building.
- Be made of weather-resistant material, such as stainless steel or material of equivalent characteristics.

It is pointed out that the product's identification items must be fixed to it. These items include information about the manufacturer, the constituent material, the strength of the product, and the serial number of the anchor point (BRASIL, 2015).

## REGULATORY STANDARD NR 35

The Regulatory Standard NR 35 is a fundamental tool for professionals in the area of occupational safety who deal with the prevention of accidents at work at height. It establishes minimum requirements and protective measures to ensure the safety and health of workers exposed to risks in this type of activity.

This standard covers everything from planning to the execution of activities at height, aiming to protect the workers involved directly or indirectly. It is essential that professionals in the area are familiar with the details of NR 35 to ensure the safety of workers and prevent accidents.

NR 35 addresses the responsibilities of both employees and employers in the face of the risks involved in working at height, ensuring that all employee safety requirements are met. One of the essential steps highlighted is the Risk Analysis, which must be carried out whenever activities at height are performed. In addition, it is crucial to conduct an analysis of the safety conditions related to the structure and protective equipment involved.

The Risk Analysis must contain the following observations:

- The place where the services will be performed and its surroundings;
- Isolation and signage around the work area;
- The establishment of systems and anchor points;
- Adverse weather conditions;
- The selection, inspection, form of use and limitation of use of collective and individual protection systems, in compliance with current technical standards, manufacturers' guidelines and the principles of reducing impact and fall factors;
- The risk of falling materials and tools;
- Simultaneous work that presents specific risks;
- Compliance with the safety and health requirements contained in the other Regulatory standards;
- The additional risks;
- The impeding conditions;
- Emergencies and rescue and first aid planning, to reduce the time of inert suspension of the worker;
- There is a need for a communication system;
- The form of supervision. (BRAZIL, 2014)

Another important aspect that must be considered and is equally addressed by NR 35 is the training of the employee, ensuring that he is qualified to follow the guidelines of this Standard. In addition, the Standard emphasizes that the worker must be fit and

undergo periodic examinations, as stipulated in the company's Medical Control and Occupational Health Program (PCMSO).

Before starting activities at height, it is essential to carry out inspections of working conditions, including personal protective equipment, anchor points and other accessories. Anchor points should be checked for load resistance and quality at the time of purchase, and should be inspected periodically. They must be discarded immediately if they present any type of damage.

## ANCHORING SYSTEM

The anchor point is defined as the specific location where the rope is attached to a mechanical element, which can be oriented vertically or horizontally. This point must be designed to withstand the load resulting from a fall or impact. An anchor system can consist of a single attachment point or multiple attachment points, which can be distributed or grouped in a single structure.

According to Paraná (2001), the anchor point is the structure responsible for supporting all the load applied in a vertical or horizontal system. It can consist of one or more attachment points, and may or may not be grouped in the same structure. It is essential to comply with criteria such as the strength of the mooring point, the location and the type of surface to ensure adequate safety.

> Anchoring is defined as the attachment of equipment to a structure, in order to be used by firefighters in an operation, and can be carried out for the safety of operators or transposition on horizontal, vertical and inclined cables. Reliable anchoring is absolutely essential to the performance of operations. An anchorage should be carried out whenever possible, in resistant structures, such as beams, columns and cable anchoring devices, however, when there is difficulty in using these types of structures, the firefighter should create his own anchor where a minimum of safety can be obtained. Like for example, a hole in the wall. Each anchor point, preferably, should be independent. The anchors must have a reinforcement point, that is, anchor at one point and reinforce it at another point, avoiding, in the event of failure of one of them, the collapse of the system. One form of anchoring that can be performed is through a hole made in the wall, but its resistance must be observed. The hole to be made in the wall, the closer to the floor, the better, as its resistance is greater. To anchor to the wall, a lever must be used to support the opposite side of the wall. Other places that can be used are: internal doors and windows, with the help of a lever and movable doors. Pipes, where good resistance is verified (fire pipes). Furniture can also be used, if necessary and the resistance has been checked. (GONÇALVES, 2001).

The Brazilian Army (2000) clarifies that anchor points are the bases used for any mooring; In reality, anchorages refer to maneuvers performed with ropes or tapes. These points must have characteristics that make them efficient for any maneuver performed by the professional, especially with regard to safety.

Buildings are subject to legislation that defines the criteria to ensure the safety of anchor points. According to current legislation, the anchor points of buildings must comply with the following requirements to ensure a minimum level of safety:

> Art. 5 Include in NR-18 item 18.15.6 - Anchoring, with the following wording:
> 18.15.56 - Anchoring
> 18.15.56.1 Buildings with at least four floors or a height of 12m (twelve meters) from the ground level must have provision for the installation of devices for the anchoring of scaffolding support equipment and safety cables for the use of personal protection, to be used in the cleaning, maintenance and restoration services of facades.
> 18.15.56.2 Anchor points shall:
> a) be arranged in such a way as to serve the entire perimeter of the building;
> b) to support a punctual load of 1,200 Kgf (one thousand two hundred kilograms-force);
> c) be included in the structural project of the building;
> d) be made of weather-resistant material, such as stainless steel or material with equivalent characteristics.
> 18.15.56.3 The anchor points of equipment and safety cables shall be independent.
> 18.15.56.4 Item 18.15.56.1 of this regulatory standard does not apply to buildings that have specific projects for the installation of definitive equipment for cleaning, maintenance and restoration of facades. (BRAZIL, 2006).

The safety of professionals who work at height and perform rescues in emergencies depends directly on the anchorages. To ensure proper anchorage, it is crucial to observe some basic safety requirements in order to avoid accidents during operation. These requirements cover the characteristics and specifications of the anchors, such as:

- Oversized carabiners with a capacity of more than 22 kN should always be used
- At least one carabiner must always be used at each anchor point, either at the Main Point or at the Secondary Point (lifeline);
- Avoid creating lever arms. Always try to tie the anchor at a point close to the base of the structure, as anchoring at a point farther from the structural base significantly increases the force applied to the structure, compromising the safety of the operation;
- Always build the Anchor System with at least two anchor points: the Main and the Secondary;
- Try to anchor yourself directly over the place of descent to avoid large pendulums;

## TYPES OF ANCHOR POINTS (ABNT NBR 16325)

The anchor point is an integral component of a structure's anchoring system. As specified by the NBR 16325 Standard, it can be defined as "the point in an anchorage system to which personal protective equipment (PPE) is intended to be connected".

This standard establishes important guidelines on the correct installation, installation sheet, documentation and periodic inspections. In addition, it determines that the anchor points must be subjected to static and dynamic tests, according to a specific methodology for each type of anchorage.

The NBR 16325 Standard presents the types of anchor points:

**Type A1:** is an anchoring device designed to be attached to a structure by means of a structural anchor or a fastening element in a simple way, as described in Figure 1 (NBR, 16325a, 2014).

Figure 1: Type A1 Anchor Point. (JRV SERVICES, 2017).

**Type A2:** It differs from the type A1 anchoring device in that it is designed to be fixed to pitched roofs (NBR, 16325a, 2014).

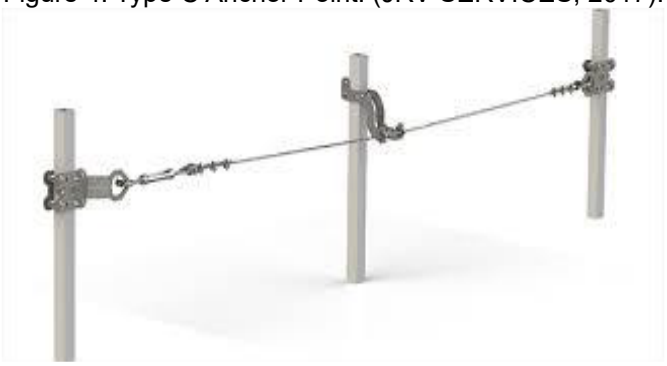
**Type B:** It is a type of transportable anchorage device with one or more anchor points, as illustrated in Figures 2 and 3 (NBR, 16325a, 2014).

Figure 2: Type B Anchor Point. (JRV SERVICES, 2017).

Figure 3: Type B Anchor Point. (JRV SERVICES, 2017).

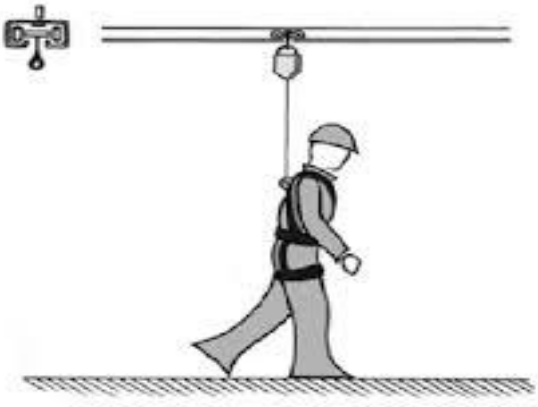
**Type C:** This type of anchoring device is the model used in horizontal flexible lifelines, and can be fixed to concrete or to rods fixed to concrete, as illustrated in Figure 4 (NBR, 16325b, 2014).

Figure 4: Type C Anchor Point. (JRV SERVICES, 2017).



**Type D:** This model of anchoring device employs a rigid anchor line that does not deviate from the horizontal plane by more than 15º. It is a rigid line made of metal rail, through which a trolley slides PPE must be connected to the trolley via an anchor point. Figure 5 exemplifies the type D anchor point model (NBR, 16325a, 2014).

Figure 5: Type D Anchor Point. (JRV SERVICES, 2017).



## RESCUE AT HEIGHT

The activity of rescue at height is one of the missions of military firefighters, requiring extensive study and mastery of techniques to help victims in high places. In these scenarios, safety is essential to ensure the effectiveness of the operation. Souza (2011) points out that knowing the concept of rescue at height, anchor point, knots and equipment, whether individual or collective, is essential to arrive at the safe procedure for the practice of rescue at height. So we have:

> For the use of rescue at height, it is essential to use safety in the activity. The Military Firefighter who performs a rescue at height must ensure his own safety, not aggravate the victim's injuries and if necessary so that in no way does he run the risk of aggravating the situation, he can use and double or even triple the safety systems. (SOUZA, 2011).

Over the years, the techniques developed to improve the execution of rescue activities at height are constantly evolving, as well as the materials and methodologies applied in the vertical rescue process, resulting in a continuous improvement of rescue practices at height. (SÃO PAULO, 2006).

Thus, rescue at height is one of the activities carried out by professionals trained to access, stabilize and transport victims in emergencies. In this sense, the Military Fire Department of Santa Catarina (2010) highlights:

> Rescue at height is an activity developed by firefighters to locate, access, stabilize and transport victims through the use of rescue techniques in elevated places, based on safety standards and specific anchoring and lowering procedures. (SANTA CATARINA, 2010).

Rigoni (2007) emphasizes that, due to the high level of commitment required of professionals in rescue at height, it is essential to remember that, despite all the theoretical and technical knowledge, experience and common sense are essential. This is due to the fact that these professionals carry out their work under psychological pressure, where any mistake can have fatal consequences.

## METHODOLOGY

This article was prepared based on the bibliographic research method, based on pre-existing sources and without direct practical application. According to Boccato (2006, p. 266), bibliographic research aims to develop solutions based on theoretical references already published, allowing analysis and discussions on these materials. In addition, it offers the researcher greater ease to access a wide range of information (GIL, 2002).

## RESULTS

The anchoring system is essential for safety in work at height and rescue operations, preventing falls and protecting lives. Its correct implementation, in line with maintenance and regulatory standards, promotes safer and more reliable work environments, reducing accidents and meeting legal requirements. In addition to providing secure attachment for PPE, the system increases workers' confidence and efficiency, and is also vital in rescues, where its robustness can determine the success of the operation.

Its implementation reduces the number of accidents and increases the reliability of the work environment. The adoption of rigorous security practices contributes to the achievement of organizational and regulatory goals.

## DISCUSSION

The anchoring system is an essential element in the safety of work at height and rescue operations, playing a vital role in preventing accidents and protecting workers. Its relevance is highlighted both for its technical functionality and for its contribution to the mitigation of risks in activity.

It consists of specific elements to resist effective forces, ensuring the safe attachment of personal protective equipment, such as seat belts, lanyards and safety ropes. Its main function is to efficiently distribute the loads generated by the worker's weight and the possible dynamic forces in the event of a fall. The reliability of this system provides workers with greater mobility and confidence to perform their duties, contributing to productivity.

In rescue operations, the robustness and reliability of the anchorage system are even more crucial. Rescues often operate in extreme conditions, where the lives of victims and the safety of rescuers depend on a well-designed anchorage in perfect working condition. In this context, failures in the system can have catastrophic consequences, highlighting the need for rigorous planning and constant maintenance.

The effectiveness of the anchoring system is intrinsically linked to compliance with technical and regulatory standards, such as NBR 16325-1 and NBR 16325-2, which establishes NR-18 and NR-35. It is important to note that regular inspections and preventive maintenance. Worn out or damaged equipment can compromise worker safety, making it essential to periodically evaluate the components and properly train the teams.

## CONCLUSION

The safety of employees who work at height is directly associated with the use of an anchoring system. This system provides greater mobility during the execution of tasks, ensuring that, in the event of a slip, the worker is properly protected against falls. When it comes to working at height, the risks involved are significant and require special care to avoid accidents. In this context, the most appropriate protection and security system to be implemented is the anchoring system.

The anchoring system aims to withstand the forces applied in the event of a fall, keeping the body suspended. In this way, it is an indispensable component for carrying out activities that involve working at height.

According to the legislation in force, any work at height must be carried out with the help of an anchoring system to ensure the support and safety of the operator. According to the applicable principles, whenever a work is conducted above 2 meters in height, the use of the anchoring system will be mandatory. Examples of situations that require this measure include, among others, building, industrial and offshore maintenance, maintenance of machinery and equipment, cleaning and maintenance of roofs and facades, activities accessed by means of ropes, and rescue operations at height.

The observation of safety items and the monitoring of activities carried out at height are extremely important to ensure that work at height is performed without putting the employee's life at risk. The anchor point is indispensable in emergency rescue situations. In this way, it must be correctly distributed and installed at the main points of the structures, thus ensuring the necessary safety.

Importantly, the provision of anchor points in a workplace should not be based on faith, unfounded optimism, or guesswork. The apparent robustness of an anchor point or structure where an anchor will be installed is not sufficient if there are no technical guarantees of its reliability.

To ensure the reliability of an anchoring system, a number of requirements must be met, including the characteristics and test methodologies of anchoring devices, the design, installation and inspection of anchoring systems, as well as the documentation required for traceability, control and auditing purposes.

Periodic inspection of the anchoring system should be carried out at least every 12 months to ensure its reliability. However, in environments that are harsh on the system materials or in the event of more intense use than initially planned, it is recommended to carry out inspections at shorter intervals. These additional inspections are necessary to ensure the safety and proper performance of the anchoring system.

## REFERENCES


1. AGUIAR, E. J.S. (2016). *Resgate Vertical* (2ª ed.). Curitiba: Associação da Vila Militar – Departamento Cultural. Disponível em: <https://pt.scribd.com/document/59062412/Resgate-Vertical>. Acesso em: 28 nov. 2024.

2. ANAMAT. (2024). História no mundo. Disponível em: https://www.anamt.org.br/portal/historia-da-medicina-do-trabalho/. Acesso em: 28 nov. 2024.

3. ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS. (2014). *NBR 16325: Proteção contra quedas de altura Parte 1: Dispositivos de ancoragem tipos A, B e D*. Rio de Janeiro, 38 p. Disponível em: <https://pdfcoffee.com/nbr-16325-1-pdf-pdf-free.html>. Acesso em: 28 nov. 2024.

4. ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS. (2014). *NBR 16325: Proteção contra quedas de altura Parte 2: Dispositivos de ancoragem tipo C*. Rio de Janeiro, 32 p. Disponível em: <https://pdfcoffee.com/nbr-16325-22014-proteao-contra-quedas-de-altura-pdf-free.html>. Acesso em: 29 nov. 2024.

5. BRASIL. (2023). Acidentes de trabalho matam ao menos uma pessoa a cada 3h47min no Brasil. Disponível em: https://tst.jus.br/-/acidentes-de-trabalho-matam-ao-menos-uma-pessoa-a-cada-3h47min-no-brasil-1#:~:text=Em%202020%2C%20foram%20446.881%20acidentes,mortes%2C%20aumento%20de%2036%25. Acesso em: 28 nov. 2024.

6. BRASIL. (2023). Observatório de Segurança e Saúde no Trabalho. Disponível em: https://smartlabbr.org/sst. Acesso em: 28 nov. 2024.

7. BRASIL. (1991). *Lei nº 8.213, de 24 de julho de 1991*. Da Finalidade e dos Princípios Básicos da Previdência Social. Brasília, DF.

8. BRASIL. (2015). *Ministério do Trabalho e Emprego. NR 18 - Condições e Meio Ambiente de Trabalho na Indústria da Construção*. Brasília: Ministério do Trabalho e Emprego. Disponível em: <https://www.gov.br/trabalho-e-emprego/pt-br/acesso-a-informacao/participacao-social/conselhos-e-orgaos-colegiados/comissao-tripartite-partitaria-permanente/normas-regulamentadora/normas-regulamentadoras-vigentes/nr-18-atualizada-2020.pdf>. Acesso em: 01 dez. 2024.

9. BRASIL. (2006). *Ministério do Trabalho e Emprego. Portaria n. 157 de 10 de abril de 2006*. Altera a redação da Norma Regulamentadora 18. Disponível em: <https://www.camara.leg.br/proposicoesWeb/prop_mostrarintegra?codteor=428579>. Acesso em: 22 nov. 2024.

10. BRASIL. (2014). *Ministério do Trabalho e Emprego. NR 35: Trabalho em Altura*. Brasília, 8 p. Disponível em: <https://www.gov.br/trabalho-e-emprego/pt-br/acesso-a-informacao/participacao-social/conselhos-e-orgaos-colegiados/comissao-tripartite-partitaria-permanente/arquivos/normas-regulamentadoras/NR35atualizada2023.pdf>. Acesso em: 19 nov. 2024.

11. BRASIL. (2012). *Ministério do Trabalho e Emprego. Secretaria de Inspeção do Trabalho. Departamento de Segurança e Saúde no Trabalho. Manual de auxílio na interpretação

e aplicação da norma regulamentadora NR 35 – Trabalhos em Altura: NR-35 comentada*. Brasília: SIT/DSST.

12. COSTA, A. A. (2002). *Resgate em Ambiente Elevado*. Fortaleza: Vercatto.

13. BOCCATO, V. R. C. (2006). Metodologia da pesquisa bibliográfica na área odontológica e o artigo científico como forma de comunicação. *Revista de Odontologia da Universidade Cidade de São Paulo, 18*(3).

14. EXÉRCITO BRASILEIRO. (2000). *Apostila do Estágio Básico do Combate de Montanha* (2ª ed.). São João Del Rey. Disponível em: <https://pt.scribd.com/document/435000772/Estagio-Basico-do-Combatente-de-Montanha-EBCM>. Acesso em: 25 nov. 2024.

15. GONÇALVES, M. A. (2001). Salvamento em altura no Corpo de Bombeiros de Santa Catarina. Florianópolis.

16. GIL, A. C. (2002). *Como elaborar projetos de pesquisa*. São Paulo, SP: Atlas.

17. JRV SERVICES. (2017). Sistemas de Ancoragem: alpinismo industrial. Disponível em: <https://web.facebook.com/jrv.alpinismoindustrial/?locale=pt_BR&_rdc=1&_rdr>. Acesso em: 25 nov. 2024.

18. PARANÁ. (2001). *Corpo de Bombeiros da Polícia Militar do Paraná. Salvamento: Técnicas Verticais – Descensão em rapel simples* (Plano Anual de Instrução/ Módulo IV).

19. RAMAZZINI, B. (2016). *As doenças dos trabalhadores* [tradução de *Morbis Artificum Diatriba*]. Trad. Estrêla, R. São Paulo: Fundacentro, 4.ª ed.

20. RIGONI, R. S. (2007). *Curso de Formação de Bombeiro Profissional Civil*.

21. SANTA CATARINA. (2011). *Corpo de Bombeiros Militar de Santa Catarina. Apostila de Curso de Salvamento em Altura* (1ª ed.). Florianópolis: CEBM.

22. SESI. (2024). Abril verde: mais de 600 mil acidentes de trabalho foram registrados no Brasil em 2023. São Paulo. Disponível em: <https://www.sesirs.org.br/blog-sesi-saude/abril-verde-mais-de-600-mil-acidentes-de-trabalho-foram-registrados-no-brasil-em-2023#:~:text=ABRIL%20VERDE%3A%20MAIS%20DE%20600%20MIL%20ACIDENTES%20FORAM%20REGISTRADOS%20EM%202023>. Acesso em: 17 nov. 2024.

23. SOUZA, L. A. A. (2011). Segurança no ponto de ancoragem na prática do Salvamento em Altura. *Curso de Formação de Soldados*. Biblioteca CEBM/SC, Florianópolis. Disponível em: <https://www.cbm.sc.gov.br/index.php/biblioteca/trabalhos-academicos/tcc-cfsd/category/38-cfsd-2011-3?start=20>. Acesso em: 12 nov. 2024.

24. SÃO PAULO. (2023). Secretaria da Saúde registra 47 mil acidentes de trabalho em 2023. Disponível em: <http://www.saude.sp.gov.br/coordenadoria-de-controle-de-doencas/noticias/27072023-secretaria-da-saude-registra-47-mil-acidentes-de-trabalho-em-2023>. Acesso em: 02 dez. 2024.

25. SÃO PAULO. (2006). *Corpo de Bombeiros Militar do Estado de São Paulo. Coletânea de Manuais Técnicos de Bombeiros: manual de salvamento em altura* (1ª ed., vol. 26). São Paulo.

26. SCHILLING, R. S. F. (1981). Developments in Occupational Health. In R. S. F. Schilling (Ed.), *Occupational health practice* (2nd ed., pp. 3-26). London: Butterworths.